

BORG CONSTRUCTION PTY LTD

RESPONSE TO SUBMISSIONS

TIMBER PROCESSING FACILITY (PARTICLE BOARD)

LOT 1 DP 1085563, LOT 2 DP 1085563, LOT 26 DP 1200697,

LOT 24 DP 1148073 AND LOT 1 DP 1076346

124 LOWES MOUNT ROAD, OBERON

DECEMBER 2016

BORG CONSTRUCTION PTY LTD

RESPONSE TO SUBMISSIONS

TIMBER PROCESSING FACILITY (PARTICLE BOARD)

LOT 1 DP 1085563, LOT 2 DP 1085563, LOT 26 DP 1200697,

LOT 24 DP 1148073 AND LOT 1 DP 1076346

124 LOWES MOUNT ROAD, OBERON

PROJECT NUMBER: 14.023

ISSUE	DATE	DESCRIPTION	AUTHOR
A	09/09/16	Draft for Client Review	AN
B	21/10/16	Revised Draft for Review	AN
C	24/10/16	Final	AN
D	01/12/16	Revised	AN
E	06/12/16	Fixed Formatting	AN

Report prepared by:

THE DESIGN PARTNERSHIP

TDP2 Pty Ltd ATF The Design Unit Trust T/A The Design Partnership

Central Coast: PO Box 6110 Long Jetty NSW 2261

Hunter: PO Box 277 Charlestown NSW 2290

T 02 4324 3633

E info@thedesignpartnership.com.au

W www.thedesignpartnership.com.au

Disclaimer | This report has been prepared based on the information supplied by the Client and investigations undertaken by The Design Partnership and other consultants. Recommendations are based on professional judgement and whilst every effort has been taken to provide accurate advice, the Client should be aware that Council, Government Agencies and other regulatory bodies may not concur with the recommendations within this report. The preparation of this report does not guarantee approval of any application.

Copyright | This document and the information contained therein is solely for the use of the authorized recipient. This document may not be used, copied or reproduced in whole or in part for any purposes other than that for which it was supplied by The Design Partnership. The Design Partnership makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely on this document for the information contained therein.

TABLE OF CONTENTS

1.0 INTRODUCTION	4
1.1. Overview	4
1.2. Overview of Approval Process and Exhibition	4
1.3. Purpose of this Report.....	4
1.4. Structure of this Report	4
2.0 SUMMARY OF SUBMISSIONS	6
2.1. Submission Process	6
2.2. Submissions Received	6
3.0 RESPONSE TO PLANNING COMMENTS.....	7
3.1. Air Quality	7
3.2. Noise	9
3.3. Surface Water Management.....	10
3.4. Use of Recycled Materials	12
3.5. Soil and Contamination.....	12
3.6. Waste Management	13
3.7. Traffic	14
3.8. Existing Borg Panels Site Processes.....	15
4.0 CONCLUSION AND UNDERTAKINGS	20
5.0 GOVERNMENT AGENCIES	21
6.0 PUBLIC SUBMISSIONS	31

LIST OF APPENDICES

- APPENDIX A Submissions received from State and Local Government agencies
- APPENDIX B Submissions from Community Stakeholders
- APPENDIX C Air Quality Impact Assessment
- APPENDIX D Existing Stormwater Management Plan
- APPENDIX E Proposed Stormwater Management
- APPENDIX F Existing Easement over Site
- APPENDIX G Correspondence Relating to Amended Easement
- APPENDIX H Sustainability Workshop Response to Submissions
- APPENDIX I Site Waste Management Plan
- APPENDIX J Borrow Pit Survey Plan
- APPENDIX K Soil Testing Plan
- APPENDIX L Traffic Impact Assessment Addendum
- APPENDIX M Noise Impact Assessment Addendum
- APPENDIX N Proof of Performance Testing
- APPENDIX O Equipment Supplier Guarantee
- APPENDIX P Revised Landscaping Plan

1.0 INTRODUCTION

1.1. Overview

Borg Construction Pty Ltd (Borg) proposed to make a number of alterations and additions to an existing timber processing facility (the Project) at 124 Lowes Mount Road Oberon under SSD 7016. The existing facility operates under DA 27/95 issued under Part 3A (repealed) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project represents a new State Significant Development project for a timber processing facility, and will result in the land the subject of the application being removed from the existing consent.

1.2. Overview of Approval Process and Exhibition

Approval for the Project is being sought under Part 4, Division 4.1. In Accordance with section 89F of the EP&A Act and the EP&A Regulation 2000 (the Regulation), the EIS is required to be placed on exhibition for not less than 30 days.

As exhibition of the EIS commenced on 10 June 2016, the exhibition period was extended by two weeks to the 27 July 2016 to accommodate the NSW School Holidays

The EIS was made available on the Department of Planning and Environment (DP&E) web site (<http://majorprojects.planning.nsw.gov.au/>). Physical copies were available for review at the Department of Planning and Environment and Oberon Council. A hardcopy was provided to the Environment Protection Authority for review.

Consultation with key stakeholders continued through, and in some cases beyond, the exhibition period.

Submissions received during and outside the exhibition period are considered in this report.

1.3. Purpose of this Report

The purpose of this report is to detail and provide responses to issues raised in the submissions received during the EIS exhibition period.

1.4. Structure of this Report

The Submissions Report has been set out to address each of the issues raised in the submissions and is structured as follows:

- **Section 1** provides an overview of the proposed modification, the EIS process and the Submissions Report purpose and structure
- **Section 2** provides a summary of the submissions received and outlines the key issues raised in the submissions
- **Section 3** provides responses to each of the issues raised in submissions received from State and local Government agencies
- **Section 4** provides responses to each of the issues raised in submissions received from community stakeholders (individuals, community groups and businesses)
- **Section 5** provides a response to key issues raised in submissions
- **Section 6** presents the final Statement of Commitments
- **Appendix A** – presents the submissions received from State and local Government agencies
- **Appendix B** – presents the submissions received from community groups and individuals
- **Appendix C** – An updated AQIA
- **Appendix D** – Existing Stormwater Management Plan
- **Appendix E** – Proposed Stormwater Plan
- **Appendix F** – Existing easement over site
- **Appendix G** – Correspondence relating to amended easement
- **Appendix H** – Sustainability Workshop response to submissions
- **Appendix I** – Site Waste Management Plan

- **Appendix J** – Borrow Pit survey plan
- **Appendix K** – Soil Testing Plan
- **Appendix L** – Traffic Impact Assessment Addendum
- **Appendix M** – Noise Impact Assessment Addendum
- **Appendix N** – Proof of Performance Testing
- **Appendix O** – Equipment Supplier Guarantee
- **Appendix P** – Revised Landscaping Plan

2.0 SUMMARY OF SUBMISSIONS

2.1. Submission Process

During the exhibition period, and for a short period thereafter, submissions in relation to the Project were accepted by the DP&E. Submissions were provided to the proponent for response. All submissions were reviewed and issues raised have been addressed in this Submissions Report.

2.2. Submissions Received

In total, twelve (12) submissions were received:

- Six (6) submissions were from State and local Government agencies (refer Appendix A) including:
 - Office of Environment and Heritage;
 - NSW Environment Protection Authority;
 - Oberon Shire Council
 - Safework NSW;
 - Roads and Maritime Service;
 - Department of Primary Industries – NSW Office of Water; and
- Six (6) submissions were received from the general public – it is noted that of this, one individual made three (3) separate submissions. One of these submissions is a duplicate due to concerns over the original submission not being received. A copy of these submissions is attached at Appendix B.

3.0 RESPONSE TO PLANNING COMMENTS

The following sets out the response to the direct issues raised by the Department in their RTS document.

3.1. Air Quality

The Department notes the Air Quality Impact Assessment (AQIA) includes an assessment of the existing and proposed development, however due to the close proximity of other similar developments (such as Highland Pine Products and Woodchem), the model does not adequately consider cumulative impacts and existing background levels in its assessment. The Department also notes the predicted levels for formaldehyde and NO2 would exceed or are close to the EPA limits. Please consider the cumulative impacts for all emissions including formaldehyde and NO2, particularly in the context of the Woodchem facility and Highland Pine Products.

An additional Air Quality Impact Assessment has been undertaken by Todoroski Air Sciences in order to address the concerns raised, and is attached as Appendix C. In summary:

- Additional cumulative modelling has been undertaken in order to include the impacts of nearby development on the existing air quality. As part of this, baseline data from the 2014 Calendar Year from the nearest two Office of Environment and Heritage monitoring stations was included. This allowed for a more detailed understanding of the potential impacts of the Project on the existing environment. This notes that the Project will generally have a positive impact on the existing environment, including a substantial reduction in overall levels of formaldehyde, both from the subject site itself, as well as when looked at in context with the surrounding development and baseline data.
- Additional clarification regarding the modelling of NO2 has been provided, which takes a conservative approach in order to ensure that the most appropriate level of mitigation is provided. The modelling indicates that the overall level of NO2 and other particulate pollutants will be below the current licensing levels.

Does the AQIA consider potential air emissions from the use of wood waste products in the particleboard manufacturing process? Please detail risks associated with other potential pollutants such as dioxins, furans, heavy metals and the mitigation and management measures to deal with these type of emissions.

Wood waste to be used in the particleboard manufacturing process will form a small component of the total makeup of the finished board and thus a much smaller component of fuel mix used on site for the Heat plants. Furthermore, dioxins, furans and heavy metals are combustion by-products which are usually found in flue gases of plant which use construction and demolition waste wood, municipal waste and Poly Vinyl Chloride (Vinyl plastic) or material with excessive Chlorine contamination as fuel. Borg does not intend to create a Waste incineration facility and will only collect specific streams of untreated waste wood products from reliable and reputable sources which will conform to the strictest requirements.

Borg are aware of the risks associated with using chemically treated and coated wood as a fuel source for solid fuel heat plants and will not use these wood sources for the particleboard manufacturing process.

Borg does not plan to use construction and demolition waste or any other high risk waste wood sources in the manufacture of its particleboard products thus the risk of creating these types of pollutants is low.

This is further underpinned by the European directive on incineration of waste, which is one of the few documents which is clear when making this type of assessment, Statement (iv) below provides the clarification regarding the incineration of wood waste:

DIRECTIVE 2000/76/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL ON THE INCINERATION OF WASTE (4 December 2000)

2. The following plants shall however be excluded from the scope of this Directive:

(a) Plants treating only the following wastes:

- (i) vegetable waste from agriculture and forestry,
 - (ii) vegetable waste from the food processing industry, if the heat generated is recovered,
 - (iii) fibrous vegetable waste from virgin pulp production and from production of paper from pulp, if it is co-incinerated at the place of production and the heat generated is recovered,
 - (iv) wood waste with the exception of wood waste which may contain halogenated organic compounds or heavy metals as a result of treatment with wood preservatives or coating, and which includes in particular such wood waste originating from construction and demolition waste,
 - (v) cork waste,
 - (vi) radioactive waste,
 - (vii) animal carcasses as regulated by Directive 90/667/EEC without prejudice to its future amendments,
 - (viii) waste resulting from the exploration for, and the exploitation of, oil and gas resources from off-shore installations and incinerated on board the installation;
- (b) Experimental plants used for research, development and testing in order to improve the incineration process and which treat less than 50 tonnes of waste per year.

Please assess the impact of burning treatment plant sludge, WESP sludge and scrubber sludge, given the potential pollutant load from the development.

The accumulated sludge has an energy value hence why it is being considered as a fuel source. It also has the added benefit of adding some moisture to the otherwise dry fuel source being utilised on site, reducing dust and cooling the flame in the furnace.

The particleboard manufacturing process will utilise virgin wood products and recycled wood products as raw material process inputs, these are the sources for any accumulation of contaminants in the WESP or scrubber sludge that will be utilised as pollution control devices.

The recycled wood will be screened and assessed for its potential contamination and the other is natural wood, hence the conclusion can be drawn that only wood products will form the source of any accumulated sludge in the WESP or Scrubber and should not require any further assessment at this time.

The site currently only utilises virgin wood for its manufacturing process as the site is allowed to burn water treatment sludge in the heat plants. However, Borg will discuss the waste wood recycling process and its ancillary effects in detail with the EPA as the project progresses. If this is found unsuitable then an alternative disposal solution will be sought.

The AQIA predicts the development would fail to meet the EPA's air quality impact criterion for formaldehyde. As per the EPA's submission, further details are required on the controls or mitigation needed to meet the impact assessment criteria.

It is noted that this question relates to a previous AQIA prepared by Stephenson Environmental. Findings from the more recent AQIA prepared by Todoroski Air Sciences are detailed below

There is some potential to exceed the NSW EPA formaldehyde criterion at the edge of the Project boundary on land used for industrial uses and as an easement. The exposure for humans at above the criteria is limited due to the fact that the area affected is predominately used for the stockpiling of process materials. This is a transitional area of the site, with no workers located in the vicinity for extended periods of time. However, the Project formaldehyde emissions at any location outside of the Project boundary, along with those from the other nearby industries, would not exceed the more current, health based World Health Organisation formaldehyde guideline set to prevent even sensory irritation. It should be noted that the Project would also reduce the current levels of formaldehyde emissions, and the modelling was undertaken on a 'worst case scenario' basis.

The equipment specified within the plant proposed has been selected in order to minimise overall pollution generated, which is shown in the significant reduction in over levels of formaldehyde generated by the site, and indeed, the overall cumulative levels of formaldehyde in the location.

During review of the RTS, the Department identified a number of additional minor points that required clarification. These are addressed as follows:

Section 3.1 of the RTS (pg 7) states that Borg is aware of the risks associated with using chemically treated and coated wood as a fuel source for the heat plants. Please provide further details on what protocols or quality assurance would be in place to ensure that chemically treated wood products are not used as a source of fuel.

Current approved fuel sources for the site are Standard fuels as defined by the POEOA and Non Standard fuels are defined in the sites EPA license. Protocols currently employed by the site are visual inspections of the fuel, training and understanding the origin of all fuel products, these will remain as controls with addition of any further requirements set by the EPA as the Wood recovery program progresses.

Similarly, the RTS also states construction and demolition waste in the manufacture of particle board would not be used. What protocols or quality assurance procedures will be in place to ensure construction and demolition waste or other high risk wood sources are not used.

As this Recovered Wood recycling process is not detailed in depth we cannot provide extensive details on the exact controls that will be utilised however the final outcome will be presented to the EPA for verification and acceptance. Procedures that may be utilised as part of the control strategy are:

- Borg will control the recycling process and not rely on third party providers. Visual inspections with initial collections to occur from within the Borg group only.
- Validation of unknown sources of wood products and laboratory analysis for potential treatment chemical.
- Barcode system to provide limited traceability of origin of product.
- Testing at heat plant stacks for combustion by products which are of concern
- Training of staff to allow more accurate determination as to origin of products
- Sourcing of solid wood products, not broken or wood products that have been reduced in size. This will enable visual inspections and allow faster assessment to determine if the products originate from construction and demolition waste.

Generally, Borg are planning to recycle particleboard, wood pallets and sawmilling residue in the short term. Longer term, different options will be further investigated in order to reduce overall waste generation from the site. Any such activities will be appropriately licensed.

3.2. Noise

The Department notes the proposed noise levels for the site are predicted to operate close to or in some instances, exceed the EPL limits. Please outline what noise attenuation measures for the proposed and existing plant and equipment (i.e. Conti 1 dryer, booster fan drive, mobile wood chippers as discussed in section 13.3 of the EIS) would be implemented to achieve the necessary sound power reductions.

Attenuation, as detailed in the existing NIA, will be implemented as follows:

- Conti 1 Dryer Fan has had the air intake redesigned and the fan speed reduced to minimise noise generated.

- Booster fan, while not detailed entirely at DA level, will receive additional insulation and a reduction in fan speed.
- Main fibre transport fan will have a concrete enclosure constructed around it
- The implementation of an electric chipper has significantly exceeded the anticipated reduction in the expected noise levels, creating a more positive impact than previously modelled.

Table 18 of the Noise Impact Assessment shows that compliance can be achieved during the day period when operating mobile chippers without acoustic enclosures during non-enhancing met conditions (neutral met). Table 19 shows minor exceedance with prevailing wind conditions. This indicates that weather management controls should be sufficient to control noise from the chippers. As such, noise attenuation for the mobile chippers is not required. Conditions relating to not being used during enhancing meteorological conditions can be applied. These mobile chippers are only to be used as a back-up if the electric plant fails. As such, they are not considered to present a significant, ongoing noise generating activity.

In short, the approach taken by Borg to mitigate noise is based on a number of factors:

- 1) Continuation of the use of mobile chippers (that is, not to enclose the mobile chippers). However, these are backup items (only to be used when enclosed, electronic chippers are not operational), and will not be used in enhancing met conditions.
- 2) Implementation of additional items to minimise noise generated by equipment as detailed above.
- 3) Provision of sound attenuation structures and enclosures where appropriate

Irrespective of the above, Borg undertakes to meet the existing plant sound power reductions specified in the NIA. If the proposed attenuation measures to the existing plant are found to be insufficient in achieving these reductions, additional works will be undertaken.

During review of the RTS, the Department identified a number of additional minor points that required clarification. These are addressed as follows:

Section 3.2 of the RTS (pg 9) states that if the proposed attenuation measures to the existing plant are insufficient in achieving reductions, additional works will be undertaken. Can you provide examples of what other attenuation or management measures might be applied if noise reductions are insufficient under the proposed attenuation measures?

As the design of the plant is being finalised the sound attenuation requirements that have been detailed in the NIA for the existing site have been exceeded, therefore we do not see the need for this. However further noise mitigation if required may be implemented post commissioning of the plant. This could include:

- More sound enclosures for existing site or developed site plant and equipment,
- Alternative materials of construction for particular noise generating sources,
- Production hall building insulation,
- Fine tuning of process and/or
- Site boundary controls.

3.3. Surface Water Management

The Department understands that stormwater runoff from the Highland Pine Products site is discharged via the Borg Panels site. Please provide details of any existing or proposed stormwater management arrangements/agreements between the two sites and evidence of any agreements with Carter Holt Harvey/Highland Pine Products.

As detailed below, there is an existing easement over the land which benefits both the Highland Pine Products site and Carter Holy Harvey/Structaflor site. The easement for the CHH/Structaflor site is proposed to be modified under this application. Modelling has been undertaken which demonstrates that the Project will have no negative impact on the function of the easement. As such, the easement will continue to function with no detriment to either site.

The existing stormwater management plan, prepared by Parsons Brinkerhoff, details how stormwater from both sites is currently dealt with. This is attached as Appendix D.

This is proposed to be altered under the application by diverting the existing CHH/Structaflor stormwater channel to the northern boundary of the site (see Appendix E and Drawing DA-02 in the original application). This allows for additional on-site treatment of the water, further improving the quality of the water discharged.

This revised stormwater management plan will not create any adverse impacts on the existing discharge arrangements for either site. As Borg is responsible for the water quality discharged from the sites, inclusive of CHH/Structaflor flows, it is important that any modification to the stormwater system does not create a greater impact than is currently approved. As such, the proposed design improves the overall quality of the water which will flow from the site.

Appendix F details the existing easement over the land. This will be re-negotiated prior to CC for the automated storage building being issued. Correspondence relating to this ongoing discussion is attached as Appendix G.

This clearly demonstrates that the existing arrangements relating to the disposal of stormwater have been considered, the user benefiting from the easement will not be impacted upon, and that there will be no additional adverse impacts upon the environment as a result of the revised location of the easement. In essence, the proposed amendment will create a positive environmental impact, as additional, natural, treatment of the stormwater will be undertaken on Borgs land prior to discharge.

Please confirm if a Water Management Plan exists for the Oberon Timber Complex (including Highland Pine Products and Structaflor) or if there are separate water management plans for each site. A copy of the existing Water Management Plan for the Borg Panels site should be included.

An approved Water Management Plan exists for the Borg Panels site. This is attached as Appendix D. This includes measures for addressing the run-off from the Structaflor site.

The EIS stated an existing v-notch weir on Kings Stockyard Creek would be moved upstream (pg 94 of the EIS). As per DPI's comments, please assess the impacts of removing the existing infrastructure as well as the impact of installing the new infrastructure upstream. This should also include mitigation measures.

The existing V notch weir will not be removed. A review of the EPL has found that in fact there is no need to construct any flow measuring device such as a V notch weir downstream. Therefore, the proposal would be amended as follows:

- a. The existing V notch weir would not be impacted by the works and left in place
- b. No new V notch weir is proposed
- c. It will be necessary to construct new swales to connect overflows from the proposed pond with the existing creek line and these will all be carried out in accordance with any Controlled Activity guidelines/permits or conditions of consent.

Please assess the impact on downstream users (including impacts on biota) as a result of the proposed harvesting and reuse scheme.

DPI noted that it was reported that the volume of runoff would remain above rural levels despite harvesting 120 ML/year of polluted water from the site. Given the large areas of impervious areas, and the large velocities and volumes of run-off as a result, not harvesting this stormwater would have a negative impact on biota. The harvesting of clean, undeveloped rural water will not occur, and existing, natural flow rates will be maintained. This is considered to be the most appropriate approach in order to ensure that impacts on downstream users are minimised, and natural flow levels are maintained. Refer to Appendix H, Sustainability Workshop response to submissions for further detail.

Further details are required on the proposed removal of the easement to drain water on Lot 1 DP 1200697, including details of consultation with other users of the easement.

No removal of the easement is proposed. Amendments and alterations are proposed. This will not impact upon the functioning of the easement. Ongoing negotiation has been held with the parties benefited by the easement and will be resolved prior to the issue of CC for the Automated Storage Building. This has been included in Appendix G.

Modelling has been undertaken as part of the Water Cycle Assessment Report, included in the EIS, which illustrated that the proposed changes to the easement will have no detrimental effect to the flow rates and quality of the water currently discharged from the site. No changes to the existing arrangements regarding the processing of stormwater prior to discharge are proposed. As such, it is considered that the concerns regarding the modifications to the easement have been addressed and are no longer an area of concern.

3.4. Use of Recycled Materials

Please provide further details of the classes and quantities of recycled wood products to be used as a source material in the particle board manufacturing process. Outline the procedure that would be implemented to control the inputs to the development, including contingency measures to be implemented if inappropriate materials are identified.

The materials that are to be used would be subject to an amended EPA licence. No such operations can be undertaken by the proponent until the amendment is approved by the EPA. As such, the proponent seeks approval for the future use of recycled materials, subject to EPA approval.

Given the above, it is considered that this is best addressed during the application for the EPA licence amendment. However, the site waste management plan (Appendix I) has begun rationalising and identifying these sources of raw materials. The majority of the raw materials will be sourced internally; that is, from Borg operations both on site and from other Borg operations throughout the state such as the Somersby and Charmhaven plants. These recovered wood materials will predominantly comprise of particleboard offcuts, sawmill residue and untreated wood pallets. These materials, once collected, inspected and validated, will be transferred to the Oberon facility to be used as a raw material for the particle board manufacturing process. As an example of this commitment, a development application is currently being prepared to create a dedicated warehouse for the storage of reject board from the Somersby operations, which can then be transported to Oberon on backloads.

There is a strong commitment within Borg to a re-use, reduce, recycle approach to materials. This decreases the amount of virgin material that is unnecessarily used, and also significantly minimises the amount of waste generated by the facility that requires offsite disposal.

3.5. Soil and Contamination

Please provide additional details about potential soil and groundwater contamination on the Borg Panels site. This should also include details of any remediation and validation that has taken place on site as well as consideration of the potential mobilisation of contaminants as a result of the construction works

There are a number of former contaminated areas of site the subject to this application. These have all been remediated, with the exception of the existing fuel depot fronting Lowes Mount Road. The validation reports associated with these works can be provided to the department if required.

In particular a Remediation Action Plan (RAP) was implemented in 2008 for historical spills that occurred on the Structaflor site. This has been the source of the majority of contamination within the Oberon Timber Complex, including Kings Stockyard Creek. This RAP was completed in 2010 by Carter Holt Harvey.

The following additional remediation has been undertaken:

- Underground Diesel tank (Lot 26 DP 1200697). Remediation was undertaken in November 2015, during the removal of an old, unused underground diesel tank. Soil sampling was undertaken which identified minor levels of contamination, and this soil was then appropriately managed. The assessed area was deemed to be suitable for continued commercial land-use.
- Kings Stockyard Creek/CSR Land (Lot 1 DP 1076346). This was previously a registered contaminated site. Remediation was undertaken by CSR Ltd prior to Borg purchasing the land. The land was purchased with a validation report, and is no longer on the register. However, as part of remediation there were two (2) borrow pits on site. These are outside of the development footprint, and will not be impacted upon. See Appendix J, Survey Plan.

- CSR Fibre Dump (Lot 24 DP 1148073). This remediation was undertaken by CSR Ltd prior to Borg purchasing the land. The land was purchased with a validation report.

It is noted that the existing fuel depot (Lot 1 DP 1085563) has not been remediated. This will be undertaken prior to any works commencing, and can be conditioned as such. A consultant has been engaged to assist with the remediation to allow for the ongoing use of the site for industrial purposes.

As a result of uncertainty regarding the activities of previous land owners, ongoing testing is being undertaken across Lot 26 DP 1200697 to ensure that there are no additional contaminants that can potentially be mobilised as a result of any construction activity. A soil testing plan has been developed to guide this process, and is attached as Appendix K.

3.6. Waste Management

Table 16 (pg 95) of the EIS shows the current and proposed levels of waste generation. It is unclear how existing and proposed operational waste is generated on site. Please describe how the waste products in Table 16 (proposed and existing) are generated and include further details on how waste products are to be disposed of or recycled. Please show on a map/figure where the main waste treatment/recycling systems are located on the site.

A waste management plan detailing this information is included as Appendix I. This includes a detailed map that clearly illustrates the location of the main waste storage, treatment and recycling facilities on the site. This WMP also provides additional detail as to levels and types of waste generated on site.

Please assess the impact of boiler ash going to local council landfill, particularly if urban waste is used.

The Project does not significantly increase the amount of ash generated, as can be seen in the waste management plan (Appendix I). The ash as under previous operation is disposed of at the Oberon Council waste disposal facility. Borg is currently researching alternative solutions for waste ash disposal, as part of a wider approach to reducing the amount of waste generated by encouraging re-use and recycling of materials. This has included characterisation of ash under current operating parameters, and Borg is committed to continuing this once particle board recycling processes are implemented.

A 2014 analysis of the ash indicates that the quality of the ash is suitable for on-site re-use as fill for commercial/industrial development. As such, no concerns are raised as to potential contaminants from disposing of this at landfill. This report can be provided to the Department if requested.

As per the EPA's comments, please confirm if the wastewater treatment plant has the capacity to treat the additional volume of waste water produced as a result of the commissioning of the wet electrostatic precipitator and the wet scrubber.

The wastewater treatment plant is currently operating at approximately half maximum capacity. There is adequate capacity to treat the additional volume of waste water produced as a result of the new pollution control devices. A water treatment process diagram will be provided to the agencies. This demonstrates current water usage levels and outlines the maximum capacities. All new works will not result in any exceedance of the maximum capacities.

During review of the RTS, the Department identified a number of additional minor points that required clarification. These are addressed as follows:

Please provide additional details on the construction and demolition waste to be generated by the proposed development (including volumes and where it will be disposed) and any potential impacts and mitigation measures.

Site Construction waste to be generated by the project will include packaging materials from containerised plant equipment arriving to site, these will be primarily plastic, wood and metal products. These will be recycled where possible with the remaining material being disposed of to landfill. Further waste will include other paper, plastic film, steel strapping and timber packing products which will be recycled where possible. As the site will remain fully

operational normal procedure for recycling of onsite materials will apply, these include Waste steel bins, Waste Oil and if required a paper products recycling bin will be used during the construction process.

Demolition of the existing offices, fuel depot, Eastern structure and gatehouse will generate waste products predominantly consisting of steel, wood, concrete and various cementitious products. Steel products of a suitable standard will be re used otherwise they will be recycled, wood products will be disposed of to landfill, concrete shall be recycled.

It is unclear what 'downgrade product generated from process upsets out of spec material' means. Please provide a simple definition for this type of operational waste.

Down grade or out of spec material is reject board material that does not meet the normal product specifications required for sale into the market place. It is manufactured with the same raw materials but does not achieve end performance required because of the process upset conditions, process breakdown or other influence. Normally this is only picked up after the board is pressed and checked in the laboratory.

The waste management table shows that 'new particle board dust burner' will be disposed offsite. What is this waste product and can it be recycled?

The waste product is Ash and is generated from the new particle board dust burner. It is seen as a potential conservative increase to the amount of ash generated from the site, it cannot be recycled. However laboratory combustible products analysis of the dust currently utilised on site anticipates that the volume generated in the dust burner will be below the quoted value in the Waste Management Plan.

3.7. Traffic

The Traffic Impact Assessment does not consider the cumulative traffic impacts of nearby industrial developments including Highland Pine Products. A cumulative assessment of traffic impacts should be carried out to include other developments along Lowes Mount Road.

A traffic report for the Project was prepared by SMEC Pty Ltd. This demonstrated that the proposed development would not have a detrimental impact upon current traffic movements in the area. This was supported by traffic counts that were carried out during August-September 2015. This included assessment of the eight (8) key intersections for traffic movements in/out of the Oberon area. At no point in time were these numbers only counting movements to/from the Borg Panels site. The traffic count focussed on all movements within the Oberon Industrial Complex.

The response prepared by SMEC Pty Ltd notes:

The previous assessment undertaken involved determining the performance of various intersections within close proximity to the site during peak periods under the following scenarios:

- 1. Existing Conditions (i.e. 2015 traffic without development);*
- 2. Conditions post development (i.e. 2019 with development); and*
- 3. Future Conditions 10 years post development (i.e. 2029 with development).*

Despite this, additional studies have been undertaken by SMEC Pty Ltd to determine capacity of the road network. These include a background growth of 5% year on year of all traffic movements to determine when intersections reach capacity and then adding traffic movements from potential, future development on the Borg site to determine when the level of service will change from A to B. This is included as Appendix M.

This report included three (3) separate assessment scenarios:

Assessment Scenario 1 – 5% annual growth rate to all movements through the intersection to determine the year in which each intersection will fail. The assessment will also provide a comparison of the traffic volumes through the intersection in the year of failure to the current 2015 traffic volumes during each peak period;

Assessment Scenario 2 - 5% annual growth rate to all movements through the intersection to determine the year in which each intersection's performance transitions from LoS A to LoS B. The assessment will also provide a

comparison of the traffic volumes through the intersection in the year where the intersection is performing with LoS B (i.e. an average delay time of 14.5 seconds) to the current 2015 traffic volumes during each peak period; and

Assessment Scenario 3 - 10% annual growth rate to the current 2015 traffic generation for the site to determine the year in which each intersection's performance transitions from LoS A to LoS B. The assessment provides a comparison of the traffic volumes through the intersection in the year where the intersection is performing with LoS B to the current 2015 traffic volumes during each peak period.

Assessment Scenario 1 had the following result:

The results of this assessment indicates that applying a conservatively high annual growth rate of 5% on all movements as observed in the 2015 traffic volumes will not cause any of the intersections assessed to fail for at least 78 years. This demonstrates that all intersections are operating well within their notional capacity with ample spare capacity to accommodate the proposed development with no adverse impact to the road network.

Assessment Scenario 2 had the following result:

The results of Assessment 2 indicate that LoS B will not be reached on any intersection for 61 years, which again indicates the extent of spare capacity on the surrounding road network.

Assessment Scenario 3 had the following result:

The results of the assessment indicates that based on the conservative trip generation growth rate, the earliest an intersection will reach LoS B (i.e. where one movement at an intersection experiences an average delay of 14.5 seconds) is 2048. This is 33 years after 2015. In addition, the adopted trip generation through each intersection at the point in which LoS B is achieved at each intersection is considered to be extremely high, demonstrating the conservative nature of the intersection as well as the extent to which the traffic generation can grow without any adverse impact on the surrounding road network.

From the above it is clear that the existing road network has more than sufficient capacity to accommodate a substantial increase in the amount of traffic. The proposed development can be undertaken without any upgrade to the surrounding road network being required. This is the case even assuming for a significant increase in non-Project associated traffic movements along Lowes Mount Road.

It is also noted that that RMS made the following comments on the Project:

The submitted documentation, including a traffic study with traffic models, has been reviewed. Roads and Maritime does not object to the proposed expansion and makes no submission.

No concerns were raised by the RMS over the adequacy of the Traffic Impact Assessment prepared.

3.8. Existing Borg Panels Site Processes

In order to address Department and other agency queries over the existing site activities, the following is provided as way of explanation:

The Borg Oberon site has 3 presses capable of producing MDF.

Conti I was commissioned in May 1988. Conti I is a Siempelkamp Conti-Roll press which has a capacity of 100,000 m³ p.a. It is equipped with a 46 inch Sands Refiner, coupled with a 3.5 MW motor and Sands Pendistor air formers. It can produce MDF with thicknesses in the range of 4.75 – 32mm.

Conti II was commissioned in September 1997. Conti II is a 33.4m Siempelkamp Conti-Roll press with a capacity of 160,000 m³ p.a. It is equipped with a 60 inch Sands refiner coupled with an 8MW motor capable of producing 25 tonnes of dry fibre per hour. It can produce MDF with thicknesses in the range 2.5mm to 49mm.

A **Washington Iron Works multi daylight press** previously owned by an independent company, Jeldwen, manufactured 3-dimensional door skins for the international internal door fabrication market. This line was capable of manufacture 30,000 door skins per day until Jeldwen ceased manufacturing operations in Australia in 2010 at which point Borg purchased the equipment including all assets and buildings. However, Borg has not operated the press since that time

The process below is the same for Conti I, Conti II and the door skin line.

OUTDOOR OPERATIONS

LOGS - Cut to size Pinus Radiata logs are brought to site using dedicated trucks from in-forest operations. The majority of the timber comes from within a 100km radius and is stored in the log yard and surrounding the log handling crane, ready for debarking and chipping.

DEBARKER - A rotating drum debarker is used to remove bark from logs, as bark is unsuitable for the MDF manufacturing process but provides a high-quality fuel for the on-site energy plants. This process of debarking is carried out inside the debarker/chipper building, the bark is stored to the side of a building in the fuel pile. Mobile debarking and chipping plant are used as a back up

CHIPPER - Log from the debarking drum is fed directly into the disk chipper which reduces the log to desired smaller 35mm square chips, these are stored for the MDF process. This operation is also carried out within the debarker/chipper building.

ALTERNATIVE CHIP - Chip is also sourced from other producers of wood products in the region, including Highland Pine Products and Carter Holt Harvey. These are introduced into the silos and process by various conveyors in the log yard.

CHIP STORAGE - Chip silos of approximately 3000m³ capacity are utilised for storage of chips which are to be used at the sites MDF manufacturing processes.

CONVEYORS/TRANSPORT TO PROCESS - Belt conveyors transport chip from silos in a continuous process to the chip wash. These conveyors can also feed chips between site processes.

CHIP WASH - Chip is washed via a water washing system which is used to remove the contaminants (foreign particles and minerals) from the chip, this process promotes longevity of the refiner discs and improves board quality and usability.

EFFLUENT generated from this process is sent to the Water treatment plant for refinement and reuse.

ENERGY PLANTS - The site has 2 existing energy plants (Esteel and Sands) both utilising dust burners to create supplemental Hot gas for the dryers and solid fuel grate burner systems to create primary hot air and oil for all site requirements. Fuel is prepared by creating a homogenous mix of bark, waste board and chip reject material, which is automatically fed to both furnaces as required.

CHIP SQUEEZE OUT AND STEAMING BIN - After the chip washing process large steel vessels are filled with clean chip, these are heated using steam to soften the chips making the refining process easier, this also increases the fibre length as it prevents overworking. Prior to refining the chip is squeezed to remove excess water. This excess water is used for top up water for the chip wash process.

REFINER - Once sufficiently softened the chip is fed in between the refiner discs and where it is ground and separated into the individual wood fibres. The Refiner consists of two large, toothed metal discs which rotate and grind the chip.

BLOWLINE - Connection of the Refiner to the dryer is via a very sturdy stainless steel pipe which is used to evacuate the steam and fibres from the refiner and feed it into the dryer tube. The blow line is also where Urea/Melamine formaldehyde resin and various additives are spray applied onto the surface of the fibres. The fibre is about 100% moisture content here.

FIBRE DRYER - Is a large diameter pipe which serves as air transport material conveyor and a fibre dryer, it utilises hot air generated at the site energy plants for transporting, and drying the resinated fibres, to the cyclones and ultimately to the forming and pressing process. After drying at approximately 125DegC the fibres will be about 12% moisture content.

FIBRE DRYER CYCLONES - Fibres travelling via air in the dryer tube at approximately 25m/sec are fed into the dryer cyclones where the cyclonic separation process allows their capture for further processing. The cyclones enable the separate release of excess air and moisture to the atmosphere without allowing uncontrolled escape of fibre.

FIBRE BIN - The dry resinated fibres collected at the base of the cyclones are accumulated in the Fibre bin ready for forming into a mat prior to pressing.

INDOOR MDF OPERATIONS

FORMING STATION - The forming station captures the fibre after being transported by air from the fibre bin to pendistors. The pendistors assist in capturing fibres in order to lay these onto the forming belt in the required orientation. This critical function marks the beginning of the continuous fibre forming and pressing process

QUALITY AND SAFETY CHECKS - After forming and trimming online mat quality checks are carried out as the material travels towards the press, these include foreign material contamination, formed mat density, moisture and mat weight.

PRESS - The formed mat is then fed into a Heated Continuous Belt (Contiroll) hydraulic press, which applies heat and pressure to cure the fibre mat into the finished board. This is the same as the technology that will be utilised in the particleboard project and is well established throughout the world. The mat needs to remain in the press for a determined time to ensure the performance characteristics are met.

DIAGONAL SAWS - Diagonal saws are used to remove the excess from the edges of the pressed board and to cut the continuous board coming from the press into the required lengths. These cut panels are called Master panels which are approximately 7.2m long x 2,5m wide and are usually only used within the board plant boundaries due to their large size and awkward handling requirements.

GRADING - After cutting to required size, the panels are scanned for quality by online measuring equipment. This includes density, moisture and board integrity using internal bond blister detection.

COOLING WHEELS - Cooling Star wheels used to accumulate the master panels post cutting, allowing them to cool sufficiently prior to stacking into large bundles. Panel temperature is required to be less than 90 deg C otherwise board properties are affected due to the resin breaking down.

HIGH BAY STORAGE - A High bay storage system is utilised to allow the boards to rest till completely cooled and full strength is achieved. This is an automated racking system utilising guided rail carts and warehouse management system. Once cooling is complete the boards are sampled for their final performance characteristics, including Internal bond strength, water resistance, surface smoothness and machinability.

SANDING - After post curing the boards are removed from the high bay storage system sanded to prepare the surface of the sheet ready for further processing on and off site. This usually involves multiple sanding passes using different roughness sanding belts.

SITE VALUE ADD PROCESSES

PAPERTREATER - The Vits paper treater is used as part of the onsite value add process and it applies the Urea and melamine formaldehyde resins to the rolls of various plain, coloured and printed papers. The treated paper is then dried in a flotation drier so it can be stored for extended periods prior to reuse in decorative laminating pressing processes, both on and off site.

HYMMEN PRESS - The Hymmen laminating press applies treated paper to the surface of the MDF and particleboard providing the colour and aesthetic appeal to the finished board. This process utilises a heated Continuous Belt press which applies pressure using high pressure air rather than oil. A material package consisting of a treated paper either side of the board is passed through the belts of the press in a continuous process. The heat activates the uncured glue

causing it to flow and become permanently adhered to the surface of the board. This now decorative pressed board is then visually inspected, graded, cut and packed ready for despatch off site.

MOULDINGS - The Moulding plant utilises the raw MDF board manufactured on site and prepares mouldings, skirtings and architraves for use in the construction industry. The moulding strips are usually cut down out of larger master panels of MDF and then machined to provide the desired profile or effect. The machined strips are then painted with a primer in a vacuum coater process and then dried ready for installation in a construction project.

DOORSKINS - The door skin paint line is where flat 3.2 and 6.4mm MDF panels are painted with a UV curable primer via a roller coater and Infra Red cured primer via curtain coater process, panels are then ready to be used in the various customers' door manufacturing processes. These painted panels are visually inspected, QC checked and graded prior to packing and entry into the warehouse

WAREHOUSE - All finished goods manufactured on site which are deemed ready for despatch are stored in the warehouse adjacent to Lowes mount road. The warehouse also incorporates 3 weighbridges and a truck loading and unloading area.

EFFLUENT TREATMENT PROCESS - All site effluent is treated in the water treatment plant on site a process flow document provided below provides a visual aid for the entire recycling process. The Water treatment plant utilises filtration and biological degradation to reduce remove contaminants from the water for re use, capturing over 300kL per day from the site and reusing it in the manufacturing process.

EXISTING PROCESS ALTERATIONS UNDER THIS APPLICATION

This application makes a number of minor process alterations. These are to be provided to relevant agencies. These alterations have been made to improve work health and safety on site, improve process efficiency, reflect advances in technology, and decrease overall pollution levels. The end product, and amount of product generated, and indeed, the footprint of the machinery itself, remain consistent with the existing development. These changes are detailed within the EIS, and are as follows:

- EPA ID 23 together with another additional Paper treater (with a total flow rate of 80,000 m³ per hour), will be diverted to EPA ID 11 (Conti II heat plant) where 95% of formaldehyde will be removed before discharge to the atmosphere;
- EPA ID 12-2 (Conti I roof vent) will be diverted to EPA ID 17 (Conti-1 heat plant) where 95% of formaldehyde will be removed before discharge to the atmosphere;
- A new 'combined stack' will be installed. This stack is proposed to be 40 metres high, 2.1 metres diameter, with a total flow rate of up to 200,000 m³ per hour;
- EPA ID 4 (DC1 baghouse) and EPA ID 5 (DC2 baghouse) will be discharged to the atmosphere through the proposed combined stack;
- A wet scrubber system will be upgraded on the Conti 2 press line.

These works to the existing plant decreases the overall emissions generated by the existing operation of the site.

During review of the RTS, the Department identified a number of additional minor points that required clarification. These are addressed as follows:

What is the combined area (in hectares) of the proposed development (including the existing MDF facility)

The proposed development as detailed in SSD 7016 will cover a land area of approximately of 60.5ha, this is detailed in the consolidation plan (DA-04) as part of the original application.

The EIS for SSD 7016 states the MDF facility currently produces up to 280,000 m³ a year (pg 15). Is this your maximum output and how does it compare to what you have approval for under DA 27/95?

To convert this value is not straight forward as products are produced with different densities thus a different finished weight. The previous estimate of production capacity within the RTS was strictly the continuous Siempelkamp MDF

presses currently operating., This did not include the potential volumes which were previously produced by the multiday light Washington Iron Works press.

Under DA 27/95, the approved combined production capacity of the timber facilities (MDF, particle board and sawmills) is 403,000 tonnes a year, of which the annual production capacity for MDF board is 272,000 tonnes (as stated in the EIS for DA 27/95, pg 34). Please convert the approved production output for MDF under DA 27/95 from tonnes to cubic metres.

The CSR feature panels (Jeldwen) and MDF facility can produce up to 272,000 tonnes of board according to DA 27/95, to convert this m3 is not easy as the products both have different density thus a different final weight. The preferred site production limitation on the consent is m3 and as such we have estimate the conversion for current productions (including potential volumes for the Multidaylight press) for the site under DA 27/95 is 380,000m3 p.a.

The total site estimate for the combined facility including Particle board production and the basis for our studies has been 880,000m3 or 620,000 tonnes of product that can be manufactured on site.

4.0 CONCLUSION AND UNDERTAKINGS

The Project represents a significant investment in jobs and industry within NSW, and allows for the expansion of one of the main employment generating industries within the region. Overall, the impacts from the Project are minimal, and generally represent an overall decrease in pollutants generated in the area. This is as a result of the investment in new, cleaner technologies.

Concern was raised in public submissions over the potential impacts on the road network. Although the RMS had already considered the report as appropriate, and no concern was raised, additional studies were undertaken. These confirm that no significant impacts on the road network will occur as a result of the development.

There has been concern raised over the relocation of the existing easement across the site that allows for site drainage. Borg Manufacturing undertakes that the existing requirements for drainage will not be impacted upon (in terms of flow rates) and the lot benefiting from the easement will be in no way impacted upon. As Borg is responsible for the quality of water discharged from the site, it is their interests to ensure that no negative impact upon existing water quality results from the work.

Borg Manufacturing is committed to reducing overall levels of waste generated by their operations. As such, a reduce, re-use, recycle initiative is being rolled out. This will decrease the amount of waste that is disposed of off-site in favour of utilising the waste material on site. This is a long term project, and will require separate approval from the EPA. This will occur before any such activities are undertaken.

The plant undergoes regular and routine monitoring as part of the EPA license that currently applies. This will continue, albeit with new license conditions imposed. Borg Manufacturing undertakes to ensure that all processes comply with these requirements, and where any exceedance occurs, will ensure that compliance is achieved through either mitigation measures in the plant, or through the installation of revised plant and machinery.

Noise is another cause of concern for the community. The main source of this appears to be the mobile chippers on site. It is proposed that these mobile chippers only be used in favourable meteorological conditions, and only as a temporary, emergency chipper for when the main electric chipping unit is unable to be operated. However, as they are mobile units, locating these in an enclosure is not feasible. By limiting their use, impacts on the surrounding area are significantly mitigated.

5.0 GOVERNMENT AGENCIES

No.	Issue	Response	Relevant Section
Office of Environment and Heritage			
1	The landscape value in the BioBanking credit calculator has been incorrectly calculated, however as the site score is below 17 this is of no consequence.	Noted	N/A
2	Four Aboriginal sites have been recorded for the development site and that a Consent to Destroy (with collection) was issued to AMCOR Pty Ltd for these sites in 1987. OEH recognises that Due Diligence has been undertaken for this project and, in relation to these four sites, no further action is required.	Noted	N/A
3	If subsequent information indicates that any areas within the OEH's responsibility require further investigation, OEH may provide future input.	Noted	N/A
Roads and Maritime Services			
4	Roads and Maritime does not object to the proposed expansion and makes no submission.	Noted	N/A
Department of Primary Industries			
5	Appendix J indicates a water supply demand from the proposed stormwater treatment pond of 200m ³ /day (73ML/yr). This report also refers to a proposed stormwater harvesting demand of 120ML/yr, the proponent should clarify the demand.	The demand for stormwater from both the existing and future pond would be regulated at a maximum of 400m³/day, i.e. 200m³/day from each pond with an estimated operational time of 300 days per year. This demand can't always be met as the ponds may or may not have a volume of water in them. This is the theoretical demand which is entered into the MUSIC model and it is the demand which will be drawn from the ponds assuming there is sufficient volume available. Two ponds are available, the existing and proposed storm water quality basins.	Appendix H of this RTS
6	The proponent should confirm the source of the runoff for the proposed storages and identify how they are considered under water legislation. The proponent should undertake further consultation with DPI Water to confirm licensing requirements where water is captured from other sources.	Only runoff from roof and operational areas will be harvested. No runoff from undeveloped rural land that feeds into the catchment will be harvested. The unpolluted rural runoff is kept separate from the polluted industrial runoff, and has a dedicated swale to the north of the site that avoids the stormwater harvesting ponds. Given that there is no clean runoff to be harvested, it is not considered appropriate to calculate or exercise any harvestable rights in this instance.	Appendix H of this RTS

		The level of undeveloped rural land run off will be maintained. By capturing the polluted industrial runoff, scouring and other downstream impacts caused by increased water velocities and volumes are to be minimised. Stormwater harvesting is considered to be a very important control mechanism for the project which will significantly mitigate the impacts to the natural waterways.	
7	Clarification of whether the proposed pond is more than 40m from the high bank of the watercourse is required.	The proposed 6 ML water quality dam will be constructed at least 40m from the top of bank of the nearest watercourse. As such it is not considered a Controlled activity However, any works within the watercourse will be carried out in accordance with any Controlled Activity guidelines/permits or conditions of consent	
8	Figure 10 of Appendix J indicates an existing v-notch weir on the watercourse at the downstream end of the site is proposed to be moved upstream. This work would be within 40m of the watercourse. The proponent should complete further assessment on the impacts of removing the existing site and the necessary mitigation measures, in addition to an impact assessment of installing the new work.	The existing v-notch weir will not be removed. A review of the EPL has found that in fact there is no need to construct any flow measuring device such as a v-notch weir downstream. Therefore, the proposal would be amended as follows: - The existing V notch weir would not be impacted by the works and left in place - No new V notch weir is proposed, however a sampling point will be created - It will be necessary to construct new swales to connect overflows from the proposed pond with the existing creek line and these will all be carried out in accordance with any Controlled Activity guidelines/permits or conditions of consent.	Appendix H of this RTS
9	The assessment of the proposed harvesting and reuse scheme indicates a reduction in runoff from the site by 133ML/yr due to implementing the proposed harvesting option. This is despite an increase in runoff of 39ML/yr from the additional impervious area (10.5 hectares of roof area). The proponent should complete an assessment of the impact on existing downstream water users due to this reduction.	DPI noted that it was reported that the volume of runoff would remain above rural levels despite harvesting 120 ML/year of polluted water from the site. We again reiterate that harvesting of clean, undeveloped rural areas will not occur. By restricting and detaining the amount of industrial runoff flow, downstream creek impacts such as scouring and biota impacts are minimised. An increase in the size of the Borg impervious area should not be classified as water available to downstream users. Pre-development rural	Appendix H of this RTS

		run off is the water available to downstream users, and this level is being maintained. Thus it is considered that no further assessment is required.	
SafeWork NSW			
10	On the same site is located Woodchem which has been determined by SafeWork NSW as a major hazard facility. The Woodchem facility was recently granted an MHF licence for a period of 2 years with 5 conditions attached. The licence is due for renewal 21 March 2018.	Noted. The Woodchem facility is located on a separate lot and DP and operates as a separate business. No application is made to vary any element of the Woodchem operations.	N/A
11	Safe Work NSW has concerns regarding the water management and discharges contained within the SEARS doc, Appendix A: Requirements 7,8 & 9, where it appears fixed infrastructure currently directs all Borg surface waters through to the Woodchem dam and swale installations which we believe to be undersized.	The dam is for fire water retention and deemed adequate in draft report carried out by Core Engineering currently under review by Borg. The redesign of the site water flows will convert this dam to an emergency catchment area ensuring sufficient volumes are always available. Furthermore, any overflow from the site system will be able to be captured in the new water treatment ponds proposed as part of the Project.	N/A
12	The proposed Fire Safety Study that will be prepared in consultation with FRNSW will need to ensure that the risk is adequately assessed and scoped to include the Woodchem interests. Particular attention needs to be given to the potential of a wood dust explosion and plant initiated fires... The question is raised whether the facility be it Borg or Woodchem could adequately address a methanol storage tank fire.	Noted. Impacts on Woodchem and the impacts of a methanol storage tank fire will be considered in this future report. However, this is not required at this point in time.	N/A
13	It is anticipated that an increase in the Borg Panels Timber Processing facility will ultimately lead to an expansion of the Woodchem plant. SafeWork NSW has general concerns regarding Woodchem's capabilities in this regard – recognising this is only a potential consequence of the expansion of the Borg facility.	Woodchem is a separate entity and is currently approved by Oberon Council. No changes to the existing approved facility are proposed under this application. Any relevant future application regarding Woodchem will be referred to SafeWork NSW.	N/A
Environment Protection Authority			
15	List of conditions relating to noise	Borg Panels does not necessarily disagree with the list of conditions (with the exception of mobile chipper operation within acoustically treated enclosures as detailed in Section 3.2 of this RTS) relating to noise. However, it is considered that where an equivalent condition is included within the Environmental Protection Licence (EPL) for the project, a separate development condition should not be imposed as part of the project approval. Clarification is requested (as per Global Acoustic comments in Appendix M) as to the whether an update to the site noise model is required if compliance with Sound Power Levels is achieved.	Appendix M provides further details regarding the mobile chipper operations

16	Confirmation that stormwater harvesting will be deployed as part of the surface water management practices at the premises.	It is confirmed that stormwater harvesting will be deployed as part of the surface water management practices of the Project. It is however important to note that the new process does not consume large quantities of water, the stormwater harvesting is to predominantly formalise intentions and support the existing approved production plant.	Appendix H
17	List of conditions relating to water	Borg Panels does not necessarily disagree with the list of conditions relating to water. However, it is considered that where an equivalent condition is included within the Environmental Protection Licence (EPL) for the project, a separate development condition should not be imposed as part of the project approval.	N/A
18	Details of expected volumes of waste material generated at the facility at any one time (including bark and waste board) and how and where this material will be stored.	Although a list of waste material has been provided in EIS, an amended version has been prepared which details material flows requested and a plan has been prepared to indicate location of these materials at the site. A site plan indicating the location for all stored materials also forms part of this RTS.	Appendix I
19	Confirmation from Borg Panels that the waste water treatment plant has the capacity to treat the additional volumes of waste water produced as a result of the commission of the wet electrostatic precipitator and the wet scrubber.	The waste water treatment plant is currently running at approximately 50% capacity. As such, there is adequate future capacity for the treatment of waste water produced from the wet electrostatic precipitator and the wet scrubber pollution control devices. This is demonstrated in the current water treatment process flowsheet A mass water balance flow sheet for the new particle board plant WESP and Scrubber System will be provided to the EPA and the Department but will not form part of public exhibition.	N/A
20	Confirmation from Borg Panels whether the resulting additional treated volume of waste water has been incorporated within the existing/proposed surface water storage system at the facility (i.e. in addition to the potential volumes of water stored in these same dams/ponds following surface water runoff and rainfall events).	Surface water runoff and treated water storage ponds operate as two independent systems. However, existing ponds are maintained at a level to accommodate rainfall. This is approx. 1m below the high level alarms. Other water storage ponds which will be utilized as part of the process waste water treatment system have sufficient capacity to deal with new flows. Furthermore, the development provides an improvement to the existing system which will capture any uncontrolled overflows from the waste water treatment area, in the form of an emergency catchment dam.	Appendix H
21	List of conditions relating to waste	Borg Panels does not necessarily disagree with the list of conditions relating to waste. However, it is considered that where an equivalent	

		condition is included within the Environmental Protection Licence (EPL) for the project, a separate development condition should not be imposed as part of the project approval. Remediation of Lot 1, DP 1085563 will occur to the relevant legislation and guidelines. Borg Panels will submit a separate application to the EPA for the Waste recycling process that will be used to assist the particle board manufacturing process.	
22	Further detail is required to demonstrate that all potential emissions to air have been listed and characterized in order to define regulatory requirements, evaluate emissions, interpret assessment results, and evaluate whether proposed controls are appropriate.	It is understood that process diagrams were not provided to EPA, as they were not made available for public exhibition. These have since been provided and address these concerns. These diagrams assist with the understanding of the process description and are synchronised by area number with the information contained within the EIS. Furthermore, diagrams where existing plant connections have been modified as part of this application will be provided to the EPA and the Department but will not form part of public exhibition	N/A
23	The following further information and supporting data is required: - Detailed process flow including any flow between the MDF plant and the PB plant. - Flow balance for both plants. - Mass balance calculation for both plants to support emissions estimates. - Emission data for the current operations related to emission estimates for the modified plant. - Evidence of the efficiency of thermal destruction of formaldehyde. - The course of the energy for heat and pressure to the PB ContiRoll. - Test reports and manufacturers performance guarantees.	It is understood that the new plant process diagrams were not provided to EPA, as they were not made available for public exhibition. These have since been provided and address these concerns. There is no cross over of process emission exhaust flows. Flow diagrams of the changes proposed to existing Borg panels equipment processes which assist with the compliance of the entire cumulative Borg Panels Oberon site have been supplied as part of the RTS. Thermal destruction efficiency testing has been carried by Stephenson Environmental and is detailed in Appendix N. Pressure to the PB Contiroll will provided via the press supplier utilising electrically driven hydraulic oil pressure pumps. The heat required will be	N/A

		supplied using a new gas fired thermal oil heater meeting the requirements of “group 6 plant standards of concentration”. Total solid particle performance from the dryer WESP is provided in Appendix O however it is noted that process conditions and raw material choices can influence the final emission values.	
24	The AQIA requires: • A comparison of existing plant performance with existing licence limits (at standard conditions); and • A demonstration that principal toxic air pollutants are controlled to the maximum extent achievable.	Refer supplementary AQIA attached as Appendix C.	Appendix C of this RTS
25	Further information is required setting out: • The configuration for MM5 – type of run, domain size and grid interval, time step; • The accuracy of MM5 for this domain; • AERMET configuration – what method was used to process MM5 data and whether observations were included; • Justification for the choice of 2014 as a representative year – usually by considering at least five years of observed data, preferably contiguous and recent; • Demonstration that the modelled meteorology is representative by comparing it to observed meteorology; and • An explanation of how the expectedly low frequency of calm winds is representative of the meteorology controlling dispersion of plant emissions.	A meeting has been held with the EPA. At this, the specific meteorological data gaps were identified and have been provided as part of this RTS. In addition, an updated AQIA has been prepared by an alternative consultant. This includes additional information and modelling results. This has been provided as Appendix C. The 2014 calendar year was selected as the meteorological year for the dispersion modelling based on an analysis of long-term data trends in the meteorological data records. Figure 5-6 and Figure 5-7 of the AQIA at Appendix C graphs the meteorological analysis conducted using data from the Bathurst Airport monitoring station. Among the data for each of the different calendar years (2012 to 2015) analysed, the calendar year 2013 and 2014 were the most similar to the recorded trends in the meteorology. Examination of the recorded dust data found that the maximum 24-hour average PM10 recorded during 2014 is the closest to the average maximum 24-hour average PM10 in the data set, and also the annual average PM10 levels in 2014 were closest to the recorded annual average of all of the data. Thus, the year 2014 was chosen in preference to 2013 for use in the modelling. In much the same way, the annual and seasonal windroses for Bathurst Airport from 2014 were used. These are presented as Figure 5.2 of the report at Appendix C. These illustrate that in summer, winds are typically from the east-northeast and east. During autumn, winds are typically	Appendix C of this RTS

		lighter than the rest of the year, with dominant winds from the east-northeast and north. During winter, there are fewer winds from the northeast quadrant, and a dominance of winds from the west-southwest. The spring distribution is similar to annual but with a higher proportion of winds from the west-southwest and southwest and lesser proportion of winds from the eastern quadrants.	
26	Additional information is needed to support the emissions estimates: • A clear description of plant processes to ensure all potentially significant emissions have been captured; • Stack test reports showing current emissions and how modified emissions relate to them; • Demonstration that estimates are conservative, noting previous sampling results and explaining any improvements; • Emission points related to process description to demonstrate that all sources have been included and properly characterized; • A clear document of all assumptions used to calculate emissions rates; and • Manufacturer's performance specifications and guarantees.	It is understood that process diagrams were not provided to EPA, as they were not made available for public exhibition. These have since been provided and address these concerns. All other requirements have been provided to EPA as part of this RTS. Stack testing reports and emission estimates are based on the previous 8 years' results. These results are averaged over this period, including an addition of a standard deviation to provide for more conservative estimates. Mass emission estimates employed for all new plant have been conservatively guided by suppliers of equipment with the exception of formaldehyde which has been based on real world testing results obtained from other plants located around the world.	N/A
27	Conversion of NO to NO2 has been done assuming a 40% conversion. This is not a method described in the Approved Methods. Alternative methods are permitted, but require robust justification. No such justification is provided.	Justification has been provided within the AQIA attached in Appendix C. In summary: Collated NO2/NOx percentage emissions data from forest product industry boilers, fired on various combinations of wood, coal, bark, waste oil and non-condensable gases have been measured as having ranges from 2.5 to 13.4% (NCASI, 2015). The NO2/NOx percentage of emissions from natural gas-fired heaters was found to be approximately 11% (Hunton & Williams, 2011), and the NO2/NOx percentage would typically be up to 23% for a natural gas-fired boiler (ECT, 2013). Some fraction of the NOx emitted from the Project would also undergo chemical change to form additional NO2 by the time the emissions reach receptors. On the basis that the plant NOx emissions would typically comprise 2.5 to 23% NO2, and to account for any potential change in the emissions once released, it was assumed that 40% of all of the emitted NOx would be in the form of NO2 at the sensitive receptors. Considering	Appendix C of this RTS

		the relatively short-distance between the sources and the receptors there would be little time for NO_x reactions to occur, and given also the generally cooler climate, and overall relatively low fraction of NO₂ in the emissions from the main sources, the assumed 40% conversion of NO_x to NO₂ would be a conservative approach to estimating the potential NO₂ effects of the Project at the most affected receptors. Note also that all NO_x emissions, including those from nearby industries are considered in the cumulative assessment.	
28	Assessment requires either use of a listed method for estimating NO ₂ , or robust justification for the alternative method used.	Justification has been provided within the updated AQIA attached in Appendix C. For abridged response please see Comment 27 above.	Appendix C of this RTS
29	The AQIA fails to present ambient data from which to establish baseline air quality and enable cumulative prediction of impacts. It also fails to consider other emission sources in the region such as proximate premises emitting similar substances, and power stations.	Additional data has been provided within the AQIA attached in Appendix C. In summary, the main sources of air pollutants in the area are emissions from local, man-made sources, such as commercial/industrial activities, motor vehicles and domestic wood heaters. It is noted that no ambient air quality monitoring data equipment is located in proximity to the site. As such, the data stations in Bathurst and Oakdale, both operated by OEH, were used. These are located 42km and 71km from the subject site respectively.	Appendix C of this RTS
30	Additional information is needed to provide a comprehensive estimate of impacts to the air environment as set out in section 5 of the Approved Methods. The impacts labelled "cumulative" in section 9 are the assessed impacts for the full proposal - modified MDF plant and new PB plant. They do not estimate the cumulative impact to the airshed.	Appendix A of Appendix C of this RTS provides cumulative impact details. This demonstrates that the Project will not exceed PM ₁₀ criteria at a cumulative level. Section 5.2 of Appendix C details cumulative formaldehyde levels, and illustrates the project will have an overall beneficial impact on these levels within Oberon.	Appendix C of this RTS
31	The pollutants assessed in the AQIA are nitrogen dioxide (NO ₂), particles, and formaldehyde (HCHO). Assessment of impacts are provided for the modified MDF plant alone, and for both the modified MDF plant and the proposed PB plant. Impacts from the full proposal are labelled "cumulative". Ambient data have not been provided and there is no assessment of the total impact of the proposal.	Additional data has been provided within the AQIA attached in Appendix C. This includes a detailed breakdown of ambient data, taken from the two nearest OEH stations.	Appendix C of this RTS
32	There are other sources of nitrogen dioxide in this locality, and the potential for emissions from this facility to combine with emissions from other industry near Oberon and the coal-fired power station to the north. There is potential for exceedance of the one-hour nitrogen	These additional sources of nitrogen dioxide have been identified and tabulated in the revised AQIA and included in modelling. The modelling indicates that the Project will not cause any exceedance of the one-hour nitrogen dioxide criterion.	Appendix C of this RTS

	dioxide criterion.		
33	Assessment of the total impact of the proposal consistent with guidance in section 5 of the Approved Methods is needed to determine whether the existing and proposed plant may exceed the one-hour nitrogen dioxide criterion.	These potential additional sources of nitrogen dioxide have been identified in the revised AQIA and included in modelling. The modelling indicates that the Project will not cause any exceedance of the one-hour nitrogen dioxide criterion.	Appendix C of this RTS
34	The maximum impacts are well below the impact assessment criteria, but there is no assessment of the total impact of the proposal and the predicted 24-hour increment is significant. Cumulative assessment is needed to assess whether emissions from the plant could exceed the PM10 criteria.	Further modelling has been provided as part of the RTS.	Appendix C of this RTS
35	Maximum impact from the proposal within the model domain is a one-hour concentration of <i>0.03mg/m</i>. This exceeds the impact assessment criterion of <i>0.02 mg/m</i> - As set out in sections 2.4.4 and 7.7 of the Approved Methods, maximum impact greater than an impact assessment criterion requires further control or mitigation sufficient to meet the impact assessment criteria. Formaldehyde is a principal air toxic pollutant and, as set out in the Approved Methods, requires control to the maximum extent achievable through the application of best practice process design and emission control.	Further modelling has been provided as part of the RTS. The controls employed exhibit the best available, repeatable and economical technologies for the production/manufacturing processes employed at the project site.	Appendix C of this RTS
Oberon Council			
36	Council are in support of the rationalisation of the conditions of consent associated to DA 27/95	Noted.	N/A
37	Subject to the implementation of noise mitigation measures it is expected that the site will comply with the EPL for operational noise. In this regard a condition of consent should be imposed requiring a management plan to incorporate the mitigation measures in Section 8.2 of the Acoustic Report including the construction activities.	Agreed.	N/A
38	Council acknowledges the existing visual impacts associated to the existing site infrastructure. However, a condition of consent should be considered requiring a management plan in accordance with the recommendations made with in the Visual Impact Assessment Report should approval be considered. Additionally, further landscaping needs to be considered adjacent to the Oberon Leagues Club and needs to be addressed in the hardstand	Compliance with the recommendations of the Visual Impact Assessment is agreed with. This can be conditioned. However, these mitigation measures are focussed on soft landscaping treatments and general upkeep of the landscaping and can be incorporated into the Site Environmental Management Plan. Noted. Additional planting will be provided along the IN1/RU1 boundary to the east of the site to minimise visual impacts. Appendix P is a revised	Appendix P

	areas to the east. It is considered that this can be easily incorporated in any approval, should it be considered.	landscaping plan.	
39	The information provided does not fully articulate the intended use for the hard stand areas identified as area 30 and 31, are these areas designated for car parking or for storage of products? Evidence needs to be provided to minimise and perceived impacts.	Hardstand area to the north (area 30) will primarily be used for parking. Hardstand to the east (area 31) will be used for storage of equipment.	N/A
40	The applicant needs to be aware and address the potential impact associated to works within the remediation area of King Stockyard Creek. This area involved soil materials containing Aldrin and Dieldrin being deposited within borrow pits, on the ground surface and a drainage channel. The EPA have advised Council that any future site owner and occupier(s) need to be aware of the presence of the material retained on site so that any future activities at the site do not result in the reintroduction of that material into King Stockyard Creek.	The borrow pits have been identified on a survey plan and no works will be carried out in the vicinity of these locations.	Appendix J of this RTS
41	Council requests that a condition of consent be imposed for the submission of a dilapidation report in accordance with the recommendations of the Traffic Management Report.	Agreed.	N/A
42	Based on future production outputs and associated heavy vehicle movements clarification via a traffic distribution plan needs to be provided supporting the proposed increase in heavy vehicle traffic movements associated to key roads and Councils infrastructure to enable Council to consider the potential impacts of the development.	A movement summary for each key intersection is provided in Appendix F – SIDRA Intersection Results (Operational Conditions) of the Traffic Impact Assessment prepared by Smec Pty LTD. This is detailed in S.3.7 of this RTS.	Appendix F of Appendix E of the EIS

6.0 PUBLIC SUBMISSIONS

Markus Schmitz (submission 1)			
43	dust / noise / additional traffic concerns.	Noted. Dust, noise and traffic impacts are considered within the EIS	Section 10, 11 and 13 of the EIS
44	Concerns over the disposal of particleboard, MDF and boiler ash being disposed of at local landfill.	The response to planning comments above provides additional information regarding waste disposal, including ash. On site re-use of the MDF is the preferred option, and the proposed particle board production process aims to recycle all reject product. In addition, a waste management plan has been updated.	Section 10, 11 and 13 of the EIS
45	Concerns about the devaluation of properties in the close proximity of the proposed new plant as further developments / subdivisions / granny flats had been rejected for property owners in a 2km range from the current BORG operations by the Oberon Council.	Cl.6.6 of the Oberon LEP sets standards for development in proximity to the Oberon Timber Complex, including setting controls for minimizing impacts on employment through implementation of building measures for new development to ensure noise impacts are mitigated	Section 7.3 of the EIS
Carter Holt Harvey/Highland Pine Products			
46	Carter Holt Harvey Australia Pty Limited (CHH) is a member of the Carter Holt Harvey group of companies, which is the largest supplier of wood-based building products, including timber, plywood and laminated veneer lumber, in Australia and New Zealand.	It is noted that this objection comes from a major competitor in the marketplace and should be considered as such.	N/A
47	The formaldehyde emission modelling in the EIS fails to consider emissions from the Woodchem MHF Major Hazard Facility (Woodchem MHF), owned and operated by the Borg group of companies. This is so despite Woodchem MHF being the largest manufacturer in NSW of formaldehyde-based resins and the second-largest in Australia. This is concerning as the EIS formaldehyde emission modelling, even without consideration of Woodchem MHF, shows that the Proposed Development will exceed the ground level concentration limits for formaldehyde by 50% in certain areas of Oberon.	Woodchem is a separate business entity, and is not considered as part of this application. Within the revised AQIA, Woodchem has been considered, and has been found to be a very minor contributor to levels of formaldehyde due to the mitigation measures already implemented. The AQIA concluded that current total formaldehyde emissions will significantly reduce as a result of the Project and modification to existing plant.	Appendix C of this RTS
48	The EIS does not include a robust baseline for assessing impact on air quality, particularly with regard to formaldehyde, fine particulates (PM10) and nitrous oxide (NOx) emissions. Three of the four facilities at the Oberon Timber Complex manufacture or utilise formaldehyde, and all facilities generate combustion by-products. The EIS fails to adequately consider changes to ground level concentration of pollutants of concern. It also fails to use a baseline derived from the emission	Further modelling has been provided as part of the RTS.	Appendix C of this RTS

	limits in the licence for each operating facility, as well as any background levels.		
49	The Noise testing methodology set out in the EIS is inadequate and the sample size used is too small to be accurate or meaningful. Further, the cumulative impact assessment is inadequate, in that it does not consider the cumulative impact of all sites operating at full capacity.	Attended noise measurements included in the NIA were never intended to form the baseline noise data as inferred. The purpose was to obtain data to inform a model validation assessment. This is detailed in Section 4 of the NIA. The NIA has been assessed as appropriate by the EPA and specific conditions of consent have been recommended.	Appendix H of the EIS and Appendix N of this RTS
50	The EIS sets out relatively random baseline measurements of noise levels. It fails to provide information on whether those measurements represent typical operating conditions, or whether any of the existing operations at the Oberon Timber Complex are below capacity or within their licence limits. A robust baseline should be measured or derived, and cumulative impact assessment made against it.	The NIA has been assessed as appropriate by the EPA and specific conditions of consent have been recommended.	Appendix N of this RTS
51	The EIS fails to provide evidence that the traffic study undertaken represents the conditions that would occur when all operations are operating at permitted capacity. Equally, the data that was provided was based on relatively few traffic counts, which undermines its credibility. The traffic study has also failed to consider current usage by other businesses along the adjacent Lowes Mount Road. Legal access to Lot 11 DP 1017456, Lot 1 DP 360361 and Lot 1 DP 128404 (all within 150m of Borg's Gate 4 entrance) has not been assessed and the traffic report fails to discuss the need for turning lanes (in both directions) to access Gate 4, suggesting by implication that the impact would be negligible. Given the current road profile (single lanes both ways), the existing railway level crossing (100m from Borg's Gate 4) and existing rights of use for adjacent industry, the traffic study fails to provide an adequate assessment of impacts to road users along Lowes Mount Road.	Traffic modelling has indicated that there is adequate capacity within the existing road network to accept estimated project traffic. The traffic count conducted at intersections included all heavy vehicle, Highland Pine Products and Structaflor traffic movements. The approved site access arrangements for Borg remain unchanged, with heavy vehicle traffic utilising existing approved access points. Potential impacts have been further mitigated through the provision of an expanded waiting area within the driveway to the site to avoid potential impacts from queuing trucks on Lowes Mount Road. The TIA has been assessed as appropriate by the RMS with no specific conditions of consent recommended.	Section 10.0 of the EIS
52	The EIS modelling relies on the assumption that the Proposed Development will receive exemption from application of the <i>Water Management Act 2000</i> . There is no guarantee that this exemption will be granted. In the event that the storm water harvesting and reuse scheme is not approved or fails operationally, the EIS fails to provide information on the impact on Oberon's potable water supply and subsequent water use impact on other Oberon Timber Complex	Noted. However, the modelling carried out indicates that there is more than sufficient water capacity to meet demand, therefore no impact on the potable water supply of Oberon is anticipated to occur. Department of Primary Industries has also indicated the eligibility of Borg to harvest polluted industrial runoff from the site, including that of the Carter Holt Harvey/Structaflor site without the need for application for a WAL.	N/A

	members, including CHH and HPP.		
53	The EIS also fails to provide an assessment of the environmental impact of the use of bore water by the Proposed Development.	Noted. No changes to current approved extraction rates or water access licenses are proposed. Thus further assessment is not required.	N/A
54	The Proposed Development site has been the subject of significant contamination issues in the past, resulting in two Site Audit Statements (Nos. 214 & GN243B). Some contaminated material is buried on the site and may be disturbed by the Proposed Development. The EIS fails to discuss how contamination risk will be managed.	The Project site has been remediated and validation reports have been provided to relevant government agencies. This was discussed at a meeting on site on 19 August 2016 between representatives of Carter Holt Harvey and Borg. Furthermore, the borrow pits are clearly identified on a survey plan, and no works will be carried out in the vicinity of these.	Appendix J of this RTS
55	The EIS has not given consideration to the mobilisation of any contamination found across the site and the management, control, testing and disposal of soil during the construction phase of the project.	It is understood that the Borg site was not the source of OCP contamination. This was as a result of a spill/leak at the Structaflor site. However additional soil testing will be conducted to ensure all remediation has been successfully carried out and to implement any control measures to avoid mobilisation.	N/A
56	In addition to the above concerns, the EIS undermines the compliance objectives of DA 27/95 in that it seeks to have DA 27/95 set aside, but does not provide any detail on the content of the proposed replacement consent, nor the extent to which the existing conditions of DA 27/95 will be retained.	An undertaking was made within the EIS that all lots not under the ownership of the Borg Group of companies would not be removed from DA 27/95 under this State Significant Development application. The lot and DPs of the affected properties have been identified in the EIS. The current Project only removes 3 of the 14 lots originally part of the DA. Significant consultation and discussion with the Department of Planning has been undertaken in regards to the operation of the existing consent, and how it will continue to operate. The objective is not to repeal the 27/95 consent. The objective is to consolidate the Borg Panels operations under one consent, removing the site from this consent. Mapping is being prepared in consultation with the Department to identify those lots still operating under the current consent for the site. The existing easement arrangements and drainage can operate independently of this consent. It is also noted that under DA 403-11-001, the Highland Pine Products facility, already operates under a separate consent from the subject site at 124 Lowes Mount Road.	N/A
57	CHH and HPP have serious concerns that the EIS does not adequately assess the cumulative impact of the existing environment at the Oberon	Noted. Government agencies have provided relevant comments which have been addressed above. The addendum reports prepared expand upon the	N/A

	Timber Complex.	information previously submitted to the Department	
58	Review of current Google Earth imagery suggests that some of the Proposed Development works may have already commenced. The Proposed Hardstand (item 31 in Figure 3, page 20), Emergency Basin (item 32 in Figure 3, page 20) and First Flush Basin (item 33 in Figure 3, page 20), all of which are listed as 'Proposed Infrastructure' in the EIS, are all at various stages of development.	Works that have been commenced on site have approval under previous modifications to the consent. It is also noted that Google Earth in no way represents the most up to date satellite imagery, and should not be used to form any assessment of works that have or have not been undertaken.	N/A
59	The EIS (page 10) notes that the nearest sensitive receptor is approximately 600m from the boundary of the Proposed Development. Receptors are located 400m to the north; 450m to the east; and the local high school is 420m to the south of the site boundary.	Noted. It is however a receptor that is not susceptible to noise as there is no significant noise generating activities located at the northern end of the site.	N/A
60	Borg currently uses approximately 200,000m ³ of particleboard per annum for its manufacturing operations, of which CHH supplies approximately 80% from its Australian sites. The EIS states that Borg currently sources its particleboard needs from 'a mix of off-shore and inter-state suppliers'. This is incorrect. Carter Holt Harvey's particleboard facility in Tumut, NSW supplies Borg with approximately 64,000m ³ of particleboard per annum. This volume comprises approximately 30% of Borg's total particleboard needs.	It is noted that this loss of market share is the primary concern of CHH.	N/A
61	The EIS states that Borg is currently operating in accordance with both DA 27/95 and its Environmental Protection Licence (EPL 3035). This is incorrect. Borg has been the subject of five penalty notices (each resulting in a fine) under the <i>Protection of the Environment Operations Act 1997</i> for various non-compliances during the past four years.	Noted. Not relevant for assessment of the current application. Regardless of penalty notices the project will be making a significant improvement to the environment in the Oberon area. The marked improvements to the overall cleanliness of the plant since the site came under the control of the current operator is testament to the commitment of Borg Panels to the ongoing environmentally friendly operation of the site.	N/A
62	As source material, the EIS refers to using 'external urban waste supplies', 'chipped waste products', 'broken pallet material', 'urban waste material' (page 35) and 'strange material' (page 36). Critical information is missing as follows: The EIS should set out fully what these materials are and their constituent parts. Without this information, the impact on air emissions from processing this material is unknown. For example, the waste material could be chemically treated timber.	As this is a product waste recycling and landfill reduction initiative, this information will be provided to EPA prior to implementing any process changes to ensure appropriate updates to the EPL. Borg is aware of the risks associated with chemically treated timber and intends to have a robust system for the control of recycled process material input products.	N/A
63	The quantity of throughput is insufficiently detailed, only stating that an additional 500,000m ³ of particle board will be produced. These numbers will be key drivers of some environmental impacts (notably heavy vehicle traffic, air emissions, noise and water quality) and should	The application sets a maximum output of 500,000m ³ . This is appropriate for the Department to make an assessment, and forms the basis of all studies conducted. Whilst it is noted that a major market competitor would like more details as to exact levels of product generated, it is not	N/A

	be substantiated.	considered necessary to assess beyond maximum output.	
64	A mass balance, indicating all inputs and outputs from the site is required to support the claims made in the EIS regarding traffic, emission, usage and benefits to the region.	Noted. Additional information has been provided to the relevant government agencies. Addendum reports regarding traffic and emissions are attached to this RTS.	N/A
65	Given that there are fibre supply constraints in the region, and because Borg is proposing to use recycled timber as a processing input, a detailed assessment of proposed supply mix is required in order to sufficiently measure the impacts outlined in the EIS.	Supply mix and material inputs are an operational matter for Borg to resolve. If necessary, Borg will be seeking an amended EPL from the EPA. However, this is not relevant to the assessment of the Project given there is fibre available to commence operations of the plant.	N/A
66	We note that the study uses an assumption that Oxides of Nitrogen (NOx) is multiplied by 40% to provide Nitrous Oxide (NO2) concentrations. This number is conservative, as stated in the report, for the one-hour averaging period. CHH and HPP understand that the Approved Methods typically assume that that all NOx is converted to NO2 or use the ozone limiting method and seeks to understand why this method was not applied in this case.	Further modelling has been provided as part of the RTS.	Appendix C of this RTS
67	A risk assessment of the use of 'urban waste' (page 35) as substrate, including a full lifecycle assessment considering potential impacts from emissions and also wind born emissions from ash residues; The risks associated with other potential pollutants, such as dioxins, furans, heavy metals and other potential carcinogenic emissions, given Borg's proposed use of 'urban waste' and other non-standard fuels, and what measures Borg will put in place to control the potential impact.	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Any use of 'urban waste' will require the separate consent of the EPA, and an application will be made at that time. This will fully detail the treatment and management approach proposed.	Appendix C of this RTS
69	Why the Proposed Development has not considered the use of a Reverse Catalytic Oxidiser or equivalent technology to reduce the impacts of formaldehyde and Volatile Organic Compounds (VOC). Wet Electrostatic Precipitator (WESP) technology, as proposed in the EIS, is ineffective in dealing with these type of emissions.	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Additional information to address specific EPA concerns are included as Appendix C. It is noted that the WESP technology is the best available and economical technology for particle board driers.	Appendix C of this RTS
70	Impacts from the 8MW gas fired heat plant (installed as part of the new press line) have not been adequately discussed in the EIS.	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Additional information to address specific EPA concerns are included as Appendix C. The impacts from the gas fired heat plant are included within the AQIA. However, the impacts are negligible.	Appendix C of this RTS
71	Justification for the claimed 95% reduction in formaldehyde emissions through the diversion of roof vent emissions to the existing site wood fired heat plants. The heat plants do not have any emissions control technology on their stacks. The claim for destruction of 95% of	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Additional information to address specific EPA concerns are included as Appendix C. Third party verification of this process has been provided in Appendix N.	Appendix C and N of this RTS

	formaldehyde has no supporting documentary evidence and remains unsubstantiated.		
72	Confirmation of whether any altered emission point on the existing Borg facility will meet Group 6 emission standards, given that new plant at the Proposed Development will be vented via existing emission points. Existing heat plants at the Borg Facility are currently Group 4 emission standards, and one plant is unable to comply with this standard (as noted in the latest available Borg Panels Annual Return submitted to the EPA).	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Additional information to address specific EPA concerns are included as Appendix C. All new equipment proposed as part of the Project will meet Group 6 emissions standards. Existing plant not subject to modification will maintain the current level of classification.	Appendix C of this RTS
73	An explanation of why the existing heat plants have not been considered as waste incinerators to be regulated under Group 6 (waste incineration limits), given that resinated urban and other wood waste, treatment plant sludge and resinated waste from existing and new processes (including from other Borg facilities) may be consumed as fuel.	The heat plants should not be considered as waste incinerators, as detailed in Section 3.1 above.	N/A
74	Given the presence of pollutants of concern such as formaldehyde (classified by the World Health Organisation as a Group 1 carcinogen), it would be prudent to undertake a Human Health Risk Assessment based on the cumulative impact assessment as part of the EIS. This has not been done.	Air Quality Impacts have been assessed in accordance with EPA Guidelines. Additional information to address specific EPA concerns are included as Appendix C. It is also noted that the limits imposed by the World Health Organisation on formaldehyde sensitivity criteria are significantly different to the EPA guidelines and have helped underpin the preparation of the AQIA.	Chapter 11 of EIS and Appendix C of this RTS
75	The EIS does not include consideration of Borg's own Woodchem MHF, which is a manufacturer of formaldehyde and a designated Major Hazard Facility. Construction of the Proposed Development will occur in close proximity to the Woodchem MHF facilities, and the proposal includes further storage of dangerous goods. No cumulative impact assessment on these risks has been provided. This issue should be considered in both a Plant Hazard Analysis and also in the EIS, given that the location of Woodchem MHF is within the Proposed Development site.	Adequate separation exists between the works and the Woodchem facility, which is a separate business on a separate lot and DP. The Woodchem facility is not included in the current approval and is not part of this application.	N/A
76	Given that the EIS acknowledges the level of noise generated with the use of a mobile chipper on-site, CHH and HPP suggest that conditions should be applied to the consent and EPL requiring: ☐ Mobile chipping only at daytime (7AM-5PM) Mon-Fri; and ☐ No mobile chipping during enhanced wind conditions (any direction).	Discussions are being held with the EPA regarding limiting the use of mobile wood chippers. Conditions will be negotiated with relevant government agencies.	N/A
77	Historical underground storage tanks (USTs) on the existing Borg MDF site are located in an area which would place them under the proposed particleboard production hall. CHH and HPP can find no reference to the	It is noted that a UST was located on the Borg site. These have been removed, the soil remediated, and the site validated.	Section 14.0 of EIS

	USTs in the EIS and it is not clear whether Borg has removed them. If not, CHH and HPP seek to confirm whether there are any remedial or management procedures proposed to prevent any future impact on surface water, groundwater or soil (including the validation and remediation of any spoil prior to its relocation as fill for other areas)		
78	In addition, CHH and HPP are aware of a number of redundant USTs on Lot 1 of DP 1085563 (formerly used as a fuel depot). This would place them under the new flake dryer which is to be constructed as part of the Proposed Development. Once again the EIS does not make mention of any proposed remedial action in relation to these USTs, or any future impact on surface water, groundwater or soil (including the validation and remediation of any spoil prior to its relocation as fill for other areas).	The EIS notes the operation of the fuel depot and undertakes that appropriate remediation as prescribed by SEPP 55 to a level suitable for the ongoing industrial use of the site will be undertaken.	Section 14 of EIS
79	CHH and HPP note that Borg plans to construct two large water storage ponds and a considerable area of hard stand on Lot 1 of DP 1076346. This lot was made subject to an EPA <i>Declaration of Significantly Contaminated Land</i> (No. 20091105) in October 2009	This land has been remediated and validated. Borrow pits located on Lot 1 DP1076346 will not be impacted by the development and are clearly identified in the plan attached.	Appendix J of this RTS
80	Neither the EIS nor the Water Cycle Assessment Report (WCAR) provides a full explanation of the following issues with respect to the impact of harvesting on the catchment: - Impacts on downstream users; - Biota impact assessment in Kings Stockyard creek; - Alternatives if extraction rates are not acceptable considering existing use rights of other industry; - An assessment of the current allowable extraction rate of existing groundwater (via the spring dam) including impacts of extraction from the Woodchem MHF bore on Borg owned land; - An assessment of historical extraction and its impacts on the perched and deep aquifer utilised by upstream users under licence; - Information on what measures and controls will be implemented if extraction is not allowed; - Supporting information regarding grounds under which the EIS recommendation that the project be granted dispensation under the Water Management Act; - An assessment of water quality considering worse case inflows managed under a commercial agreement with upstream contributors to the storm water system; and	See response to DPI – Water and Section 3.3 of this RTS.	Appendix H of this RTS

	- Consideration of existing easements and commercial agreements with upstream contributors to the storm water system given the EIS proposes to alter water flow across the catchment;		
81	The EIS does not provide proper assessment of the impacts of the Proposed Development on groundwater given that: - the perched aquifer is within 1 metre of storm water drainage network infrastructure at the adjacent industrial facility; - changes to groundwater flows could impact on existing containment cells of contaminated spoil upgradient of the Proposed Development site; and - the Proposed Development engaged Sustainability Workshop to complete a WCAR. It should be noted that Table 13 (p.91) is incorrect by three orders of magnitude (i.e., 1000X) for the discharge of aldrin and dieldrin. The EPL (3035) has a 0.3µg/L (not mg/L) limit on aldrin and dieldrin. This error has the potential to significantly distort the water impact assessment.	Noted. This is a typographical error in the report and does not alter the outcome of the WCAR assessment. The containment cells are located well outside the development footprint and will not be impacted upon by the Project. It is also noted that the stormwater drainage network will not be relocated in most areas and a thorough assessment of potential impacts in the new water quality ponds area to the east of the site will be conducted prior to the CC stage of the project.	N/A
82	The EIS refers to 'burning of gas products on site' as a 'key aspect of the Project' (EIS 16.3 p 96) but there is limited detail regarding this in Chapter 6 of the EIS. EIS 16.2 Table 16 indicates that the existing wood fired heat plants on site are to be used in the role of waste incinerators. CHH and HPP is aware that these heat plants have little or no emissions control equipment currently fitted to them.	Specific process information has been provided to agencies only. It is not considered appropriate to release this level of detail to a major competitor in the market. Third party validation of the proposed burning of gas products has been provided in Appendix N.	Appendix N of this RTS
83	Lot 26 DP 1200697 is burdened by registered Easement to Drain Water 5 Wide 10 Wide & Variable Width (AA) (shown as item 1 on DP 1200697) (Easement). The Easement is a proprietary right in favour of neighbouring Lot 86 DP 574012, Lot 10 DP 1017456 (both HPP facility land) and Lot 11 DP 1017456 (on which a CHH facility is situated). The Easement infrastructure allows the benefited lots the opportunity to contain any form of surface water pollution if required. The changes mooted in the EIS have the effect of removing this infrastructure to a large extent. The EIS provides no information on how any surface water pollution from the benefited lots would otherwise be contained and managed.	Noted. This is a legitimate concern for CHH. Borg undertakes to ensure that no negative impacts to the existing water quality will occur. Ongoing discussions have been held with CHH regarding this easement. Stormwater loads from benefitted lots have been assessed in the current modelling. Final details will be included within the Stormwater Management Plan. However, it is noted that Borg is ultimately responsible for the water quality from the CHH facility	Appendix G of this RTS
Jenolan Caravan Park			
84	Smoke can be hard to determine from where it is coming. It seems in the main part to come from the area of the other parts of the timber complex, not Borgs. However, we make mention of it here as smoke	Noted. Excessive smoke is not a part of the normal operations of the Borg plant. As a result it is more likely that this comes from a different operator within the Oberon Timber Complex, or indeed the wider industrial estate.	N/A

	comes over the caravan park often on a Sunday, and also on other days of the week. It is a 'blue' smoke.		
85	It is even harder to detect the direction of smells than it is for smoke. An unpleasant smell is not as frequent as the smoke (or the noise) but can be extremely unpleasant and very hard to describe when it does occur. We have considered other businesses in the area e.g. the relatively new bitumen plant but when we situated ourselves outside their business we could not smell any bad smells. Again it is mentioned here because it has been a problem and finding the source seems to be a big problem.	The Project should not result in any unpleasant smells, and the operation of the existing Borg facility does not generate any offensive odour off site. As there are a number of industrial facilities in the area it is hard to locate where this may come from (as the submission notes).	N/A
86	In 2011, when we had the opportunity to manage the caravan park for the previous owners before purchase, the synonym used by both people operating the Park and guests in the Park when describing the noise was "like waves on the seashore". During February/March 2011, a six week period, the Mill (complex) was quiet and the sound was not an unpleasant background noise. After purchasing the caravan park we believe the noise has steadily grown in volume and this could probably be measured against improved sales in the Borg business.	Noted. Borg purchased the business in a state of disrepair and has since improved and modernised the site. A considerable portion of this has been in process improvements which have resulted in noise attenuation including a completely enclosed truck loading facility. The latest noise study completed over a 3-month period shows the OTC is in full compliance.	N/A
87	Sound monitoring has been carried out at the Park on a number of occasions by both the EPA and Borgs Panels. We have not been privy to the results of these but whenever we have asked we have been advised that the noise is within the allowable limits. It concerns us that the loud bangs (spikes on the noise monitor) that wake up our guests are not monitored individually but they are averaged out over the nightly period. That is no consolation to our guests as they were awakened by the bang and still can't get back to sleep!	The sound monitoring program has been concluded and the results provided to the EPA. The report findings will be discussed with the public once the EPA investigation is concluded.	N/A
88	Looking forward to the new extension we would ask that there be no loud noises or 'spikes' between the hours of 9.00pm and 8.00am.	As acknowledged in the submission, there are a number of noise generators in the vicinity.	N/A
89	We understand that when the portable chippers were in the forest they were required to operate at a distance of not less than 600 metres from a house.	Noted. The site is subject to noise limits and operation of the chippers is thus also governed by those controls.	N/A
Markus Schmitz (Submission 2)			
90	formaldehyde emission will be above the legal limit for my home and workplace address.	Exceedance of the criteria is in one location, which is close to the site boundary on an adjoining industrial property. No exceedance of the limits occurs in any residential area.	N/A
91	emissions and airborne fibre the population of Oberon had to endure in the past	Noted. There are a number of unrelated timber processing and manufacturing facilities within the Oberon Timber Complex. The Project upgrades existing infrastructure, and will be constructed utilising the most	N/A

		up to date emission controls which will minimise impacts on Oberon.	
92	On a windy day my car would be covered in what appears to be wood fibres from the BORG site	Noted. There are a number of unrelated timber processing and manufacturing facilities within the Oberon Timber Complex. The Project upgrades existing infrastructure, and will be constructed to the most up to date emission controls which will minimise impacts on Oberon.	N/A
93	I am also worried that no study had been carried out during a rainy period as formaldehyde is water soluble and could end up in the rain over the township of Oberon.	The AQIA prepared addresses the required details.	
94	I live in Oberon and my house was build in 1946 before the current PB plant was constructed	Noted.	
95	Oberon Council will not allow dual occupancy in areas close to the current BORG site and justify their decision on the fact that the current BORG site is close to my address.	Noted. Oberon Council has set guidelines to ensure that new development is not unduly affected by noise from the wider Oberon Timber Complex, which includes a number of different companies, including Borg and Carter Holt Harvey/Highland Pine Products. Nowhere within the LEP are dual occupancies prohibited explicitly, except in certain large lot and rural zones. Oberon Council have made a strategic planning decision to ensure that the major employer in the region does not unduly impact upon new dwellings, and provided the standards that Council requires are met, there is no reason why development should not be able to be carried out.	
96	I can also see an increased risk to the environmental pollution	Noted. A number of studies have been commissioned that outline that the Project will reduce overall levels of pollution. Also new equipment being installed is the best available technology and is designed to meet more stringent environmental standards.	N/A
97	Defective PB panels regularly appear at the local landfill site	Noted. Borg Panels has not previously manufactured Particle Board Panels on site.	N/A
98	PB panels had also been buried in the state forest at black bullock road in the past.	Noted. Borg Panels has not previously manufactured Particle Board Panels on site. This particular issue was associated with the original developer and owner of the site and cannot be controlled by Borg.	N/A
99	The Oberon Council had burned truckloads of panels from the BORG site in the past at the local landfill site.	Noted.	N/A
Oberon District Museum			
100	Letter of support for the proposed development, citing the proponents' merits as a business operator and community partner	Noted. Borg Panels, as a major employer in the region, is appreciative of the benefit that such organisations contribute to the community.	N/A

APPENDIX A

Submissions from State and Local Government Agencies

APPENDIX B

Submissions from Community Stakeholders

APPENDIX C

Air Quality Impact Assessment

APPENDIX D

Existing Stormwater Management Plan

APPENDIX E

Proposed Stormwater Management Plan

APPENDIX F

Existing Easement Details

APPENDIX G

Consultation Regarding Easement

APPENDIX H

Sustainability Workshop Response to Submissions

APPENDIX I

Site Waste Management Plan

APPENDIX J

Survey Plan with Borrow Pit

APPENDIX K

Soil Testing Plan

APPENDIX L

Traffic Impact Assessment Addendum

APPENDIX M

Noise Impact Assessment Addendum

APPENDIX N

Proof of Performance Testing

APPENDIX O

Equipment Supplier Guarantee

APPENDIX P

Landscaping Plan

OBERON COUNCIL

137-139 Oberon Street
PO Box 84
OBERON NSW 2787



ABN 13 632 416 736

Telephone: (02) 6329 8100
Fax: (02) 6329 8142
email: council@oberon.nsw.gov.au
Website: www.oberon.nsw.gov.au

Contact: Jaclyn Burns

Your Ref:

Our Ref: PO36-124 JB:JB

7 September 2016

Department of Environment and Planning
Attention M P Morales
GPO Box 39
SYDNEY NSW 2001

Dear Ms Morales

I refer to Development Application (SSD 7016) for the Borg Panels Timber Processing Facility Expansion, located at 124 Lowes Mount Road, Oberon.

In consideration of the proposed expansion please find following comments made to the application submitted:

1. Council are in support of the rationalisation of the conditions of consent associated to DA 27/95.
2. Noise Impacts - Subject to the implementation of noise mitigation measures it is expected that the site will comply with the EPL for operational noise. In this regard a condition of consent should be imposed requiring a management plan to incorporate the mitigation measures in Section 8.2 of the Acoustic Report including the construction activities.
3. Visual Impacts – Council acknowledges the existing visual impacts associated to the existing site infrastructure. However, a condition of consent should be considered requiring a management plan in accordance with the recommendations made with in the Visual Impact Assessment Report should approval be considered.
Additionally, further landscaping needs to be considered adjacent to the Oberon Leagues Club and needs to be addressed in the hardstand areas to the east. It is considered that this can be easily incorporated in any approval, should it be considered.
4. The information provided does not fully articulate the intended use for the hard stand areas identified as area 30 and 31, are these areas designated for car parking or for storage of products? Evidence needs to be provided to minimise and perceived impacts.
5. The applicant needs to be aware and address the potential impact associated to works within the remediation area of King Stockyard Creek. This area involved soil materials containing Aldrin and Dieldrin being deposited within borrow pits, on the ground surface and a drainage channel. The EPA have advised Council that any future site owner and occupier(s) need to be aware of the presence of the material retained on site so that any future activities at the site do not result in the re-introduction of that material into King Stockyard Creek.
6. The Traffic Management Plan: - Council requests that a condition of consent be imposed for the submission of a dilapidation report in accordance with the recommendations of the Traffic Management Report.

Based on future production outputs and associated heavy vehicle movements clarification via a traffic distribution plan needs to be provided supporting the proposed increase in heavy vehicle traffic movements associated to key roads and Councils infrastructure to enable Council to consider the potential impacts of the development.

Should you wish to discuss this matter further please don't hesitate in contacting Councils Health and Building Manager, Mrs Jaclyn Burns on (02) 6329 8100.

Yours Sincerely



Gary Wallace
Acting General Manager

From: Battye, Andrew <Andrew.Battye@safework.nsw.gov.au>
Sent: Tuesday, 26 July 2016 4:26 PM
To: Pamela Morales
Subject: SSD 7016 - Borg Panels Timber Panel Processing Facility Expansion - Oberon

Security Classification: Sensitive

Hi Pamela,

Further to the correspondence received from your office regarding the Borg Facility at Oberon then we provide comment as follows:-

1. On the same site is located Woodchem which has been determined by SafeWork NSW as a major hazard facility. The Woodchem facility was recently granted an MHF licence for a period of 2 years with 5 conditions attached. The licence is due for renewal 21 March 2018.
2. SafeWork NSW has concerns regarding the water management and discharges contained within the SEARS doc, Appendix A: Requirements 7,8 & 9, where it appears fixed infrastructure currently directs all Borg surface waters through to the Woodchem dam and swale installations which we believe to be undersized.
3. The proposed Fire Safety Study that will be prepared in consultation with FRNSW will need to ensure that the risk is adequately assessed and scoped to include the Woodchem interests. Particular attention needs to be given to the potential of a wood dust explosion and plant initiated fires. SafeWork NSW has established that through its own site visits that fire safety infrastructure is well established however there is a failure to acknowledge neighbouring impacts between the two facilities. We are still not satisfied there is clear demarcation between the two facilities. The question is raised whether the facility be it Borg or Woodchem could adequately address a methanol storage tank fire.
4. It is anticipated that an increase in the Borg Panels Timber Processing facility will ultimately lead to an expansion of the Woodchem plant. SafeWork NSW has general concerns regarding Woodchems capabilities in this regard – recognising this is only a potential consequence of the expansion of the Borg facility).

We have nothing further to add at this stage but would be very interested should there be any modifications to the DA's for Woodchem as a result of this proposed development, in particular a significant increase in the storage of methanol on site.

Regards

Andrew

Andrew Battye

A/Team Manager

Hazardous Chemical Services

SafeWork NSW

p 02 8867 2740 | **m** 0434 602 586

e Andrew.battye@safework.nsw.gov.au | www.safework.nsw.gov.au

Level 4 , 2 Burbank Place, Baulkham Hills NSW 2153



SafeWork NSW



This message, including any attached files, is intended solely for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender.

This email is subject to copyright. No part of it should be reproduced, published, communicated or adapted without the copyright owner's written consent.

"This message and any attached files is intended solely for the use of the individual or entity to whom it is addressed and may contain information that is privileged, confidential, proprietary and/or exempt from disclosure under applicable law. Personal and health information is highly sensitive. You should not disclose or retain such information unless you have consent or are authorised by law. If you are not the intended recipient of this message, please delete all copies and notify the sender. Any views expressed in this message are not necessarily the views of SafeWork NSW"

27 July 2016

SF2014/052971; WST14/00072/05

The Manager
Industry Assessments
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Pamela Moras

Dear Ms Moras

**SSD7016: Lots 1 & 2 DP1085563, Lot 26 DP1200697, Lot 24 DP 1148073 and Lot 1 DP 1076346;
124 Lowes Mount Road, Oberon; Borgs Panels Timber Panel Processing Facility Expansion**

Thank you for your letter dated 8 June 2016 referring SSD7016 to Roads and Maritime Services for comment. I note SSD7016 has been referred to Roads and Maritime in accordance with clause 104 of *State Environmental Planning Policy (Infrastructure) 2007*.

The submitted documentation, including a traffic study with traffic models, has been reviewed. Roads and Maritime does not object to the proposed expansion and makes no submission.

Please forward a copy of the Department's determination of the development proposal to Roads and Maritime at the same time it is sent to the applicant.

Should you require further information please contact Andrew McIntyre, Manager Land Use Assessment, on 02 6861 1453.

Yours faithfully



Susie Mackay
Network & Safety Manager
Western

Roads and Maritime Services

Our Ref. DOC16/365205-1
Your Ref. SSD 7016

Leanne Grove
DA Coordinator, Industry, Key Sites & Priority Projects
Department of Planning and Environment
GPO Box 39 SYDNEY 2001

Dear Leanne

RE: Borg Panels Timber Processing Facility Expansion (SSD 7016)

Thank you for your invitation for the Office of Environment and Heritage (OEH) to comment on the proposed expansion to Borg panels timber processing facility.

OEH understands that Borg Construction seeks to:

- modernise the existing facility;
- allow for expansion for a chip processing facility;
- expand the plant to include an emergency retention basin, first flush basin and hardstand for vehicles; and
- construct an overflow carpark and to maintain access around the site after construction of an automated warehouse.

OEH has assessed the Biodiversity Assessment Report (BAR) and notes that 1.1 hectares of native vegetation is to be removed by the proposed development. This vegetation is identified in the BAR as native grassland most likely to have been derived from Apple Box – Yellow Box Grassy Woodland of the SE Highlands Bioregion (CW 105), classified as an Endangered Ecological Community (EEC) in the *Threatened Species Conservation Act 1995*. As the site score is less than 17, the vegetation is regarded as in low condition. A site score of less than 17 also means that no further assessment of this native vegetation is required and there are no offset requirements for this development under the FBA.

OEH notes that the landscape value in the BioBanking credit calculator has been incorrectly calculated, however as the site score is below 17 this is of no consequence.

OEH notes that four Aboriginal sites have been recorded for the development site and that a Consent to Destroy (with collection) was issued to AMCOR Pty Ltd for these sites in 1987. OEH recognises that Due Diligence has been undertaken for this project and, in relation to these four sites, no further action is required.

Please note that if subsequent information indicates that any areas within the OEH's responsibility require further investigation, OEH may provide future input.

Should you require further information regarding issues that are the responsibility of the OEH please contact David Geering, Conservation Planning Officer on (02) 6883 5335 or david.geering@environment.nsw.gov.au.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'SC', with a long horizontal line extending to the right.

STEVEN COX
Senior Team Leader Planning
North West Region



Our reference : EF13/3921; DOC16/282523-01
Contact : Mr Andrew Helms, (02) 6332 7604

Ms Joanna Bakopanos
Team Leader – Industry Assessments
Department of Planning & Environment
GPO Box 39
SYDNEY, NSW, 2001

Attention: Ms Pamela Morales

2 August 2016

Dear Ms Bakopanos

BORG PANELS – PROPOSED EXPANSION OF OBERON FACILITY (SSD 7016)

I refer to your email of 8 June 2016 requesting that the Environment Protection Authority (EPA) provides comment on the exhibited Environmental Impact Statement (EIS) prepared for the proposed 'Borg Panels Timber Panels Processing Facility Expansion, Oberon' (the Project).

As requested, the EPA has considered the EIS for the Project in relation to the environmental issues for which the EPA has the primary legislative responsibility, being air, noise, surface water and waste management.

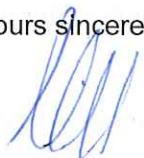
Please find in Attachment 1 the EPA's assessment of the EIS, which includes general comments on the adequacy of the impact assessment, recommendations regarding the provision of additional information and where practicable, recommended conditions of consent if approval is recommended by the Department of Planning & Environment (DPE). Attachment 2 provides additional EPA comment on the air assessment.

It is the EPA's expectation that it will be provided with a copy of any 'Response to Submissions Report' prepared for the Project and adequate opportunity for the EPA to provide further recommendations to the DPE in relation to the Project. Further, the EPA requests the opportunity to review the draft Secretary's Environmental Assessment report for the Project and to comment on any conditions of consent, should approval be recommended by the DPE.

Furthermore, should consent be granted under the provisions of the *Environmental Planning and Assessment Act 1979*, the proponent will be required to make a separate application to the EPA to vary Environment Protection Licence No. 3035 to reflect the conditions of project consent.

Should you have any enquiries in relation to this matter please contact Mr Andrew Helms at the Central West (Bathurst) Office of the EPA by telephoning (02) 6332 7604.

Yours sincerely


DARRYL CLIFT
Head Central West Unit
Environment Protection Authority

Attachment 1: EPA comment on EIS prepared for SSD 7016
Attachment 2: Specific EPA comments on the Air Quality Impact Assessment (Appendix F of EIS)

Attachment 1: EPA comment on Environment Impact Assessment

Noise:

Comments:

- The Noise Impact Assessment (NIA), prepared by Global Acoustics (appendix H of the EIS), states that the current operations at the Borg Panels facility are approaching the noise limits stipulated in the Environment Protection Licence number 3035 (the Licence) for the premises.
- The noise impact assessment predicts that the combination of noise producing activities generated within the existing factory and that generated by the plant associated with the particle board expansion will likely result in an exceedance of the licence noise limits. To ensure that this does not occur Borg Panels has committed to achieving sound power level reductions at three key plant items in the existing factory, namely the Conti 1 dryer fan (a 7 dB sound power reduction required), the booster fan drive (a 7 dB sound power reduction) and at the main fibre transport fan (a 6 dB sound power reduction).
- The EPA notes that under various modelled scenarios reported by Global Acoustics that there are predicted exceedances of noise limits during the day time period which are invariably the result of the operation of mobile wood chippers. Section 13.3 of the EIS states that the mobile wood chippers do not form part of the 'normal' operations at the site and that potential noise exceedances can be avoided through management practices including restricting the use of mobile wood chippers under certain meteorological conditions.

EPA's recommended conditions of project consent:

- That there are no changes to the existing noise limits stipulated by environment protection licence 3035 (the licence) for the day, evening and night time periods.
- The existing evening operational noise limit on the licence (50 dBA) will apply for construction works being undertaken between the proposed 6:00 pm to 7:00 pm period.
- That there are respite periods for construction activities, such as rock breaking, which result in noise levels 75 dBA or more at any non-industrial location as per Section 4.1.1 of the *Interim Construction Noise Guidelines* (DECC 2009).
- The modification on the licence of noise condition L4.3b) to replace the existing reference to '2 metres/second' with '0.5 metres/second' to recognise the observations in the NIA that the site is largely flat and that drainage flows are not considered applicable.
- The modification of condition L4.1 on the Licence to recognise the Industrial Noise Policy's distinction between Sunday and Public Holiday day time hours being different to that of Monday through Saturday (i.e. Sunday and Public Holiday day time being 8:00 am to 6:00 pm).
- The EPA recommends that the following specific conditions be applied to the use of mobile wood chippers on the premises:-
 - The operation of mobile wood chippers are not permissible on the premises from six (6) months following the commissioning of the Particle Board factory unless the mobile wood chipper(s) operates within an acoustically treated enclosure.
 - No mobile wood chipper can be operated in the open when winds are from the northern hemisphere (i.e. when winds are from the west through to the east or winds from 270°, through 0°, to 90°).

- Two or more mobile wood chippers are not to operate simultaneously when winds are from the south-west through to the south-east (i.e. 225°, through 0°, to 135°).
- The preparation of a mobile wood chipper operation management plan. The plan would include the documentation of the above requirements and other measures that will be implemented (prior to the cessation of all mobile wood chipper operations on the premises) to limit their operation to periods of breakdown or maintenance of the permanent wood debarkers/chippers.
- The requirement for Borg Panels to implement all necessary noise mitigation measures at the Conti 1 dryer fan, the booster fan drive and the main fibre transport fan, and other plant as appropriate, in order to achieve the noise levels proposed in the NIA.
- That Borg Panels undertakes noise compliance testing within three (3) months following the commissioning of all elements of the proposal to demonstrate achievement of the sound power levels used in the NIA.
- Updating the site noise model (as described in the NIA) based on the results of the compliance monitoring and the implementation of all feasible and reasonable mitigation measures, to the satisfaction of the DPE and the EPA, if the updated model indicates non-compliance with the noise limits for the premises. This report must be provided to the DPE and the EPA within six (6) months of commissioning of all elements of the proposal.

Water:

Comments:

- The EPA notes in the EIS (Section 15.0 and Appendix J – 'Water Cycle Impact Assessment') that Borg Panels proposes to:-
 - undertake works to further segregate the clean-water run-on to the premises (from the south and west of the premises) from the site derived run-off;
 - provide additional retention time and treatment for surface water derived from the adjacent Oberon Timber Industry factories (Structaflor and Highland Pine Panels); and
 - construct a first flush stormwater basin with a minimum design capacity of 6 ML.
- In addition, an emergency catchment pond and two smaller emergency catchment dams (formerly sediment basins) will be created, with appropriate isolation gates, to assist in the management of any spills or firefighting water. The EPA supports these proposed upgrades to the clean and dirty water management at the premises and notes the recommendation in Appendix J to construct these dams/ponds prior to the commencement of earthworks associated with the site expansion proposal.
- Section 4.1.1 of Appendix J of the EIS states that key sources of pollution from the redevelopment of the premises are likely to come from the increase in roof and other impermeable surface areas; the storage of logs in the log yards, general handling and transport of woodchips and general traffic movements on site. The likely key pollutants were stated as being tannins (tannic acid), total suspended solids and total nitrogen and phosphorous. The EPA, noting that an additional two log yards will be operating as part of the expanded operations, expects that an increase in the roof area will not contribute to pollution from the premises and instead be a key contributor to on-site stormwater harvesting.);
- Section 6.0 of Appendix J of the EIS states that a stormwater harvesting and reuse scheme will be deployed at the premises utilising the existing water treatment plant however Section 15.3 of the EIS states that *'it is also recommended that the harvesting of stormwater be investigated'* which implies that the proposed 200 m³/day drawn from the various stormwater basins (as per section 5.1.2 of Appendix J) is not necessarily a certainty. The potential absence of surface water harvesting may negatively impact upon the volume and quality of water leaving the site via a licensed discharge point.

- Comment is made in Section 15.3 of the EIS of the need to review the 100% water quality limits on the licence for pollutants discharged from the premises citing natural environments that have higher total suspended solid concentrations in times of rainfall and which exceed the 50mg/L limit currently on the licence. The EPA considers that the comparisons are not valid given that Borg Panels is in full control of the surface water flow within the premises and the range of contaminants that make up total suspended solids discharging from the premises (predominantly wood particles of various sizing) are not likely to reflect a natural range of sediments in surface water flow. On this basis the EPA will not consider varying the Licence to replace the 100% limit with a 95% limit. Water quality limits should not be seen as a target, rather they are an upper range within which a licensee may operate. It is the EPA's expectation that licensees will do everything that is reasonable and feasible to achieve the best water quality outcomes possible at their premises.

Further information required from Borg Panels:

- Confirmation that stormwater harvesting will be deployed as part of the surface water management practices at the premises.

EPA's recommended conditions of project consent:

- Borg Panels must update (or prepare if such a plan is not available) the Water Management Plan for the premises which reflects the new site layout and operating plant. The plan must also include procedures for the inspection and maintenance of all surface water management structures (including emergency pollution control catchments).
- Surface water runoff from all log yards and wood chip processing areas must report through an appropriately designed and sized gross pollutant trap prior to discharging to the site surface water system.
- An application will need to be made to the EPA, should project consent be granted, to vary the Licence to relocate the site surface water discharge point to the new first flush basin.

Waste:

Comments:

- The Secretary Environmental Assessment Requirements (SEARs) required that the EIS provide details on the quantities and classification of all waste streams to be generated on site; details of waste storage, handling and disposal; and details on all waste streams to be brought on to the site for alternative fuel purposes. The EPA considers that little to no information has been provided on waste storage and handling on site and no details or commentary on waste streams to be used as alternative fuels.
- The EPA notes from Table 16 under Section 16.2 'Potential Impacts' (from waste) of the EIS that an additional 128,000 L of waste water will be generated per annum as a result of the operation of the wet electrostatic precipitator at the new particle board dryer plant (96,000 L per year) and a wet scrubber at the Conti 2 press line (32,000 L per year). There is no detailed discussion on how this water will be managed at the waste water treatment plant nor the plant's capacity to treat this waste water in addition to the load from the existing facility other than a brief sentence in Section 4.4.2 of Appendix J of the EIS ('Water Cycle Impact Assessment'). Section 4.4.1 of Appendix J appears to indicate that the treatment plant is for 'treating' water (through the reverse osmosis plant or otherwise) to be returned to the factory rather than treating waste water prior to discharge to trade waste or on-site storage.
- The EPA also notes in Section 14.2 of the EIS that there is the potential for hydrocarbon contamination in the soils around the former fuel depot and that no assessment has been undertaken to ascertain whether this is the case.

Further information required from Borg Panels:

- Details of expected volumes of waste material generated at the facility at any one time (including bark and waste board) and how and where this material will be stored.
- Confirmation from Borg Panels that the waste water treatment plant has the capacity to treat the additional volume of waste water produced as a result of the commissioning of the wet electrostatic precipitator and the wet scrubber.
- Confirmation from Borg Panels whether the resulting additional treated volume of waste water has been incorporated within the existing/proposed surface water storage system at the facility (i.e. in addition to the potential volumes of water stored in these same dams/ponds following surface water runoff and rainfall events).

EPA's recommended conditions of project consent:

- The current waste conditions described in Environment Protection Licence No. 3035 (conditions L3.1 and L6.1) for the Borg Panels Oberon facility are considered appropriate for the proposed expansion at the premises. Should consent be granted for the proposal Borg Panels will need to make an application to the EPA to vary the Licence should it seek to import waste wood material on to the site (used pallets, etc) for use as a raw material in the Particle Board plant.
- The EPA recommends that DPE conditions any project consent to include the need for Borg Panels to undertake an assessment of the contamination status of that part of the premises (former Lot 1, DP 1085563) that comprised the former fuel depot and to provide a statement as to the suitability of this portion of the premises for its intended use. Should the investigation not indicate the suitability of the site then appropriate remedial action must be undertaken prior to the construction of the dryer and flaker plant with a report detailing the works undertaken, including the results of any soil and/or groundwater validation sampling, provided to DPE and the EPA.

Air Quality:

Comments:

- The EPA has undertaken an assessment of the report titled '*Air Quality Impact Assessment – Proposed Particle Board Plant – Borg Manufacturing Pty Limited, Oberon (May 2016)*' (AQIA) prepared by Stephenson Environmental Management Australia and presented as Appendix F of the EIS. The EPA considers that the AQIA is incomplete and does not provide a thorough assessment of the impacts to the air environment from the proposed modification to the Borg Panels facility.
- The EPA therefore is currently not in a position to recommend any conditions of project consent on the basis that insufficient information has been provided in the Air Quality Impact Assessment in the EIS.

Further information required from Borg Panels:

- The EPA's assessment of the AQIA and additional information requirements are provided in **Attachment 2**.

Attachment 2: EPA Assessment of AQIA

Summary

The assessment of impacts to the air environment from the proposed modification to the Borg Panels facility is incomplete. Although incomplete, the air assessment predicts the proposal fails to meet the EPA's air quality impact criterion for formaldehyde.

The EPA recommends that the following additional details be provided:

1. Description of the existing and proposed processes. This is needed to characterise all emissions from the site.
2. Confirmation that all air quality regulatory obligations will be met.
3. The methodology used for the assessment.
4. Modification of the proposal to mitigate the exceedences predicted by the assessment.

Documents reviewed

- '*Borg Construction Pty Ltd Environment Impact Statement Timber Processing Facility (Particle Board)*', June 2016 – (EIS).
- Appendix F to the Environmental Impact Statement, '*Air Quality Impact Assessment Proposed Particle Board Plant Borg Manufacturing Pty Ltd Oberon NSW*' – (AQIA).

1. Process description

Section 6.1 of the EIS provides a general process description but is not detailed enough to demonstrate that all potential emissions to the air have been listed and characterised. Borg Panels proposes to modify their current MDF facility and build and operate a Particle Board (PB) facility.

The proposed modification to existing plant includes the construction of a new stack; the installation of a wet scrubber on the Conti-2 press line; and the diversion of emissions to provide thermal destruction of formaldehyde (95%) – namely the paper treater emissions are diverted to the Conti-2 heat plant and the Conti-1 roof vent emissions are diverted to the Conti-1 heat plant.

The change to the emissions from the heat plants following these diversions has not been stated. Furthermore, evidence has not been provided to establish the destruction efficiency of the heat plants for formaldehyde, and no detail has been provided regarding the thermal destruction process.

Modification of the MDF facility may result in it belonging to Group 6 (Schedule 4, *Protection of the Environment Operations (Clean Air) Regulation 2010* (POEO (Clean Air) Regulation)). If so, the POEO (Clean Air) Regulation specifies that thermal treatment of a principal toxic air pollutant in a Group 6 treatment plant requires that the emissions for treatment be held at a temperature of at least 980°C for at least 2 second (clauses 47-52).

The description of the proposed PB facility provided in section 6 of the EIS notes the use of hot oil and of hydraulic oil to provide the heat and pressure for the ContiRoll (area 7). It is not clear how the oil is to be heated, nor the energy source for generating hydraulic pressure.

Figure 4-3 (AQIA) provides a schematic of the proposed PB facility but with insufficient resolution to allow clear identification of the elements in the proposal.

Further detail is required to demonstrate that all potential emissions to air have been listed and characterised in order to define regulatory requirements, evaluate emissions, interpret assessment results, and evaluate whether proposed controls are appropriate.

The following further information and supporting data is required:

- Detailed process flow including any flow between the MDF plant and the PB plant.
- Flow balance for both plants.
- Mass balance calculation for both plants to support emissions estimates.
- Emission data for the current operations related to emission estimates for the modified plant.
- Evidence of the efficiency of thermal destruction of formaldehyde.
- The source of the energy for heat and pressure to the PB ContiRoll.
- Test reports and manufacturers performance guarantees.

2. Regulatory requirements

The AQIA does not provide a detailed discussion or assurance of compliance with regulatory obligations. The EPA advises that current regulation requires meeting limits set out in:

- the *Protection of the Environment (Clean Air) Regulation 2010*;
- all environment protection licences; and
- the associated '*Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*' (Approved Methods) ¹.

The POEO (Clean Air) Regulation requires that new and modified plant meets Group 6 limits. The current (unmodified) MDF plant is in Group 4. Further, emissions need to be sufficiently low in order to meet impact assessment criteria outside the plant boundary, and, as set out in the Approved Methods, principal air toxic pollutants must be reduced to the maximum extent practicable.

While emission test results were not provided in the EIS or AQIA, previous correspondence from Borg panels to the EPA shows that emissions from the Conti-1 heat plant exceeded licence limits for particulate matter in 2015 and on average for the previous four years.

The AQIA requires:

- a comparison of existing plant performance with existing licence limits (at standard conditions); and
- a demonstration that principal toxic air pollutants are controlled to the maximum extent achievable.

3. Air Quality Assessment Methods

Meteorology

The AQIA states that meteorology used in dispersion modelling was generated from running the MM5 model for the year 2014 and then processing the output using AERMET to generate appropriate data for AERMOD.

MM5 is a prognostic mesoscale model run from standard meteorology data. The AQIA does not set out its configuration. Neither domain size or grid resolution is stated. No justification is given for modelling 2014, and no comparison is made with observations to demonstrate its suitability.

¹ *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* is available at <http://www.epa.nsw.gov.au/resources/air/ammodelling05361.pdf>

No information is provided regarding the processing undertaken in AERMET. Further, there is no demonstration that the meteorological modelling provides representative meteorology. This can be established by comparing model output to observations not used in the modelling.

Further information is required setting out:-

- the configuration for MM5 – type of run, domain size and grid interval, time-step;
- the accuracy of MM5 for this domain;
- AERMET configuration – what method was used to process MM5 data and whether observations were included;
- justification for the choice of 2014 as a representative year – usually by considering at least five years of observed data, preferably contiguous and recent;
- demonstration that the modelled meteorology is representative by comparing it to observed meteorology; and
- an explanation of how the unexpectedly very low frequency of calm winds is representative of the meteorology controlling dispersion of plant emissions.

Emissions

The AQIA states that the pollutants of most potential concern from the proposal are particulate matter, nitrogen dioxide, and formaldehyde. Emission rates for these pollutants used in the dispersion modelling are set out tables 5-1 and 5-2 (modified MDF plant) and tables 7-1 and 7-2 (proposed particle board plant) in the AQIA.

Additional information is needed to support the emissions estimates:-

- a clear description of plant processes to ensure all potentially significant emissions have been captured;
- stack test reports showing current emissions and how modified emissions relate to them;
- demonstration that estimates are conservative, noting previous sampling results and explaining any improvements;
- emission points related to process description to demonstrate that all sources have been included and properly characterised;
- a clear documentation of all assumptions used to calculate emission rates; and
- manufacturer's performance specifications and guarantees.

NO₂ conversion

Conversion of NO to NO₂ has been done assuming a 40% conversion. This is not a method described in the Approved Methods. Alternative methods are permitted, but require robust justification. No such justification is provided.

Assessment requires either use of a listed method for estimating NO₂, or robust justification for the alternative method used.

Cumulative assessment (increment plus background)

The AQIA fails to present ambient data from which to establish baseline air quality and enable cumulative prediction of impacts. It also fails to consider other emissions sources in the region such as proximate premises emitting similar substances, and power stations.

Additional information is needed to provide a comprehensive estimate of impacts to the air environment as set out in section 5 of the Approved Methods. The impacts labelled "cumulative" in section 9 are the

assessed impacts for the full proposal – modified MDF plant and new PB plant. They do not estimate the cumulative impact to the airshed.

4. Predicted Impacts

The pollutants assessed in the AQIA are nitrogen dioxide (NO₂), particles, and formaldehyde (HCHO). Assessment of impacts are provided for the modified MDF plant alone, and for both the modified MDF plant and the proposed PB plant. Impacts from the full proposal are labelled “cumulative”. Ambient data have not been provided and there is no assessment of the total impact of the proposal.

Nitrogen dioxide

Maximum impact from the proposal within the model domain is a one-hour concentration of 225 µg/m³ and annual increment of 4 µg/m³. These are less than the project criteria of 246 µg/m³ and 62 µg/m³ respectively.

There are other sources of nitrogen dioxide in this locality, and the potential for emissions from this facility to combine with emissions from other industry near Oberon and the coal-fired power station to the north. There is potential for exceedence of the one-hour nitrogen dioxide criterion.

Assessment of the total impact of the proposal consistent with guidance in section 5 of the Approved Methods is needed to determine whether the existing and proposed plant may exceed the one-hour nitrogen dioxide criterion.

Particles

Maximum impact from the proposal within the model domain is set out in the table below.

	TSP (annual) (µg/m ³)	PM₁₀ (annual) (µg/m ³)	PM₁₀ (24-hour) (µg/m ³)
Impact assessment criterion	90	30	50
Maximum impact (proposal)	8	4	25

The maximum impacts are well below the impact assessment criteria, but there is no assessment of the total impact of the proposal and the predicted 24-hour increment is significant. Cumulative assessment is needed to assess whether emissions from the plant could exceed the PM₁₀ criteria.

Formaldehyde

Maximum impact from the proposal within the model domain is a one-hour concentration of 0.03mg/m³. This exceeds the impact assessment criterion of 0.02 mg/m³.

As set out in sections 2.4.4 and 7.7 of the Approved Methods, maximum impact greater than an impact assessment criterion requires further control or mitigation sufficient to meet the impact assessment criteria.

Formaldehyde is a principal air toxic pollutant and, as set out in the Approved Methods, requires control to the maximum extent achievable through the application of best practice process design and emission control.



Department of Primary Industries

OUT16/28123

Ms Pamela Morales
Industry Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Pamela.morales@planning.nsw.gov.au

Dear Ms Morales

Borg Panels Timber Processing Facility (SSD 7016) Comment on the Environmental Impact Statement

I refer to your email dated 8 June 2016 to the Department of Primary Industries in respect to the above matter. Comment has been sought from relevant divisions of DPI. Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

The Department reviewed the exhibited Environmental Impact Statement and provides the following comments and recommendations:

- Appendix J indicates a water supply demand from the proposed stormwater treatment pond of 200m³/day (73ML/yr). This report also refers to a proposed stormwater harvesting demand of 120ML/yr, the proponent should clarify the demand. The proponent should also provide details on the difference in the water demands between the existing and the proposed project and how this may alter the current demands from on-site and town water supplies.
- Section 15.3 indicates the proposed surface water harvesting and reuse scheme will result in a reduction of runoff leaving the site by approximately 133ML/yr. The proponent has requested a dispensation from requiring an access licence under the *Water Management Act 2000* to harvest the volumes generated from the impervious site. DPI Water advises that where a dam is constructed solely to manage runoff from potentially contaminated sites and is sized appropriately, an access licence is not required. The capture of rainwater from roof runoff in tanks also does not require an access licence. However clean runoff from upstream sources and/or within the project site that is captured in dams on minor watercourses would need to be considered in the proponents Maximum Harvestable Rights Dam Capacity (MHRDC) or by adequate entitlement held in a Water Access Licence. The proponent should confirm the source of the runoff for the proposed storages and identify how they are considered under water legislation. The proponent should undertake further consultation with DPI Water to confirm licensing requirements where water is captured from other sources.
- An additional 6ML stormwater treatment pond is proposed. This pond appears to be in close proximity to the existing watercourse, however the EIS indicates no works are proposed within 40m of a creek line. The proponent should clarify if this pond is outside of the 40m as no specific distance to the high bank of the watercourse has been provided. Works that are proposed within 40m of a watercourse need to be

carried out in accordance with DPI Water's Guidelines for Controlled Activities on Waterfront Land.

- Figure 10 of Appendix J indicates an existing v-notch weir on the watercourse at the downstream end of the site is proposed to be moved upstream. This work would be within 40m of the watercourse. The proponent should complete further assessment on the impacts of removing the existing site and the necessary mitigation measures, in addition to an impact assessment of installing the new work.
- Scenario modelling of the runoff from the site in Appendix J indicates 1) rural runoff from the project site would equate to 140.35ML/yr, 2) runoff from the developed site with harvesting would be 287.5ML/yr and 3) runoff from the developed site without harvesting would be 406.5ML/yr. This indicates the significant increase in runoff from impervious areas in comparison to rural land due to the project.
- The assessment of the proposed harvesting and reuse scheme indicates a reduction in runoff from the site by 133ML/yr due to implementing the proposed harvesting option. This is despite an increase in runoff of 39ML/yr from the additional impervious area (10.5 hectares of roof area). The proponent should complete an assessment of the impact on existing downstream water users due to this reduction.

Should you require further information please contact Tim Baker, Senior Water Regulation Officer on (02) 68417403, Tim.Baker@dpi.nsw.gov.au.

Yours sincerely



Graeme White
A/Director, Planning Policy & Assessment Advice
27 July 2016

Laurie McMahon
President Oberon & District Museum,
Postal Address:

Ct 62 Scotia Ave
Oberon 2787 N.S.W.



Oberon District Museum — Society Inc.

19th July 2016.

Dept. of Planning and Environment,
G.P.O. Box 39,
Sydney 2001.



Dear Sir/Madam,

Re Borg Construction Pty Ltd at Oberon (SSD 7016).

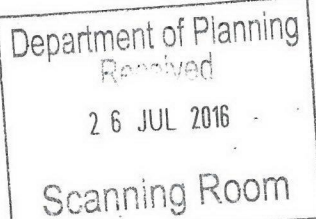
The Oberon & District Museum find Borg Construction P/L of Oberon, an extremely valued asset to Oberon and surrounding areas, an excellent community partner, well managed and show pride in their business activities.

Oberon & District Museum must not be confused with Oberon Tarana Heritage Railway (O.T.H.R.).

Oberon & District Museum wishes Borg Construction Pty. Ltd. every success in their planned extensions in Oberon.

Yours sincerely,
L. E. McMahon.

L.E. McMahon
President O.D.M.S.



Response to Environmental Impact Statement

in respect of

**Application SSD 15_7016: Proposed Timber Processing Facility
Expansion by Borg Constructions Pty Ltd**

Submission by

CARTER HOLT HARVEY AUSTRALIA PTY LIMITED

and

HIGHLAND PINE PRODUCTS PTY LIMITED



1. BACKGROUND

Carter Holt Harvey Australia Pty Limited (**CHH**) is a member of the Carter Holt Harvey group of companies, which is the largest supplier of wood-based building products, including timber, plywood and laminated veneer lumber, in Australia and New Zealand. One of the manufacturing facilities operated by the Carter Holt Harvey group is a particleboard flooring facility at the Oberon Timber Complex in Oberon, NSW, adjacent to the existing Borg medium-density fireboard (**MDF**) facility and the site of the proposed expanded facility.

Highland Pine Products Pty Limited (**HPP**) operates a timber processing facility at the Oberon Timber Complex in Oberon, NSW, adjacent to the existing Borg MDF facility and the site of the proposed expanded facility. HPP is a joint venture between Carter Holt Harvey and Boral Limited.

CHH and HPP have reviewed the Environmental Impact Statement (**EIS**) prepared by Borg Constructions Pty Ltd (**Borg**) in relation to the proposed Timber Processing Facility Expansion by Borg (**Proposed Development**). CHH and HPP have serious concerns that the EIS fails to meet the requirements of the Secretary's Environmental Assessment Requirements (**SEAR**), in that it:

- does not adequately assess the cumulative impact of the existing environment at the Oberon Timber Complex;
- provides inadequate information on major environmental and planning risks (including information that is incorrect or based on deficient methodology);
- undermines the compliance objectives of the original development approval (DA 27/95); and
- shows that construction on the Proposed Development will interfere with the proprietary rights created by existing Easement (AA) on DP 1200697.

These concerns are set out in further detail below.

2. EXECUTIVE SUMMARY

The EIS fails to provide an assessment of the cumulative environmental impact of all four manufacturing facilities at the Oberon Timber Complex operating at full capacity as permitted under their respective consent conditions. Accordingly, the EIS does not provide a robust baseline from which the cumulative impact of the Proposed Development can be properly measured.

In addition, the EIS does not adequately consider the environmental and operational impact of the Proposed Development on the broader Oberon Timber Complex and surrounding area, particularly in respect of the following key risks:

- ❑ **Formaldehyde emissions:** The formaldehyde emission modelling in the EIS fails to consider emissions from the Woodchem MHF Major Hazard Facility (**Woodchem MHF**), owned and operated by the Borg group of companies. This is so despite Woodchem MHF being the largest manufacturer in NSW of formaldehyde-based resins and the second-largest in Australia. This is concerning as the EIS formaldehyde emission modelling, even without consideration of Woodchem MHF, shows that the Proposed Development will exceed the ground level concentration limits for formaldehyde by 50% in certain areas of Oberon.

In addition, the Proposed Development is for the manufacture of 500,000m³ of particleboard per annum by Borg; this translates into approximately 35,000 tonnes per annum of additional formaldehyde-based resin being produced by Woodchem MHF at the Oberon Timber Complex to meet the demand of the new particleboard line. The EIS fails to consider the impact of this increased production.

- ❑ **Air quality:** The EIS does not include a robust baseline for assessing impact on air quality, particularly with regard to formaldehyde, fine particulates (PM10) and nitrous oxide (NOx)

emissions. Three of the four facilities at the Oberon Timber Complex manufacture or utilise formaldehyde, and all facilities generate combustion by-products. The EIS fails to adequately consider changes to ground level concentration of pollutants of concern. It also fails to use a baseline derived from the emission limits in the licence for each operating facility, as well as any background levels.

- **Noise:** The testing methodology set out in the EIS is inadequate and the sample size used is too small to be accurate or meaningful. Further, the cumulative impact assessment is inadequate, in that it does not consider the cumulative impact of all sites operating at full capacity.

The EIS sets out relatively random baseline measurements of noise levels. It fails to provide information on whether those measurements represent typical operating conditions, or whether any of the existing operations at the Oberon Timber Complex are below capacity or within their licence limits. A robust baseline should be measured or derived, and cumulative impact assessment made against it.

- **Traffic:** The EIS fails to provide evidence that the traffic study undertaken represents the conditions that would occur when all operations are operating at permitted capacity. Equally, the data that was provided was based on relatively few traffic counts, which undermines its credibility. The traffic study has also failed to consider current usage by other businesses along the adjacent Lowes Mount Road. Legal access to Lot 11 DP 1017456, Lot 1 DP 360361 and Lot 1 DP 128404 (all within 150m of Borg's Gate 4 entrance) has not been assessed and the traffic report fails to discuss the need for turning lanes (in both directions) to access Gate 4, suggesting by implication that the impact would be negligible. Given the current road profile (single lanes both ways), the existing railway level crossing (100m from Borg's Gate 4) and existing rights of use for adjacent industry, the traffic study fails to provide an adequate assessment of impacts to road users along Lowes Mount Road.

- **Water:** The EIS modelling relies on the assumption that the Proposed Development will receive exemption from application of the *Water Management Act 2000*. There is no guarantee that this exemption will be granted. In the event that the storm water harvesting and reuse scheme is not approved or fails operationally, the EIS fails to provide information on the impact on Oberon's potable water supply and subsequent water use impact on other Oberon Timber Complex members, including CHH and HPP.

The EIS also fails to provide an assessment of the environmental impact of the use of bore water by the Proposed Development.

- **Soil:** The Proposed Development site has been the subject of significant contamination issues in the past, resulting in two Site Audit Statements (Nos. 214 & GN243B). Some contaminated material is buried on the site and may be disturbed by the Proposed Development. The EIS fails to discuss how contamination risk will be managed.

Further, the EIS has not given consideration to the mobilisation of any contamination found across the site and the management, control, testing and disposal of soil during the construction phase of the project.

In addition to the above concerns, the EIS undermines the compliance objectives of DA 27/95 in that it seeks to have DA 27/95 set aside, but does not provide any detail on the content of the proposed replacement consent, nor the extent to which the existing conditions of DA 27/95 will be retained. This move may substantially affect the rights and obligations of neighbouring landowners. Given Borg's environmental compliance history (which includes five penalty notices in the past four years and a prosecution in June 2016), CHH and HPP seek reassurance that the existing conditions of DA 27/95 be retained in any new consent. The Proposed Development also purports to interfere with Easement (AA) on Lot 26 DP 1200697, which is protected by law as a proprietary right of adjoining lot owners.

3. FAILURE TO ASSESS CUMULATIVE IMPACT OF THE EXISTING ENVIRONMENT

CHH and HPP have serious concerns that the EIS does not adequately assess the cumulative impact of the existing environment at the Oberon Timber Complex.

The SEAR specifically requires the EIS to set out 'likely interactions between the proposed development, the existing operation and other neighbouring developments' (at page 1) and address cumulative impact issues including 'the existing on-site operations, all existing industrial facilities in the area and other nearby approved and proposed developments, particularly in relation to noise, air quality, soil, water, traffic, waste and hazards and risk' (at page 4).

The Oberon Timber Complex comprises four major manufacturing facilities:

- Borg MDF facility (MDF production);
- Woodchem MHF (resin production);
- Carter Holt Harvey Pinepanels facility (particleboard flooring production); and
- Highland Pine Products facility (sawn and kiln dried timber production).

Woodchem MHF is the second largest producer of formaldehyde-based resins in Australia and the largest producer in NSW. It is the only Major Hazard Facility in regional NSW. Woodchem MHF is a member of the Borg group of companies.

All four facilities at the Oberon Timber Complex generate some form of environmental impact (either actual or permitted). Any new development must be assessed not as a standalone operation, but in the context of a cumulative impact assessment. To achieve this, it is necessary to determine a baseline which represents the total impacts of all existing approved development at the Oberon Timber Complex, and then to assess the additional impacts caused by the Proposed Development.

The EIS fails to provide an assessment of the cumulative environmental impact of all four manufacturing facilities at the Oberon Timber Complex operating at full capacity as permitted under their respective consent conditions. Accordingly, the EIS does not provide a robust baseline from which the cumulative impact of the Proposed Development can be properly measured.

4. INADEQUATE INFORMATION ON MAJOR ENVIRONMENTAL AND PLANNING RISKS

The EIS provides inadequate information on major environmental and planning risks relevant to the Proposed Development. In some cases, the information that has been provided is incorrect or based on deficient methodology. Further details are set out in the table below.

1.6 & Figure 3 Project Map

A review of current Google Earth imagery suggests that some of the Proposed Development works may have already commenced. The Proposed Hardstand (item 31 in Figure 3, page 20), Emergency Basin (item 32 in Figure 3, page 20) and First Flush Basin (item 33 in Figure 3, page 20), all of which are listed as 'Proposed Infrastructure' in the EIS, are all at various stages of development.

The EIS (page 10) notes that the nearest sensitive receptor is approximately 600m from the boundary of the Proposed Development. Receptors are located 400m to the north; 450m to the east; and the local high school is 420m to the south of the site boundary.

4.2 Project Need

Borg currently uses approximately 200,000m³ of particleboard per annum for its manufacturing operations, of which CHH supplies approximately 80% from its Australian sites. The EIS states that Borg currently sources its particleboard needs from 'a mix of off-shore and inter-state suppliers'. This is incorrect. Carter Holt Harvey's particleboard facility in Tumut, NSW supplies Borg with approximately 64,000m³ of particleboard per annum. This volume comprises approximately 30% of Borg's total particleboard needs.

5.1.3 Preferred Option

The EIS states that Borg is currently operating in accordance with both DA 27/95 and its Environmental Protection Licence (EPL 3035). This is incorrect. Borg has been the subject of five penalty notices (each resulting in a fine) under the *Protection Of the Environment Operations Act 1997* for various non-compliances during the past four years.

In addition, in June 2016, Borg was prosecuted in the Land and Environment Court for breach of Environmental Protection Licence EPL 3035. Borg was ordered to pay fines and costs in excess of \$130,000 and also issue a written public apology.

6.0 Project Description

As source material, the EIS refers to using 'external urban waste supplies', 'chipped waste products', 'broken pallet material', 'urban waste material' (page 35) and 'strange material' (page 36). Critical information is missing as follows:

- The EIS should set out fully what these materials are and their constituent parts. Without this information, the impact on air emissions from processing this material is unknown. For example, the waste material could be chemically treated timber;
- The quantity of throughput is insufficiently detailed, only stating that an additional 500,000m³ of particle board will be produced. These numbers will be key drivers of some environmental impacts (notably heavy vehicle traffic, air emissions, noise and water quality) and should be substantiated;
- A mass balance, indicating all inputs and outputs from the site is required to support the claims made in the EIS regarding traffic, emission, usage and benefits to the region; and
- Given that there are fibre supply constraints in the region, and because Borg is proposing to use recycled timber as a processing input, a detailed assessment of proposed supply mix is required in order to sufficiently measure the impacts outlined in the EIS.

11.0 Air Quality

The emission points in the EIS do not match those on the accompanying plans. It appears that several emission points have been omitted from the air quality study without explanation (e.g. stacks in the New Press Building, new thermal oil boiler and new bag houses, including those on new treatment lines internal to existing buildings). These omissions require further explanation.

We note that the study uses an assumption that Oxides of Nitrogen (NO_x) is multiplied by 40% to provide Nitrous Oxide (NO₂) concentrations. This number is conservative, as stated in the report, for the one-hour averaging period. CHH and HPP understand that the Approved Methods typically assume that all NO_x is converted to NO₂ or use the ozone limiting method and seeks to understand why this method was not applied in this case.

For cumulative emission scenario, the study has considered the existing site plus the proposed expansion. TSP, PM₁₀ and NO₂ are present in the atmosphere at background levels without the existing or proposed expansion as these are generated both naturally and also as a result of human activity.

Measurements in 2014 at Bathurst indicate maximum 24 hour and annual mean PM₁₀ concentrations of 37.6 µg/m³ and 21.2 µg/m³. When these indicative background concentrations are added to the modelled cumulative impact, this indicates a potential to exceed the 24 hour standard in all reported locations, and levels close to criterion for the annual mean.

For NO₂ the closest monitoring location is Oakdale, which is within the Sydney basin and is likely to be a conservative indication of background NO₂. Maximum and annual mean concentrations measured there in 2014 were 53.4 µg/m and 4.1 µg/m.

If similar background levels occurred in Oberon it would indicate a possibility of

exceedance of the one hour NO₂ concentration in the maximum off-site location.

The above results exclude the existence of other facilities at the Oberon Timber Complex which undertake similar activities.

CHH and HPP seek clarity on why background levels have not been considered in the EIS modelling and further, given that the SEAR required that cumulative impacts of other facilities be assessed, why these have not been added to any impact assessments.

Other operations in close proximity to the site include Highland Pine Products, Carter Holt Harvey, Woodchem MHF and Australian Native Landscapes. Emissions from these industries must be included in a detailed cumulative assessment as discussed above.

If their emissions are similar to those from Borg, and the usual background levels of PM₁₀ and NO₂ as listed above are present, it is likely that ambient air quality for all modelled parameters would be above acceptable criteria and this could have significant implications for all operators within the OTC.

The following issues identified in the EIS require further investigation:

- A risk assessment of the use of 'urban waste' (page 35) as substrate, including a full lifecycle assessment considering potential impacts from emissions and also wind born emissions from ash residues;
- The risks associated with other potential pollutants, such as dioxins, furans, heavy metals and other potential carcinogenic emissions, given Borg's proposed use of 'urban waste' and other non-standard fuels, and what measures Borg will put in place to control the potential impact;
- Why the Proposed Development has not considered the use of a Reverse Catalytic Oxidiser or equivalent technology to reduce the impacts of formaldehyde and Volatile Organic Compounds (VOC). Wet Electrostatic Precipitator (WESP) technology, as proposed in the EIS, is ineffective in dealing with these type of emissions;
- Impacts from the 8MW gas fired heat plant (installed as part of the new press line) have not been adequately discussed in the EIS;
- Justification for the claimed 95% reduction in formaldehyde emissions through the diversion of roof vent emissions to the existing site wood fired heat plants. The heat plants do not have any emissions control technology on their stacks. The claim for destruction of 95% of formaldehyde has no supporting documentary evidence and remains unsubstantiated;
- Confirmation of whether all new emission points will comply with Group 6 emission standards as required under the *Protection of the Environment (Clean Air) Regulation 2010* for industry in NSW;
- Confirmation of whether any altered emission point on the existing Borg facility will meet Group 6 emission standards, given that new plant at the Proposed Development will be vented via existing emission points. Existing heat plants at the Borg Facility are currently Group 4 emission standards, and one plant is unable to comply with this standard (as noted in the latest available Borg Panels Annual Return submitted to the EPA);
- Cumulative impacts generated by adjacent operations at the Oberon Timber Complex as discussed in paragraph 3 above and as required by the SEARs, including:
 - Emissions from the adjacent Borg-owned Woodchem MHF formaldehyde resin manufacturing facility (including fugitive emissions from vents and pipes/tanks), given that the site must increase throughput or alter production in order to supply the proposed new

	development; - Fugitive emission discharge from the existing site waste water treatment plant including future potential impacts, given additional waste water generation and potentially a change in influent quality; - Existing fugitive emissions from stockpiles and other areas such as start-up cyclones, fibre dumps, onsite wood chipping operations and onsite board shredding operations; and - The impact that additional truck movements – which are above the maximum limits already approved for adjacent facilities – will have on pollutant load in the airshed; ▪ The Proposed Development's use of 'urban waste' for substrate may result in frequent reject of resinated fibre immediately prior to the press. Air emissions (including formaldehyde emissions) associated with this process do not appear to have been taken into account in any air modelling set out in the EIS; and ▪ An explanation of why the existing heat plants have <u>not</u> been considered as waste incinerators to be regulated under Group 6 (waste incineration limits), given that resinated urban and other wood waste, treatment plant sludge and resinated waste from existing and new processes (including from other Borg facilities) may be consumed as fuel.
11.0 Formaldehyde	Given the presence of pollutants of concern such as formaldehyde (classified by the World Health Organisation as a Group 1 carcinogen), it would be prudent to undertake a Human Health Risk Assessment based on the cumulative impact assessment as part of the EIS. This has not been done. Given that the airshed is impacted by all industry, best practice measures require that any new development must look to reduce impacts on amenity. Should the cumulative impact of industry increase as a result of the development, there is a risk to all existing businesses within the airshed. The EIS should explore this issue in greater detail.
12.0 Hazard and Risk	The EIS does not include consideration of Borg's own Woodchem MHF, which is a manufacturer of formaldehyde and a designated Major Hazard Facility. Construction of the Proposed Development will occur in close proximity to the Woodchem MHF facilities, and the proposal includes further storage of dangerous goods. No cumulative impact assessment on these risks has been provided. This issue should be considered in both a Plant Hazard Analysis and also in the EIS, given that the location of Woodchem MHF is within the Proposed Development site. It is noted in the specialist Hazard and Risk Report (EIS Appendix G) that there is a need to revise the Woodchem MHF safety report before it can be considered to be a fully separate operation and site. This should have occurred prior to the submission of the EIS.
13.0 Noise & Vibration	The EIS is deficient in two key respects. First, the testing methodology is inadequate and the sample size used is too small to be accurate or meaningful. Second, the cumulative impact assessment is inadequate, in that it does not consider the cumulative impact of all sites operating at full capacity. Specifically: ▪ The testing methodology described in paragraph 2.3 of Appendix H comprised three noise measurements of 15 minutes each, taken on one day (14 October 2015) between 10pm and 10:45pm. This is grossly unreliable as an indicator of noise levels at the site and does not consider seasonal or operational factors that may have affected the results; ▪ As noted earlier, the EIS fails to derive a full baseline which is based on all

other sites operating at capacity, and therefore fails to provide an accurate cumulative impact assessment with regard to noise;

- Any noise assessment should also consider tonal and impulsive noise impacts and include vendor supplied noise generation data, not best guess estimates as noted in the EIS-supplied noise monitoring report;
- The Noise Impact Assessment (contained at Appendix H to the EIS) claims that no manufacturer data is available for noise modelling. CHH and HPP reject this claim. All reputable manufacturers have noise emission information available which can be used for modelling in this context. Without this information, the noise impact assessment in the EIS has little value;
- The noise assessment is based on the site meeting its EPL criteria and not the noise criteria as set out in the current site DA 27/95 (which Borg seeks to have withdrawn as part of this DA approval). Therefore there is no real assessment of the cumulative impacts of the Proposed Development, and other surrounding operations at the receptor locations;
- Given that noise is a common source of complaint in the township, we note with concern that the results of the modelling predict that current EPL licence limits will be exceeded under certain conditions. We also note that the results considerably exceed the conditions of DA 27/95. The EIS does not suggest how compliance can be achieved without having to rely on administrative controls (which can be easily overridden);
- The impact traffic movement (noted in the EIS supplied noise assessment as a 2dB increase) has not been assessed considering the cumulative effect of existing operations (at full approved capacity). The EIS fails to provide evidence that the traffic study undertaken represents the conditions that would occur when all operations are operating at permitted capacity. Equally, the data that was provided was based on relatively few traffic counts, which undermines its reliability; and
- There has been no detailed assessment of potential vibration impacts on adjacent industrial facilities for the proposal including vibration from chippers, log debarking, vehicle movement and new press operations, including potential impacts on the adjacent (Borg owned) Woodchem MHF.

Given that the EIS acknowledges the level of noise generated with the use of a mobile chipper on-site, CHH and HPP suggest that conditions should be applied to the consent and EPL requiring:

- Mobile chipping only at daytime (7AM-5PM) Mon-Fri; and
- No mobile chipping during enhanced wind conditions (any direction).

14.0 Soil

The Proposed Development site has been the subject of significant contamination issues in the past, resulting in two Site Audit Statements (Nos. 214 & GN243B). Some contaminated material is buried on the site and may be disturbed by the Proposed Development.

The EIS has not given consideration to the mobilisation of any contamination found across the site and the management, control, testing and disposal of spoil during the construction phase of the project.

Historical underground storage tanks (USTs) on the existing Borg MDF site are located in an area which would place them under the proposed particleboard production hall. CHH and HPP can find no reference to the USTs in the EIS and it is not clear whether Borg has removed them. If not, CHH and HPP seek to confirm whether there are any remedial or management procedures proposed to prevent any future impact on surface water, groundwater or soil (including the validation and remediation of any spoil prior to its relocation as fill for other areas).

In addition CHH and HPP are aware of a number of redundant USTs on Lot 1 of DP 1085563 (formerly used as a fuel depot). This would place them under the

new flake dryer which is to be constructed as part of the Proposed Development. Once again the EIS does not make mention of any proposed remedial action in relation to these USTs, or any future impact on surface water, groundwater or soil (including the validation and remediation of any spoil prior to its relocation as fill for other areas).

CHH and HPP note that Borg plans to construct two large water storage ponds and a considerable area of hard stand on Lot 1 of DP 1076346. This lot was made subject to an EPA *Declaration of Significantly Contaminated Land* (No. 20091105) in October 2009. The Declaration states:

This Declaration applies to the section of King's Stockyard Creek found to be impacted with aldrin and dihedron, located wholly within the boundary of Lot 1 in DP 1076346 in the local government area of Oberon. The Declaration also applies to the drainage line that runs from the eastern site boundary to King's Stockyard Creek.

CHH and HPP understand that the previous owner of the land undertook remediation of the site during the last five years and that the remediation is the subject of Site Audit Statement 214 (**SAS214**).

SAS214 details remediation work carried out by the former landowner, including the location of Borrow pits 1 and 2 (containment cells). These contain contaminated spoil relocated from drainage lines with organo chlorine pesticides (**OCP**) in the 2-10mg/kg range. The proposed development details the installation of surface water storage dams adjacent to, or directly on, Borrow pit 1. There is no explanation in the EIS (or its supporting documentation) of how this risk will be managed, or what validation method will be used to manage human health impacts.

SAS214 also notes the relocation of low level contaminants on the site to area of low impact i.e. away from drainage lines although the contamination remains on Lot 1 DP1076346.

The EIS contains no reference to this remediation, any risks associated with the mobilisation of residual contaminants in the soil, or SAS214 itself. Similarly, the EIS does not confirm whether the proposed earthworks (constructing two water storage basins (14,000m³) and the construction of 12,000m² of hard stand) have been designed in conformance with any recommendations made by the Site Auditor. If not, it is unclear how Borg is intending to prevent contamination of Kings Stockyard Creek and the Fish River with OCP during the construction and operational phases.

CHH and HPP note that the proposed development of a 14,000m² hardstand on Lot 24 of DP 1148073 covers an area that was historically used for storage of a significant volume of potentially contaminated material. There is no evidence in the EIS to suggest remediation and validation of potentially historical contamination has taken place.

15.0 Water

The EIS is deficient in three key respects. First, it has assumed exemption from the *Water Management Act* will be granted. Second, it fails to properly consider the potential impact on groundwater in the Oberon region. Third, its calculations contain a fundamental error. Specifically:

- The EIS does not provide a proper basis for its assumption that the Proposed Development will be granted exemption from the Water Management Act, nor does it properly assess the risks of such exemption being withdrawn or the failure of storm water harvesting processes. In the event that water levels in the dam supplying the Oberon township fall below 10%, and the project cannot harvest as described in the EIS, the potential impact on water supply to existing industry is significant. This potential consequence is ignored in the EIS;

- There is no mention of licence requirements for the new dams, nor the Maximum Harvestable Right Dam Capacity (**MHRDC**) for the site;
- Neither the EIS nor the Water Cycle Assessment Report (**WCAR**) provides a full explanation of the following issues with respect to the impact of harvesting on the catchment:
 - Impacts on downstream users;
 - Biota impact assessment in Kings Stockyard creek;
 - Alternatives if extraction rates are not acceptable considering existing use rights of other industry;
 - An assessment of the current allowable extraction rate of existing groundwater (via the spring dam) including impacts of extraction from the Woodchem MHF bore on Borg owned land;
 - An assessment of historical extraction and its impacts on the perched and deep aquifer utilised by upstream users under licence;
 - Information on what measures and controls will be implemented if extraction is not allowed;
 - Supporting information regarding grounds under which the EIS recommendation that the project be granted dispensation under the Water Management Act;
 - An assessment of water quality considering worse case inflows managed under a commercial agreement with upstream contributors to the storm water system; and
 - Consideration of existing easements and commercial agreements with upstream contributors to the storm water system given the EIS proposes to alter water flow across the catchment;
- The EIS does not provide proper assessment of the impacts of the Proposed Development on groundwater given that:
 - the perched aquifer is within 1 metre of storm water drainage network infrastructure at the adjacent industrial facility;
 - changes to groundwater flows could impact on existing containment cells of contaminated spoil upgradient of the Proposed Development site; and
 - the Proposed Development engaged Sustainability Workshop to complete a WCAR. It should be noted that Table 13 (p.91) is incorrect by three orders of magnitude (i.e., 1000X) for the discharge of aldrin and dieldrin. The EPL (3035) has a 0.3µg/L (not mg/L) limit on aldrin and dieldrin. This error has the potential to significantly distort the water impact assessment.

16.0 Waste

The EIS refers to 'burning of gas products on site' as a 'key aspect of the Project' (EIS 16.3 p 96) but there is limited detail regarding this in Chapter 6 of the EIS. EIS 16.2 Table 16 indicates that the existing wood fired heat plants on site are to be used in the role of waste incinerators. CHH and HPP is aware that these heat plants have little or no emissions control equipment currently fitted to them.

Only a minor assessment of waste impacts has been provided and the assessment of waste has not fully considered:

- the impact of burning treatment plant sludge given the potential additional

**17.3
Management
and
Mitigation
Measures
and Drawing
271 Press
Building (sht
2)**

pollutant load contemplated in the development;

- the impact of burning the WESP sludge;
- the impact of burning scrubber sludge on the air shed;
- as mentioned above, given the amount of product burnt, supporting information as to why the existing heat plants should not be considered as waste incinerators and be required to meet tighter emission standards as noted in the Protection of the Environment (Clean Air) Regulation 2010;
- the impact of ash going to local council landfill given the burning of urban waste; or
- the impact on human health given the potential accumulation of contaminants in the ash should they become fugitive emissions.

The Proposed Development includes an 8MW thermal oil heat plant; however, the EIS contains no information on its specifications, risks or impact on the Proposed Development's emission profile.

5. THE EXISTING DEVELOPMENT APPROVAL CONDITIONS - DA 27/95

Borg has stated that it is seeking to set aside the existing development approval DA 27/95 with respect to all land owned by Borg Panels Pty Limited, including the Proposed Development site. The EIS does not adequately explain how the existing development conditions in DA 27/95 will apply to the Proposed Development land, nor how the new DA will affect the rights and obligations of neighbouring landowners, including CHH and HPP. Given that DA 27/95 affects the operations of neighbouring landowners, CHH and HPP require assurances that the existing development conditions contained in DA 27/95 will be assumed by the new lots once consolidated.

6. EASEMENT (AA) TO DRAIN WATER (ITEM 1 OF LOT 26 DP 1200697)

Lot 26 DP 1200697 is burdened by registered Easement to Drain Water 5 Wide 10 Wide & Variable Width (AA) (shown as item 1 on DP 1200697) (**Easement**). The Easement is a proprietary right in favour of neighbouring Lot 86 DP 574012, Lot 10 DP 1017456 (both HPP facility land) and Lot 11 DP 1017456 (on which a CHH facility is situated).

The Easement infrastructure allows the benefited lots the opportunity to contain any form of surface water pollution if required. The changes mooted in the EIS have the effect of removing this infrastructure to a large extent. The EIS provides no information on how any surface water pollution from the benefited lots would otherwise be contained and managed.

By law, the Easement cannot be interfered with, modified or extinguished without the consent of the registered proprietors of the benefiting lots. As at the date of this submission, no registered proprietor has received a request for consent from Borg in relation to its proposed interference with the Easement.

7. CONCLUSION

The EIS fails to meet the requirements of the SEAR in four key respects. First, it does not provide a comprehensive cumulative impact assessment which takes into account the existing environment and other land users at the Oberon Timber Complex. Second, the assessment which the EIS does provide contains inadequate information on major environmental and planning risks and includes information that is incorrect or based on deficient methodology. Third, Borg's proposal to remove the existing development consent DA 27/95 risks undermining the compliance objectives of the original development approval and may adversely affect the rights and obligations of neighbouring landowners. Fourth, the Proposed Development purports to interfere with Easement (AA) on Lot 26 DP 1200697, which is protected by law as a proprietary right of the registered proprietors of Lot 86 DP 574012, Lot 10 DP 1017456 and Lot 11 DP 1017456.

CHH and HPP support economic development of the Oberon region and of the Australian timber industry. However, such development must be sustainable and in accordance with environmental management best practice. The EIS as currently drafted does not achieve this. CHH and HPP have set out its concerns and, where appropriate, further measures and information required to carry out a comprehensive risk assessment which meets the requirements of the SEAR.

CHH and HPP trust that the detail provided in this response sets out its concerns with sufficient clarity. However, CHH and HPP welcome the opportunity to discuss these issues further. Please contact David Toyne on 0447 015 991 or david.toyne@chhbuildingsupplies.com to arrange.

Submitted by

A handwritten signature in black ink, appearing to be 'DT', written over a horizontal line.

David Toyne

on behalf of

Carter Holt Harvey Australia Pty Limited

Highland Pine Products Pty Limited

27 July 2016

SUBMISSION

DEPARTMENT OF PLANNING AND ENVIRONMENT

BORG PANELS “TIMBER PROCESSING FACILITY EXPANSION”

**Author: Robert and Sally Parrington
JENOLAN CARAVAN PARK
7 Cunynghame Street
OBERON NSW 2787
Telephone: 02 6336 0344**

Thank you for the opportunity to provide a submission regarding Borg Panels Timber Processing Facility Expansion.

By way of introduction, we, Robert and Sally Parrington, purchased the lease on the Jenolan Caravan Park in March 2012. The Park cabins were immediately increased from 8 to 10 and numerous other improvements were carried out at the Park. Another two cabins were purchased at the end of 2014 and business has increased very nicely.

The caravan parks northern boundary is approximately 440 metres from the southern boundary of the Borg complex. By our measurement, the Borg complex is approximately 850 metres from the town centre.

We are supportive of the industry in Oberon as Oberon would not be the fantastic town that it is without the mills employing so many Oberon residents and the supporting businesses such as trucking and engineering. However our concerns are:

- Smoke
- Smell/s
- Noise

Smoke

Smoke can be hard to determine from where it is coming. It seems in the main part to come from the area of the other parts of the timber complex, not Borgs. However, we make mention of it here as smoke comes over the caravan park often on a Sunday, and also on other days of the week. It is a 'blue' smoke.

Smell

It is even harder to detect the direction of smells than it is for smoke. An unpleasant smell is not as frequent as the smoke (or the noise) but can be extremely unpleasant and very hard to describe when it does occur. We have considered other businesses in the area e.g. the relatively new bitumen plant but when we situated ourselves outside their business we could not smell any bad smells. Again it is mentioned here because it has been a problem and finding the source seems to be a big problem.

Noise

In 2011, when we had the opportunity to manage the caravan park for the previous owners before purchase, the synonym used by both people operating the Park and guests in the Park when describing the noise was "like waves on the seashore". During February/March 2011, a six week period, the Mill (complex) was quiet and the sound was not an unpleasant background noise. After purchasing the caravan park we believe the noise has steadily grown in volume and this could probably be measured against improved sales in the Borg business.

In May 2013 we started attending the Community Consultative Meetings held generally at a meeting room within the timber complex and with other interested parties such as Oberon Council General Manager, the Council Mayor and the owners of neighbouring properties to the complex. We first started going to these meetings when the noise from the mill/s started increasing in volume. Our main concerns were when there were loud noises through the night and our guests were being woken with a

jolt and then (in some cases) not able to go back to sleep. Our Park is a holiday park and most of our guests are tourists whether they are visiting the local attractions or catching up with family and friends but essentially they are on holiday and not expecting to hear loud bangs/clanging through the night or hearing a chipper start up at 7.00am to disturb their holiday rest. We also have sub-contractors staying whilst working in the area.

Some of the negative reviews received:

Trip Advisor:

“Won't be back!” Reviewed 25 April 2014 via mobile

We camped here over the Easter break but wouldn't come back here again:

1. For a country caravan park too noisy some factory out the back making noise 24/7.
2. No individual fire places only one big communal one.
3. The owners are noseey and looking out for anyone doing the slightest thing wrong.

Otherwise the park is clean and well maintained.

Stayed April 2014

JenolanCP, Manager at Jenolan Caravan Park, responded to this review, 17 May 2014

Hello NoName0102 Thank you for taking the time to review our Park. We have been in touch with the factory regarding the noise and your comment. Unfortunately the company were unable to pinpoint the source of the noise at that time, but will be completing a noise study in the next month and we hope this will bring to light any noise over and above any scheduled limits. The factory does a wonderful job keeping our local people employed and Oberon has one of the lowest unemployment rates in NSW. Your other points have been noted.

“Relaxing with central location” Reviewed 18 March 2015

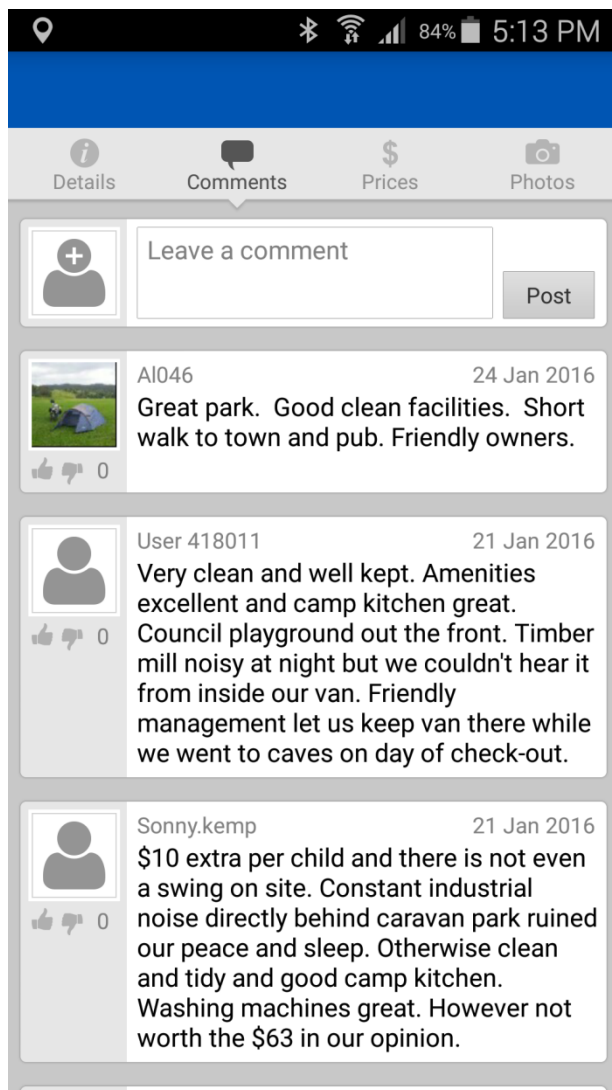
Spent 2 nights at the caravan park (in our 4 man tent). Found the place very neat, well tended with very modern and clean amenities. All guests of the caravan park have access to the communal kitchen which has a microwave, stove, bbq, crockery, cutlery, pots.. and anything else you might find in your own kitchen. The ablutions were neat as a pin and kept clean at all times. No guests at the park need walk more than 1-2 minutes to get to either the kitchen or the ablutions. The only detraction we found was the industrial plant neighbouring the caravan park. During the day one can quite easily forget that it's there. At night there is a slight hum. It's for those who sleep in a tent at night that the sound becomes a bit louder...especially when you are inside your tent. Fortunately it isn't a loud noise so didn't really affect our time there. There was no bad odour or smog coming from the plant either. Overall the visit was great and we'd definitely stay there again.

Room Tip: Take warm clothes and blankets along for at night when the temperature drops really low.

[See more room tips](#)

Stayed March 2015, travelled as a couple

Wikicamps (phone app):



Facebook:

[Mark Coleman](#) reviewed [Jenolan Caravan Park, Oberon](#) — [1 star](#)

April 7, 2015 ·

Freezing weather and not allowed Campfire even on communal fire pit.

Spoken to like children for trying to keep dry and warm in communal kitchen, "Right, pack up had complaints bout noise"(No music, 3 people talking at normal levels NOT Loud at all) at the ripe old time of 9:35pm!

Then being SPYED on by rude management for whatever we dont know. Photos, walk bys at night and early in morning.

Toilets were brand new BUT not cleaned over entire long weekend.

Oh did the photos of the park tell you how van park backs onto a 24hr operational MDF board manufacturing plant with constant stinky emmissions?

Could of been a great stay ruined by RUDE staff.

If your a 75 yr old tea totaler that goes to bed @ 7:00 then this is the park for you.

If you enjoy talking andchaving a beer or if your kids wanna play hide and seek DON'T bother comming here



(Picture included on Facebook by Mark Coleman)

“Not So Quite As We Had Been Led To Believe Thru Others Reviews.” Reviewed 21 May 2016

Stayed on a Powered Site - The Park was grassy and pleasant enough But the Mill was very noisy all night 7 days a week (we stayed 7) All reviews I had previously read had said it was quiet but this is NOT true, those who had reviewed the park must have had a hearing disability. I found the staff not all that friendly as the young woman that was working there just grunted at us during the time we said hello. Pet Friendly.

Room Tip: Bring your ear plugs for a good nights sleep.

[See more room tips](#)

Stayed May 2016, travelled as a couple

JenolanCP, Manager at Jenolan Caravan Park, responded to this review, 28 May 2016

Hi Mary-Anne N thank you for taking the time to review our Park and we are sorry that the noise from the Mill disturbed you. Some times it is noisier than at other times and you may have noticed a microphone placed near a black box in the Park - this is provided by the Mill and is measuring the noise we experience in the Park. They are sympathetic to tourists and townspeople alike and are endeavouring to identify individual noises to lessen the impact. It is a work in progress and we hope next time you come to stay you will see an improvement. We were also dismayed to read that you were grunted at - our staff were particularly dismayed and are not sure of the occasion ... however please accept our apologies. We do hope that you enjoyed the beautiful area in which we live during your week stay and we hope to see you again. Cheers Sally

An example of the Reviews we receive most often:

“Grey nomad stay” Reviewed 22 October 2014

My wife and I, late 50's and retired, stayed at Jenolan Caravan Park in October 2014. This is our second time here, once in a cabin and this time in our caravan. This is a great park in a very good location. It is comfortable walking distance from the Main Street and an easy drive from all of the attractions that this area has to offer. The park is well laid out with large shady sites, individual water and sullage and very comfortable cabins. The amenities are clean and there is a very well appointed camp kitchen. The owners are very friendly and helpful, both when on site and if contacted by phone. For anyone wanting to visit the caves, gardens or Bathurst region, this is a wonderful place to stay.

Stayed October 2014, travelled as a couple

Running a successful caravan park is enormously satisfying. Having factories close to us and receiving negative comments via social media is very damaging to our business and extremely difficult to measure the damage done e.g. people that read about the noise and just decide not to visit.

We have received courteous response and attendance at our Park from the Borg crew from management to workers but unfortunately we are having the same conversations every time we speak – it's too noisy. We don't doubt efforts are being made to address the noise issues and there is no doubt there has been some improvement in some areas but the problem for us is, we are still getting complaints from our guests whether they be on social media or the guest attending in our office.

Sound monitoring has been carried out at the Park on a number of occasions by both the EPA and Borgs Panels. We have not been privy to the results of these but whenever we have asked we have been advised that the noise is within the allowable limits. It concerns us that the loud bangs (spikes on the noise monitor) that wake up our guests are not monitored individually but they are averaged out over the nightly period. That is no consolation to our guests as they were awakened by the bang and still can't get back to sleep!

Looking forward to the new extension we would ask that there be no loud noises or 'spikes' between the hours of 9.00pm and 8.00am.

If the noise problems can't easily be rectified now for the existing factory, what time frame would the factory complex be allowed to source and fix any future loud noises from the new factory?

We understand that when the portable chippers were in the forest they were required to operate at a distance of not less than 600 metres from a house. We are less than 500 metres from the factory boundary and along with our commercial lease, we also hold a residential lease. It does not seem to be equitable.

We also understand that the NSW Industrial Noise Policy is currently being reviewed. It is our opinion that 45dB for the proximity of the timber complex to town, is too generous. We would ask that consideration be given to reducing this nightly limit.

Please do not hesitate to contact us if any clarification is required. Over the last three years we have been addressing these problems with the following people:

Borg Panels:

John Borg (only recently)

Jim Snelson

Greg Muir

Victor Bendeviski

Louis Snelson

Aaron Evans

Highlands / Structaflor Complex:

Tom Williams

Peter Hotham (no longer in their employ)

Spiro Kavaleiros

Numerous noise reports to 1800 802 795 (community hotline for the whole complex)

EPA

Andrew Helms

Pamela Morales

From: system@acelo.com on behalf of Markus Schmitz
<markus.schmitz@bigpond.com>
Sent: Thursday, 16 June 2016 4:31 PM
To: Pamela Morales
Subject: Submission Details for Markus Schmitz (object)

Confidentiality Requested: no

Submitted by a Planner: no

Disclosable Political Donation: no

Name: Markus Schmitz
Email: markus.schmitz@bigpond.com

Address:
19. Carrington Avenue Oberon

Oberon, NSW
2787

Content:

I would like to raise my concerns about the proposed extension of the BORG OBERON operations.

My family and myself live close to the current Borg site and have been exposed to dust / noise / additional traffic on poorly maintained roads over the years.

I am also concerned about particleboard and MDF being dumped at the local landfill as well as commercial quantities of boiler ash and other by products produced by BORG .

Dumped waste products have " self combusted " on a number of occasions at the local landfill site and reported to the EPA.

I am also concerned about the devaluation of properties in the close proximity of the proposed new plant as further developments / subdivisions / granny flats had been rejected for property owners in a 2km range from the current BORG operations by the Oberon Council.

IP Address: - 101.191.251.146

Submission: Online Submission from Markus Schmitz (object)
https://majorprojects.affinitylive.com/?action=view_activity&id=150430

Submission for Job: #7016 Timber Processing Facility Expansion
https://majorprojects.affinitylive.com/?action=view_job&id=7016

Site: #3085 Borg Panels Oberon
https://majorprojects.affinitylive.com/?action=view_site&id=3085

Pamela Morales

From: Markus Schmitz <Markus.Schmitz@health.nsw.gov.au>
Sent: Wednesday, 6 July 2016 11:59 AM
To: Pamela Morales
Subject: Objection to SSD 15_7016 Oberon BORG PB plant

Hi Pamela,

I tried to complete the official forms but was unable due to a problem with the security code.

I attached my letter for you.

Objection to proposed BORG OBERON PB plant

I have checked the environmental report for the proposed PB plant and found that the formaldehyde emission will be above the legal limit for my home and workplace address.

I wish to raise my concerns about the emissions and airborne fibre the population of Oberon had to endure in the past.

On a windy day my car would be covered in what appears to be wood fibres from the BORG site.

I am also worried that no study had been carried out during a rainy period as formaldehyde is water soluble and could end up in the rain over the township of Oberon.

I live in Oberon and my house was built in 1946 before the current PB plant was constructed .

Oberon Council will not allow dual occupancy in areas close to the current BORG site and justify their decision on the fact that the current BORG site is close to my address.

I can also see an increased risk to the environmental pollution .

Defective PB panels regularly appear at the local landfill site .

PB panels had also been buried in the state forest at Black Bullock Road in the past.

The Oberon Council had burned truckloads of panels from the BORG site in the past at the local landfill site.

Markus Armin Schmitz

Maintenance Supervisor Oberon Health Service Mobil: 0407416547

This message is intended for the addressee named and may contain confidential information. If you are not the intended recipient, please delete it and notify the sender.

Views expressed in this message are those of the individual sender, and are not necessarily the views of NSW Health or any of its entities.



AIR QUALITY IMPACT ASSESSMENT
REVISED BORG MANUFACTURING TIMBER
PANELS PROCESSING FACILITY
EXPANSION

16 February 2017

Job Number 16080595A

Prepared by

Todoroski Air Sciences Pty Ltd

Suite 2B, 14 Glen Street

Eastwood, NSW 2122

Phone: (02) 9874 2123

Fax: (02) 9874 2125

Email: info@airsciences.com.au

Air Quality Impact Assessment

Revised Borg Panels Timber Panels Processing Facility Expansion

Author(s): Aleks Todoroski Michelle Yu
Position: Director Chemical Engineer

DOCUMENT CONTROL

Report Version	Date	Prepared by	Reviewed by
DRAFT – 001	6/12/2016	M Yu	A Todoroski
FINAL - 001	7/12/2016	A Todoroski	V Bendevski
FINAL - 002	13/12/2016	M Yu, A Todoroski	V Bendevski
FINAL - 003	16/02/2017	A Todoroski	

This report has been prepared in accordance with the scope of works between Todoroski Air Sciences Pty Ltd (TAS) and the client. TAS relies on and presumes accurate the information (or lack thereof) made available to it to conduct the work. If this is not the case, the findings of the report may change. TAS has applied the usual care and diligence of the profession prevailing at the time of preparing this report and commensurate with the information available. No other warranty or guarantee is implied in regard to the content and findings of the report. The report has been prepared exclusively for the use of the client, for the stated purpose and must be read in full. No responsibility is accepted for the use of the report or part thereof in any other context or by any third party.

TABLE OF CONTENTS

1	INTRODUCTION.....	1
2	LOCAL SETTING.....	1
3	PROJECT BACKGROUND	4
4	AIR QUALITY ASSESSMENT CRITERIA	4
4.1	Preamble.....	4
4.2	Particulate matter.....	4
4.2.1	New South Wales Environment Protection Authority impact assessment criteria	4
4.2.2	National Environment Protection (Ambient Air Quality) Measure.....	5
4.3	Other pollutants	5
4.3.1	World Health Organisation Guidelines	6
4.3.2	Protection of the Environment Operations (Clean Air) Regulation 2010	6
4.3.3	NSW EPA Licence Limit.....	6
5	EXISTING ENVIRONMENT.....	7
5.1	Ambient air quality.....	7
5.1.1	PM ₁₀ monitoring.....	7
5.1.2	NO ₂ monitoring	9
5.1.3	Summary of background concentrations used in the Level 1 assessment	9
5.2	Local climate	10
5.3	Local meteorological conditions.....	11
5.3.1	Selection of meteorological year for modelling.....	13
6	DISPERSION MODELLING APPROACH	16
6.1	Introduction.....	16
6.2	Modelling methodology	16
6.2.1	Meteorological modelling	16
6.2.2	Dispersion modelling	21
6.3	Emission estimation	23
6.3.1	NO ₂ assessment.....	24
7	DISPERSION MODELLING RESULTS.....	32
7.1	Particulate matter and NO ₂	32
7.2	24-hour average PM ₁₀ impacts	39
7.3	Formaldehyde.....	39
7.3.1	Sensitivity analysis	42
8	POLLUTION CONTROL.....	44
8.1	Pollution Reduction Program.....	44
9	SUMMARY AND CONCLUSIONS	46
10	REFERENCES	47
	CONTRIBUTION ANALYSIS - FORMALDEHYDE.....	B-1

LIST OF APPENDICES

Appendix A – Further detail regarding 24-hour analysis

LIST OF TABLES

Table 4-1: NSW EPA air quality impact assessment criteria	5
Table 4-2: Standard for PM ₁₀ and PM _{2.5} concentrations (µg/m ³)	5
Table 4-3: Applicable air quality impact assessment criteria for formaldehyde (µg/m ³)	5
Table 4-4: Applicable air quality guideline for formaldehyde (µg/m ³)	6
Table 4-5: Standards of concentration for scheduled premises	6
Table 4-6: NSW EPA environmental licence limits	6
Table 5-1: Summary of PM ₁₀ levels from NSW OEH TEOM monitoring (µg/m ³)	8
Table 5-2: Summary of NO ₂ levels from NSW OEH monitoring sites (µg/m ³)	9
Table 5-3: Background concentrations used in the Level 1 assessment	9
Table 5-4: Monthly climate statistics summary – Bathurst Airport AWS	10
Table 6-1: Surface observation stations	17
Table 6-2: Emission inventory of the existing MDF stacks	26
Table 6-3: Emission inventory of the existing MDL stacks	27
Table 6-4: Emission inventory of the proposed changes to the MDF plant	28
Table 6-5: Emission inventory of the proposed PB plant	29
Table 6-6: Emission inventory of other key industries near the Project	30
Table 6-7: Emission concentration of the proposed Project sources	30
Table 7-1: Model-predicted impacts of existing Project using maximum incremental and background	32
Table 7-2: Model-predicted impacts of proposed Project using maximum incremental and background	33
Table 7-3: NSW EPA contemporaneous assessment - maximum number of additional days above 24-hour average PM ₁₀ criterion depending on background level at monitoring sites	39
Table 7-4: Model-predicted formaldehyde impacts of the existing plant and the proposed Project	40

LIST OF FIGURES

Figure 2-1: Project location	2
Figure 2-2: Representative view of the topography surrounding the Project location.....	3
Figure 5-1: NSW EPA monitoring sites	7
Figure 5-2: 24-hour average PM ₁₀ concentrations (clipped at 100µg/m ³ ; highest level at 145µg/m ³)	8
Figure 5-3: Maximum daily 1 hour average NO ₂ concentrations.....	9
Figure 5-4: Monthly climate statistics summary – Bathurst Airport AWS.....	11
Figure 5-5: Annual and seasonal windroses for Bathurst Airport AWS	12
Figure 5-6: Statistical analysis of temperature, wind speed, relative humidity and rainfall data at Bathurst Airport.....	14
Figure 5-7: Statistical analysis of wind direction data - Bathurst Airport.....	15
Figure 6-1: Example of the wind field for one of the 8,760 hours of the year that are modelled	17
Figure 6-2: Windroses from CALMET extract at 10m height (Cell Ref 5050).....	19
Figure 6-3: Meteorological analyses of CALMET extract (Cell Ref 5050)	20
Figure 6-4: Location of existing sources modelled	21
Figure 6-5: Location of proposed sources modelled	22
Figure 7-1: Predicted maximum 24-hour average PM ₁₀ concentration (µg/m ³) due to the Project.....	34
Figure 7-2: Predicted max. 24-hr ave. PM ₁₀ concentration (µg/m ³) due to the Project and other surrounding industries	34
Figure 7-3: Predicted annual average PM ₁₀ concentration (µg/m ³) due to the Project.....	35
Figure 7-4: Predicted annual average PM ₁₀ concentration (µg/m ³) due to the Project and other surrounding industries	35
Figure 7-5: Predicted annual average TSP concentration (µg/m ³) due to the Project	36
Figure 7-6: Predicted annual average TSP concentration (µg/m ³) due to the Project and other surrounding industries	36
Figure 7-7: Predicted maximum 1-hour average NO ₂ concentration (µg/m ³) due to the Project.....	37
Figure 7-8: Predicted max. 1-hr average NO ₂ concentration (µg/m ³) due to the Project and other surrounding industries	37
Figure 7-9: Predicted annual average NO ₂ concentration (µg/m ³) due to the Project	38
Figure 7-10: Predicted annual average NO ₂ concentration (µg/m ³) due to the Project and other surrounding industries	38
Figure 7-11: Predicted 99.9 th percentile 1-hour average formaldehyde concentration (µg/m ³) for the Project.....	41
Figure 7-12: Predicted 99.9 th percentile 1-hr ave formaldehyde conc (µg/m ³) for the Project and surrounding industries	41
Figure 7-13: Predicted maximum 30-minute average formaldehyde concentration due to the Project and other industries– WHO guideline (100µg/m ³).....	42
Figure 7-14: Predicted 99.9 th percentile 1-hr ave formaldehyde for the Modified MDF Plant and Particle Board Plant – NSW EPA criterion of 21.8µg/m ³	43

1 INTRODUCTION

Todoroski Air Sciences has prepared this air quality impact assessment report for Borg Manufacturing Pty Ltd (hereafter referred to as the Proponent). It provides an assessment of the potential air quality impacts associated with the existing operations and proposed expansion of the Borg Timber Panels Processing Facility at Oberon, New South Wales (NSW) (hereafter referred to as the Project).

The existing Project comprises the medium-density fibreboard (MDF) plant and multi-daylight (MDL) plant.

The proposed expansion of the Project would include modifications to the existing MDF plant and installation of a new particle board (PB) plant.

To assess the potential air quality impacts associated with the Project, this report incorporates the following aspects:

- ✦ An outline of the local setting and background to the Project;
- ✦ A review of the existing meteorological and air quality environment;
- ✦ A description of the dispersion modelling approach used to assess potential air quality impacts;
- ✦ An outline of the estimated potential air emissions associated with the existing and proposed expansion of the Project; and,
- ✦ Presentation of the predicted results and a discussion of the potential air quality impacts.

This assessment report differs from a similar report dated 21 October 2016 by the inclusion of the MDL plant and some additional fugitive sources.

2 LOCAL SETTING

The Project is situated in an industrial area directly to the north of the township of Oberon, located approximately 39 kilometres (km) southeast of Bathurst and approximately 36km southwest of Lithgow. The surrounding land use in the wider area is characterised as predominantly agricultural land, with the residential areas of Oberon to the south of the industrial precinct in which the Project is located. **Figure 2-1** presents the location of the Project in relation to the potentially most affected sensitive receptors of relevance to this assessment. Also shown in the figure are the other facilities in the industrial precinct. These facilities are similar in nature to the Project and include Woodchem, Carter Holt Harvey (CHH), Structaflor and Highland Pine Products (HPP).

Figure 2-2 presents a pseudo three-dimensional (3D) visualisation of the topography in the general vicinity of the Project area. The Project is located at a high altitude with dipping complex terrain sloping down to the nearby creeks and up to some receptor locations. The terrain features of the surrounding area would have an effect on the local wind distribution patterns and flows.



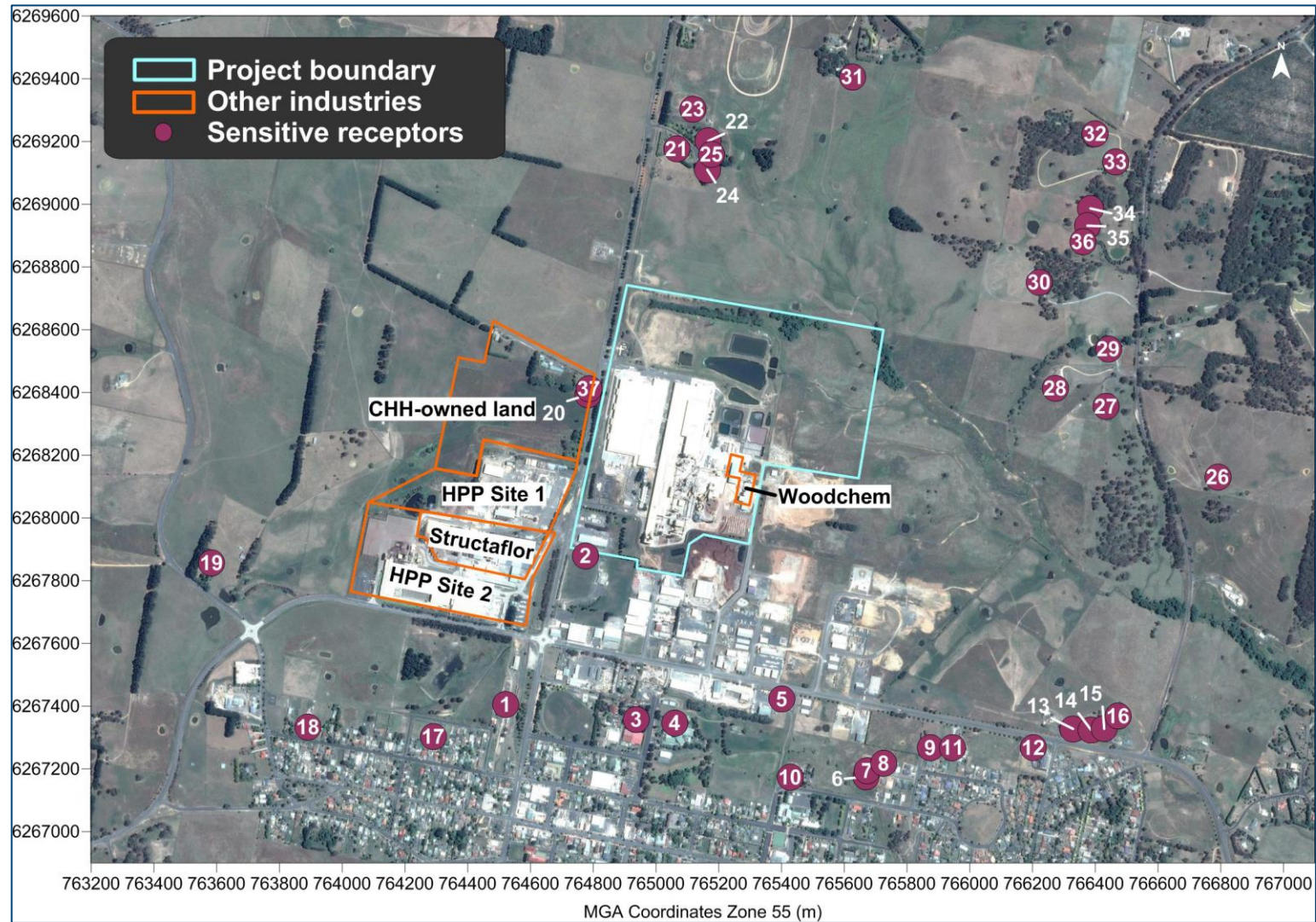


Figure 2-1: Project location

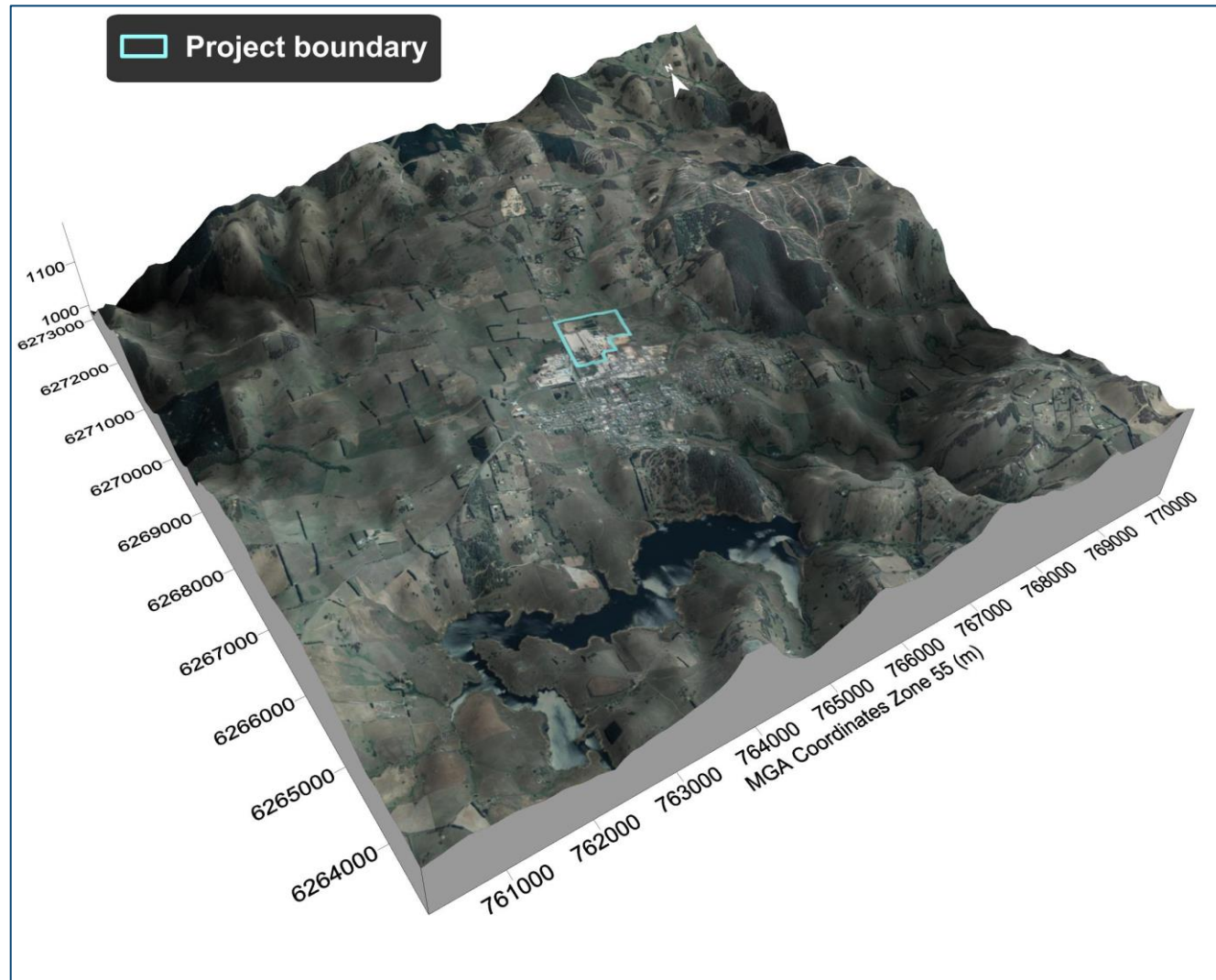


Figure 2-2: Representative view of the topography surrounding the Project location

3 PROJECT BACKGROUND

The existing plant at the Project processes wood to produce MDF. The proposed expansion would allow the facility to produce another product (Particleboard) using similar processes to those existing. The processes include chipping the fresh and waste wood materials received on-site, flaking the chips from fresh wood materials, drying the chipped and flaked materials, sorting and cleaning the dried chips, gluing the dry chips together with the addition of resins and other additives, forming and pressing the glued wood particles into mats, trimming, cooling and stacking the pressed MDF and PB, and sanding of the final product.

4 AIR QUALITY ASSESSMENT CRITERIA

4.1 Preamble

Air quality criteria are benchmarks set to protect the general health and amenity of the community in relation to air quality. The sections below identify the potential air emissions generated by the Project and the applicable air quality criteria.

4.2 Particulate matter

Particulate matter consists of dust particles of varying size and composition. Air quality goals refer to measures of the total mass of all particles suspended in air defined as the Total Suspended Particulate matter (TSP). The upper size range for TSP is nominally taken to be 30 micrometres (μm) as in practice particles larger than 30 to 50 μm will settle out of the atmosphere too quickly to be regarded as air pollutants.

Two sub-classes of TSP are also included in the air quality goals, namely PM_{10} , particulate matter with equivalent aerodynamic diameters of 10 μm or less, and $\text{PM}_{2.5}$, particulate matter with equivalent aerodynamic diameters of 2.5 μm or less.

Particulate matter, typically in the upper size range, that settles from the atmosphere and deposit on surfaces is characterised as deposited dust. The deposition of dust on surfaces is considered a nuisance and can adversely affect the amenity of an area by soiling property in the vicinity.

4.2.1 New South Wales Environment Protection Authority impact assessment criteria

Table 4-1 summarises the air quality goals that are relevant to this study as outlined in the NSW EPA document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (**NSW DEC, 2005**).

The air quality goals for total impacts relate to the total dust burden in the air and not just the dust from the Project. Consideration of background dust levels needs to be made when using these goals to assess potential impacts.

Table 4-1: NSW EPA air quality impact assessment criteria

Pollutant	Averaging period	Impact	Criteria
TSP	Annual	Total	90µg/m ³
PM ₁₀	Annual	Total	30µg/m ³
	24 hour	Total	50µg/m ³
Deposited dust	Annual	Incremental	2g/m ² /month
		Total	4g/m ² /month

Source: **NSW DEC, 2005**µg/m³ = micrograms per cubic metreg/m²/month = grams per square metre per month

4.2.2 National Environment Protection (Ambient Air Quality) Measure

The National Environment Protection Council (NEPC) Act 1994 and subsequent amendments define the National Environment Protection Measures (NEPMs) as instruments for setting environmental objectives in Australia.

The Ambient Air Quality NEPM specifies national ambient air quality standards and goals for air pollutants including PM₁₀ and PM_{2.5}. The standard for PM₁₀ and PM_{2.5} is outlined in **Table 4-2**. The Ambient Air Quality NEPM allows for exceedance above the 24-hour average criterion in exceptional events such as bush fires and regional dust storms.

Table 4-2: Standard for PM₁₀ and PM_{2.5} concentrations (µg/m³)

Pollutant	Averaging period	Maximum concentration
PM ₁₀	24 hour	50
	Annual	25
PM _{2.5}	24 hour	25
	Annual	8

Source: **NEPC, 2016**

As with each of the NEPM goals, these apply to the average, or general exposure of a population, rather than to "hot spot" locations or to individual industry projects.

4.3 Other pollutants

Other main air pollutants emitted due to the operation of the Project include formaldehyde and nitrogen dioxide (NO₂). **Table 4-3** outlines the applicable air quality assessment criteria, as outlined in the document *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (Approved Methods) (**NSW DEC, 2005**), for the other main air pollutants that are considered in this assessment.

With the exception of formaldehyde, all the other air pollutants are assessed against their applicable criteria using the maximum predicted concentrations at the sensitive receptors. For formaldehyde, the 99.9th percentile predicted concentrations are assessed against the criteria at or beyond the Project boundary.

Table 4-3: Applicable air quality impact assessment criteria for formaldehyde (µg/m³)

Pollutant	Averaging period	Criterion
NO ₂	1-hour	246
	Annual	62
Formaldehyde	1-hour	21.8 (20*)

*The applicable criterion for formaldehyde is presented as 20µg/m³ at 25°C in the Approved Methods (**NSW DEC, 2005**). To be consistent with the other pollutant criteria (and hence the modelling results), the table above presents the criterion at 0°C which is 21.8µg/m³.

16080595A_BorgPanelsOberon_AQIA_170216



4.3.1 World Health Organisation Guidelines

Table 4-4 presents the formaldehyde guideline recommended by the World Health Organisation (WHO) to prevent sensory irritation in the general public. The WHO Guideline is based on current knowledge of health impacts and is generally less stringent than the NSW EPA Criterion.

Table 4-4: Applicable air quality guideline for formaldehyde ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging period	Guideline
Formaldehyde	30-minute	100

Source: **WHO, 2010**

4.3.2 Protection of the Environment Operations (Clean Air) Regulation 2010

The Protection of the Environment Operations (Clean Air) Regulation 2010 (**POEO, 2010**) outlines standards of concentrations for air emissions emitted from various plant. The emission limits applicable to the Project are summarised in **Table 4-5**.

Table 4-5: Standards of concentration for scheduled premises

Pollutant	Standard of concentration (mg/m^3)	
	Existing sources	Proposed sources (Group 6)
TSP	250	50
NO_x , as NO_2 equivalent	2,500	350

Source: **POEO, 2010**

4.3.3 NSW EPA Licence Limit

The Proponent's environmental licence number 3035 contains emission limits for several of the existing emissions points on the Premises. The emission limits relevant to this assessment are summarised in **Table 4-6**.

Table 4-6: NSW EPA environmental licence limits

Source	TSP emission limit (mg/m^3)	Formaldehyde emission limit (mg/m^3)
EPA 11	200	5
EPA 17	200	5

Source: NSW EPA Licence 3035 (2016)



5 EXISTING ENVIRONMENT

This section describes the existing environment including the climate and ambient air quality in the general area surrounding the Project.

5.1 Ambient air quality

The main sources of air pollutants in the area surrounding the Project include emissions from local anthropogenic activities such as various commercial or industrial activities, motor vehicle exhaust and domestic wood heaters.

Ambient air quality monitoring data for the Project site are not available. Therefore the available data from the nearest air quality monitors operated by the NSW Office of Environment and Heritage (OEH) were used to quantify the existing background level for assessed pollutants at the Project site.

The NSW OEH air quality monitors at Bathurst and Oakdale (see **Figure 5-1**) are located approximately 42km to 71km from the site. Whilst not ideal, the data from these monitors have been used to quantify the existing ambient levels of air pollutants in this study.



Figure 5-1: NSW EPA monitoring sites

5.1.1 PM₁₀ monitoring

A summary of the available data from the NSW OEH monitoring stations is presented in **Table 5-1**. Recorded 24-hour average PM₁₀ concentrations are presented in **Figure 5-2**.

A review of **Table 5-1** indicates that the annual average PM₁₀ concentrations for each monitoring station were below the relevant criterion of 30µg/m³. The maximum 24-hour average PM₁₀ concentrations recorded at these stations were found to exceed the relevant criterion of 50µg/m³ at times during the review period (see **Figure 5-2**).

Table 5-1: Summary of PM₁₀ levels from NSW OEH TEOM monitoring (µg/m³)

Station ID	Annual average					Maximum 24-hour average				
	2011	2012	2013	2014	2015	2011	2012	2013	2014	2015
Bathurst	11.0	13.4	15.1	14.6	13.4	24.3	55.5	145.0	42.8	94.6
Oakdale	10.7	11.7	13.6	13.1	11.4	54.7	38.9	99.0	56.3	61.7

The Ambient Air Quality NEPM standard for 24-hour average PM₁₀ is a level of 50µg/m³ with an allowance for extraordinary events such as bushfires and dust storms which may produce dust levels above the standard (refer to **Section 3.2.2**).

It can be seen from **Figure 5-2** that PM₁₀ concentrations are nominally highest in the spring and summer months with the warmer weather raising the potential for drier ground elevating the occurrence of windblown dust, bushfires and increased pollen levels.

The PM₁₀ monitoring data at Bathurst are measured on the same side of the dividing range as the Project site, and are more likely to experience similar levels of pollen and natural dust etc. The data also show some of the highest maximum dust levels. Therefore the Bathurst data are considered to be representative background data and were used in this assessment.

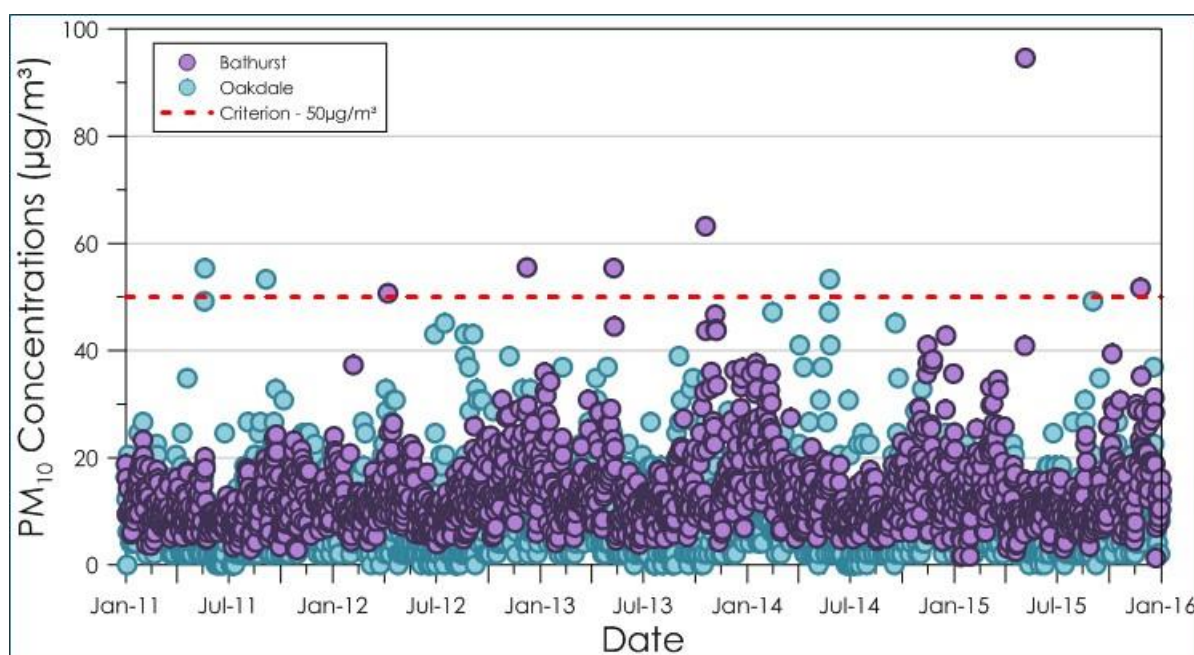


Figure 5-2: 24-hour average PM₁₀ concentrations (clipped at 100µg/m³; highest level at 145µg/m³)

5.1.2 NO₂ monitoring

Table 5-2 presents a summary of the NO₂ monitoring data recorded at Oakdale from 2011 to 2015.

Table 5-2: Summary of NO₂ levels from NSW OEH monitoring sites (µg/m³)

Station ID	2011	2012	2013	2014	2015
	Annual Average				
Oakdale	4.1	4.1	4.1	4.1	4.1
	Maximum 1-hour average				
Oakdale	55.4	45.1	39.0	53.3	49.2

Figure 5-3 presents the maximum daily 1-hour average NO₂ concentrations recorded at the NSW EPA Oakdale monitoring site from 2011 to 2015. The data indicate that there were no exceedances of the NSW EPA 1-hour average goal of 246µg/m³ during this period.

The data also indicate that levels of NO₂ are relatively low compared to the criterion level.

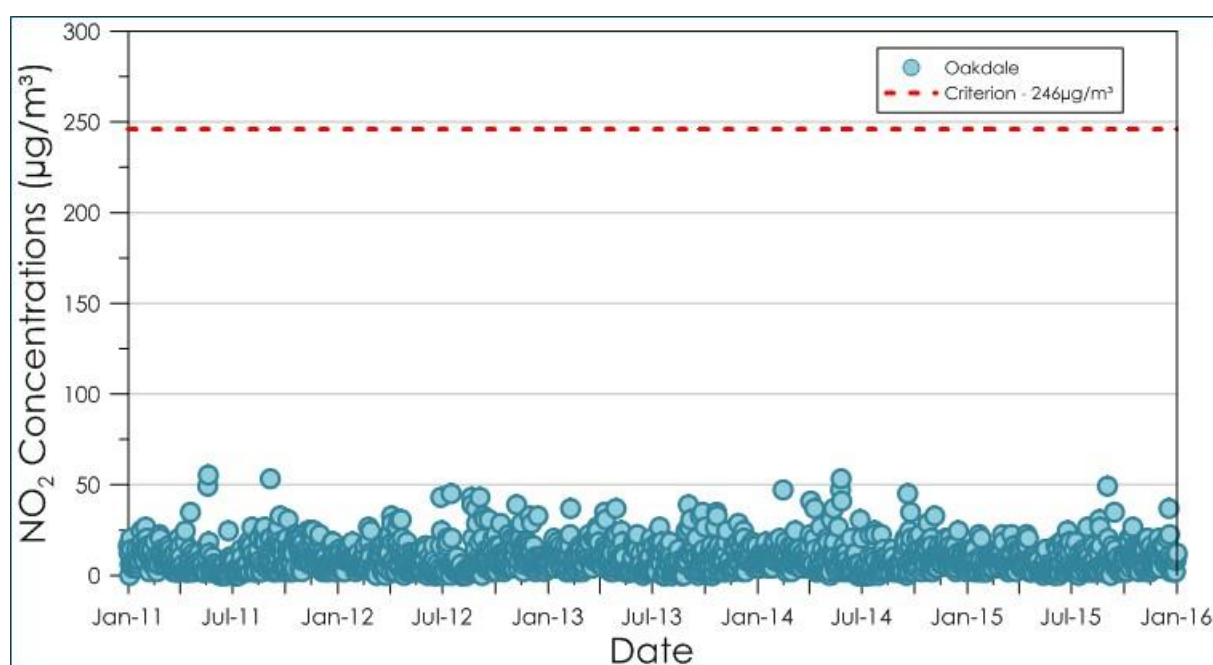


Figure 5-3: Maximum daily 1 hour average NO₂ concentrations

5.1.3 Summary of background concentrations used in the Level 1 assessment

A summary of background concentrations used in the Level 1 cumulative assessment (i.e. maximum prediction added with maximum background concentration) is presented in **Table 5-3**. The (maximum) background concentrations occur in the chosen meteorological modelling year (2014).

Table 5-3: Background concentrations used in the Level 1 assessment

Pollutant	Averaging period	Background concentrations	Monitoring station
PM ₁₀	24-hour	42.8	Bathurst
	Annual average	14.6	Bathurst
NO ₂	1-hour	53.3	Oakdale
	Annual average	4.1	Oakdale

5.2 Local climate

Long-term climatic data from the closest Bureau of Meteorology (BoM) weather station at Bathurst Airport Automatic Weather Station (AWS) (Site No. 063291) were analysed to characterise the local climate in the proximity of the Project. The Bathurst Airport AWS is located approximately 36km south-southeast of the Project. The next closest weather station at Mt Boyce is approximately 39km away and is located in a more hilly and steep terrain.

Table 5-4 and **Figure 5-4** present a summary of data from the Bathurst Airport AWS collected over a 19 to 25-year period for the various meteorological parameters.

The data indicate that January is the hottest month with a mean maximum temperature of 28.5 degrees Celsius (°C) and July is the coldest month with a mean minimum temperature of 0.8°C.

Rainfall exhibits seasonal variation with a higher amount of rainfall occurring in the warmer months. The annual average rainfall is 610.3 millimetres (mm) over 71.1 days. The data indicate that December is the wettest month with an average rainfall of 74.9mm over 7.1 days and May is the driest month with an average rainfall of 33.8mm over 4.7 days.

Relative humidity exhibits seasonal variability which generally increases in the first half of the year and decreases thereafter. Mean 9am relative humidity ranges from 66% in December to 91% in June. Mean 3pm relative humidity levels range from 40% in January and December to 64% in June.

The spread between the mean 9am and 3pm wind speeds does not vary greatly across the year. Mean 9am wind speeds range from 8.1 kilometres per hour (km/h) in May to 12.5km/h in September and October. Mean 3pm wind speeds range from 15.9km/h in May to 21.0km/h in September.

Table 5-4: Monthly climate statistics summary – Bathurst Airport AWS

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann.
Temperature													
Mean max. temperature (°C)	28.5	27.3	24.7	20.7	16.3	12.6	11.9	13.8	17.1	20.4	23.7	26.5	20.3
Mean min. temperature (°C)	13.6	13.5	10.5	6.4	3.1	2.0	0.8	1.2	3.6	6.1	9.4	11.5	6.8
Rainfall													
Rainfall (mm)	60.6	60.3	54.7	34.3	33.8	41.3	45.2	38.5	45.4	52.9	64.0	74.9	610.3
Mean No. of rain days (≥1mm)	5.9	5.9	5.2	4.0	4.7	6.6	6.7	6.1	5.1	6.4	7.4	7.1	71.1
9am conditions													
Mean temperature (°C)	19.4	18.2	15.3	12.4	8.0	5.2	4.4	6.0	9.9	13.5	15.6	18.1	12.2
Mean relative humidity (%)	67	75	78	78	88	91	90	84	77	69	71	66	78
Mean wind speed (km/h)	10.7	10.1	9.0	8.6	8.1	8.8	9.1	10.9	12.5	12.5	11.8	10.8	10.2
3pm conditions													
Mean temperature (°C)	26.8	25.6	23.4	19.5	15.2	11.5	10.8	12.5	15.6	18.7	21.6	24.7	18.8
Mean relative humidity (%)	40	46	44	44	54	64	62	53	50	47	47	40	49
Mean wind speed (km/h)	18.6	17.7	17.3	16.6	15.9	16.6	17.3	20.1	21.0	19.9	19.4	19.5	18.3

Source: Bureau of Meteorology, 2016 (24 August 2016)



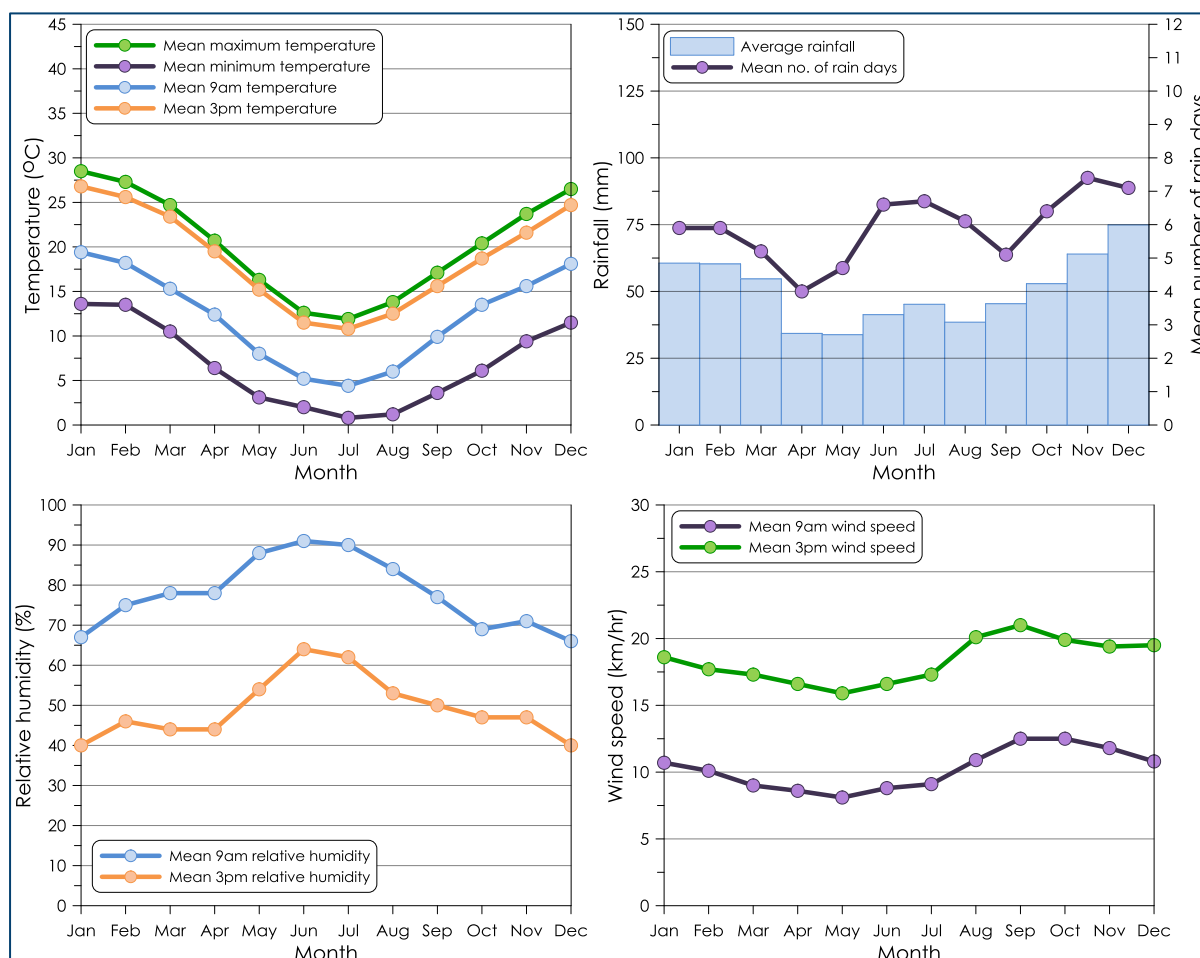


Figure 5-4: Monthly climate statistics summary – Bathurst Airport AWS

5.3 Local meteorological conditions

Annual and seasonal windroses for the Bathurst Airport AWS during the 2014 calendar period are presented in **Figure 5-5**.

Winds are generally observed to be relatively evenly spread across all directions on an annual average basis, but with a somewhat more frequent occurrence of winds originating from the west-southwest, the north, east-northeast and southwest.

In summer, winds are typically from the east-northeast and east. During autumn, winds are typically lighter than the rest of the year, with dominant winds from the east-northeast and north. During winter, there are fewer winds from the northeast quadrant, and a dominance of winds from the west-southwest. The spring distribution is similar to annual but with a higher proportion of winds from the west-southwest and southwest and a lesser proportion of winds from the eastern quadrants.



Figure 5-5: Annual and seasonal windroses for Bathurst Airport AWS



5.3.1 Selection of meteorological year for modelling

The 2014 calendar year was selected as the meteorological year for the dispersion modelling based on an analysis of data trends in the meteorological data records. **Figure 5-6** and **Figure 5-7** graph the meteorological analysis conducted using data from the Bathurst Airport. Among the data for each of the different calendar years (2012 to 2015) analysed, the calendar years 2013 and 2014 were the most similar to the recorded trends in the meteorology.

Examination of the recorded dust data found that the maximum 24-hour average PM_{10} recorded during 2014 is the closest to the average maximum 24-hour average PM_{10} in the data set, and also the annual average PM_{10} levels in 2014 were closest to the recorded annual average of all of the data. Thus, the year 2014 was chosen in preference to 2013 for use in the modelling.



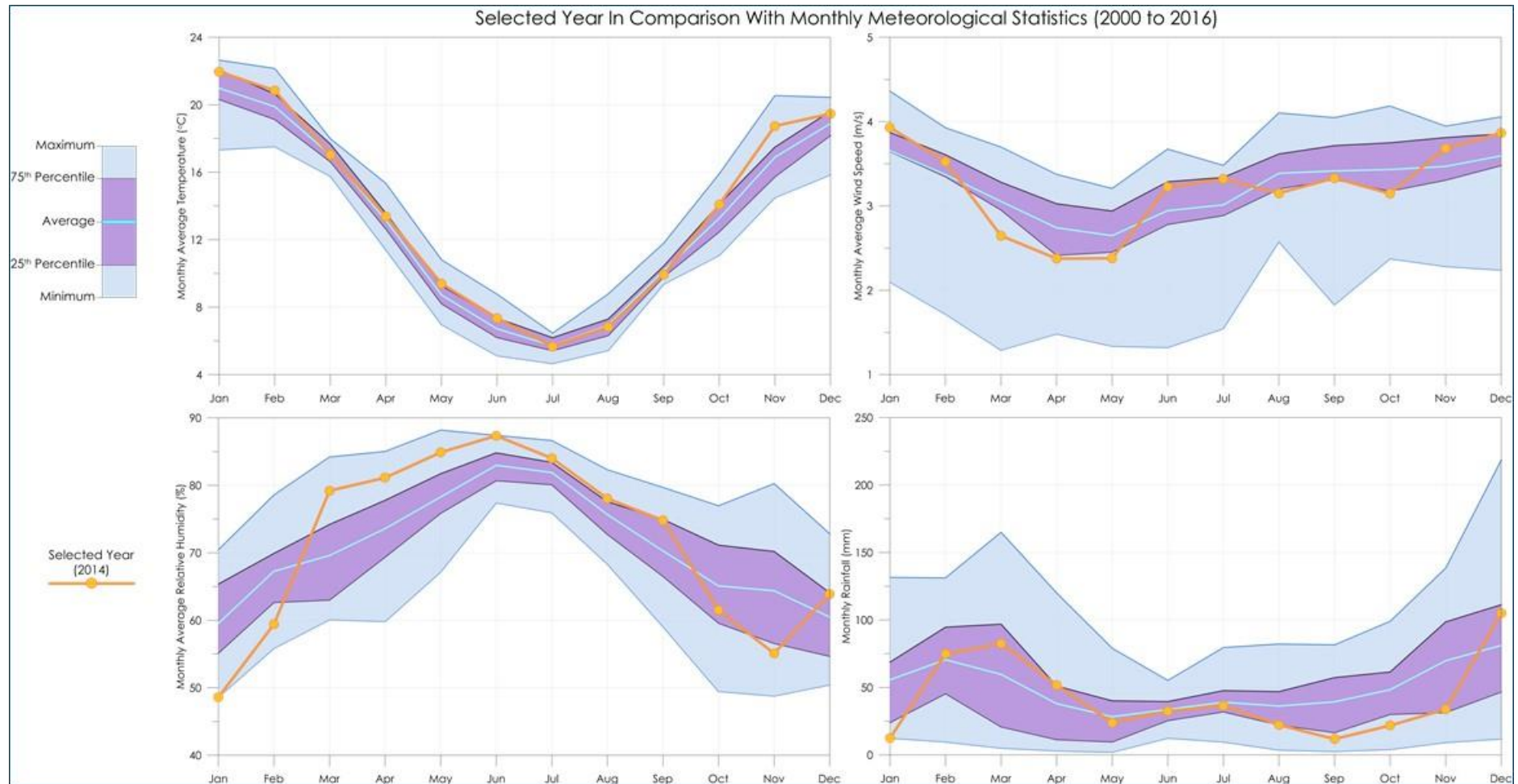


Figure 5-6: Statistical analysis of temperature, wind speed, relative humidity and rainfall data at Bathurst Airport

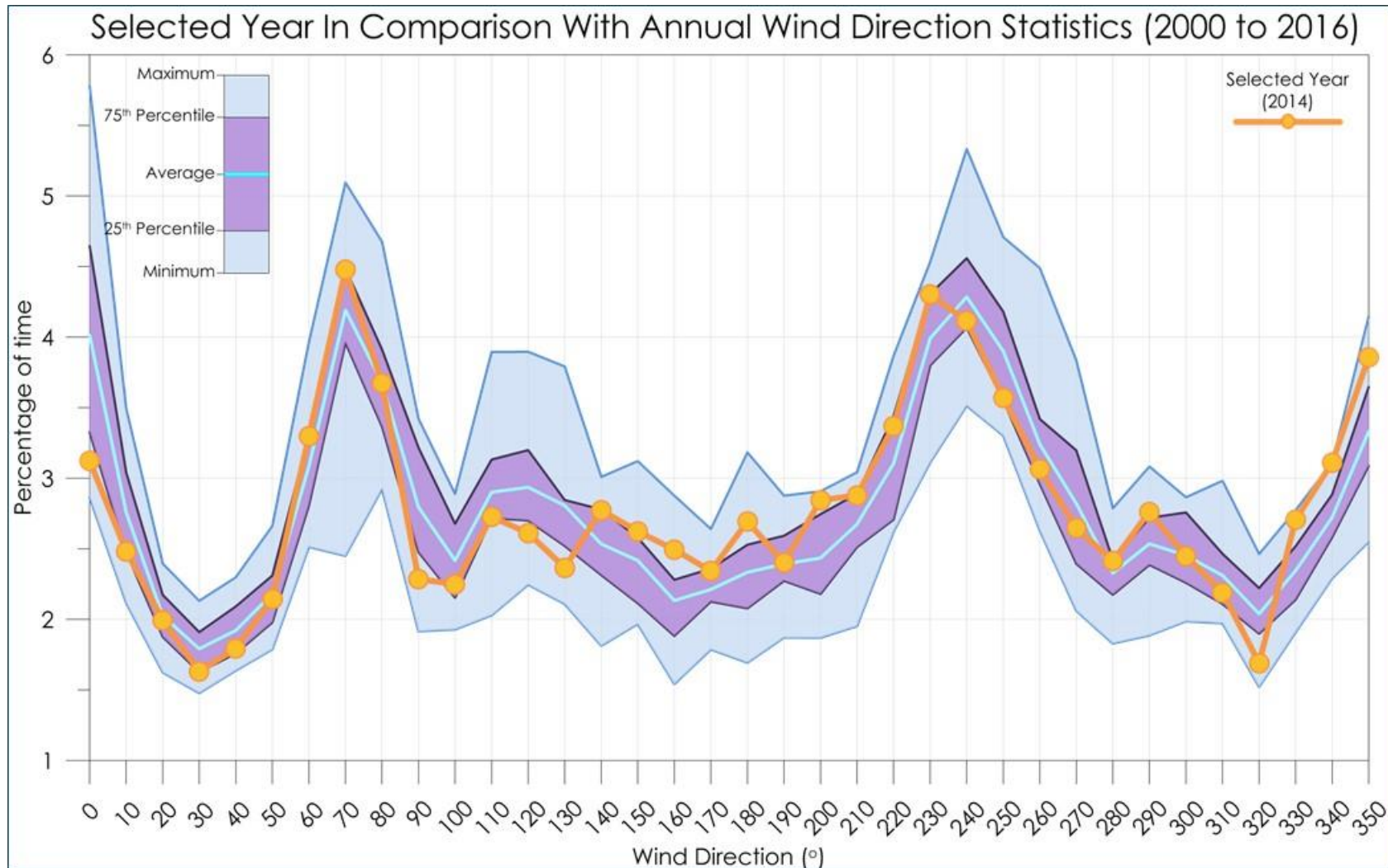


Figure 5-7: Statistical analysis of wind direction data - Bathurst Airport



6 DISPERSION MODELLING APPROACH

6.1 Introduction

The following sections are included to provide the reader with an understanding of the model and modelling approach.

For this assessment the CALPUFF modelling suite is applied to dispersion modelling. The CALPUFF model is an advanced "puff" model that can deal with the effects of complex local terrain on the dispersion meteorology over the entire modelling domain in a three dimensional, sub-hourly varying time step. CALPUFF is an air dispersion model approved by NSW EPA for use in air quality impact assessments. The model setup used is in general accordance with methods provided in the NSW EPA document *Generic Guidance and Optimum Model Setting for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'* (TRC Environmental Corporation, 2011).

6.2 Modelling methodology

Modelling was undertaken using a combination of The Air Pollution Model (TAPM) and the CALPUFF Modelling System. The CALPUFF Modelling System includes three main components: CALMET, CALPUFF and CALPOST and a large set of pre-processing programs designed to interface the model to standard, routinely available meteorological and geophysical datasets.

TAPM is a prognostic air model used to simulate the upper air data for CALMET input. The meteorological component of TAPM is an incompressible, non-hydrostatic, primitive equation model with a terrain-following vertical coordinate for 3D simulations. The model predicts the flows important to local scale air pollution, such as sea breezes and terrain induced flows, against a background of larger scale meteorology provided by synoptic analysis.

CALMET is a meteorological model that uses the geophysical information and observed/simulated surface and upper air data as inputs and develops wind and temperature fields on a 3D gridded modelling domain.

CALPUFF is a transport and dispersion model that advects "puffs" of material emitted from modelled sources, simulating dispersion processes along the way. It typically uses the 3D meteorological field generated by CALMET.

CALPOST is a post processor used to process the output of the CALPUFF model and produce tabulations that summarise the results of the simulation.

6.2.1 Meteorological modelling

TAPM was applied to the available data to generate a 3D upper air data file for use in CALMET. The centre of analysis for TAPM was 33.69deg south and 149.86deg east (765100mE, 6268100mS). The simulation involved an outer grid of 30km, with three nested grids of 10km, 3km and 1km with 35 vertical grid levels.

CALMET modelling used a nested approach where the 3D wind field from the coarser grid outer domain is used as the initial guess (or starting) field for the finer grid inner domain. This approach has several



advantages over modelling a single domain. Observed surface wind field data from the near field as well as from far field monitoring sites can be included in the model to generate a more representative 3D wind field for the modelled area. Off domain terrain features for the finer grid domain can be allowed to take effect within the finer domain, as would occur in reality. Also, the coarse scale wind flow fields give a better set of starting conditions with which to operate the finer grid run.

The CALMET initial domain was run on a 50 x 50km area with a 1km grid resolution and refined for a second domain on a 30 x 30km area with a 0.6km grid resolution and further refined for a final domain on a 10 x 10km area with a 0.1km grid resolution. **Table 6-1** outlines the parameter inputs to the model.

Table 6-1: Surface observation stations

Weather stations	Parameters						
	WS	WD	CH	CC	T	RH	SLP
Bathurst AWS (BoM) (Station No. 63291)	✓	✓	✓	✓	✓	✓	✓
Mt Boyce AWS (BoM) (Station No. 63292)	✓	✓	✓	✓	✓	✓	

WS = wind speed, WD = wind direction, CH = cloud height, CC = cloud cover, T = temperature, RH = relative humidity, SLP = station level pressure

Local land use and detailed topographical information was included in the simulation to produce realistic fine scale flow fields (such as terrain forced flows) in surrounding areas as shown in **Figure 6-1**.

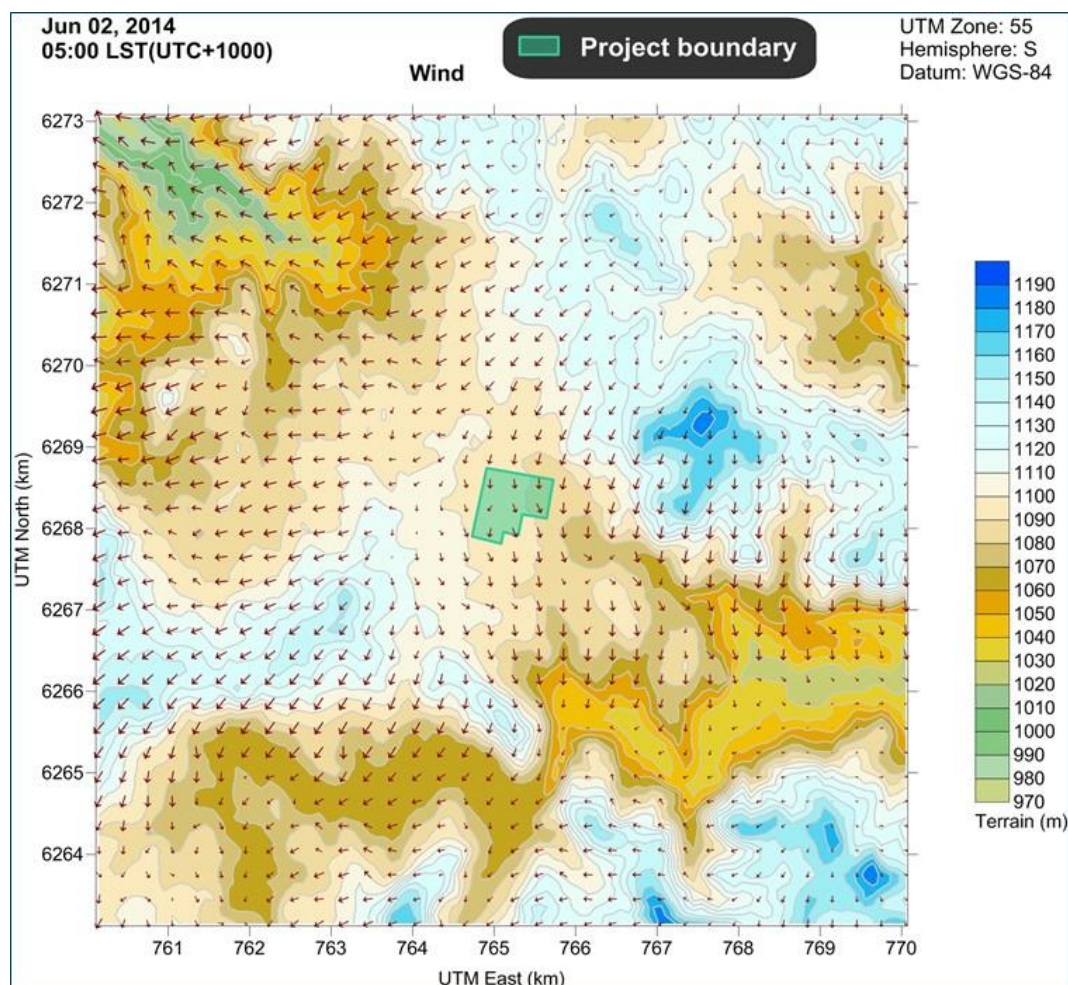


Figure 6-1: Example of the wind field for one of the 8,760 hours of the year that are modelled

CALMET generated meteorological data were extracted from a point within the CALMET domain and are graphically represented in **Figure 6-2** and **Figure 6-3**.

Figure 6-2 presents the annual and seasonal windroses from the CALMET data. The figure shows that winds are generally light from all directions with the exception of winds from the western quadrants which reflects the expected wind distribution patterns of the area based on expected terrain effects on the prevailing winds and katabatic flows. Apart from winter, light winds from the north dominate the distribution. On an annual basis, winds are varied with a high proportion of light winds from the south and relatively stronger winds from the west.

During summer, winds are typically from the northeast quadrant. The autumn distribution is varied and the westerly winds are relatively less strong compared to those of other seasons. Winds from the west-northwest are frequent. The winter distribution is characterised by relatively strong winds from the west and light winds from the south. The spring distribution is characterised by winds typically from the western quadrants, with winds from the west-southwest dominating the distribution after the light northern winds.

Figure 6-3 includes graphs of the temperature, wind speed, mixing height and stability classification over the modelling period and show sensible trends considered to be representative of the area.

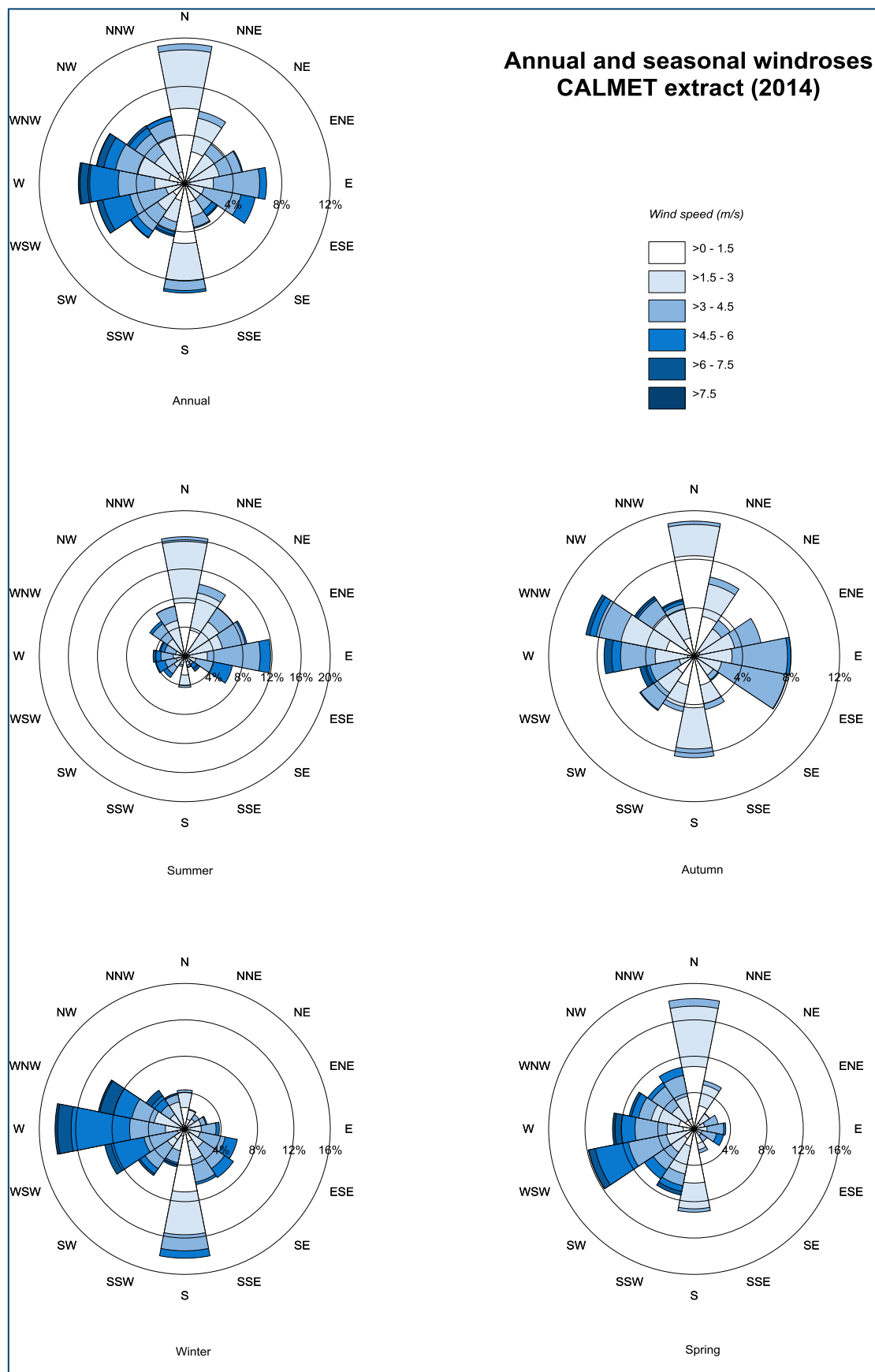


Figure 6-2: Windroses from CALMET extract at 10m height (Cell Ref 5050)

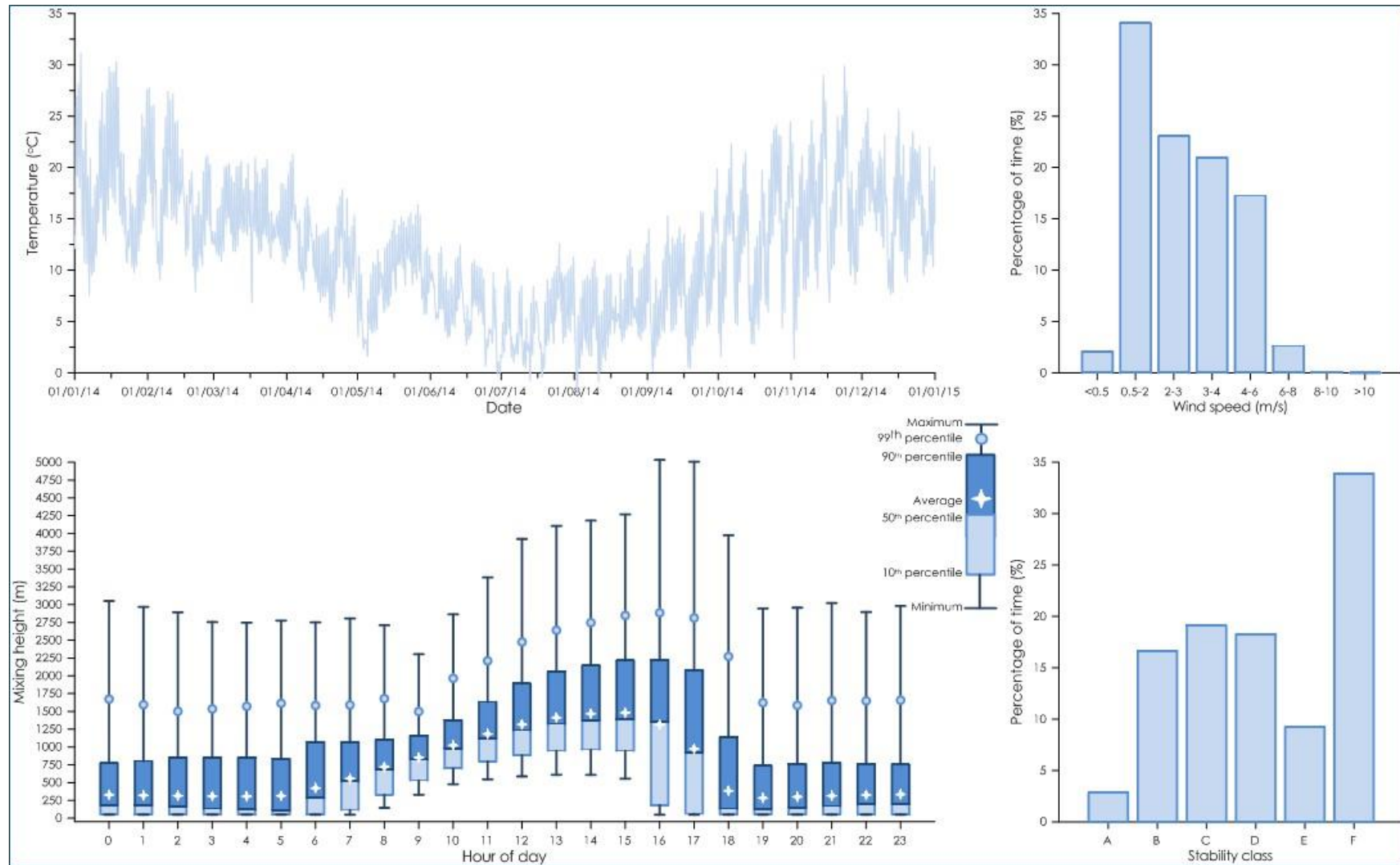


Figure 6-3: Meteorological analyses of CALMET extract (Cell Ref 5050)

6.2.2 Dispersion modelling

CALPUFF modelling was used to predict the potential air impacts in the wider area associated with the existing and proposed operations of the Project.

The key air emissions from the Project arise from the main processes as enumerated in **Section 3**. The main existing emissions to atmosphere are from the stacks of the existing MDF and MDL plants as shown in **Figure 6-4**. The main emissions to be released to atmosphere from the proposed expansion are from the existing stacks of the MDF and MDL plants, a proposed additional stack servicing the MDF plant, and proposed stacks for the PB plant as shown in **Figure 6-5**.

Fugitive emissions from the press lines are also considered. These sources are shown in purple shading in the **Figure 6-4** and **Figure 6-5**. Some of the existing MDF plant stack emissions and emissions from other new sources would be diverted into the existing heat plant (for destruction) and to the proposed additional stack.

Other emission sources from the nearby industries are also included in the model as point sources. The model includes consideration of potential "building" wake effects on air dispersion that arise due to the effects of winds passing over the buildings within the Project and nearby industrial sites. The Project and other industrial sources are summarised with their likely emission parameters in **Section 6.3**.

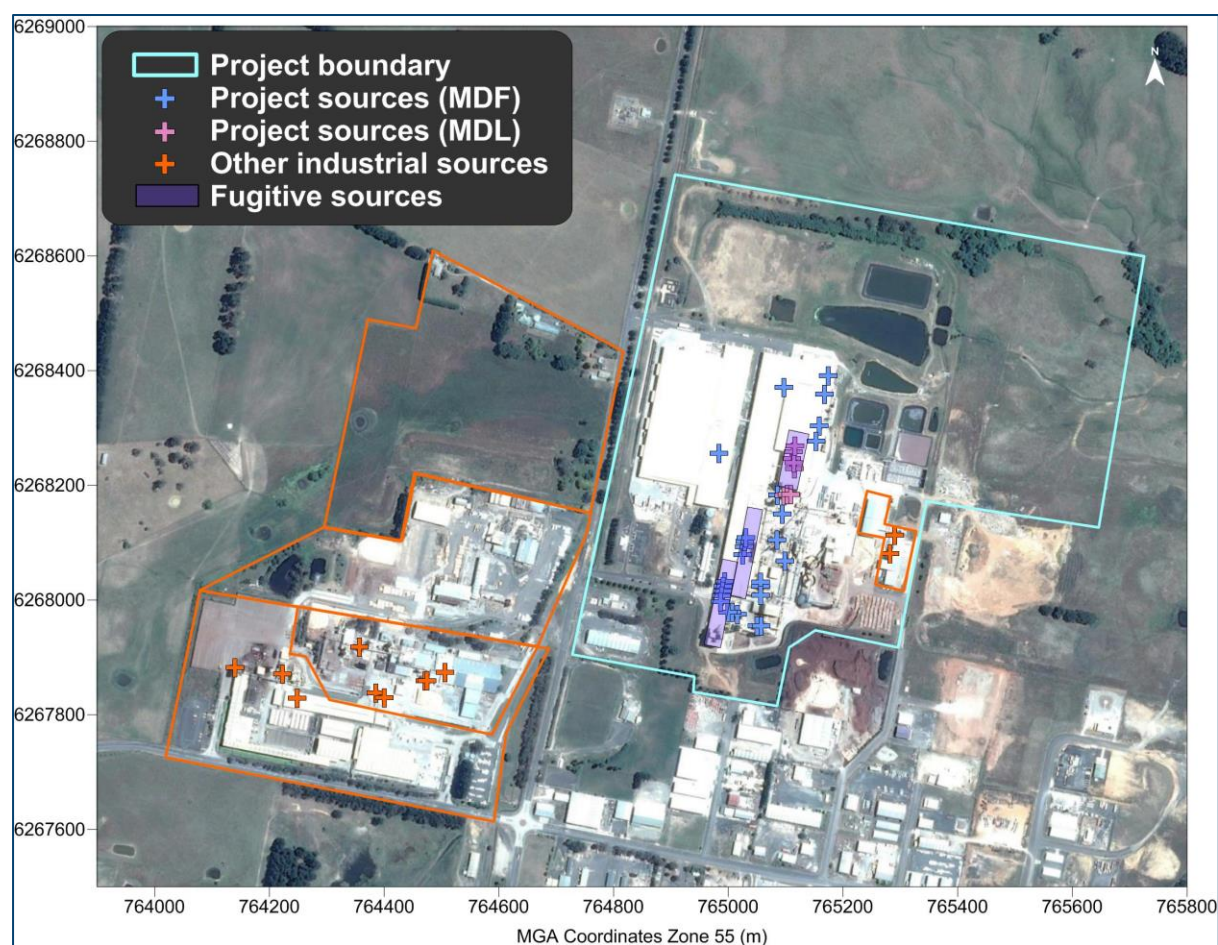


Figure 6-4: Location of existing sources modelled

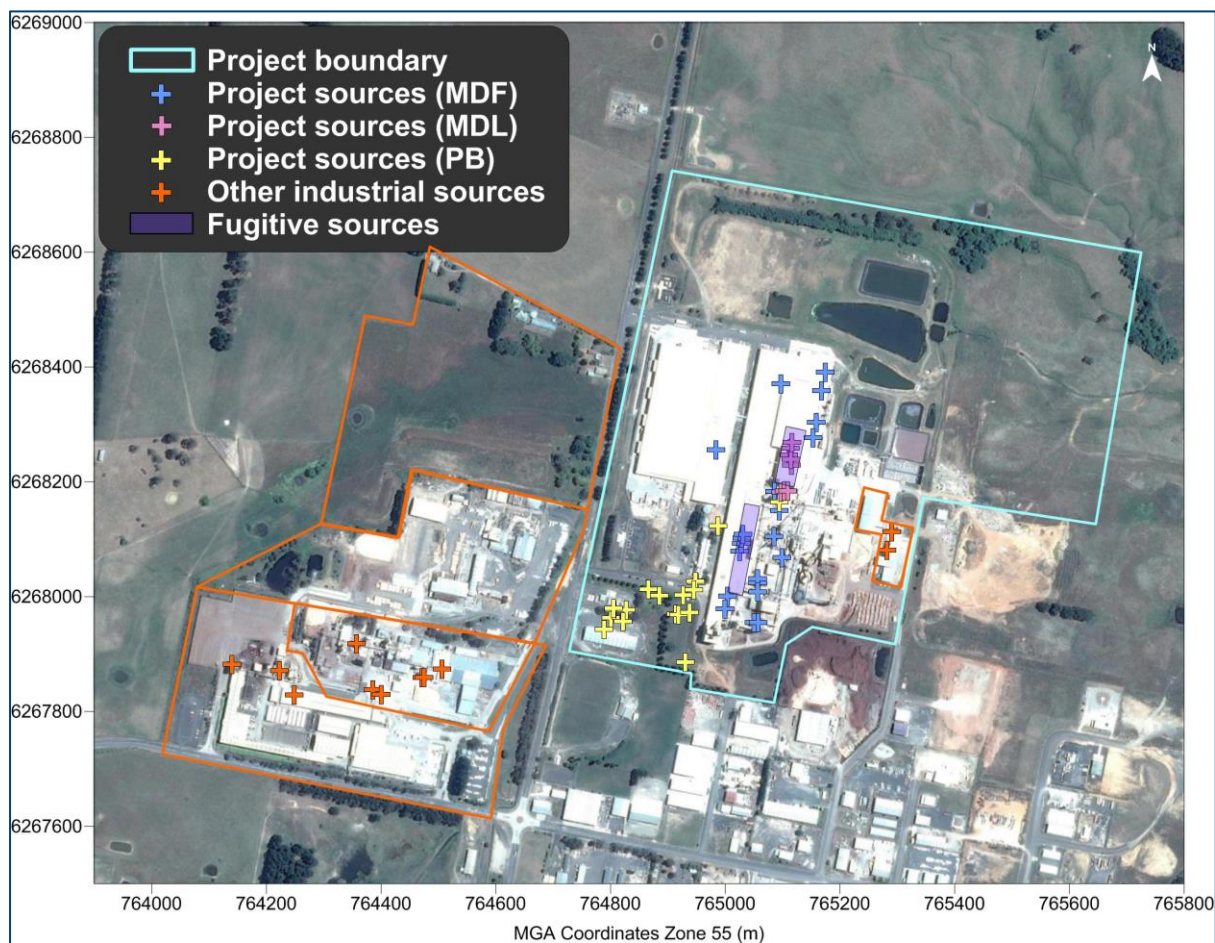


Figure 6-5: Location of proposed sources modelled

6.3 Emission estimation

Dispersion modelling parameters for the existing MDF and MDL plants, proposed PB and modified MDF plant, and other existing industries are presented in **Table 6-2** to **Table 6-6**, respectively.

Table 6-7 presents the emission concentrations of the proposed Project sources (i.e. proposed modified MDF plant, proposed PB plant) for comparison with the applicable POEO (Clean Air) Regulation and licence limits. As shown, all the sources comply with the POEO limits.

It is important to note that the Project would modify emission point EPA 11 (a heat plant) to include additional emissions from other sources. Accordingly the TSP emission was modelled at a concentration of 215.6mg/m³ to take into account the proposed changes to the plant design.¹

Thus, the table shows that there is potential for the proposed emissions from emission point EPA 11 (a heat plant) to exceed the existing licence limits, but not the Regulation limits. An amendment of the licence limit for TSP for EPA 11 may be necessary due to its proposed modification (i.e. diversion of other emissions into EPA 11).

The emission parameters of the existing sources including parts of the modified MDF plant were taken directly from the historical stack testing results. For conservatism, the average plus standard deviation of the historical stack testing results were modelled. Formaldehyde emissions which were considered to be erroneous were omitted from the analysis of the historical stack testing results. The formaldehyde emissions omitted include the following:

- ✦ Emission results from tests conducted on April 2013 and February 2015 which were generally significantly higher than the rest of the stack testing data across all stacks sampled. For EPA12 Conti 1 Press Vents, where results for both test times were present, only one was omitted which was the February 2015 results.
- ✦ Emission results from testing conducted on September 2016 for the EPA 23 Paper treater duct was considered an outlier as it was much higher than any other data recorded.

Where the emission sources will be modified, the emissions were calculated using the values from the stack testing results by taking into account the modifications that are proposed, as follows:

- ✦ EPA 4 (DC1 Baghouse) and EPA 5 (DC2 Baghouse) emissions would be diverted to the New Combined Stack, together with 60% of the emissions from the new Conti 2 Scrubber;
- ✦ EPA 12 (b), diversion of this press roof vent to the inlet air of Conti 1 Heat plant (EPA 17).
- ✦ EPA 23 (Paper Treater) emissions and 40% of the emissions from the Conti 2 Scrubber would be diverted to EPA 11 (Conti 2 Heat Plant). Another paper treater, whose emissions are assumed

¹ The historical stack testing data of EPA 11 shows up to 140mg/m³ of TSP emissions which is below the licence limit of 200 mg/m³. The destruction of the TSP from other sources that would be diverted into the heat plant serviced by emission point EPA 11 has not been taken into account, and thus in reality, the TSP emissions from EPA 11 would be lower than modelled due to combustion in the heat plant.



to be the same as the existing paper treater (EPA 23), would be installed and its emissions would also go to the EPA 11.

Where stack testing results are not available, assumptions were made to calculate for the emissions, as follows:

- ✦ 45mg/Nm³ of formaldehyde going into the Conti 2 Scrubber based on the plant manufacturer's specification (of 35 to 50mg/Nm³);
- ✦ A formaldehyde destruction efficiency of 30% in the Conti 2 Scrubber based on the plant manufacturer's guarantee of 30 to 40%;
- ✦ A formaldehyde destruction efficiency of 99% in the Conti 1 Heat Plant based on actual Destruction Efficiency Testing (**Stephenson, 2016a**); and,
- ✦ As PM₁₀ emission data are not available for all sources, it was assumed that the measured TSP emitted is comprised entirely of PM₁₀.

Fugitive emissions from the press vents were also modelled and assumed to be 20% of the total emissions from the press vents, and that 80% of the total emissions are what is measured in the stacks.

The emission parameters for the proposed PB plant were based on a previous assessment conducted by **Stephenson (2016b)** and confirmed by the Proponent. Similar to the MDF emissions, the following assumptions were made:

- ✦ 35mg/Nm³ of formaldehyde going into the scrubber based on the plant manufacturer's specification (of 30 to 40mg/Nm³);
- ✦ A formaldehyde destruction efficiency of 30% in the scrubber based on the plant manufacturer's specification (of 30 to 40%); and,
- ✦ The manufacturer's specification for TSP emission levels was assumed to represent PM₁₀ emissions in the model.

The emissions from the Woodchem facility were derived from the historical stack testing results.

The emission parameters for other industries in the area were supplied by the Proponent from previous stack testing reports and website data.

6.3.1 NO₂ assessment

The NO_x emissions from plant at the site would contain some fraction of harmful NO₂. To understand this some investigation of the likely range of NO fractions in the NO_x emissions was conducted.

Collated NO₂/NO_x percentage emissions data from forest product industry boilers, fired on various combinations of wood, coal, bark, waste oil and non-condensable gases ranges from 2.5 to 13.4% (**NCASI, 2015**). The NO₂/NO_x percentage of emissions from natural gas-fired heaters was found to be approximately 11% (**Hunton & Williams, 2011**), and the NO₂/NO_x percentage would typically be up to 23% for a natural gas-fired boiler (**ECT, 2013**).



Some fraction of the NO_x emitted from the Project would also undergo chemical change to form additional NO₂ by the time the emissions reach receptors. On the basis that the plant NO_x emissions would typically comprise 2.5 to 23% NO₂, and to account for any potential change in the emissions once released, it was assumed that 40% of all of the emitted NO_x would be in the form of NO₂ at the sensitive receptors. Considering the relatively short-distance between the sources and the receptors there would be little time for NO_x reactions to occur, and given also the generally cooler climate and overall relatively low fraction of NO₂ in the emissions from the main sources, the assumed 40% conversion of NO_x to NO₂ would be a conservative approach to estimating the potential NO₂ effects of the Project at the most affected receptors.

Note also that all NO_x emissions, including those from nearby industries, are considered in the cumulative assessment.

Table 6-2: Emission inventory of the existing MDF stacks

Source ID	Description	Easting (m)	Northing (m)	Stack height (m)	Discharge Temperature (°C)	Stack Diameter (m)	Exit Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	Formaldehyde (g/s)	NO _x (g/s)
EPA4	Bag filter forming line	765016	6267975	8.00	40	1.04	10.4	0.054	0.049	0.021	-
EPA5	Bag filter air grader	765007	6267979	6.00	30	1.56	12.1	0.068	0.056	0.034	-
EPA7	Conti 2 Stage 1 Dryer Cyclone #1 (west)	765050	6267955	44.40	51	2.48	13.8	0.94	0.94	0.43	-
EPA8	Conti 2 Stage 1 Dryer Cyclone #2 (east)	765057	6267955	44.40	51	2.48	14.2	0.88	0.88	0.19	-
EPA9	Conti 1 Dryer Cyclone #1 (south)	765056	6268024	30.50	53	2.23	12.3	0.66	0.56	0.20	4.6
EPA10	Conti 1 Dryer Cyclone #1 (north)	765056	6268031	30.50	55	2.23	12.6	0.69	0.58	0.34	4.6
EPA11	Conti 2 Heat Plant	765099	6268068	22.00	305	1.50	8.7	0.78	0.61	0.020	3.0
EPA12a	Conti 1 Press Vents	765025	6268079	11.95	39	1.14	6.7	0.026	0.025	0.015	0.036
EPA12b	Conti 1 Press Vents	765028	6268093	11.95	42	1.14	9.7	0.098	0.087	0.066	0.066
EPA12c	Conti 1 Press Vents	765028	6268093	11.95	39	1.14	7.5	0.055	0.055	0.037	0.033
EPA12d	Conti 1 Press Vents	765029	6268102	11.95	38	1.17	7.7	0.060	0.043	0.039	0.042
EPA12e	Conti 1 Press Vents	765031	6268109	11.95	33	1.19	8.0	0.055	0.055	0.0069	0.030
EPA17	Conti 1 Heat Plant	765085	6268105	30.50	234	1.20	11.7	1.2	0.93	0.0057	6.0
A3-1	A3 Baghouse	765174	6268391	4.00	27	0.80	30.1	0.069	0.069	-	-
A3-2	A3 Baghouse	765168	6268359	4.00	27	0.80	30.1	0.069	0.069	-	-
A2-1	A2 Baghouse	765159	6268304	4.00	27	0.80	24.4	0.056	0.056	-	-
A2-2	A2 Baghouse	765153	6268277	4.00	27	0.80	24.4	0.056	0.056	-	-
EPA6	DC3 Baghouse	764999	6267979	6.00	33	1.18	10.1	0.070	0.052	-	-
EPA3	Moulding Oven Exhaust	764984	6268256	15.00	93	0.55	7.8	0.0074	0.0074	-	0.0068
EPA1	DC4 Baghouse	765094	6268150	6.00	30	1.93	16.0	0.18	0.034	-	-
-	Hot oil heater	765097	6268371	15.00	250	0.40	8.5	-	-	-	0.083
EPA13a	Conti 2 Press Vents	764994	6268032	12.00	40	1.24	6.4	0.035	0.033	0.010	0.024
EPA13b	Conti 2 Press Vents	764991	6268024	12.00	40	1.24	6.5	0.031	0.031	0.0069	0.032
EPA13c	Conti 2 Press Vents	764990	6268016	12.00	35	1.24	6.2	0.043	0.038	0.027	0.029
EPA13d	Conti 2 Press Vents	764988	6268007	12.00	35	1.24	6.3	0.067	0.055	0.055	0.051
EPA13e	Conti 2 Press Vents	764986	6267997	12.00	35	1.24	9.2	0.23	0.22	0.22	0.065
EPA2	DC7 Baghouse	765086	6268183	8.00	26	0.76	18.0	0.020	0.020	-	-
-	Conti Fibre Transport Cyclone	765056	6268008	25.00	27	1.70	3.6	0.050	0.048	0.0025	-

16080595A_BorgPanelsOberon_AQIA_170216



Table 6-3: Emission inventory of the existing MDL stacks

Source ID	Description	Easting (m)	Northing (m)	Stack height (m)	Discharge Temperature (°C)	Stack Diameter (m)	Exit Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	Formaldehyde (g/s)	NO _x (g/s)
EPA18a	Existing Press Vents	765111	6268247	16.00	26	1.24	9.1	0.064	0.064	0.041	-
EPA18b	Existing Press Vents	765113	6268259	16.00	26	1.24	5.5	0.037	0.037	0.045	-
EPA18c	Existing Press Vents	765115	6268229	16.00	26	1.24	8.4	0.057	0.057	0.058	-
EPA18d	Existing Press Vents	765114	6268239	16.00	25	1.24	7.9	0.030	0.030	0.020	-
EPA18e	Existing Press Vents	765116	6268269	17.00	25	1.24	8.4	0.045	0.045	0.013	-
EPA19	Point 3 Dryer Stack	765097	6268182	35.00	53	1.62	24.9	3.22	0.39	0.0081	2.2
-	Old Jeldwen Point 20	765102	6268184	12.00	23	0.98	10.5	0.062	0.062	0.0050	-
-	Old Jeldwen Point 21	765102	6268184	12.00	25	0.73	12.0	0.033	0.033	0.0066	-
-	Old Jeldwen Point 22	765109	6268184	5.00	20	1.02	23.0	0.092	0.092	0.0078	-



Table 6-4: Emission inventory of the proposed changes to the MDF plant

Source ID	Description	Easting (m)	Northing (m)	Stack height (m)	Discharge Temperature (°C)	Stack Diameter (m)	Exit Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	Formaldehyde (g/s)	NO _x (g/s)
EPA7	Conti 2 Stage 1 Dryer Cyclone #1 (west)	765050	6267955	44.40	51	2.48	13.8	0.94	0.94	0.43	0.92
EPA8	Conti 2 Stage 1 Dryer Cyclone #2 (east)	765057	6267955	44.40	51	2.48	14.2	0.88	0.88	0.19	0.95
EPA9	Conti 1 Dryer Cyclone #1 (south)	765056	6268024	30.50	53	2.23	12.3	0.66	0.56	0.20	4.6
EPA10	Conti 1 Dryer Cyclone #1 (north)	765056	6268031	30.50	55	2.23	12.6	0.69	0.58	0.34	4.6
EPA11	Conti 2 Heat Plant	765099	6268068	22.00	305	1.50	8.7	1.3	0.026	0.0080	0.12
EPA12a	Conti 1 Press Vents	765025	6268079	11.95	38	1.14	6.7	0.026	0.025	0.015	0.036
EPA12c	Conti 1 Press Vents	765028	6268093	11.95	39	1.14	7.5	0.055	0.055	0.037	0.033
EPA12d	Conti 1 Press Vents	765029	6268102	11.95	38	1.17	7.7	0.060	0.043	0.039	0.042
EPA12e	Conti 1 Press Vents	765031	6268109	11.95	33	1.19	8.0	0.055	0.055	0.0069	0.030
EPA17	Conti 1 Heat Plant	765085	6268105	30.50	234	1.20	11.7	1.2	1.0	0.0064	6.1
-	New Combined Stack	765004	6268001	40.00	35	1.90	20.0	0.84	0.82	0.56	2.8
A3-1	A3 Baghouse	765174	6268391	4.00	27	0.80	30.1	0.069	0.069	-	-
A3-2	A3 Baghouse	765168	6268359	4.00	27	0.80	30.1	0.069	0.069	-	-
A2-1	A2 Baghouse	765159	6268304	4.00	27	0.80	24.4	0.056	0.056	-	-
A2-2	A2 Baghouse	765153	6268277	4.00	27	0.80	24.4	0.056	0.056	-	-
EPA6	DC3 Baghouse	764999	6267979	6.00	33	1.18	10.1	0.070	0.052	-	-
EPA3	Moulding Oven Exhaust	764984	6268256	15.00	93	0.55	7.8	0.0074	0.0074	-	0.0068
EPA1	DC4 Baghouse	765094	6268150	6.00	30	1.93	16.0	0.18	0.034	-	-
-	Hot oil heater	765097	6268371	15.00	250	0.40	8.5	-	-	-	0.083
EPA2	DC7 Baghouse	765086	6268183	8.00	26	0.76	18.0	0.020	0.020	-	-
-	Conti Fibre Transport Cyclone	765056	6268008	25.00	27	1.70	3.6	0.050	0.048	0.0025	-



Table 6-5: Emission inventory of the proposed PB plant

Source ID	Description	Easting (m)	Northing (m)	Stack height (m)	Discharge Temperature (°C)	Stack Diameter (m)	Exit Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	Formaldehyde (g/s)	NO _x (g/s)
E1	Fines Blower	764801	6267963	20.00	12	0.26	20.0	0.0053	0.0053	-	-
E2	Hammermill Particles	764806	6267977	40.00	12	0.22	20.0	0.0038	0.0038	-	-
E3	Chipper Cyclofilter	764930	6267886	10.00	12	0.66	20.0	0.035	0.035	-	-
E4	Hammermill Cyclofilter	764827	6267977	19.00	12	0.97	15.0	0.056	0.056	-	-
E5	Flakers Baghouse	764822	6267957	19.00	12	1.10	15.0	0.072	0.072	-	-
E7	Baghouse	764885	6268002	30.00	12	0.25	15.0	0.0038	0.0038	-	-
E8	Air Grader Baghouse	764927	6268003	15.00	45	1.40	10.0	0.076	0.076	-	-
E9	Mill Cyclofilter	764914	6267970	12.00	50	0.72	15.0	0.031	0.031	-	-
E10	Mill Cyclofilter	764918	6267969	12.00	50	0.72	15.0	0.031	0.031	-	-
E12	Forming Line Baghouse including PB scrubber	764950	6268025	40.00	20	1.60	20.0	1.26	0.70	0.69	-
E13	Forming Station Baghouse	764938	6267972	40.00	20	0.96	20.0	0.036	0.036	0.042	-
E14	Reject Mat Dump	764789	6267943	20.00	20	0.69	15.0	0.028	0.028	-	-
E15	Trimming Saws	764948	6268027	15.00	20	0.91	15.0	0.049	0.049	-	-
E16	Dust Transport	764805	6267980	20.00	12	0.25	15.0	0.0038	0.0038	-	-
E18	Cooling Tuners	764987	6268123	20.00	20	1.02	15.0	0.014	0.014	0.063	-
E19	Wet Electrostatic Precipitator	764866	6268013	40.00	67	2.80	17.2	0.63	0.63	0.021	9.7
E20	Hot Oil Heater	764945	6268012	20.00	150	0.80	8.6	-	-	-	0.47
-	Baghouse for particle board sander	765094	6268165	8.00	30	1.80	18.0	0.17	0.054	-	-



Table 6-6: Emission inventory of other key industries near the Project

Source	Easting (m)	Northing (m)	Stack height (m)	Discharge Temperature (°C)	Stack Diameter (m)		Exit Velocity (m/s)	TSP (g/s)	PM ₁₀ (g/s)	Formaldehyde (g/s)	NO _x (g/s)
Woodchem											
Catalytic oxidizer	765290	6268113	6.00	267	0.45		20.7	0.0072	0.0072	0.0067	0.0070
Batch reactor stack	765282	6268081	12.00	23	0.17		8.9	0.00080	0.00080	0.0027	-
Structaflor											
Roof vent	764506	6267874	12.00	29	1.10		11.0	0.084	0.071	0.082	-
Roof vent	764506	6267874	11.00	24	1.10		7.4	0.067	0.067	0.042	-
Roof vent	764506	6267874	11.00	28	1.10		12.0	0.078	0.053	0.078	-
Core Dryer Stack 125	764357	6267918	30.00	21	1.24		16.0	3.3	3.0	0.0020	1.1
Surface Dryer Stack 105	764357	6267918	30.00	13	0.90		23.0	0.94	0.65	0.0020	1.7
Cyclones	764471	6267859	15.00	29	0.58		6.3	0.033	0.016	0.0025	-
Cyclones	764475	6267859	15.00	29	0.58		5.9	0.032	0.0096	0.0027	-
Highland Pine Products											
S2 Boiler Stack	764223	6267871	35.00	279	2.07		8.3	3.3	2.2	0.0030	1.6
S1 Planer Mill Cyclone	764386	6267838	16.00	17	0.50		5.4	0.0013	0.0027	-	-
S2 Baghouse	764400	6267830	7.00	25	1.82		13.0	0.054	0.047	-	-
S2 Chip Bin Cyclone	764140	6267882	18.00	18	0.90		4.2	0.0030	0.0030	-	-
S2 Drying Kiln	764248	6267829	15.00	26	0.45		4.5	-	-	0.00010	-

Table 6-7: Emission concentration of the proposed Project sources

Source ID	Description	Modelled TSP concentration (mg/m ³)	TSP POEO limit (mg/m ³)	TSP licence limit (mg/m ³)	Modelled Formaldehyde concentration (mg/m ³)	Formaldehyde licence limit (mg/m ³)	Modelled NO _x (as NO ₂) concentration (mg/m ³)	NO _x (as NO ₂) POEO limit (mg/m ³)
EPA7	Conti 2 Stage 1 Dryer Cyclone #1 (west)	20.1	250	-	9.3	-	19.7	2,500
EPA8	Conti 2 Stage 1 Dryer Cyclone #2 (east)	18.2	250	-	3.9	-	19.7	2,500
EPA9	Conti 1 Dryer Cyclone #1 (south)	19.6	250	-	6.0	-	136.5	2,500
EPA10	Conti 1 Dryer Cyclone #1 (north)	20.0	250	-	9.8	-	131.5	2,500
EPA11	Conti 2 Heat Plant	215.6	250	200	1.3	5	19.7	2,500
EPA12a	Conti 1 Press Vents	4.4	250	-	2.6	-	6.1	2,500

16080595A_BorgPanelsOberon_AQIA_170216



Source ID	Description	Modelled TSP concentration (mg/m ³)	TSP POEO limit (mg/m ³)	TSP licence limit (mg/m ³)	Modelled Formaldehyde concentration (mg/m ³)	Formaldehyde licence limit (mg/m ³)	Modelled NO _x (as NO ₂) concentration (mg/m ³)	NO _x (as NO ₂) POEO limit (mg/m ³)
EPA12c	Conti 1 Press Vents	9.0	250	-	6.2	-	5.6	2,500
EPA12d	Conti 1 Press Vents	8.4	250	-	5.5	-	5.8	2,500
EPA12e	Conti 1 Press Vents	6.8	250	-	0.9	-	3.8	2,500
EPA17	Conti 1 Heat Plant	195.4	250	200	1.1	5	1,012.6	2,500
-	New Combined Stack	21.1	50	-	14	-	70.2	350
A3-1	A3 Baghouse	5.0	250	-	-	-	-	2,500
A3-2	A3 Baghouse	5.0	250	-	-	-	-	2,500
A2-1	A2 Baghouse	5.0	250	-	-	-	-	2,500
A2-2	A2 Baghouse	5.0	250	-	-	-	-	2,500
EPA6	DC3 Baghouse	8.1	250	-	-	-	-	2,500
EPA3	Moulding Oven Exhaust	6.2	250	-	-	-	5.7	2,500
EPA1	DC4 Baghouse	4.8	250	-	-	-	-	2,500
-	Hot oil heater	-	250	-	-	-	150	2,500
EPA2	DC7 Baghouse	3.1	250	-	-	-	-	2,500
-	Conti Fibre Transport Cyclone	7.7	250	-	0.38	-	-	2,500
E1	Fines Blower	3.2	50	-	-	-	-	350
E2	Hammermill Particles	1.4	50	-	-	-	-	350
E3	Chipper Cyclofilter	5.0	50	-	-	-	-	350
E4	Hammermill Cyclofilter	6.3	50	-	-	-	-	350
E5	Flakers	2.0	50	-	-	-	-	350
E7	Baghouse	1.4	50	-	-	-	-	350
E8	Air Grader Baghouse	5.5	50	-	-	-	-	350
E9	Mill Cyclofilter	4.4	50	-	-	-	-	350
E10	Mill Cyclofilter	4.4	50	-	-	-	-	350
E12	Forming Line Baghouse Including new PB scrubber	5.0	50	-	27.93	-	-	350
E13	Forming Station Baghouse	4.3	50	-	5	-	-	350
E14	Reject Mat Dump	5.0	50	-	-	-	-	350
E15	Trimming Saws	8.7	50	-	-	-	-	350
E16	Dust Transport	3.4	50	-	-	-	-	350
E18	Cooling Tuners	1.1	50	-	5	-	-	350
E19	Wet Electrostatic Precipitator	15.0	50	-	0.76	-	233.3	350
E20	Hot Oil Heater	-	50	-	-	-	170.0	350

16080595A_BorgPanelsOberon_AQIA_170216



7 DISPERSION MODELLING RESULTS

7.1 Particulate matter and NO₂

Table 7-1 and **Table 7-2** present a summary of the predicted particulate matter and NO₂ impacts of the Level 1 assessment (adding the maximum predicted level with the maximum measured background level irrespective of when these occur) of the existing and proposed Project, respectively. A Level 1 assessment of the 24-hour average PM₁₀ would show unrealistic results and the 24-hour average PM₁₀ impacts are assessed separately in more detail (see **Section 7.2**).

The predicted annual average concentrations of PM₁₀ and NO₂ and the predicted 1-hour average NO₂ concentrations are below the relevant criterion at all the sensitive receptors at all times.

Table 7-1: Model-predicted impacts of existing Project using maximum incremental and background

Receptor ID	PM ₁₀ (µg/m³)		TSP (µg/m³)	NO ₂ (µg/m³)		PM ₁₀ (µg/m³)	NO ₂ (µg/m³)	
	Project impact					Total impact		
	24-hr ave.	Ann. ave.	Ann. ave.	1-hr ave.	Ann. ave.	Ann. ave.	1-hr ave.	Ann. ave.
	Air quality impact criteria							
	-	-	-	-	-	30	246	62
1	11.8	1.0	1.5	66.4	0.9	17.3	119.8	5.5
2	27.5	3.2	4.6	66.9	2.5	21.7	120.4	7.6
3	19.7	1.6	2.4	79.2	2.1	17.5	132.5	6.6
4	15.8	1.6	2.3	76.6	2.1	17.2	129.9	6.5
5	13.4	1.5	2.3	47.6	1.6	16.9	101.0	6.0
6	8.6	0.9	1.4	35.9	1.0	16.0	89.2	5.2
7	8.9	0.9	1.4	35.9	1.0	16.0	89.3	5.3
8	9.0	0.9	1.4	34.4	1.0	16.0	87.7	5.3
9	7.8	0.8	1.3	41.3	0.9	15.9	102.2	5.1
10	9.4	1.0	1.5	45.5	1.1	16.2	98.8	5.3
11	7.0	0.8	1.2	46.9	0.8	15.8	107.2	5.1
12	5.6	0.6	0.9	50.7	0.7	15.6	109.3	4.9
13	5.9	0.6	0.9	49.1	0.7	15.6	106.5	4.9
14	5.9	0.6	0.9	46.3	0.6	15.6	103.6	4.8
15	5.8	0.6	0.8	44.4	0.6	15.5	101.5	4.8
16	6.1	0.6	0.8	44.5	0.6	15.5	105.0	4.8
17	10.4	0.7	1.1	39.7	0.6	16.4	93.1	5.0
18	10.9	0.5	0.8	35.3	0.4	16.0	88.6	4.8
19	7.0	0.6	0.8	39.1	0.5	16.6	111.6	5.1
20	18.1	2.1	3.0	60.4	1.3	17.9	114.5	5.7
21	9.1	0.4	0.7	54.2	0.3	15.3	107.5	4.5
22	9.3	0.4	0.7	50.8	0.3	15.3	104.9	4.5
23	8.1	0.4	0.6	49.5	0.3	15.2	102.8	4.4
24	10.3	0.5	0.8	52.5	0.4	15.4	106.5	4.5
25	9.9	0.4	0.7	52.5	0.3	15.3	106.6	4.5
26	9.0	0.7	1.0	29.2	0.7	15.6	85.7	4.9
27	8.8	0.8	1.2	34.1	0.9	15.8	90.8	5.1
28	10.6	0.9	1.5	39.2	1.0	15.9	96.3	5.2
29	10.3	0.8	1.2	36.3	0.8	15.8	94.9	5.0
30	13.5	0.8	1.4	34.1	0.8	15.9	89.4	5.1
31	6.7	0.4	0.6	53.7	0.3	15.2	107.1	4.4
32	9.8	0.5	0.9	44.4	0.5	15.5	99.5	4.7
33	10.0	0.6	1.0	39.8	0.5	15.5	96.4	4.7
34	13.6	0.7	1.1	41.6	0.6	15.6	96.8	4.8
35	14.4	0.7	1.1	38.0	0.7	15.7	93.1	4.9
36	14.4	0.7	1.2	36.3	0.7	15.7	92.9	4.9
37	17.0	2.0	2.9	59.9	1.2	17.8	113.9	5.6

16080595A_BorgPanelsOberon_AQIA_170216

Table 7-2: Model-predicted impacts of proposed Project using maximum incremental and background

Receptor ID	PM ₁₀ (µg/m³)		TSP (µg/m³)	NO ₂ (µg/m³)		PM ₁₀ (µg/m³)	NO ₂ (µg/m³)	
	Project impact					Total impact		
	24-hr ave.	Ann. ave.	Ann. ave.	1-hr ave.	Ann. ave.	Ann. ave.	1-hr ave.	Ann. ave.
	Air quality impact criteria							
	-	-	-	-	-	30	246	62
1	13.9	1.2	1.9	89.1	1.3	17.6	142.4	5.9
2	31.7	4.4	6.4	89.9	4.0	23.0	143.4	9.1
3	18.7	1.7	2.9	127.8	2.3	17.5	181.2	6.7
4	15.4	1.6	2.9	119.4	2.1	17.2	172.7	6.5
5	15.2	1.8	2.9	48.7	2.2	17.1	102.0	6.5
6	9.8	1.1	1.7	39.1	1.3	16.1	92.5	5.6
7	10.1	1.1	1.8	38.2	1.4	16.2	91.5	5.6
8	10.0	1.1	1.7	38.8	1.4	16.2	92.1	5.6
9	8.3	1.0	1.6	53.4	1.2	16.0	114.2	5.5
10	10.7	1.1	1.9	51.4	1.4	16.3	104.7	5.7
11	7.4	0.9	1.5	60.7	1.1	16.0	120.9	5.4
12	6.6	0.7	1.2	67.7	0.9	15.7	126.3	5.1
13	6.8	0.7	1.2	65.7	0.9	15.7	123.1	5.1
14	6.6	0.7	1.1	62.5	0.9	15.7	119.7	5.1
15	6.4	0.7	1.1	60.0	0.9	15.7	117.1	5.1
16	7.0	0.7	1.1	56.9	0.9	15.6	117.4	5.1
17	11.8	0.8	1.3	57.3	0.9	16.5	110.7	5.3
18	13.1	0.6	1.0	40.6	0.7	16.1	93.9	5.0
19	9.0	0.7	1.1	41.7	0.8	16.8	115.0	5.3
20	17.1	2.3	3.5	69.8	1.6	18.1	123.8	6.0
21	10.1	0.5	0.8	56.9	0.4	15.3	110.2	4.6
22	10.2	0.5	0.8	57.6	0.4	15.3	110.9	4.6
23	9.0	0.4	0.7	53.7	0.4	15.2	107.0	4.5
24	11.2	0.5	0.9	56.5	0.5	15.4	109.8	4.7
25	10.7	0.5	0.8	58.0	0.5	15.4	111.4	4.6
26	10.6	0.8	1.3	38.6	1.0	15.7	95.1	5.2
27	10.1	0.9	1.5	55.1	1.1	15.9	111.8	5.3
28	12.1	1.1	1.8	52.6	1.3	16.1	110.8	5.5
29	11.6	0.9	1.5	47.3	1.1	15.9	106.3	5.3
30	15.1	1.0	1.7	38.0	1.1	16.0	92.8	5.3
31	8.4	0.4	0.7	58.7	0.4	15.3	112.0	4.6
32	10.8	0.6	1.1	46.8	0.6	15.6	101.8	4.9
33	11.6	0.7	1.2	42.6	0.7	15.6	99.3	4.9
34	15.5	0.8	1.3	43.9	0.8	15.8	99.1	5.1
35	16.1	0.8	1.4	39.2	0.9	15.8	94.3	5.1
36	16.0	0.8	1.5	39.6	0.9	15.9	95.2	5.2
37	16.9	2.2	3.4	68.9	1.5	18.0	122.7	5.9

The predicted dust impacts of the existing and proposed Project are relatively similar. Although there would be a small increase in NO₂ concentrations for the proposed Project, the off-site concentrations remain below acceptable levels.

Figure 7-1 to **Figure 7-10** present the isopleth plots of the model-predicted PM₁₀ and NO₂ concentrations due to the Project alone and due to the Project and other industries.



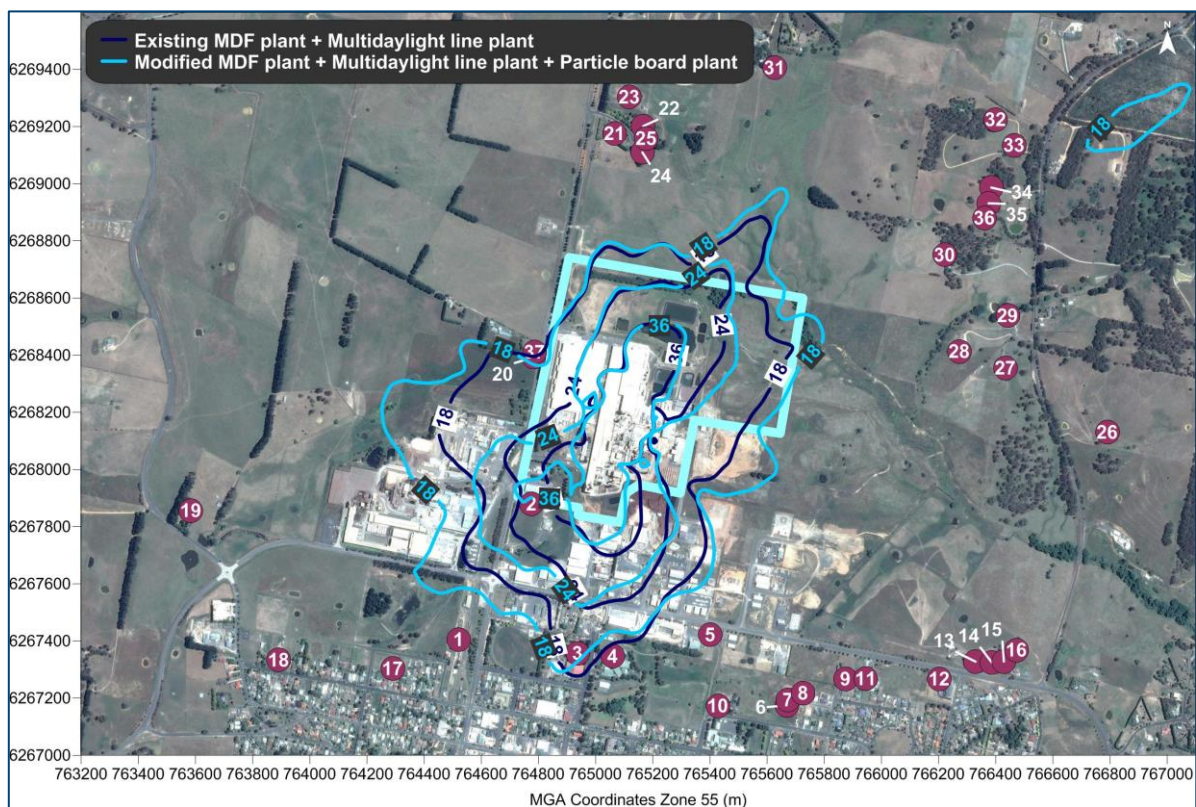


Figure 7-1: Predicted maximum 24-hour average PM_{10} concentration ($\mu g/m^3$) due to the Project

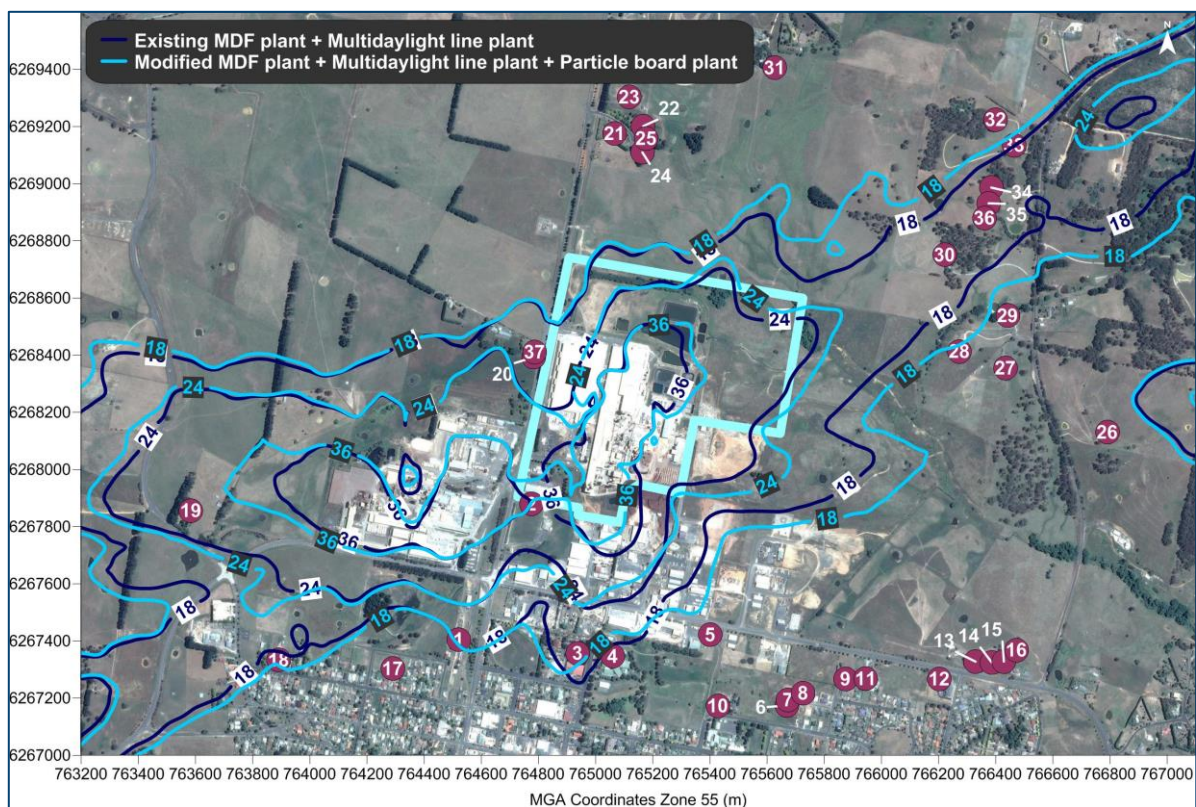


Figure 7-2: Predicted max. 24-hr ave. PM_{10} concentration ($\mu g/m^3$) due to the Project and other surrounding industries

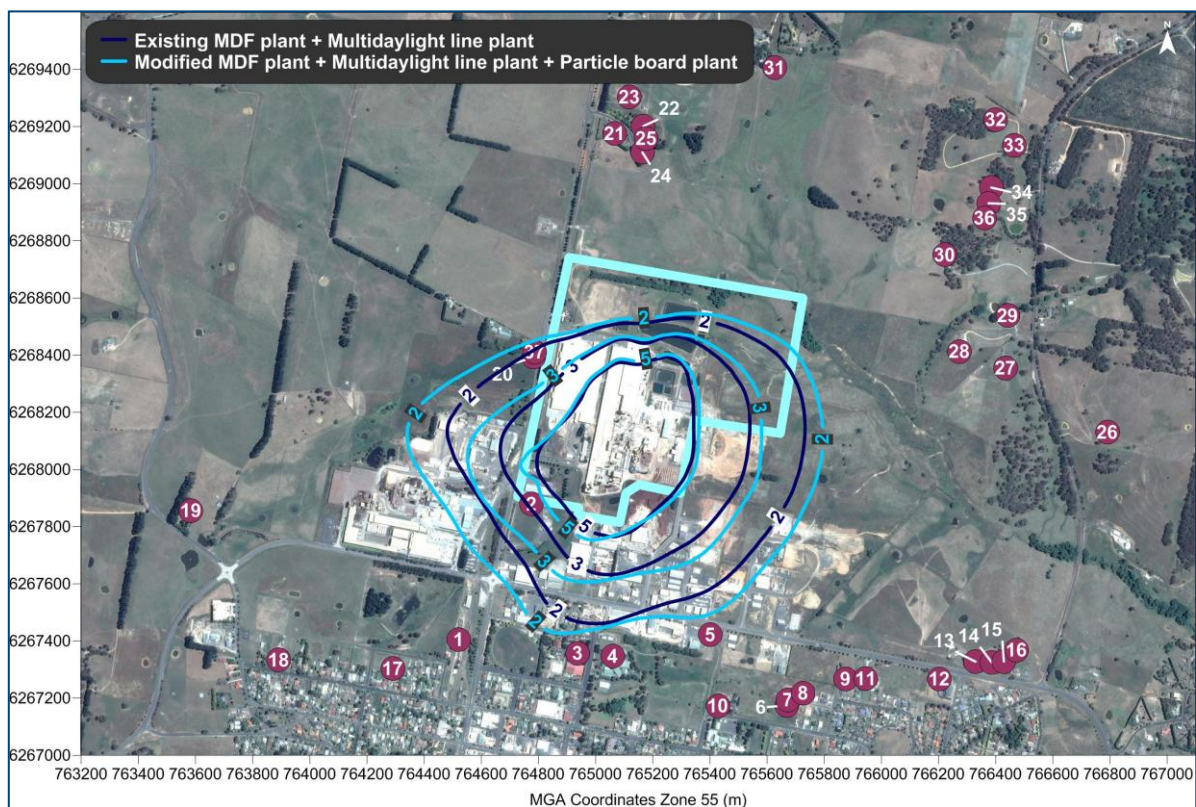


Figure 7-3: Predicted annual average PM₁₀ concentration (µg/m³) due to the Project

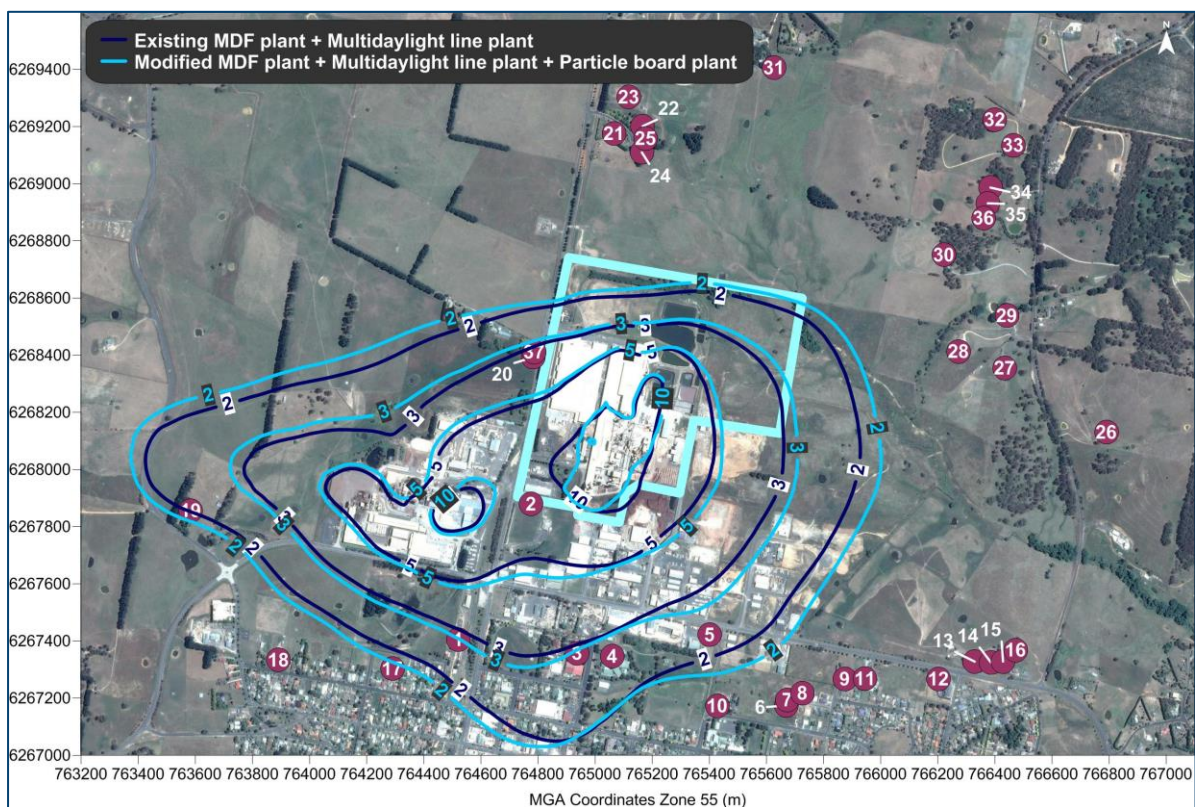


Figure 7-4: Predicted annual average PM₁₀ concentration (µg/m³) due to the Project and other surrounding industries

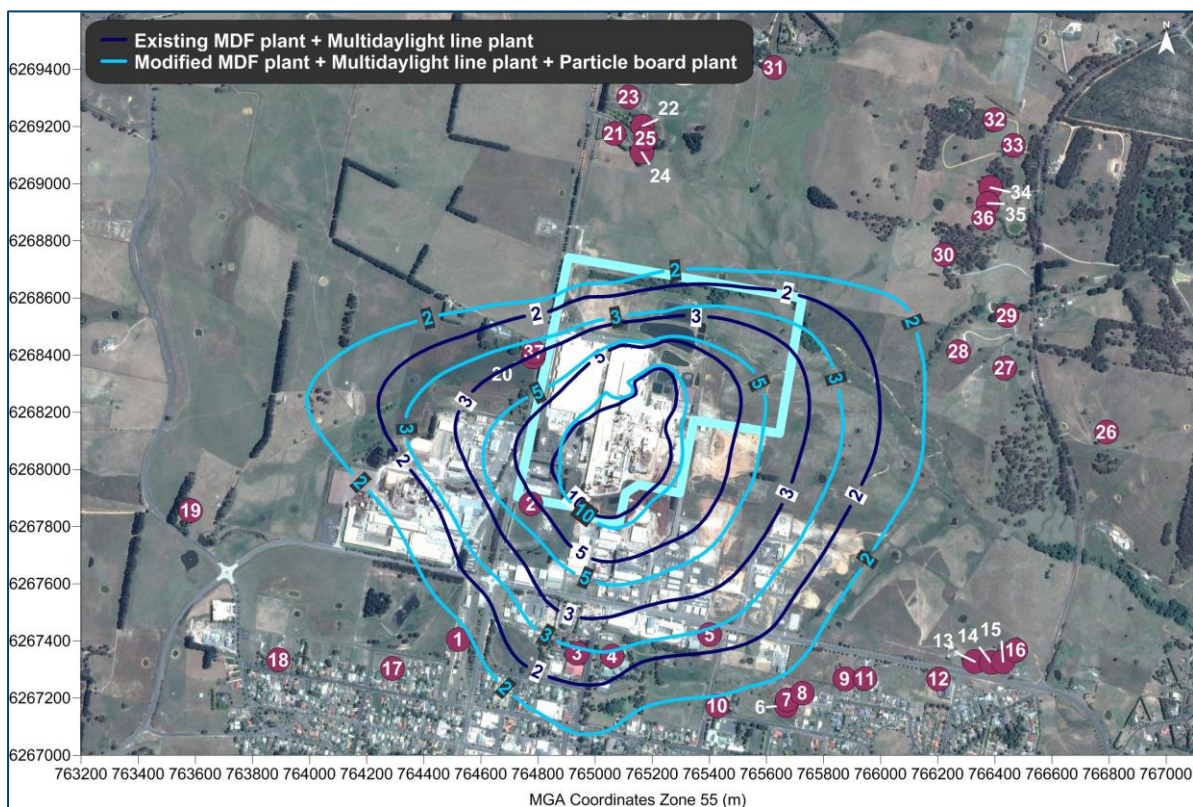


Figure 7-5: Predicted annual average TSP concentration ($\mu\text{g}/\text{m}^3$) due to the Project

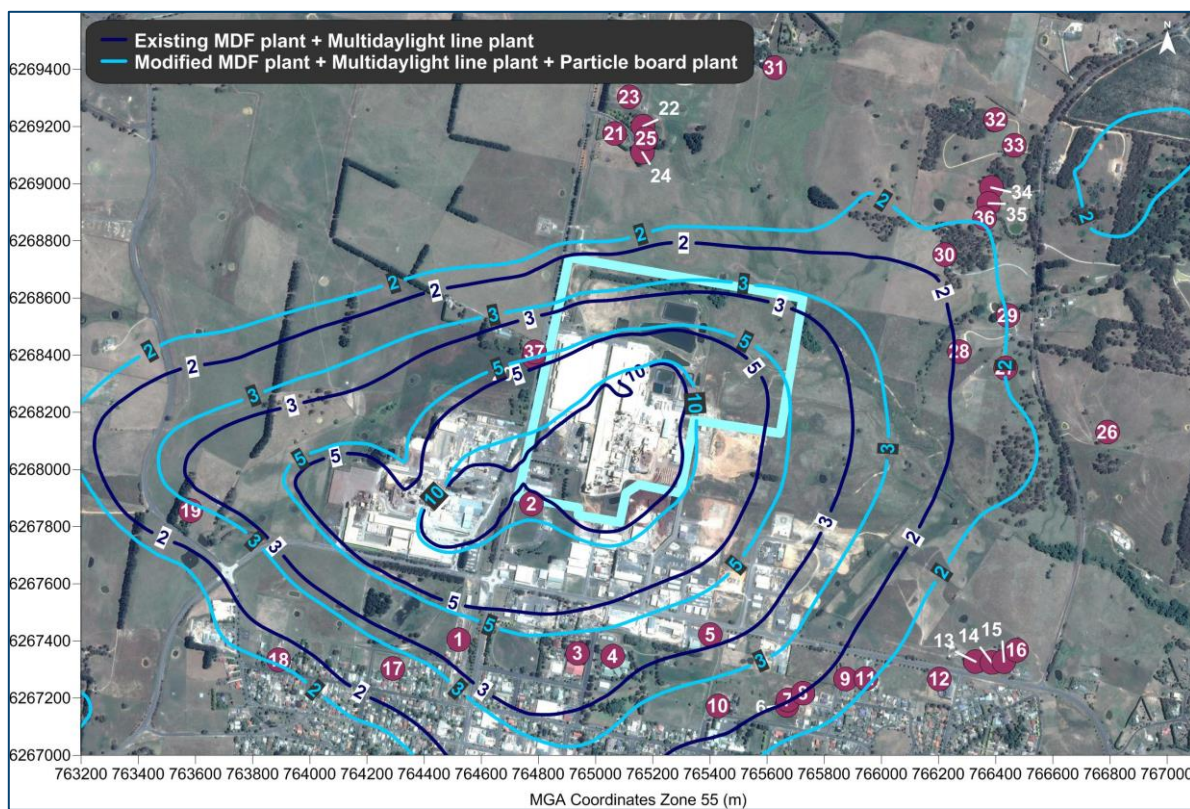


Figure 7-6: Predicted annual average TSP concentration ($\mu\text{g}/\text{m}^3$) due to the Project and other surrounding industries

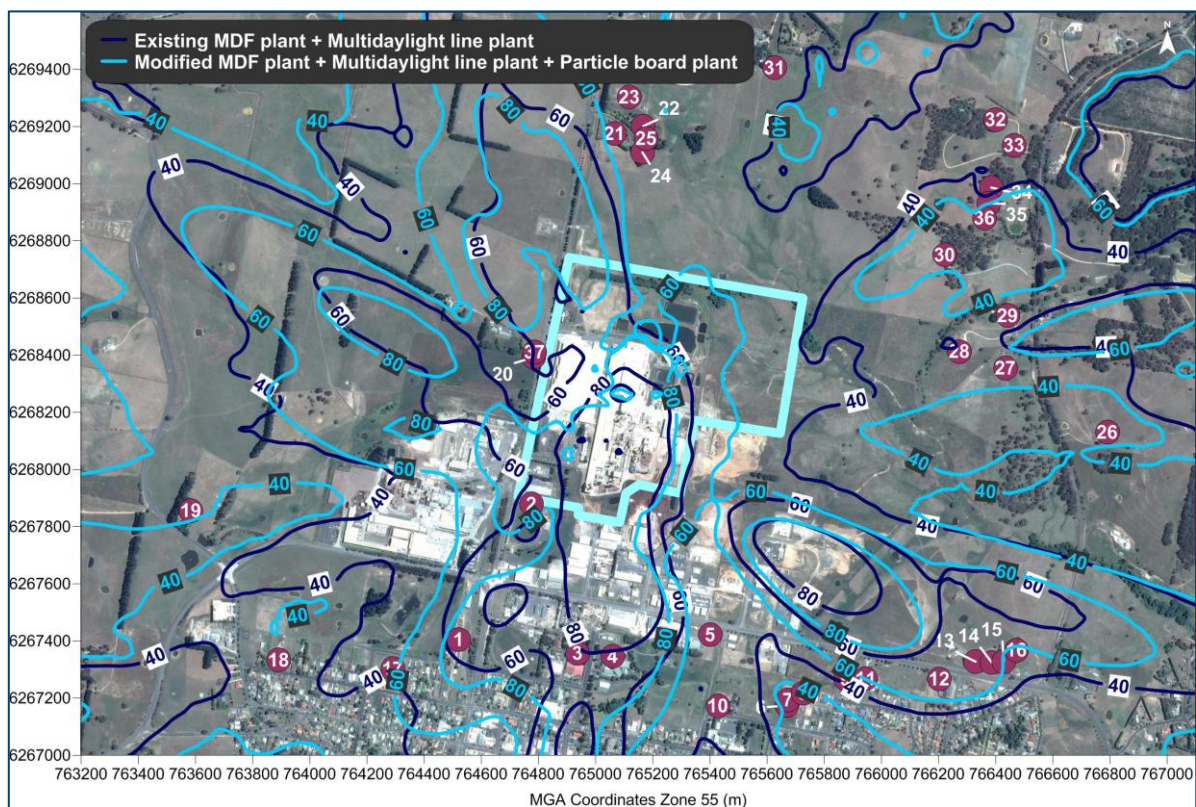


Figure 7-7: Predicted maximum 1-hour average NO_2 concentration ($\mu\text{g}/\text{m}^3$) due to the Project

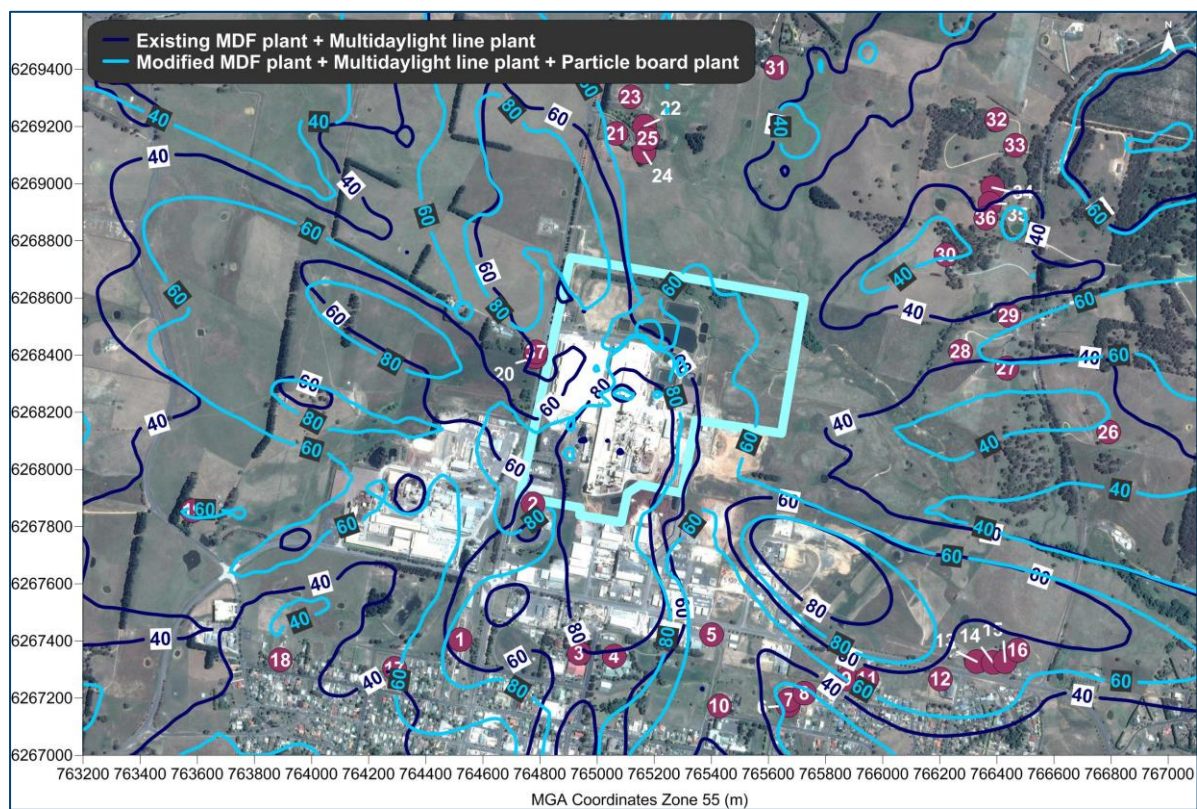


Figure 7-8: Predicted max. 1-hr average NO_2 concentration ($\mu\text{g}/\text{m}^3$) due to the Project and other surrounding industries

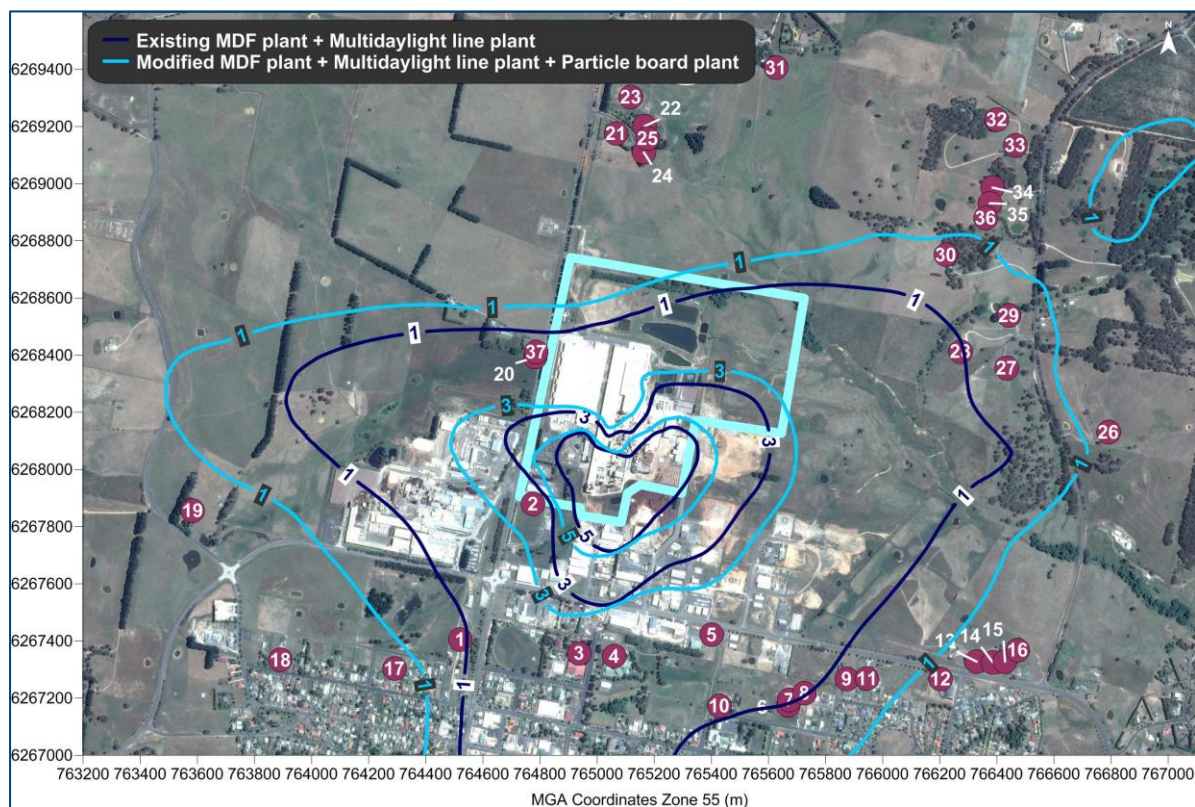


Figure 7-9: Predicted annual average NO₂ concentration (µg/m³) due to the Project

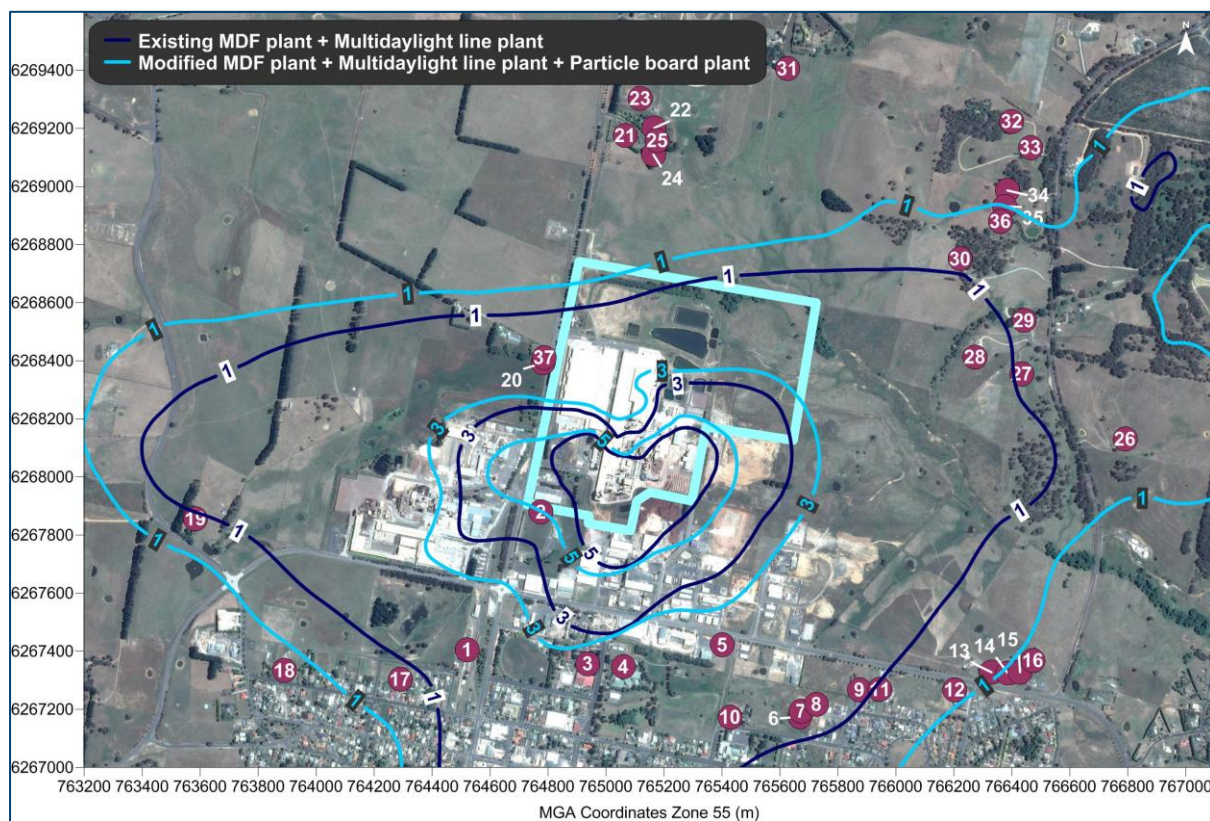


Figure 7-10: Predicted annual average NO₂ concentration (µg/m³) due to the Project and other surrounding industries

7.2 24-hour average PM₁₀ impacts

Due to the elevated levels in the monitoring data, the screening Level 1 approach of adding maximum background levels with maximum predicted Project only levels would not be appropriate for assessing the potential 24-hour average PM₁₀ impacts on these elevated days.

In such situations, the NSW EPA approach applies a more thorough Level 2 assessment whereby the measured background level on a given day is added contemporaneously with the corresponding Project level predicted using the same day's weather data.

An assessment of cumulative 24-hour average PM₁₀ impacts was undertaken in accordance with the methods outlined in Section 11.2 of the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (NSW DEC, 2005)*. The "Level 2 assessment - Contemporaneous impact and background approach" was applied to assess potential impacts. This method factors into the assessment the spatial and temporal variation in background levels affected by the weather and existing sources of dust in the area on a given day. However, the approach has limitations in predicting short term impacts. The approach has been applied at the most potentially affected sensitive receptor locations where there may be persons present for 24 hours or longer.

Ambient (background) dust concentration data for January 2014 to December 2014 from the Bathurst monitor have been applied in the Level 2 contemporaneous 24-hour average PM₁₀ assessment.

Table 7-3 provides a summary of the findings of the contemporaneous assessment at each key assessment location. Detailed tables of the full assessment results are provided in **Appendix A**.

The results in **Table 7-3** indicate that the existing and proposed Project is unlikely to exceedance the cumulative 24-hour average PM₁₀ impacts at any sensitive receptor.

Table 7-3: NSW EPA contemporaneous assessment - maximum number of additional days above 24-hour average PM₁₀ criterion depending on background level at monitoring sites

Receptor ID	Maximum number of additional days above 24-hour average PM ₁₀ criterion	
	Existing	Proposed
5	0	0
20	0	0
24	0	0
28	0	0
30	0	0

7.3 Formaldehyde

Table 7-4 presents the 99.9th percentile 1-hour average formaldehyde concentration at the sensitive receptors due to the operations of the existing plant and the proposed Project. The results show that the Project would meet the EPA criteria at all assessed receptor locations.

Table 7-4: Model-predicted formaldehyde impacts of the existing plant and the proposed Project

Receptor ID	99.9 th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$)			
	Existing plant	Existing plant + other industries	Proposed plant	Proposed plant + other industries
	Air quality impact criteria			
	21.8			
1	13.6	13.7	10.4	10.4
2	27.9	28.0	18.5	18.5
3	11.7	11.8	10.7	10.7
4	10.6	10.6	9.9	9.9
5	8.9	8.9	11.1	11.2
6	5.2	5.2	7.5	7.5
7	5.2	5.2	7.4	7.5
8	5.2	5.3	7.2	7.3
9	5.1	5.3	6.7	6.7
10	7.1	7.2	9.5	9.5
11	5.1	5.3	7.1	7.2
12	5.5	5.5	6.8	6.9
13	5.6	5.7	6.9	7.2
14	5.5	5.5	6.8	7.0
15	5.4	5.5	6.7	7.0
16	5.4	5.8	7.0	7.3
17	10.2	10.6	9.3	9.3
18	9.5	12.1	8.2	10.0
19	7.3	12.0	8.8	10.7
20	16.4	16.4	16.3	16.4
21	9.3	9.3	9.6	9.7
22	8.7	8.7	8.1	8.1
23	8.3	8.3	7.9	8.0
24	9.3	9.4	8.8	8.8
25	8.8	8.8	9.6	8.6
26	6.9	8.0	8.3	8.4
27	6.4	6.9	8.1	7.9
28	6.4	7.5	9.0	8.4
29	6.5	7.9	9.1	8.5
30	8.8	10.0	10.4	10.1
31	8.2	8.4	8.0	7.3
32	8.5	9.4	9.5	9.3
33	8.1	9.6	9.9	9.6
34	8.2	9.2	10.8	10.3
35	8.3	9.9	10.8	10.3
36	8.7	10.0	10.7	10.4
37	16.3	16.4	17.7	15.3

The spatial distribution of the dispersion modelling predictions for the Project alone and for the Project and other surrounding industries are presented as isopleth diagrams showing the 99.9th percentile 1-hour average formaldehyde concentrations in **Figure 7-11** and **Figure 7-12**, respectively. The thicker isopleth lines indicate the predicted concentration of $21.8\mu\text{g}/\text{m}^3$, corresponding to the criterion level.

As shown in the figures, the maximum one hour average impacts from the existing operation may exceed the NSW EPA formaldehyde criterion outside the plant boundary. However, the proposed operation would substantially reduce the extent of the predicted impacts relative to the existing situation such that maximum one hour average formaldehyde concentrations at the EPA impact assessment criterion remain essentially within the plant boundary. This remains the case even when cumulative impacts with the neighbouring activity are considered.



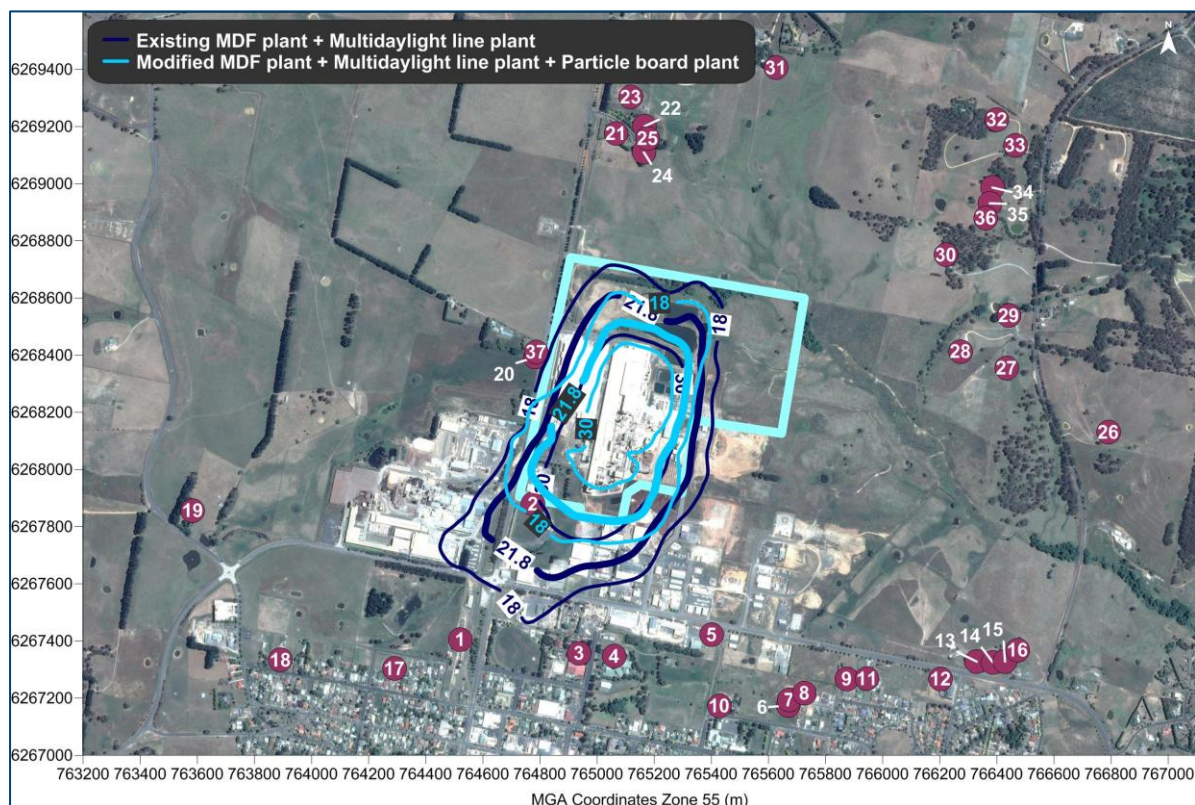


Figure 7-11: Predicted 99.9th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$) for the Project

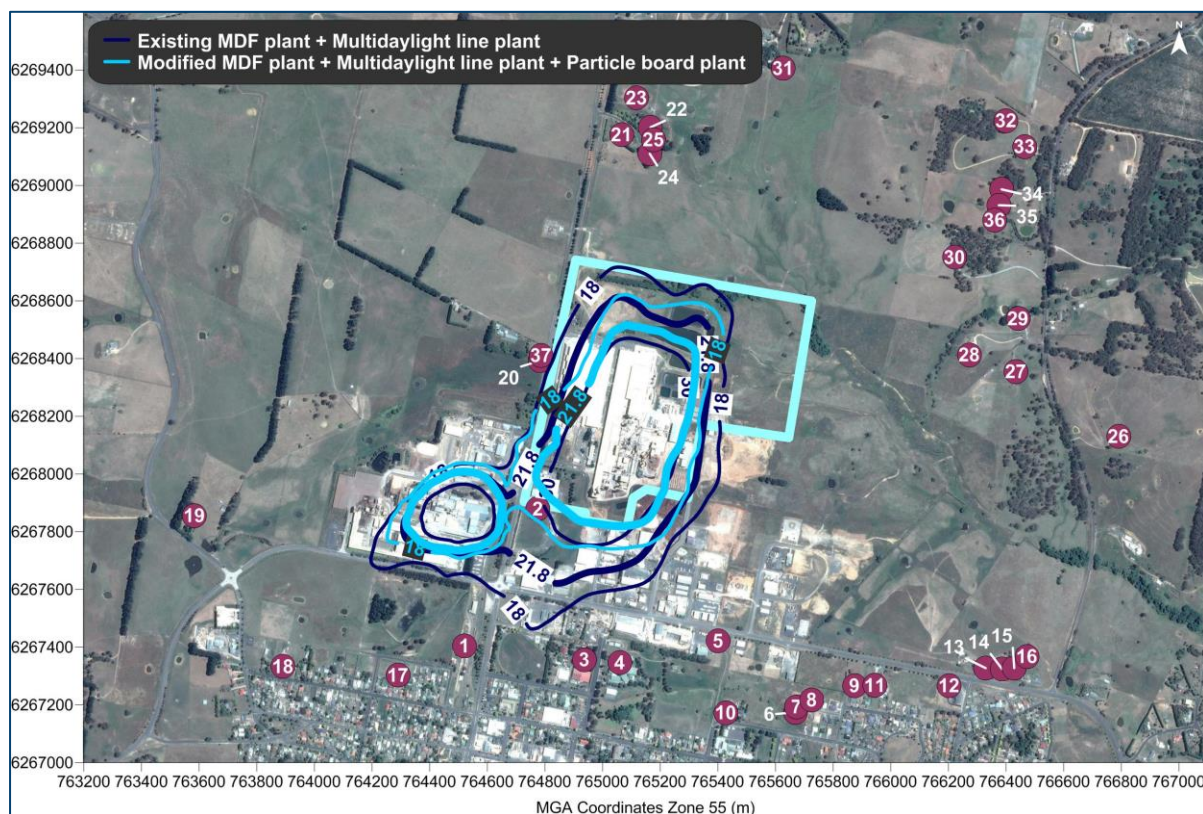


Figure 7-12: Predicted 99.9th percentile 1-hr ave formaldehyde conc ($\mu\text{g}/\text{m}^3$) for the Project and surrounding industries

It is noted that the WHO conducted detailed health based studies into the effects of human exposure to formaldehyde in 2010. The WHO criterion is set at $100\mu\text{g}/\text{m}^3$ and is designed to prevent sensory irritation. Potential health impacts occur when exposed to double this level.

Figure 7-13 presents an isopleth plot for the maximum 30-minute average formaldehyde concentration at the WHO guideline of $100\mu\text{g}/\text{m}^3$. The figures show that the predicted formaldehyde concentrations due to the Project, along with those from other nearby industries, would not exceed the WHO limits at any location outside the Project boundary.

Hence no impact in terms of sensory irritation or health impact due to formaldehyde emissions in the locality is predicted to arise off-site.

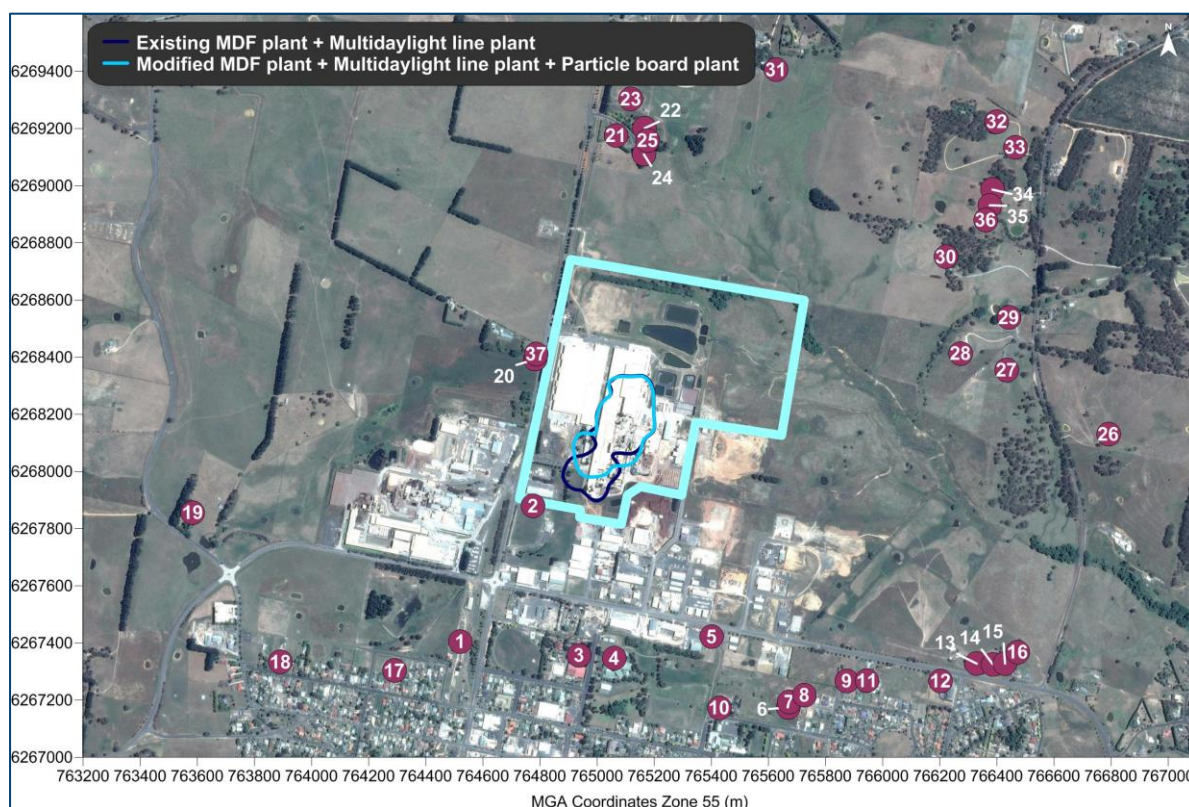


Figure 7-13: Predicted maximum 30-minute average formaldehyde concentration due to the Project and other industries– WHO guideline ($100\mu\text{g}/\text{m}^3$)

7.3.1 Sensitivity analysis

A sensitivity analysis was conducted by modelling the emission rates using the average, average plus standard deviation and average minus standard deviation of the historical stack testing results. The modelling results are presented as isopleth plots in **Figure 7-14**. The results show that the predicted formaldehyde concentrations are essentially within the Project boundary, and that there is no predicted level above the EPA criteria on any publically accessible land outside of the Project boundary.

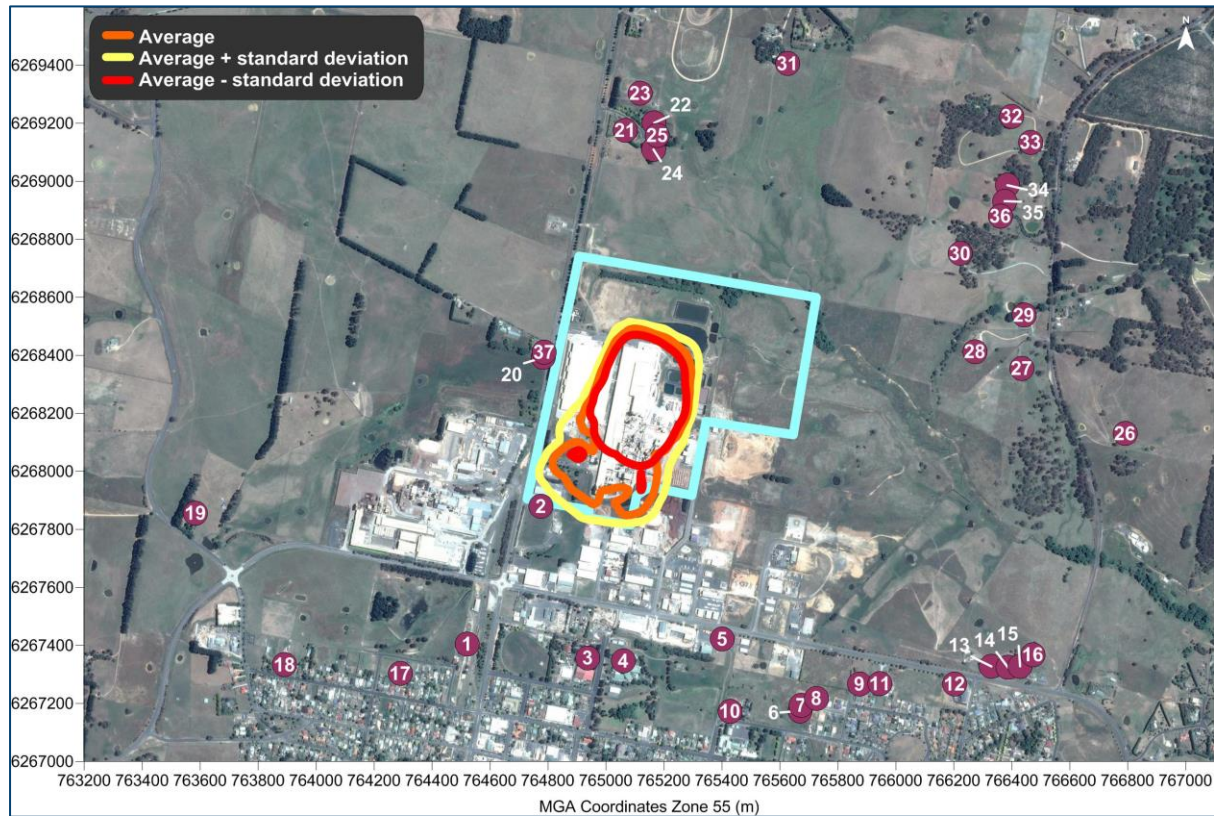


Figure 7-14: Predicted 99.9th percentile 1-hr ave formaldehyde for the Modified MDF Plant and Particle Board Plant – NSW EPA criterion of 21.8 $\mu\text{g}/\text{m}^3$

Further analysis has been conducted to examine the potential formaldehyde emissions from the Project, as outlined in **Appendix B**.

8 POLLUTION CONTROL

To reduce the potential amount of pollutants emitted by the Project, the Proponent would install and utilise best available technologies on-site. These would include the following:

- ✦ Cyclones for process particle capture;
- ✦ Wet Electrostatic precipitator (WESP)/scrubber system for the dryer with exhaust gas circulation; and,
- ✦ Best available press suction system for the press exhausts.

The recirculation of some of the exhaust gases to heat plant, as part of the existing plant modification, would expose the gases to high temperatures resulting in the oxidation of the contaminants including formaldehyde, thus reducing the quantity of pollutants emitted from the plant.

The WESP and scrubber system would capture small particles and other water-soluble contaminants including formaldehyde. The system would be continually bled and fresh water would be regularly introduced into the system to prevent saturation. This system would thus allow for the effective removal of the contaminants. The scrubber is anticipated to remove up to 70% of the formaldehyde emissions by maintaining good water quality in the system. For conservatism in the assessment, the scrubber has been modelled with only a 30% removal efficiency.

To limit fugitive emissions, a press fume extraction system would be installed on the existing Conti 2 press line to replace the existing roof ventilators, and also on the new PB Plant (instead of roof ventilators). The system would allow the capture of most of the emissions from the press lines and direct these into the scrubber oxidation system for treatment prior to release to the atmosphere via a stack, (instead of the existing release of untreated emissions from the roof-level ventilators and other fugitive sources). The system would thus also improve the air quality inside the press line building for the benefit of the workers.

The Proponent is currently examining the feasibility of capturing formalin (i.e. formaldehyde dissolved in water) in a reactive bark filter. This bark would then be used as a fuel in the heat plant resulting in the thermal destruction of formaldehyde. A potential side benefit is an anticipated reduction in NO_x emitted by the furnace due to the cooler flame temperature arising from a portion of the fuel stream being high moisture bark.

8.1 Pollution Reduction Program

The Proponent is committed to reducing its environmental impacts where it is possible (practicable and economically viable) to do so, and plans to conduct a pollution reduction program for the plant. It is suggested that this would be conducted in two parts as follows;

Part 1.

- a) A detailed examination of the existing processes to identify the potential for emissions reductions, with a primary focus on formaldehyde;

-
- b) This may include measurement (stack testing) of the existing unmonitored sources, with a focus on formaldehyde.
 - c) Where practicable and economically feasible measures can be put into place, a description of the measures and a timeframe for their implementation would be provided. This may range from minor changes to parts of the existing plant or pollution control, through to large scale upgrades of existing plant or processes. Any large scale changes may be subject to planning approval timelines.

Part 2. (Post Part 1 or in parallel with Part 1 as timeframes allow).

- d) Measurement (stack testing) of the proposed and modified emissions sources would be conducted as part of the commissioning of the proposed Project,
- e) Further air quality modelling would be conducted to determine the likely actual effects of the best practice mitigation at c) if any, by utilising the actual stack test results from b), and/or if the results at d), or any other new information about the existing sources (or other PRP related changes to existing other plant which may be identified show greater emissions than assumed.



9 SUMMARY AND CONCLUSIONS

This study has examined the potential air quality impacts which may arise due to the Project.

The study applies generally conservative assumptions and applies stack testing data and manufacturer's specifications supplied by the Proponent to calculate the potential emissions from the Project.

The Project in-stack emission concentrations are all below the POEO limits, and would remain so due to the Project.

The proposed modification to emissions point "EPA 11" would direct additional new emissions sources through this stack, thus the existing EPA licence limit for TSP may need to be amended to reflect the revised stack configuration. It should be noted that the assumed emission values in the modelling have not taken into effect any destruction of the redirected TSP afforded by the furnace, and the actual TSP emissions from this point may be lower than assumed.

The CALPUFF model is used to predict the potential off-site effects which may arise due to emissions from the Project, including other sources and background pollutant levels as applicable.

The results indicate that the Project is unlikely to lead to any exceedance of any criteria at any residential receptor at any time.

The Project would significantly reduce the currently approved off-site formaldehyde levels and would essentially limit the impacts to within the plant boundary and not result in any formaldehyde levels above EPA criteria on any publically accessible land.

Importantly, the predicted formaldehyde concentrations would not exceed the more current, health based WHO formaldehyde guideline to prevent sensory irritation, set at a concentration that is half of that necessary to protect against the onset of any harm to health.

Hence by comparison of the results with the EPA and WHO criteria, it can be concluded that no impact in terms of sensory irritation or health due to formaldehyde is predicted to arise outside of the plant boundary as a result of the Project.

Overall, the study finds that the Project would not lead to any unacceptable or harmful level of air pollutants off-site.

10 REFERENCES

Bureau of Meteorology (2016)

Climate Averages Australia, Bureau of Meteorology website, accessed 24 August 2016.
<<http://www.bom.gov.au/climate/averages>>

Department of Environment and Conservation (2005)

"Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales",
Department of Environment and Conservation (NSW), August 2005

ECT (2013)

"Jacksonville Lime Facility – Supplemental Air Quality Dispersion Modeling Protocol (Use of Tier 3 Method for 1-hour NO₂ Modeling", prepared by Environmental Consulting & Technology, Inc for Jacksonville Lime, March 2013.

Hunton & Williams (2011)

"Comments on EPA's March 1, 2011 Memorandum: Application of Appendix W Modeling Guidance for the 1-hour NO₂ NAAQS", a memo by Hunton & Williams, 14 June 2011.

National Environment Protection Council (2016)

"National Environment Protection (Ambient Quality) Measure", National Environment Protection Council, Canberra, February 2016.

NSW EPA Licence 3035 (2016)

NSW EPA Environment Protection Licence Number 3035, version date 8 April 2016.

NCASI (2015)

"In-Stack Ratios for NO₂/NO_x in Stack Gases for FPI Power Boilers, Lime Kilns, Thermal Oxidizers, and Kraft Recovery Furnaces", a memo by the National Council for Air and Stream Improvement, Inc, 13 October 2015.

POEO (Clean Air) Regulation (2010)

Protection of the Environment Operations (Clean Air) Regulation 2010.

Stephenson (2016a)

"HCHO Proof of Performance Trial", prepared by Stephenson Environmental Management Australia for Borg Panels Pty Ltd, September 2016.

Stephenson (2016b)

"Air Quality Impact Assessment – Proposed Particle Board Plant", prepared by Stephenson Environmental Management Australia for Borg Panels Pty Ltd, May 2016.

TRC Environmental Corporation (2011)

"Generic Guidance and Optimum Model Setting for the CALPUFF Modelling System", prepared for NSW OEH, March 2011.

WHO (2010)

"WHO guidelines for indoor air quality: selected pollutants", World Health Organization, 2010.



Appendix A

Further detail regarding 24-hour PM_{10} analysis



Contemporaneous assessment per NSW EPA Approved Methods

The analysis below provides a detailed cumulative 24-hour PM₁₀ impact assessment per the NSW EPA Approved Methods; refer to the worked example on Page 52 to 54 of the Approved Methods.

The background level is the total ambient measured level at the nearest monitoring station to the sensitive receptor for the said date.

The predicted increment is the change in level predicted to occur at the receptor due to the Project.

The total is the sum of the background level and the predicted level due to the Project.

Each table assesses one receptor individually. The left hand half of the table examines the cumulative impact during the periods of highest background levels and the right hand half of the table examines the cumulative impact during the periods of highest contribution from the Project.

The **green** shading represents days where the existing background level is below the criterion.

The values in **bold red** are above the criteria.

Table A-1 to **Table A-5** show the predicted maximum PM₁₀ cumulative levels for the existing sources at each of the most-affected receptors surrounding the Project.

Table A-6 to **Table A-10** show the predicted maximum PM₁₀ cumulative levels for the proposed sources at each of the most-affected receptors surrounding the Project.



Table A-1: Receptor 5 (PM₁₀ 24-hr average concentration) (µg/m³) – existing sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	0.0	42.8	19/02/2014	12.2	13.4	25.6
14/11/2014	41.0	4.3	45.3	1/12/2014	16.3	13.1	29.4
24/11/2014	38.3	4.1	42.4	9/09/2014	10.1	11.7	21.8
15/11/2014	37.7	0.6	38.3	25/12/2014	10.1	11.1	21.2
16/01/2014	37.6	1.5	39.1	15/03/2014	10.4	10.9	21.3
23/11/2014	37.4	6.3	43.7	27/05/2014	15.7	10.5	26.2
17/01/2014	36.4	0.4	36.8	10/04/2014	14.7	10.3	25.0
10/02/2014	35.7	0.1	35.8	19/06/2014	11.7	9.5	21.2
30/12/2014	35.7	0.0	35.7	20/11/2014	26.2	9.2	35.4
7/01/2014	35.6	0.3	35.9	9/07/2014	11.9	9.2	21.1

Table A-2: Receptor 20 (PM₁₀ 24-hr average concentration) (µg/m³) – existing sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	1.0	43.8	12/12/2014	10.3	18.1	28.4
14/11/2014	41.0	0.0	41.0	5/09/2014	8.0	17.0	25.0
24/11/2014	38.3	0.1	38.4	9/06/2014	11.6	16.7	28.3
15/11/2014	37.7	0.0	37.7	28/08/2014	8.6	16.1	24.7
16/01/2014	37.6	1.5	39.1	6/06/2014	10.0	15.2	25.2
23/11/2014	37.4	0.7	38.1	7/11/2014	19.8	15.0	34.8
17/01/2014	36.4	0.0	36.4	22/02/2014	19.9	14.6	34.5
10/02/2014	35.7	5.1	40.8	20/08/2014	8.7	14.0	22.7
30/12/2014	35.7	0.0	35.7	27/08/2014	7.3	13.9	21.2
7/01/2014	35.6	4.2	39.8	6/04/2014	6.5	13.6	20.1

Table A-3: Receptor 24 (PM₁₀ 24-hr average concentration) (µg/m³) – existing sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	0.1	42.9	19/07/2014	10.6	10.3	20.9
14/11/2014	41.0	0.0	41.0	12/04/2014	7.7	10.2	17.9
24/11/2014	38.3	0.0	38.3	4/09/2014	7.9	9.1	17.0
15/11/2014	37.7	0.0	37.7	18/08/2014	4.9	7.4	12.3
16/01/2014	37.6	0.0	37.6	19/08/2014	6.7	6.7	13.4
23/11/2014	37.4	0.6	38.0	29/08/2014	8.2	6.5	14.7
17/01/2014	36.4	0.0	36.4	7/06/2014	9.1	6.3	15.4
10/02/2014	35.7	0.6	36.3	8/06/2014	11.0	5.3	16.3
30/12/2014	35.7	0.4	36.1	17/04/2014	12.3	4.7	17.0
7/01/2014	35.6	0.1	35.7	21/05/2014	17.7	4.6	22.3



Table A-4: Receptor 28 (PM₁₀ 24-hr average concentration) (µg/m³) – existing sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	3.2	46.0	17/09/2014	9.8	10.6	20.4
14/11/2014	41.0	0.0	41.0	4/05/2014	8.0	9.8	17.8
24/11/2014	38.3	0.9	39.2	6/07/2014	6.3	9.8	16.1
15/11/2014	37.7	3.9	41.6	30/06/2014	5.7	9.5	15.2
16/01/2014	37.6	0.0	37.6	11/07/2014	7.9	7.2	15.1
23/11/2014	37.4	0.9	38.3	12/07/2014	7.5	6.8	14.3
17/01/2014	36.4	0.0	36.4	30/12/2014	35.7	6.8	42.5
10/02/2014	35.7	0.0	35.7	24/05/2014	19.1	6.7	25.8
30/12/2014	35.7	6.8	42.5	17/06/2014	8.6	6.3	14.9
7/01/2014	35.6	0.1	35.7	15/06/2014	7.5	6.2	13.7

Table A-5: Receptor 30 (PM₁₀ 24-hr average concentration) (µg/m³) – existing sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	5.4	48.2	7/07/2014	4.8	13.5	18.3
14/11/2014	41.0	0.0	41.0	15/06/2014	7.5	13.4	20.9
24/11/2014	38.3	0.7	39.0	18/09/2014	9.2	9.8	19.0
15/11/2014	37.7	0.9	38.6	2/11/2014	9.5	7.3	16.8
16/01/2014	37.6	0.0	37.6	17/11/2014	6.1	7.0	13.1
23/11/2014	37.4	0.4	37.8	11/09/2014	11.0	6.9	17.9
17/01/2014	36.4	0.0	36.4	6/07/2014	6.3	6.4	12.7
10/02/2014	35.7	0.1	35.8	30/06/2014	5.7	6.3	12.0
30/12/2014	35.7	2.1	37.8	5/05/2014	8.0	6.3	14.3
7/01/2014	35.6	0.1	35.7	25/11/2014	16.9	6.1	23.0

Table A-6: Receptor 5 (PM₁₀ 24-hr average concentration) (µg/m³) – proposed sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	0.0	42.8	19/02/2014	12.2	15.2	27.4
14/11/2014	41.0	5.0	46.0	1/12/2014	16.3	14.0	30.3
24/11/2014	38.3	4.9	43.2	15/03/2014	10.4	12.7	23.1
15/11/2014	37.7	0.8	38.5	25/12/2014	10.1	12.6	22.7
16/01/2014	37.6	1.6	39.2	27/05/2014	15.7	12.2	27.9
23/11/2014	37.4	7.2	44.6	9/09/2014	10.1	11.7	21.8
17/01/2014	36.4	0.4	36.8	20/11/2014	26.2	11.0	37.2
10/02/2014	35.7	0.1	35.8	10/04/2014	14.7	11.0	25.7
30/12/2014	35.7	0.0	35.7	10/05/2014	12.4	10.9	23.3
7/01/2014	35.6	0.3	35.9	19/06/2014	11.7	10.5	22.2



Table A-7: Receptor 20 (PM₁₀ 24-hr average concentration) (µg/m³) – proposed sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	1.0	43.8	5/09/2014	8.0	17.1	25.1
14/11/2014	41.0	0.0	41.0	7/11/2014	19.8	17.0	36.8
24/11/2014	38.3	0.1	38.4	12/12/2014	10.3	16.1	26.4
15/11/2014	37.7	0.0	37.7	9/06/2014	11.6	16.0	27.6
16/01/2014	37.6	1.5	39.1	6/06/2014	10.0	15.9	25.9
23/11/2014	37.4	0.6	38.0	22/02/2014	19.9	15.7	35.6
17/01/2014	36.4	0.0	36.4	20/08/2014	8.7	15.5	24.2
10/02/2014	35.7	4.5	40.2	30/08/2014	8.3	15.1	23.4
30/12/2014	35.7	0.0	35.7	28/08/2014	8.6	15.1	23.7
7/01/2014	35.6	4.8	40.4	6/04/2014	6.5	14.4	20.9

Table A-8: Receptor 24 (PM₁₀ 24-hr average concentration) (µg/m³) – proposed sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	0.1	42.9	19/07/2014	10.6	11.2	21.8
14/11/2014	41.0	0.0	41.0	12/04/2014	7.7	10.8	18.5
24/11/2014	38.3	0.0	38.3	4/09/2014	7.9	9.8	17.7
15/11/2014	37.7	0.0	37.7	18/08/2014	4.9	8.8	13.7
16/01/2014	37.6	0.0	37.6	29/08/2014	8.2	7.1	15.3
23/11/2014	37.4	0.6	38.0	7/06/2014	9.1	6.2	15.3
17/01/2014	36.4	0.0	36.4	19/08/2014	6.7	6.2	12.9
10/02/2014	35.7	0.6	36.3	20/09/2014	12.5	5.7	18.2
30/12/2014	35.7	0.5	36.2	8/06/2014	11	5.6	16.6
7/01/2014	35.6	0.1	35.7	17/04/2014	12.3	5.3	17.6

Table A-9: Receptor 28 (PM₁₀ 24-hr average concentration) (µg/m³) – proposed sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	3.8	46.6	17/09/2014	9.8	12.1	21.9
14/11/2014	41.0	0.0	41.0	4/05/2014	8.0	11.1	19.1
24/11/2014	38.3	1.0	39.3	6/07/2014	6.3	11.1	17.4
15/11/2014	37.7	4.4	42.1	30/06/2014	5.7	10.7	16.4
16/01/2014	37.6	0.0	37.6	11/07/2014	7.9	8.0	15.9
23/11/2014	37.4	1.1	38.5	12/07/2014	7.5	7.7	15.2
17/01/2014	36.4	0.0	36.4	30/12/2014	35.7	7.6	43.3
10/02/2014	35.7	0.1	35.8	24/05/2014	19.1	7.5	26.6
30/12/2014	35.7	7.6	43.3	17/06/2014	8.6	7.1	15.7
7/01/2014	35.6	0.1	35.7	16/10/2014	10.1	6.8	16.9



Table A-10: Receptor 30 (PM₁₀ 24-hr average concentration) (µg/m³) – proposed sources

Ranked by Highest to Lowest Background Concentration				Ranked by Highest to Lowest Predicted incremental Concentration			
Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level	Date	Measured background level	Predicted increment due to Project	Total cumulative 24-hr average level
17/12/2014	42.8	5.7	48.5	15/06/2014	7.5	15.1	22.6
14/11/2014	41.0	0.0	41.0	7/07/2014	4.8	15.0	19.8
24/11/2014	38.3	0.8	39.1	18/09/2014	9.2	11.8	21.0
15/11/2014	37.7	1.0	38.7	2/11/2014	9.5	8.6	18.1
16/01/2014	37.6	0.0	37.6	11/09/2014	1.01	8.1	19.1
23/11/2014	37.4	0.5	37.9	17/11/2014	6.1	8.0	14.1
17/01/2014	36.4	0.0	36.4	30/06/2014	5.7	7.3	13.0
10/02/2014	35.7	0.1	35.8	6/07/2014	6.3	7.1	13.4
30/12/2014	35.7	2.5	38.2	5/05/2014	8.0	6.9	14.9
7/01/2014	35.6	0.1	35.7	25/11/2014	16.9	6.8	23.7



Appendix B

Further analysis of off-site formaldehyde concentrations



Contribution analysis - formaldehyde

Figure B-1 and **Figure B-2** present isopleth plots for the predicted 99.9th percentile 1-hour average formaldehyde concentration due to the existing and proposed Project, respectively. (The figures show the same data that are shown combined in **Figure 7-11**).

As shown, there would be a substantial decrease in formaldehyde impacts due to the operation of the proposed Project.

It is thus desirable to understand how this comes about and which sources contribute to the off-site formaldehyde concentrations.

Figure B-3 presents an isopleth plot for the predicted 99.9th percentile 1-hour average formaldehyde concentration due to the existing plant and the existing plant with the proposed new PB plant. The results show that the proposed new PB plant makes only a small difference to the current situation in regard to off-site formaldehyde concentrations.

This suggests that the main cause of the predicted formaldehyde impact is the existing plant.

Figure B-4 presents an isopleth plot for the predicted 99.9th percentile 1-hour average formaldehyde concentration due to the operation of the PB plant alone. It is noted that the maximum PB plant contribution does not occur at the same time as the maximum contribution from the existing plant, thus the levels shown in **Figure B-4** cannot be directly added with those shown in say **Figure B-1** or **Figure B-2**.

As part of the proposed Project and installation of the PB plant, the proponent proposes to modify the existing MDF plant to reduce the overall formaldehyde impact. **Figure B-5** presents an isopleth plot for the predicted 99.9th percentile 1-hour average formaldehyde concentration due to the modified MDF plant with the existing MDL plant. The figure shows a substantial improvement of the predicted formaldehyde levels from the existing Project due to the proposed modifications.

This confirms that the maximum off-site impacts are indeed primarily influenced by the existing activities, rather than the proposed new PB line.



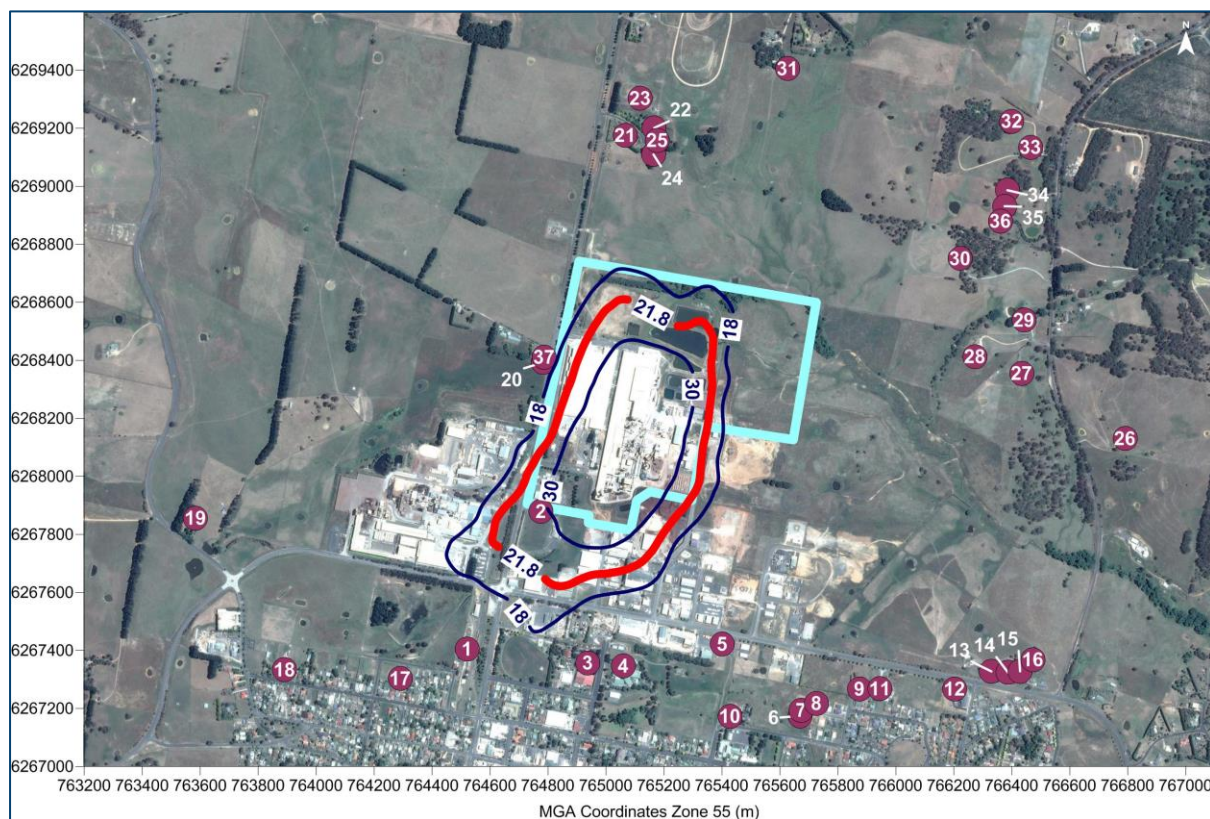


Figure B-1: Predicted 99.9th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$) for the Project - existing

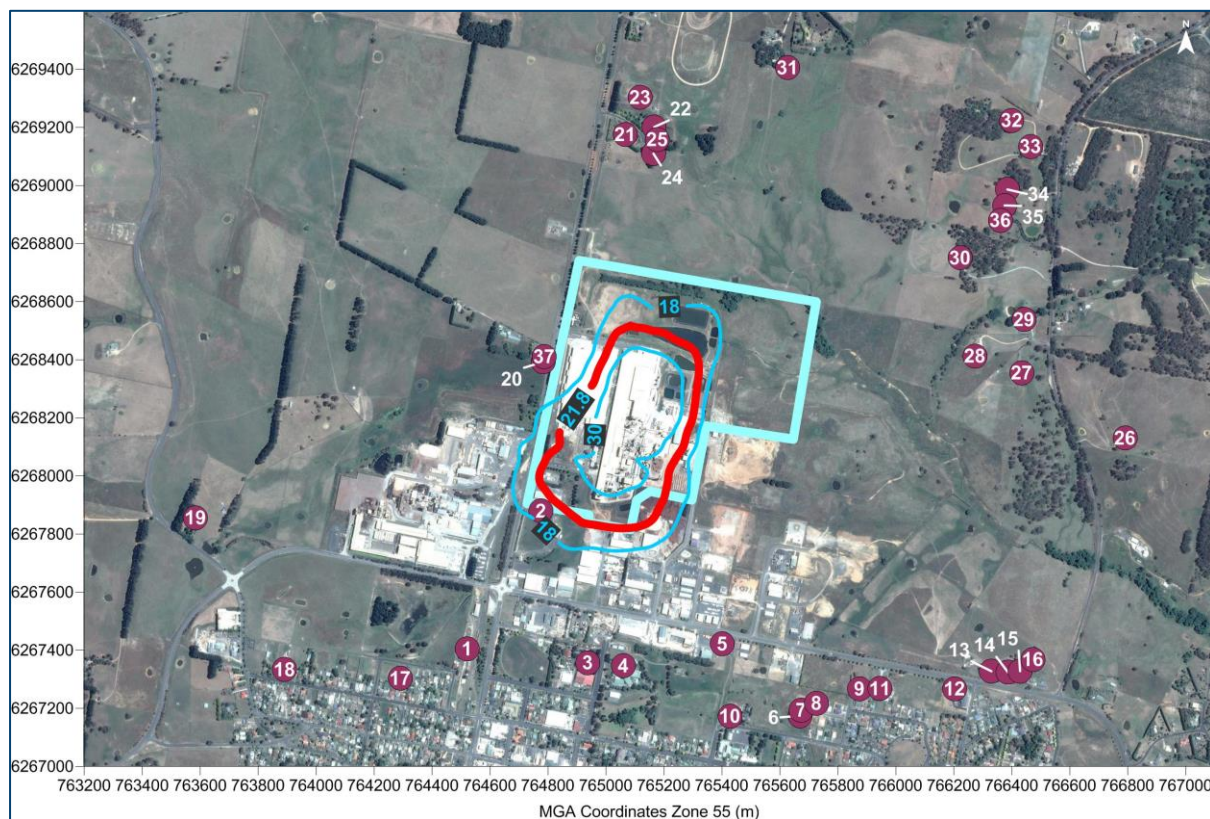


Figure B-2: Predicted 99.9th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$) for the Project - proposed

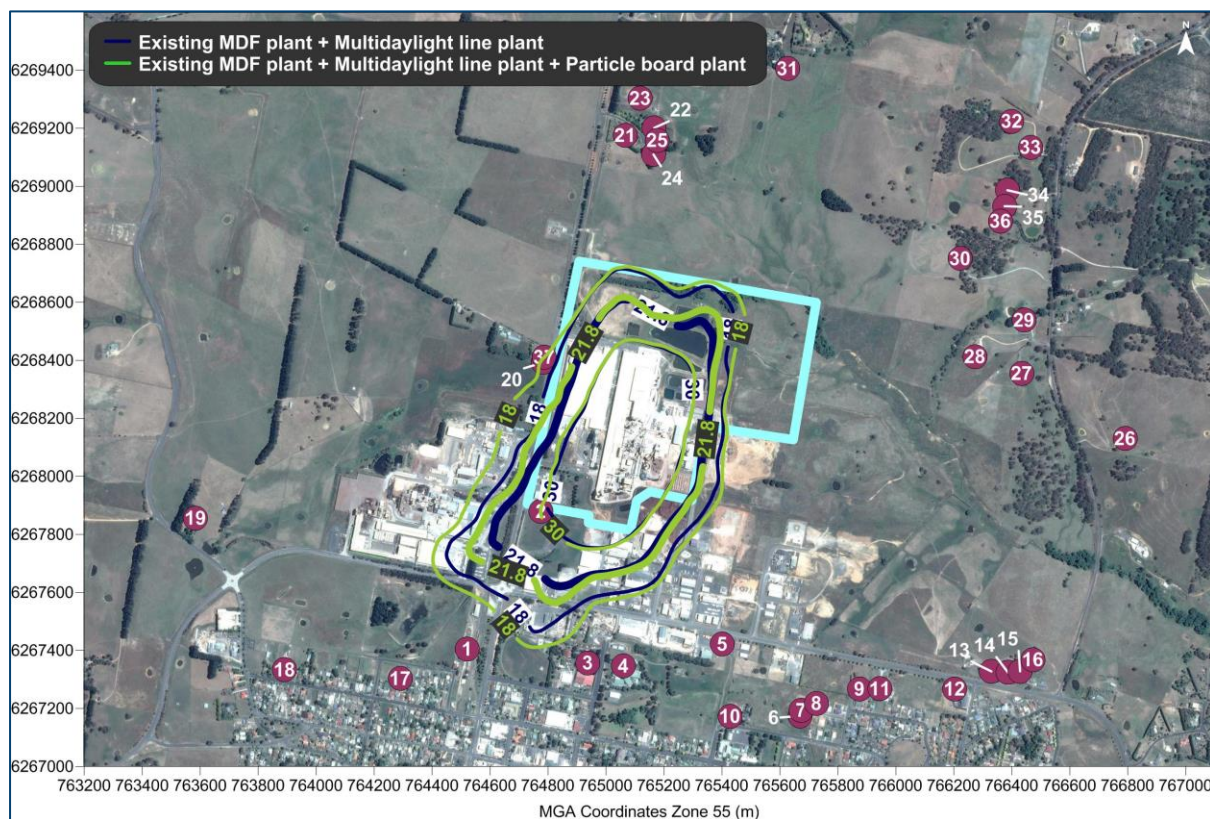


Figure B-3: Predicted 99.9th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$) for the Project

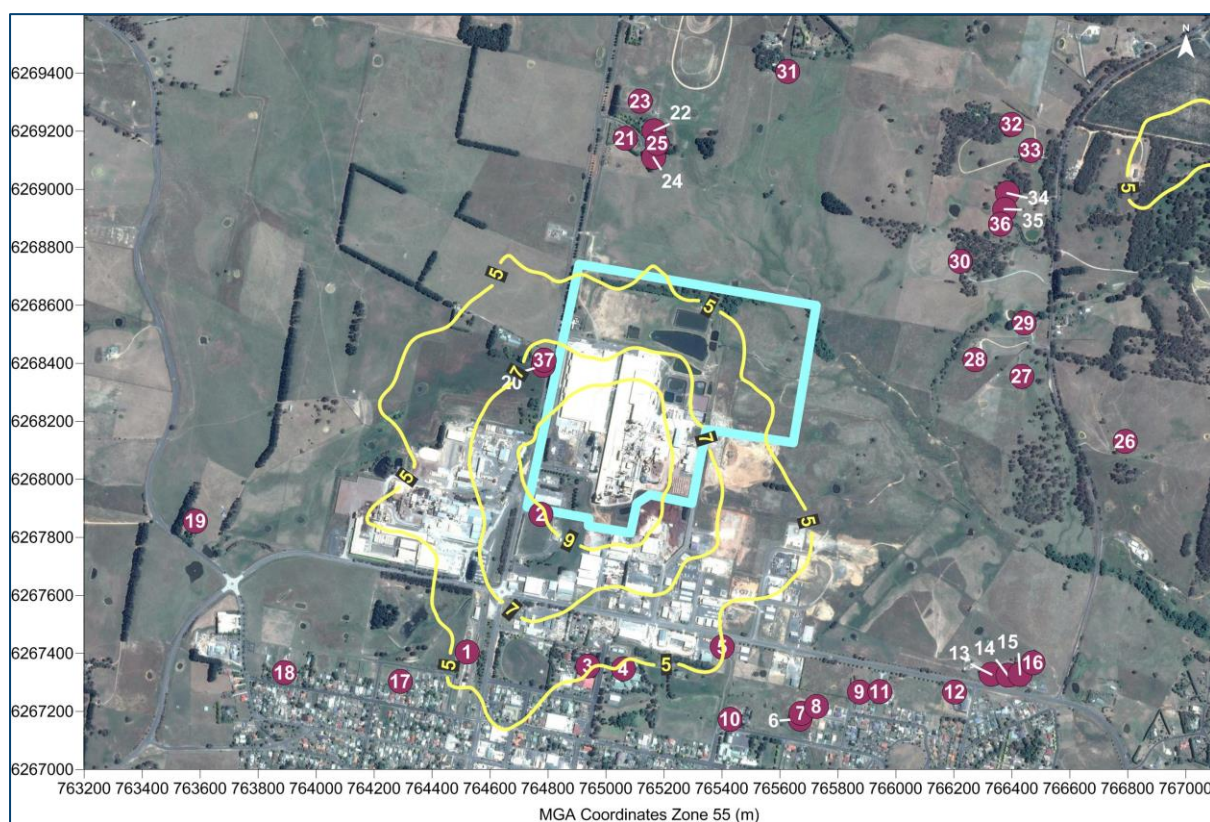


Figure B-4: Predicted 99.9th percentile 1-hour average formaldehyde concentration ($\mu\text{g}/\text{m}^3$) for the PB Plant only

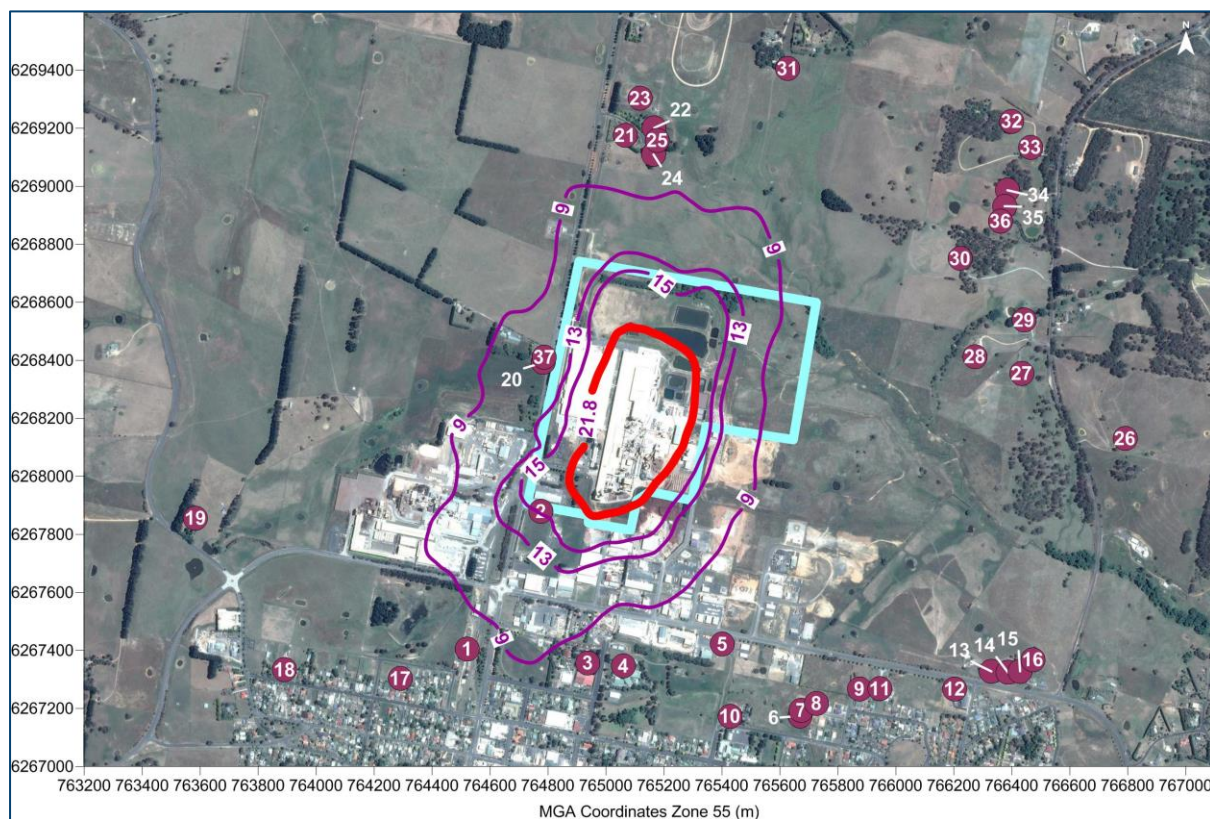


Figure B-5: Predicted 99.9th percentile 1-hr ave formaldehyde ($\mu\text{g}/\text{m}^3$) for the Modified MDF Plant and Existing MDL Plant Only

Oberon Stormwater Management Strategy

March 2012

Borg Group (Borgs)



*Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798*

*Level 3
51–55 Bolton Street
NEWCASTLE NSW 2300
PO Box 1162
NEWCASTLE NSW 2300
Australia
Telephone +61 2 4929 8300
Facsimile +61 2 4929 8382
Email newcastle@pb.com.au*

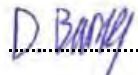
*Certified to ISO 9001, ISO 14001, AS/NZS 4801
A+ GRI Rating: Sustainability Report 2009*

Revision	Details	Date	Amended By
C	Borgs Comments	08 December 2010	BG
D	New Design Strategy	01 April 2011	DB
E	Figure 4 Amended	31 May 2011	BG
F	Figure 2 Amended	02 June 2011	BG
G	Figure 4 Amended and report restructured for separated stormwater flows	06 March 2012	JW

©Parsons Brinckerhoff Australia Pty Limited (PB) [2012].

Copyright in the drawings, information and data recorded in this document (the information) is the property of PB. This document and the information are solely for the use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by PB. PB makes no representation, undertakes no duty and accepts no responsibility to any third party who may use or rely upon this document or the information.

Author: Duncan Barnes.....

Signed: .....

Reviewer: Stuart Holle.....

Signed: .....

Approved by: Stuart Holle.....

Signed: .....

Date: 02 March 2012

Distribution:

Please note that when viewed electronically this document may contain pages that have been intentionally left blank. These blank pages may occur because in consideration of the environment and for your convenience, this document has been set up so that it can be printed correctly in double-sided format.

Contents

Page number

Executive summary	iv
1. Introduction	1
1.1 Background	1
1.2 Objectives and scope of works	1
1.3 Site characteristics	2
1.4 Existing drainage	2
1.5 Available data	3
2. Design criteria	5
3. Design constraints and issues	7
3.1 Tannins	7
3.2 Flatness of the site	7
3.3 High ground water table	7
3.4 Northern fibre dump	7
4. Stormwater management strategy	9
4.1 Site strategy	9
4.2 Maintenance	10
5. Peak flows	11
5.1 General	11
5.2 Catchment plan	11
5.3 Catchment parameters	11
5.4 Design rainfall	12
5.5 Model calibration	12
5.6 Existing drainage network capacity	13
5.7 Proposed drainage network capacity	13
5.7.1 General	13
5.7.2 Results	13
5.8 Peak flow rate results	14
6. Water quality control	15

6.1	General	15
6.2	Existing conditions	15
6.2.1	MUSIC parameters	15
6.2.2	MUSIC calibration	17
6.2.3	Existing water quality controls	18
6.3	Developed conditions	19
6.3.1	General	19
6.3.2	Proposed water quality controls	19
6.4	MUSIC results	20
6.5	Discussion of water quality treatment strategies	21
7.	Conclusions and recommendations	23
8.	References	25

List of tables

		Page number
Table 5-1	Adopted loss parameters in XP SWMM	11
Table 5-2	Comparison of rational method and XP-SWMM estimated flow rates at the site outlet	12
Table 5-3	Estimated peak flow rates and flow depths	13
Table 5-4	Existing and developed peak flow rates at Gate 6	14
Table 6-1	Monthly average areal potential evapotranspiration values	16
Table 6-2	MUSIC hydrology parameters for each landuse	16
Table 6-3	Baseflow and stormflow pollutant mean concentrations for each land use	17
Table 6-4	Comparison of typical and predicted volumetric runoff coefficients	18
Table 6-5	Existing sediment basin parameters	18
Table 6-6	Proposed sediment basin parameters	20
Table 6-7	MUSIC treatment train efficiency and results	20

List of figures

Figure 1	Locality plan
Figure 2	Breakdown of site and processes
Figure 3	Existing drainage system
Figure 4	Proposed development and stormwater strategy
Figure 5	Catchment plan

Appendices

Appendix A	Existing pipe conduits and open channels
------------	--



Appendix B	Developed pipe conduits and open channels
Appendix C	Oberon IFD
Appendix D	PRM calculations
Appendix E	MUSIC rainfall graph
Appendix F	Existing subcatchment data
Appendix G	Developed subcatchment data

Executive summary

This stormwater management strategy for the Borgs Oberon Timber Complex is to:

- support a Development Application for warehouse and additional hardstand areas that will increase the impervious area by approximately 2 ha
- provide guidance to Borgs in the management of on-site stormwater issues having regard to environmental requirements and the proximity of the site to the upstream Carter Holt Harvey plant.

The site was modelled using XP-SWMM and MUSIC to assess the stormwater flow and quality issues respectively to develop a suitable stormwater treatment train.

The peak instantaneous runoff rate from proposed future buildings is expected to marginally increase, however the industrial processes at the site require large volumes of water, which it is proposed to source from captured stormwater. Accordingly, the discharge from the site is not expected to increase significantly beyond predevelopment flow rates.

Water quality devices proposed within the strategy include the use of grassed swales to convey the water through the site and the expansion of an existing sediment basin to provide further treatment and to hold water that can then be re-used on-site. These devices are in addition to the recently implemented water quality devices on the upstream Carter Holt Harvey (CHH) site that are also expected to further improve the quality of water running on to the Borg site in the future.

Two stormwater strategy scenarios were investigated in MUSIC to help in the decision making process for the site. The first scenario involved the existing case and the second involved the proposed development with the associated conveyance and treatment devices.

The MUSIC modelling results indicate that the proposed treatment train would exceed Borgs Environmental Protection Licences requirements for Total Suspended Solids (TSS), Total Nitrogen (TN) and Total Phosphorous (TP). Further, they are expected to improve the overall water quality discharging from the site.

The proposed strategy for the site is described in Figure 4 and comprises:

- filling in of the two existing sediment dams and the existing channels to make way for the new proposed warehouse
- the inclusion of a new swale (Swale 1). Swale 1 has been design to accommodate flows for the 100yr ARI storm event whilst separating CHH and Boral stormwater flows up to the 1yr ARI event. The new swale has 1:1 side slopes and a lined bund to separately convey and treat the stormwater falling on and passing through the Borgs site in addition to the existing flows from the CHH and Boral sites
- a junction pit and approximately 30m of 1050mm diameter stormwater line to intercept the line from HPP Site 2 and StructaFlor and connect to the upstream side of proposed Swale 1
- constructing two (2) sets of twin 1050 mm diameter RCP culverts, approximately 33 m long to connect the proposed swale system (Swale 1) with the existing culverts upstream of 'Gate 6'
- construction of a diversion bund at the upstream end of the existing CHH swale to separately convey CHH/Borgs and Boral stormwater flows to separate downstream swales

- retaining the two separate sediment dams located prior to the licensed discharge point to Kings Stockyard Creek to maintain flow segregation of the site.

1. Introduction

1.1 Background

PB was engaged by Borgs to undertake a stormwater management strategy for the Oberon Timber Complex site to allow for the construction of a new proposed warehouse and associated hardstand areas. Borgs recently purchased the site from Carter Holt Harvey (CHH) and are required to meet stormwater quality requirements in line with their Environmental Protection Licences (EPL) prior to discharging into Kings Stockyard Creek.

A spill of Aldrin/Dieldrin, an organo-chlorine pesticide (OCP) occurred prior to the purchase of the site by CHH. During rain events, soils contaminated with OCP were transported throughout the site's trunk drainage system and low levels of OCP were periodically measured at the discharge point. A Remediation Action Plan (RAP) was subsequently developed and mainly concentrated on preventing the movement of sediments, which allow the transport of the OCP, throughout the sites drainage network.

PB was previously commissioned by CHH to undertake an assessment of the existing trunk stormwater network at the 'HPP Site 2' and 'StructaFlor' sites, refer Figure 2, and propose a concept design for the improvement of this network. A strategy was then developed to prevent the mobilisation of contaminated sediments, limit the movement of sediments through the site's trunk drainage line, aerate water in some drainage channels and to make new channels and water quality structures to be machine maintainable.

The work previously undertaken on these upstream areas is expected to improve the quality of water running on to the Borg site. This is due to the implementation of water quality devices such as aeration cascades, gross pollutant traps with drive in sumps and closable gates across channels and culvert inlets.

1.2 Objectives and scope of works

The main objectives outlined by Borgs for the sites stormwater network were:

- improve water quality discharging from the site and adhere to the sites various Environmental Protection Licences (3035, 11566 and 887) requirements
- be capable of conveying the 100 year ARI rainfall event to the discharge location on Kings Stockyard Creek
- provide an adequately sized retention basin to allow water to be reused on-site
- minimise peak flow rates
- maintaining the separation of upstream CHH and Boral stormwater flows.

To achieve the objectives described above, the following works were carried out:

- review of existing data including drainage plans, water monitoring data and survey details

- site inspection to identify the key design objectives and assess the existing drainage system
- hydrological and hydraulic modelling of the existing and proposed drainage network using XP-SWMM software (expanded upon PB's previous XP-SWMM model)
- water quality modelling of the existing and post-development networks using MUSIC
- development of a practical and suitable stormwater management strategy
- preparation of a report outlining the modelling methodology, key results of the model, discussion of proposed works and conclusions and recommendations.

1.3 Site characteristics

The Borgs site is located within the township of Oberon, 45 km south-east of Bathurst, NSW. The site is situated at an elevation of approximately 1100 m AHD and has a total area of approximately 60 ha. A locality plan of the site is shown in Figure 1. The majority of the site comprises hardstand area with other land types being small pockets of pervious areas and open water dams.

Generally, the site grades towards the east and the licensed discharge point to Kings Stockyard Creek is located in the north eastern corner of the site. Figure 2 shows a breakdown of the total site area and differentiates between the different processes being undertaken.

A high ground water table is known to exist at the site and generally flows towards its north eastern corner. This fluctuating ground water table is a significant constraint of the site since excavation below this level cannot occur without consequential groundwater recharging taking place.

1.4 Existing drainage

The existing drainage network comprises vegetated open channels with culverts passing under road crossings. A 300 m long 1050 mm diameter RCP culvert, commencing at the north eastern corner of the 'HPP Site 2', conveys runoff from the 'HPP Site 2' and 'StructaFlor' areas to the sediment dam at the Borgs site. Survey levels obtained suggest that the majority of this culvert would be permanently submerged under the current design, which is not ideal and not considered to be engineering best practice. Overflow from the sediment dam then passes down a grassed channel before passing beneath the road (via three 1050 mm diameter culverts) at 'Gate 6'. It then runs down another grassed channel prior to another sediment dam.

After passing through the site's trunk drainage network, runoff is directed to a final sediment dam before discharging into Kings Stockyard Creek. This is the licensed discharge point for the site and discharges are quantified using a V-notch weir. The holding dam is also the location where contaminant sampling is carried out.

Runoff from the adjacent 'HPP Site 1' and a large upstream (approximately 20 ha) rural catchment area passes through a separate drainage network. Water from the 'HPP Site 1'

area passes beneath Lowes Mount Road and then flows downstream in a swale parallel to the road for approximately 165 m.

This water then combines with the runoff from the upstream rural catchment (some of which is owned by CHH) before discharging into a sediment dam, separated from the aforementioned drainage network and the 'HPP Site 2' and 'StructaFlor' areas. This basin then overflows into a small swale before passing through another set of three 1050 mm diameter culverts under the road at 'Gate 6'. Water from these culverts then flows along a swale adjacent to the northern boundary of the site before discharging into another sediment dam prior to discharging into Kings Stockyard Creek.

A detailed schematic of the site's existing drainage network is provided in Figure 3. The figure shows the two trunk drainage lines that have been analysed for this study and distinguishes between pipe and channel links.

1.5 Available data

The following data was used during this investigation:

- aerial survey with 1.0 m contours in electronic format
- survey showing the invert levels of existing culverts
- invert levels under and immediately downstream of 'Gate 6' provided by Borgs
- specific culvert diameters and pit depths measured in the field by Borgs
- culvert diameters previously measured in the field by CHH staff
- previous XP-SWMM model developed for the site by PB including the first flush drainage line and the recent works completed on the 'HPP Site 2' and 'StructaFlor' sites
- pluviograph data (6-minute rainfall intensity) for Oberon (Jenolan Caves Road), from January 1993 to September 2005
- an approximate depth of the 'HPP Site 1' sediment dam provided by CHH
- an aerial schematic drawing of the proposed development
- estimates of the volume of water re-used on-site per day provided by Borgs
- water monitoring results at the Borg discharge point, the adjacent 'HPP Site 1' 'north dam' discharge point and at the 'StructaFlor' 'gate 1' discharge point.

A site inspection was also carried out on 21/10/2010 to determine and confirm the site characteristics and to develop a suitable catchment plan.

2. Design criteria

Design criteria for trunk drainage infrastructure were based on current best practices and requirements outlined by Borg's management staff during the site visit.

The following design criteria were adopted for the stormwater strategy:

- trunk drainage system is to be capable of conveying the 100 year Average Recurrence Interval (ARI) storm event from the site
- stormwater runoff should meet the Environmental Protection Licences limits for TSS (30 mg/L), True colour (160 Hazen), TP (0.3 mg/L), TN (10 mg/L) and BOD (20 mg/L)
- minimise peak flow rates.

Drainage swales and basins are to be designed to promote aeration where possible as runoff from the site has historically had high concentrations of Tannins that reduce the amount of Dissolved Oxygen (DO) in receiving waters. In addition, the system is to be designed to be retrofitted to allow for a possible mechanical aeration device post development if required.

3. Design constraints and issues

3.1 Tannins

An issue brought about by the timber processes undertaken in the complex is the presence of tannins which leach out of wood products as they biodegrade on-site. This is evident due to the black discolouration of runoff within the sites drainage lines. The implication of this is that tannins reduce the amount of dissolved oxygen within the runoff. Adequate aeration of the runoff is therefore desirable wherever possible.

3.2 Flatness of the site

The site is constrained by the upstream culvert invert connecting into the existing first flush basin (sediment basin 1) and the culvert inverts below the road at 'Gate 6'. From survey data and information provided by Borg's staff on-site, the inverts of the 'Gate 6' culvert inlets are actually 170 mm above the upstream culvert outlet level that conveys runoff from the 'HPP Site 2' and 'StructaFlor' catchments. As such, significant amounts of water is expected to pond at the site prior to passing beneath 'Gate 6'. In addition, aeration cascade devices that accelerate water down the face of rock lined channels to promote higher oxygen levels in the water are not practical on the Borg site. Therefore, coupled with the known high water tables the stormwater strategy is very constrained by the extreme flatness of the site.

3.3 High ground water table

A high groundwater table is known to exist at the site and limits the amount of excavation that can occur in certain locations. Groundwater was not largely considered in this investigation but further analysis may be required in the detailed design stage.

3.4 Northern fibre dump

A fibre dump is located to the north of 'Gate 6'. This fibre dump is believed to have the potential to leach contaminants into the groundwater system and therefore the placement of a basin immediately up gradient (western side) of the groundwater flow is not recommended.

3.5 Separation of Carter Holt Harvey and Boral stormwater

During negotiations with adjacent landholders (CHH and Boral), it was identified that the combination of flows originating from the two sites, for a <1 year ARI event, would not be preferable. For this reason, distinct separation of flows originating from the two sites, up to a 1 year ARI event, is required to be maintained through to the final outfall at Kings Stockyard Creek.

4. Stormwater management strategy

4.1 Site strategy

The main stormwater strategy for the site is to convey and treat stormwater from the Borg and upstream sites using a large, flat grassed swale and by increasing an existing sediment basin, downstream of 'Gate 6'. The increased retention of runoff at the sediment basin will allow water to be reused on-site and will settle out sediments. A detailed schematic of the proposed development and stormwater strategy is shown in Figure 4.

Due to the extreme flatness at the site the grassed swale will act more like an elongated basin and will retain a significant volume of water prior to discharging into the channel systems downstream from 'Gate 6'. The geometry of the proposed development makes it problematic and unfeasible to convey the stormwater all the way to the culverts beneath 'Gate 6' via a grassed swale. The most practical and cost effective way to hydraulically link these two sections is to pipe the final 30 m or so beneath the corner of the development. In order to convey this runoff without backing up the upstream swale, four (4) x 1050 mm diameter culverts are required (laid in two separate arrangements).

The inlet levels of these culverts would be raised slightly higher than the upstream swale invert to effectively connect into the existing culverts below 'Gate 6'. This would be achieved by constructing a large pit type area between the two sets of culverts. This pit is likely to be shotcreted, however the exact details of this pit will be confirmed at the detailed design stage. The alignment of these culverts and the proposed 'large pit area' can be seen in Figure 4.

Minor earthworks are proposed immediately downstream of 'Gate 6' to enable a flow diversion bund to be constructed to pass down the segregated flows to the existing swale system, nearest the warehouses on the site.

Calculations and XP-SWMM modelling of the existing culverts below 'Gate 6' indicate that they are adequately sized to convey the 100 year ARI flow rates from the upstream catchments. Some minor work to increase the capacity of the swales prior to the sediment dams may be required to safely convey water through the site. More detailed survey in the detailed design stage would be needed to confirm that the capacity of the downstream swale is adequate to cater for the increased flow rates.

As mentioned previously in Section 1.4 the culvert currently discharging into the first flush basin is permanently submerged. This is detrimental to the existing stormwater system for a number of reasons. Firstly it makes the culvert difficult to maintain. It also reduces the effective pipe capacity and the velocities in the pipe. This promotes sediment build up in the pipe that is not easily removed and reduces the self-cleansing ability of the pipe. The proposed site strategy will reduce the amount water backing up this culvert and will therefore improve water quality and bring it more in line with current best engineering practice principles.

4.2 Maintenance

Due to the flat longitudinal swale grades it is likely that a relatively large amount of sediment will build up in the proposed swale system. This is acceptable and indeed desirable provided that a strict and routine maintenance program is put into place.

The swales and basins will need to be cleaned on a regular basis and it should be obviously apparent when a significant amount of sediment builds up. Frequent inspections and swale invert mark posts are some possible methods to keep the swales operating at their optimal performance level.

5. Peak flows

5.1 General

Modelling was carried out using XP-SWMM, a one-dimensional hydrodynamic model, to assess the capacity of the existing drainage system and to provide flow rates to be used in the design of proposed water quality structures.

An existing XP-SWMM model was previously developed for the site, predominately for the upstream 'HPP Site 2' and 'StructaFlor' sites. This model included the trunk drainage line draining these upstream areas, the first flush basin and the Borg site. However, it did not include the 'HPP Site 1' area, the second sediment pond on the Borg site and the upstream rural area. These elements were added to the previous model and this enabled an assessment of the current networks capacity to be carried out.

The existing model was then updated to include the proposed development and the stormwater management strategy to size the conveyance and treatment devices and to assess flow rates post development. Provided below are details of the XP-SWMM models.

5.2 Catchment plan

A catchment plan of the site was based on available contour data and observations made during the site visit.

The study area was divided into three main catchments. The southern catchment consisted of the 'HPP Site 2' and 'StructaFlor' areas. This catchment was linked to the eastern catchment via the major culvert crossing under Lowes Mount Road. The eastern catchment was formed by the Borg site and the western catchment was formed by the large upstream rural catchment and the 'HPP Site 1' area. Each of the major catchments were subdivided and a catchment plan is provided in Figure 5.

5.3 Catchment parameters

The XP-SWMM model accounts for rainfall losses across a subcatchment by implementing an Initial-Continuing Loss Rate Model. The loss and roughness parameters used in the XP-SWMM model are provided below in Table 5-1.

Table 5-1 Adopted loss parameters in XP SWMM

Land type	Initial loss (mm)	Continuing loss rate (mm/hr)	Overland manning's 'n'
Hardstand	1.5	0	0.018
Pervious	20.0	2.7	0.03

Details of the modelled geometry of pipe conduits and open channels have been provided in Appendix A and this represents the configuration adopted for the estimation of the capacity of the existing drainage network. The developed modelled geometry can be seen in

Appendix B. Existing and developed sub-catchment data can be seen in Appendix F and G respectively.

Detailed design plans of the sites sediment basins, showing internal dimensions and outlet configurations were unavailable during the modelling exercise. These parameters were determined using information obtained during the site inspection and storage-height relationships were developed using the plan area of the basins. Since the basin's main function is to provide water quality storage, the amount of detention storage afforded by the dams is less critical for the modelling exercise.

During the site inspection Borgs management estimated that they re-use approximately 150 kL/day on-site. A conservative value of 100 kL/day was therefore adopted in this investigation. The existing basins were modelled in XP-SWMM with a combined nominal initial depth equivalent to the overflow depth minus 500 kL (or 5 days combined worth of re-use). The new proposed sediment basin was also modelled with an equivalent volume of 500 kL below the overflow level to allow for a consistent amount of water re-use between the developed and the existing scenarios.

5.4 Design rainfall

Hydrologic calculations were carried out using intensity-frequency-duration (IFD) data for Oberon, as calculated using the method described in Australian Rainfall and Runoff (AR&R) (1987). The calculated IFD table is provided in Appendix C.

Design rainfall pluviographs for a range of storm durations and recurrence intervals were generated by the XP-SWMM software using the calculated average rainfall intensity data for Oberon. This enabled the sizing of drainage and water quality structures to be carried out.

5.5 Model calibration

As mentioned previously, an existing XP-SWMM model from previous work for CHH was expanded upon for this investigation. Due to the absence of recorded stream flow data from the site, this model was previously compared against estimates from the probabilistic rational method (PRM), as described in AR&R (1987).

A comparison of the rational method and XP-SWMM predicted peak flows is provided in Table 5-2 for the 1, 5, 10, 20, 50 and 100 year ARI storm events. Details of the PRM calculations are provided in Appendix D.

Table 5-2 Comparison of rational method and XP-SWMM estimated flow rates at the site outlet

ARI	Rational method estimated flow (m ³ /s)	XP-SWMM predicted flow (m ³ /s)	% Difference to rational method estimate
1	2.1	2.8	+33
5	4.1	4.9	+20
10	4.9	5.7	+16
20	5.9	6.6	+12
50	7.7	7.4	-4
100	9.1	8.1	-11

5.6 Existing drainage network capacity

Using the previously developed XP-SWMM model and the additional 'HPP Site 1', Borg site and upstream rural catchments the capacity of the existing drainage network was assessed by comparing the flow depth within channels against the total channel depth indicated by the contour plan. The second sediment basin was also incorporated into the model to accurately reflect the real world processes occurring. With regard to the detention of stormwater, XP-SWMM only uses the storage available between the permanent water level and the top of overflow weirs.

Results obtained from the XP-SWMM model indicate that the sites drainage network, consisting of vegetated open channels and concrete culverts, is, generally, adequately sized to convey the 100 year ARI design event. The existing swales immediately prior to the sediment basin downstream of 'Gate 6' appear to be slightly undersized when water is overflowing from these basins. However this will need to be confirmed with more detailed survey data in the detailed design phase of development.

5.7 Proposed drainage network capacity

5.7.1 General

The XP-SWMM model was updated to assess the hydraulic performance of the proposed development and water quality structures.

Details of the modelled geometry of pipe conduits and open channels have been provided in Appendix B and this represents the configuration adopted for the estimation of design flow rates for the site's water quality devices.

5.7.2 Results

Estimated peak flow rates and water levels, for the 100 year ARI storm event, at key elements along the sites trunk drainage line are provided below in Table 5-3. The critical storm duration for each of the drainage elements is also provided.

Table 5-3 Estimated peak flow rates and flow depths

Element name	Drainage element	Peak flow (m ³ /s)	Peak flow depth (m)	Critical storm duration (min)
Swale 1	Grassed Bunded Swale (1.5 m deep)	6.95	1.54	90
Culvert 1	4 × 1050 mm dia. RCP	6.58	NA	60
Gate 6 Culvert 2	3 × 1050 mm dia. RCP	3.36	NA	60
Gate 6 Culvert 3	3 × 1050 mm dia. RCP	3.07	NA	60
CHH and Borgs Flows Swale	Grassed Swale (0.68 m deep)	6.11	0.68	60
Boral Flows Swale	Grassed Swale (0.6 m deep)	2.14	0.50	60

The results show that the proposed drainage network is adequately sized to convey the 100 year ARI design storm with a minor increase in the capacity of the 'CHH and Borgs Flows Swale', as shown in Figure 4. The dimensions of this swale indicate the likely capacity that this swale will need to convey the 100 year flow. Exact dimensions of this swale will depend on site specific factors and will be decided upon during the detailed design stage. Results from XP-SWMM also indicate that building slabs should not be built below 1094m AHD.

5.8 Peak flow rate results

Both the existing and developed peak flow rates were estimated in XP-SWMM leaving the site at the licensed discharge location. These discharge rates can be seen below in Table 5-4 along with the critical storm event durations.

Table 5-4 Existing and developed peak flow rates at Gate 6

ARI	Existing peak flow rates (m ³ /s)	Developed peak flow rates (m ³ /s)	Relative increase (%)
1	1.65 (540 min)	1.82 (540 min)	9.3
10	3.62 (60 min)	4.85 (60 min)	25.4
100	7.17 (60 min)	8.78 (60 min)	18.3

It can be seen from Table 5-4 that the development is expected to slightly increase the peak flow rates discharging from the site. This occurs due to an increase in impervious area.

Detention of the peak flows discharging from these basins is largely dependent on the initial water level in the basins. Since the basins have a permanent storage volume below the outlet this initial water level is essentially dependent on the amount of water that has been pumped out and re-used on-site. Therefore the only detention that these basins provide is the volume between the initial water level and the overflow level. The main function of the sediment basins is to provide water quality storage rather than the mitigation of peak flow rates.

Unfortunately, traditional detention basin structures are difficult to integrate into the extremely flat site. In addition, a preferential geographic location for a possible detention basin (downstream of 'Gate 6') is limited by potential groundwater contamination issues with the northern fibre dump.

Given these considerable constraints and the large amount of water reused on-site, the modelled peak flow rates observed at the licensed discharge location are considered acceptable for the site. Additional basins and increased capacity of existing infrastructure prior to the site discharge location could be a future possibility if peak flow rates are later required to be mitigated further.

6. Water quality control

6.1 General

Water quality is currently monitored at several locations at the Oberon Timber Complex. Sampling results from three of these monitoring points were analysed during this investigation. These included the Borg discharge point, the adjacent 'HPP Site 1' 'north dam' discharge point and at the 'StructaFlor' 'gate 1' discharge point.

The Model for Urban Stormwater Improvement Conceptualisation (MUSIC) has been utilised as the key water quality modelling tool for this project. MUSIC is a continuous simulation water quality model used to evaluate the short and long-term performance of stormwater improvement devices that are configured in series or in parallel to form a 'treatment train'. MUSIC enables the end-user to determine if proposed systems can meet specified water quality objectives.

The MUSIC model considers suspended solids, total nitrogen and total phosphorus, which are typical components and key indicators of stormwater runoff. The key MUSIC model inputs are:

- rainfall and evaporation data
- catchment area and percentage impervious
- soil storage parameters
- pollutant event mean concentrations for source nodes.

All input parameters to the MUSIC model were derived from either climate data supplied by the Bureau of Meteorology (BOM) or estimated from the MUSIC model manual (2009) and other published papers.

MUSIC model outputs include:

- average annual pollutant export rates
- treatment train effectiveness, expressed in terms of pollutant reduction.

6.2 Existing conditions

6.2.1 MUSIC parameters

6.2.1.1 Rainfall and evapotranspiration

Six minute rainfall data for Oberon (Jenolan Caves Road) and Oberon Dam were obtained from the Bureau of Meteorology (BOM). The data for Oberon spanned approximately 12 years from 1993 to 2005 and the data for Oberon Dam spanned approximately 33 years from 1955 to 1988. Rainfall from the Oberon pluviograph data was used in the MUSIC

modelling as it is the more recent of the two sets and contains the longest period without any missing data.

The mean annual rainfall recorded at this gauging station is 457 mm. A summary graph of rainfall used within the MUSIC models is provided in Appendix E.

Monthly average areal potential evapotranspiration values for the area were obtained from the *Climatic Atlas of Australia – Evapotranspiration* (BOM, 1999). Evapotranspiration values are given in Table 6-1. The total annual evapotranspiration was 1175 mm.

Table 6-1 Monthly average areal potential evapotranspiration values

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Evapo-transpiration (mm/month)	160	120	115	80	55	40	45	60	85	120	145	150

6.2.1.2 Time step

The model was run with a time step of 6 minutes that spanned the period 2000 to 2005 as this was the longest period without any missing data. This time step was used to maximise the model reliability and output sensitivity.

6.2.1.3 Land use

The following land uses were defined within the model:

- rural – this represents the upstream rural catchment adjacent to the ‘HPP Site 1’ area
- industrial – this represents the developed areas of the site including buildings and pavement areas, with portions of intermittent pervious areas.

6.2.1.4 Hydrology

MUSIC hydrology parameters adopted for each land use are summarised in Table 6-2 are based on the default parameters provided in the MUSIC User Guide Version 4 (2009).

Table 6-2 MUSIC hydrology parameters for each land use

Parameter	Rural	Industrial
<i>Impervious area</i>		
Impervious percentage	5%	90%
Rainfall threshold (mm/day)	1	1
<i>Pervious area properties:</i>		
Soil storage capacity (mm)	120	120
Initial storage (%)	30	30
Field capacity (mm)	80	80
Infiltration capacity coefficient, a	200	200
Infiltration capacity exponent, b	1	1
<i>Groundwater properties:</i>		
Initial groundwater depth (mm)	10	10
Daily recharge rate (%)	25	25

Parameter	Rural	Industrial
Daily baseflow rate (%)	5	5
Daily deep seepage rate (%)	0	0

6.2.1.5 Event mean concentrations

The MUSIC model requires pollutant generation parameters for baseflow and stormflow conditions. Baseflow is derived from the groundwater store, which is recharged from the pervious soil store. Stormflow is generally generated from the impervious area, and under some conditions the pervious area as well.

Pollutant parameters for the rural area were based on concentrations documented in *Australian Runoff Quality* (Engineers Australia, 2006). The pollutant parameters for the developed parts of the site were obtained from the water quality monitoring data for the 'StructaFlor' 'gate 1' discharge point. This data was used as it was the only available sampling site that monitors runoff purely from the developed site (without any large undeveloped area) and was considered a good representation of the likely water quality that would run off all the highly developed areas at the site.

A summary of event mean concentrations adopted for baseflow and stormflow conditions are provided in Table 6-3. Baseflow and stormflow values for the industrial areas were the same since observed pollutant concentration averages were utilised in the MUSIC modelling.

Table 6-3 Baseflow and stormflow pollutant mean concentrations for each land use

Land use	Mean concentration		
	Total suspended solids (mg/L)	Total phosphorous (mg/L)	Total nitrogen (mg/L)
Rural - baseflow	18	0.06	0.9
Rural - stormflow	112	0.21	2.00
Industrial – baseflow	37	0.2	3.22
industrial - stormflow	37	0.2	3.22

6.2.2 MUSIC calibration

Due to the absence of site specific runoff quantity data, accurate calibration of the MUSIC model could not be undertaken. Instead, the predicted volumetric runoff coefficients have been compared against typical values for similar land uses documented in *Managing Urban Stormwater: Strategic Framework* (DEC, 1997).

A comparison of model predicted and typical volumetric runoff coefficients is summarised in Table 6-4 for each land use. Predicted volumetric runoff coefficients were calculated using the predicted runoff volume and the average annual rainfall reported in the model for the analysed rainfall period. As site actual observed specific pollutant data was used in the MUSIC model, calibration of the pollutant loads was not required.

Table 6-4 Comparison of typical and predicted volumetric runoff coefficients

Land use	Volumetric runoff coefficient	
	Typical	MUSIC predicted
Rural	0.2	0.19
Industrial	0.8	0.79

6.2.3 Existing water quality controls

6.2.3.1 Existing treatment devices

Water quality controls on the site currently consist of:

- vegetated open channels
- sediment basins both upstream and downstream of 'Gate 6'.

6.2.3.2 Modelling parameters

Sediment basins

The existing sediment basins were modelled in MUSIC using information obtained during the site inspection and aerial imagery. Storage-height relationships were then developed using the respective plan areas to model the pollutant removal characteristics of the basins as realistically as possible. Input data used to model the basins is shown below in Table 6-5.

Table 6-5 Existing sediment basin parameters

Parameter	Sediment basin 1	Sediment basin 2	Sediment basin 3	Sediment basin 4	Sediment basin 5
Low Flow By-Pass (m ³ /s)	0	0	0	0	0
High Flow By-Pass (m ³ /s)	100	100	100	100	100
Surface Area (m ²)	2300	1750	3000	900	900
Extended Detention Depth (m)	0	0	0	0	0
Permanent Pool Volume (m ³)	3060	4410	5520	1100	1100
Exfiltration Rate (mm/hr)	0	0	0	0	0
Evaporative Loss as % of PET	100	100	100	100	100
Overflow Weir Width (m)	2.5	2.8	9.0	3.5	3.5
Daily Re-Use Demand (kL/day)	50	50	0	0	0

Vegetated swales

Existing channels at the site were modelled as vegetated swales in MUSIC. These swales facilitate an even distribution and slowing of flows thus encouraging particulate pollutant settlement. The swale parameters used in MUSIC are the same as those used in XP-SWMM and are shown in Appendix A.

6.3 Developed conditions

6.3.1 General

The proposed development at the site including the proposed warehouse and adjacent hardstand areas was determined to increase the impervious area at the site by approximately 2 ha.

The proposed stormwater treatment train was investigated in MUSIC to determine the most practical and cost-effective water quality strategy that would comply with the EPL requirements for the site. It should be noted that this study only investigated the stormwater treatment devices that receive and are affected by runoff from the proposed development. Therefore the MUSIC results are not an accurate representation of what is likely to be observed at the licensed discharge location. However, they do allow an accurate approach to compare the existing pollutant loads with the developed pollutant loads post development.

The proposed stormwater management strategy involved a large, flat swale network that treats the runoff from the site and upstream areas and conveys the water into downstream sediment basins with increased storage capacity prior to discharge from the site. Due to the flat nature of the swale connecting the upstream areas to the culverts below 'Gate 6', it was modelled in MUSIC as a pond with a very small permanent pool volume, simply because this was predicted to provide a more accurate representation of the real life processes involved with the treatment of the runoff.

The swale treatment efficiency equations and parameters in MUSIC are not designed for flat grades and a sensitivity analysis conducted in MUSIC suggested that the swale nodes significantly overestimated the treatment capabilities of swales at very low grades. A summary of the treatment train can be seen in Figure 4.

6.3.2 Proposed water quality controls

6.3.2.1 Proposed treatment devices

Water quality controls proposed at the site include:

- grassed swales
- existing sediment basins with increased storage capacities.

6.3.2.2 Modelling parameters

Sediment basins

The sediment basins were modelled using plans of the proposed development to determine the available surface area for any potential upgrades to the basins. Similar storage-height relationships to those used to model the existing basins were then used to model the proposed basins, post development. A consistent amount of water re-used from the basins (100 m³/day) was adopted in the model. Input parameters for the proposed basins and the proposed flat swale through the site can be seen below in Table 6-6.

Table 6-6 Proposed sediment basin parameters

Parameter	Proposed flat Swale 1	Upgraded basin 3	Upgraded basin 4
Low Flow By-Pass (m ³ /s)	0	0	0
High Flow By-Pass (m ³ /s)	100	100	100
Surface Area (m ²)	2205	3500	1800
Extended Detention Depth (m)	0	0	0
Permanent Pool Volume (m ³)	745	6435	2200
Exfiltration Rate (mm/hr)	0	0	0
Evaporative Loss as % of PET	100	100	100
Overflow Weir Width (m)	10.0	9.0	3.5
Daily Re-Use Demand (kL/day)	0	100	0

Vegetated swales

Proposed grass swales were modelled in MUSIC using the parameters shown in Figure 4. Many of the existing swales are expected to be retained as part of the stormwater management strategy and were therefore modelled in MUSIC with the same parameters used in the existing model. The CHH and Borgs Flows Swale downstream of 'Gate 6' was modelled with an increased swale capacity compared to the existing capacity, as this was a requirement identified by the XP-SWMM modelling.

6.4 MUSIC results

The MUSIC results at the site outlet for the existing and developed scenarios are shown below in Table 6-7. Pollutants investigated in the model include Total Suspended Solids (TSS), Total Phosphorous (TP) and Total Nitrogen (TN).

Table 6-7 MUSIC treatment train efficiency and results

	Pollutant	Flow (ML/year)	Mitigated pollutant load (kg/year)	Treatment efficiency (%)	Treated concentration (mg/L)	Meet EPL target?
Existing	TSS	87.3	1380	80.7	15.81	Yes (30 mg/L))
	TP	87.3	10.0	72.9	0.114	Yes (0.3 mg/L)
	TN	87.3	176	70.5	2.02	Yes (10 mg/L)
Developed	TSS	97.8	1530	80.4	15.64	Yes (30 mg/L))
	TP	97.8	11.2	73.0	0.114	Yes (0.3 mg/L)
	TN	97.8	218	67.6	2.23	Yes (10 mg/L)

It can be seen from Table 6-7 that both the existing and developed scenarios removed approximately the same amount of pollutants from the stormwater runoff discharging from

the site. In addition, both scenarios meet the EPL targets for TSS, TP and TN. Existing pollutant concentration results discharging from the site are similar to what would be expected in this location, given that the investigation only considered the stormwater treatment devices that receive and are affected by runoff from the proposed development.

The observed average pollutant concentrations recorded leaving the Borg site are:

- TSS = 7.82 mg/L.
- TP = 0.08 mg/L.
- TN = 2.75 mg/L.

6.5 Discussion of water quality treatment strategies

From the stormwater management investigation and modelling results the proposed stormwater management strategy is a feasible and acceptable solution for the site post development. It provides similar treatment efficiencies to the existing system mainly because more runoff is directed through the enlarged sediment dam. In addition, by joining the two small dams immediately prior to the site discharge location the treatment capability of the system is increased because the northern dam can be utilised to treat more of the runoff from the site.

It should be noted that there is potential for the upgraded basin in the developed scenario to be further enlarged for additional water storage depending on considerations during the detailed design stage.

It is quite possible that infrequent higher pollutant levels are due to maintenance issues with the existing water quality treatment devices. Sediment build up in the existing channels was observed during the site inspection and may be adding to pollutant concentrations at the discharge location. The devices should be designed to be easily cleaned and inspected as discussed in Section 4.2.

Other pollutants that were not able to be modelled in MUSIC such as BOD and the true colour of the stormwater runoff are also expected to be treated to an adequate level by the stormwater management strategy, since these pollutants are generally linked to the pollutants modelled in MUSIC. For instance if the TSS is reduced then it is likely that the true colour of the runoff will also be reduced. In addition, the previous upstream works are expected to gradually improve water quality over the next year, and continue into the future, which will have beneficial impacts on the water discharging from the Borg site.

Aeration devices are able to be retrofitted to the system in the future if more Dissolved Oxygen (DO) is required within the stormwater treatment train.

7. Conclusions and recommendations

The stormwater management strategy for the proposed warehouse and associated hardstand development at the Oberon Timber Complex was required to manage runoff quality and quantity at the site. XP-SWMM and MUSIC were used to ensure that the final strategy was capable of conveying the 100 year ARI flow rates and that the site maintained pollutant runoff concentrations within its EPL limit requirements.

Two scenarios were investigated in MUSIC including the existing and developed cases. The proposed stormwater management strategy for the developed case was found to provide similar and adequate pollutant removal efficiencies with respect to the EPL limits. The final recommended stormwater strategy incorporated:

- Approximately 250 m of new grassed swales.
- Increasing the surface area and volume of one of the existing sediment basins by approximately 500 m².
- Construction of a new segregated swale used to separate and convey flows from the CHH and Boral sites.
- A junction pit and approximately 83m of 1050mm diameter stormwater line to intercept the line from HPP Site 2 and StructaFlor and connect to the upstream side of proposed Swale 1.
- The construction of 2 sets of 2 x 1050 mm diameter culverts approximately 33 m long to connect the proposed swale system with the existing culverts below 'Gate 6'.
- Providing a diversion bund downstream of 'Gate 6' to maintain the separation of CHH and Boral flows up to the 1yr ARI event.
- Maintaining the two small sediment dams prior to the licensed discharge point.
- Checking the capacity of the existing swales and drainage to ensure compliance with the 100 year ARI standard.

This proposed stormwater management is in addition to water quality work previously undertaken by PB upstream of the Borg site. These upstream works are anticipated to further improve the water quality discharging from the site into Kings Stockyard Creek.

Peak flows at the site are expected to increase slightly due to the increased impervious areas however this was considered acceptable given the site constraints and the large amount of water re-used at the site.

If peak flow rates are required to be further attenuated in the future there is potential to increase the storage and detention capabilities of the existing sediment basins immediately upstream of the discharge point. Aeration devices could also be retrofitted to the proposed stormwater treatment devices to improve the performance of the system if required.

The proposed treatment devices will require frequent inspection and maintenance to maintain optimal performance.

8. References

Bureau of Meteorology (BOM), 1999, Climatic atlas of Australia: evapotranspiration.

Department of Environment and Conservation (DEC): Environment Protection Authority (EPA), 1997, Managing urban stormwater strategic framework.

Duncan H P, 1999, Urban stormwater quality: a statistical overview, Cooperative Research Centre for Catchment Hydrology (CRC).

Engineers Australia, 2006, Australian Runoff Quality, a Guide to Water Sensitive Urban Design.

eWater, 2009, MUSIC Manual v4.

Institution of Engineers Australia, 2001, Australian rainfall and runoff, Institution of Engineers Australia.

Institution of Engineers Australia, 1987, Australian rainfall and runoff, Institution of Engineers Australia.

Parsons Brinckerhoff, 2008, Stormwater Strategy, report number 2106252A_PR_1120, prepared for Carter Holt Harvey.

Wong T (ed), 2005, MUSIC model reference manual, Cooperative Research Centre for Catchment Hydrology (CRC).

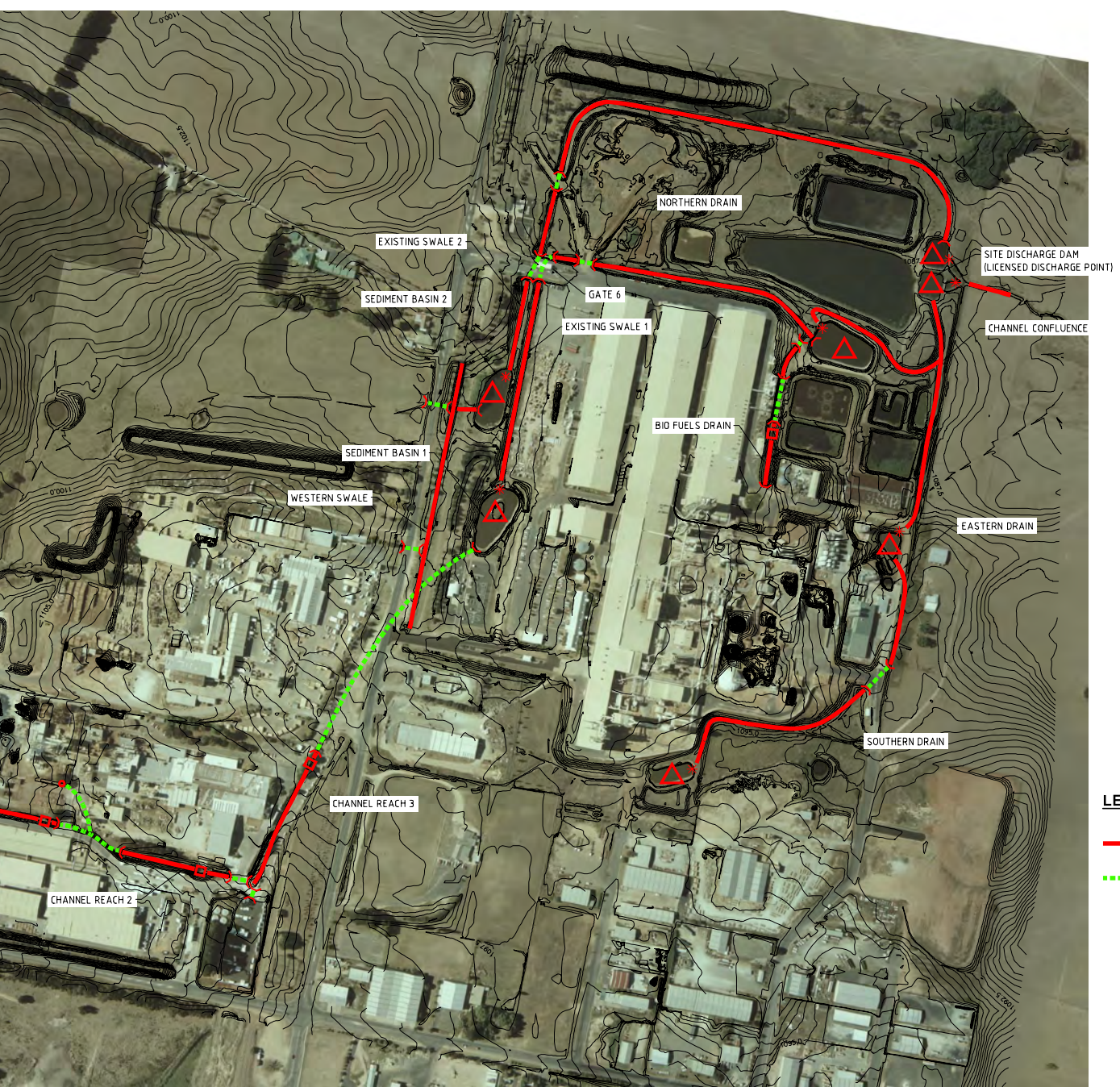
Figures



Locality Plan

Figure No. 1

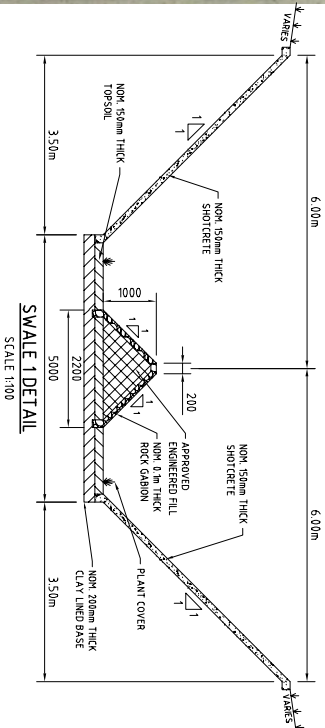




LEGEND:

-  OPEN CH
-  PIPE LIN
-  CULVER
-  OVERFL
-  STORAGE
-  GPT
-  DRIVE IN

**PARSONS
BRINCKERHOFF**



NOTE:
BOUND IN PROPOSED SWALE 11 IS INCLUDED TO SEPARATE FLOWS FROM THE BORAL AND CHH SITES.





Legend

- Catchment (New XP)
- Catchment (From Previous Project)

Appendix A

Existing pipe conduits and open
channels

Borg Oberon

Hydrologic and Hydraulic Analysis

Existing XP-SWMM Link Data

Project No. 2103481A

Client Ref.

Date: 15/03/2011

Link Name	Length (m)	Shape	Roughness	Bottom Width (m)	Diameter/ Height (m)	Slope (%)	Left-hand Batter (1 in)	Right-hand Batter (1 in)
Pipe1	15	Circular	0.014	0	0.45	6.667	0	0
Link51	10	Trapezoidal	0.014	2	1.5	0	2	2
link2	30	Trapezoidal	0.014	2	2	0.667	3	3
lowflow	40	Circular	0.014	0	0.375	0.42	0	0
road	100	Trapezoidal	0.014	2	0.5	0	3	3
Link33	63	Trapezoidal	0.014	2	1.7	0.206	3	2
231.1	20	Circular	0.014	0	1.05	-0.2	0	0
road2	20	Natural	0.014	0	0	1	0	0
road2	20	Natural	0.014	0	0	1	0	0
Link38	85	Circular	0.014	1	1.2	0.771	3	3
Pipe5	20	Circular	0.014	0	0.375	8.9	0	0
culvert	300	Circular	0.014	0	1.05	2.053	0	0
234.1	10	Circular	0.014	0	0.05	0	0	0
overflow	10	Circular	0.014	0	0.05	0	0	0
Channel4	240	Trapezoidal	0.03	2.5	1.5	0.425	3	3
FFCUL	34	Circular	0.014	0	1.05	0.265	0	0
FFOV	10	Circular	0.014	0	0.05	0	0	0
FFOFL	10	Circular	0.014	0	0.05	0	0	0
Link86	39	Trapezoidal	0.05	4.6	1	0.026	3	3
weir1	10	Circular	0.014	0	0.05	0	0	0
overflow.1	10	Circular	0.014	0	0.05	0	0	0
channel8	80	Trapezoidal	0.03	2	1.5	1.938	3	3
242.1	10	Circular	0.014	0	0.05	0	0	0
weir	10	Circular	0.014	0	0.05	0	0	0
245.1	70	Circular	0.014	0	0.375	0	0	0
over	70	Circular	0.014	0	0.375	0	0	0
channel6	60	Trapezoidal	0.014	2	1.5	1	3	3
RCP	50	Circular	0.014	0	0.45	2	0	0
channel	60	Trapezoidal	0.02	7	1	0	2	2
channel7	50	Trapezoidal	0.02	2	1	2	3	3
Link37	100	Trapezoidal	0.03	3	2	1	3	3
Pipe3	55	Circular	0.014	0	0.75	4.349	0	0
channel9	50	Trapezoidal	0.03	2	1.5	0.7	3	3
channel10	220	Trapezoidal	0.03	2	1.5	0.25	3	3
pipe	30	Circular	0.014	0	0.45	2.5	0	0
bypass	10	Circular	0.014	0	0.05	0	0	0
lowFcul	20	Circular	0.014	0	1.05	0.5	0	0
lowFOF	10	Circular	0.014	0	0.05	0	0	0
lowFOF	10	Circular	0.014	0	0.05	0	0	0
Link30	80	Trapezoidal	0.03	3	0.5	0.525	4	4
Link31	100	Trapezoidal	0.03	3	0.5	1.059	4	4
Link32	80	Trapezoidal	0.03	3	0.5	0.713	4	4
Link34	63	Trapezoidal	0.014	2	1.9	0.111	3	2
top	50	Natural	0.02	3	0.2	1	3	3
low	38.181	Circular	0.014	0	0.3	0.909	0	0
southweir	10	Circular	0.014	0	0.05	0	0	0
Link95	10	Trapezoidal	0.03	10	2	1	3	3
Link39	60	Circular	0.014	1	1.2	0.707	3	3
rack	10	Circular	0.014	0	0.05	0	0	0
trash	10	Circular	0.014	0	0.05	0	0	0
Link67	61.23	Trapezoidal	0.014	2	1	1.943	1.5	1.5
Link36	320	Trapezoidal	0.03	2	1	2.188	3	3
STRUpipe1	65	Circular	0.014	0	0.45	0.277	0	0
Link71	13.131	Circular	0.014	0	0.3	0.998	0	0
Link70	16.698	Circular	0.014	0	0.3	1	0	0
twin250-1	24.6	Circular	0.014	0	0.25	2.2	0	0
twin250-2	24.6	Circular	0.014	0	0.25	2.2	0	0
Link74	24	Circular	0.014	0	1.05	2.625	0	0
Link77	20	Trapezoidal	0.03	10	1	2	3	3
Link78	40	Circular	0.014	0	0.6	0.89	0	0
Link76	20	Trapezoidal	0.03	2	1	1.12	1	1
pond2OF	10	Circular	0.014	0	0.05	0	0	0
Pon2OF	10	Circular	0.014	0	0.05	0	0	0
SWCUL	31.2	Circular	0.014	0	1.05	0.801	0	0
SWOVF	10	Circular	0.014	0	0.05	0	0	0
SWOV	10	Circular	0.014	0	0.05	0	0	0
Link87	77	Trapezoidal	0.05	1.5	1	0.039	4	4
Link79	107	Trapezoidal	0.03	2.86	0.7	0.636	4.4	4.4
Link75	164	Trapezoidal	0.03	1	1.5	0.717	1	1
HighFCul	24.8	Circular	0.014	0	1.05	0.605	0	0
HighFOF	10	Circular	0.014	0	0.05	0	0	0
HighFOF	10	Circular	0.014	0	0.05	0	0	0
Link90	291	Trapezoidal	0.05	3	1	0.704	3	3
Link91	170	Trapezoidal	0.05	1	0.8	1.053	5	5
Link92	103	Trapezoidal	0.05	3.5	0.65	0.728	6	6
weir2	10	Circular	0.014	0	0.05	0	0	0
weir2	10	Circular	0.014	0	0.05	0	0	0
Link94	100	Trapezoidal	0.03	3	2	1	3	3

Appendix B

Developed pipe conduits and open channels

Borg Oberon

Hydrologic and Hydraulic Analysis

Developed XP-SWMM Link Data

Project No. 2103481A

Client Ref.

Date: 22/03/2011

Link Name	Length (m)	Shape	Roughness	Bottom Width (m)	Diameter/ Height (m)	Slope (%)	Left-hand Batter (1 in)	Right-hand Batter (1 in)
Pipe1	15	Circular	0.014	0	0.45	6.667	0	0
Link51	10	Trapezoidal	0.014	2	1.5	0	2	2
link2	30	Trapezoidal	0.014	2	2	0.667	3	3
lowflow	40	Circular	0.014	0	0.375	0.42	0	0
road	100	Trapezoidal	0.014	2	0.5	0	3	3
Link33	63	Trapezoidal	0.014	2	1.7	0.206	3	2
231.1	20	Circular	0.014	0	1.05	-0.2	0	0
road2	20	Natural	0.014	0	0	1	0	0
road2	20	Natural	0.014	0	0	1	0	0
Link38	85	Circular	0.014	1	1.2	0.771	3	3
Pipe5	20	Circular	0.014	0	0.375	8.9	0	0
Link95	299	Circular	0.014	0	1.05	1.866	0	0
Link87	125	Trapezoidal	0.03	3	1.5	0	2	2
Link91	10	Trapezoidal	0.03	20	2	0.2	0.01	0.01
weir1	10	Circular	0.014	0	0.05	0	0	0
overflow.1	10	Circular	0.014	0	0.05	0	0	0
channel8	50	Trapezoidal	0.03	2	1.5	3.1	3	3
weirA	10	Circular	0.014	0	0.05	0	0	0
weirB	10	Circular	0.014	0	0.05	0	0	0
weirA	10	Circular	0.014	0	0.05	0	0	0
weirB	10	Circular	0.014	0	0.05	0	0	0
245.1	70	Circular	0.014	0	0.375	0	0	0
over	70	Circular	0.014	0	0.375	0	0	0
channel6	60	Trapezoidal	0.014	2	1.5	1	3	3
RCP	50	Circular	0.014	0	0.45	2	0	0
channel	60	Trapezoidal	0.02	7	1	0	2	2
channel7	50	Trapezoidal	0.02	2	1	2	3	3
Link37	100	Trapezoidal	0.03	3	2	1	3	3
Pipe3	55	Circular	0.014	0	0.75	4.349	0	0
channel9	50	Trapezoidal	0.03	2	1.5	0.7	3	3
channel10	220	Trapezoidal	0.03	2	1.5	0.25	3	3
pipe	30	Circular	0.014	0	0.45	2.5	0	0
bypass	10	Circular	0.014	0	0.05	0	0	0
lowfcu	20	Circular	0.014	0	1.05	0.5	0	0
lowfOF	10	Circular	0.014	0	0.05	0	0	0
lowfOF	10	Circular	0.014	0	0.05	0	0	0
Link30	80	Trapezoidal	0.03	5	0.6	0.525	4	4
Link31	100	Trapezoidal	0.03	5	0.6	1.059	4	4
Link32	80	Trapezoidal	0.03	5	0.6	0.713	4	4
Link34	63	Trapezoidal	0.014	2	1.9	0.111	3	2
top	50	Natural	0.02	3	0.2	1	3	3
low	38.181	Circular	0.014	0	0.3	0.909	0	0
southweir	10	Circular	0.014	0	0.05	0	0	0
Link39	60	Circular	0.014	1	1.2	0.707	3	3
rack	10	Circular	0.014	0	0.05	0	0	0
trash	10	Circular	0.014	0	0.05	0	0	0
Link67	61.23	Trapezoidal	0.014	2	1	1.943	1.5	1.5
Link36	320	Trapezoidal	0.03	2	1	2.188	3	3
STRUpipe1	65	Circular	0.014	0	0.45	0.277	0	0
Link71	13.131	Circular	0.014	0	0.3	0.998	0	0
Link70	16.698	Circular	0.014	0	0.3	1	0	0
twin250-1	24.6	Circular	0.014	0	0.25	2.2	0	0
twin250-2	24.6	Circular	0.014	0	0.25	2.2	0	0
Link74	24	Circular	0.014	0	1.05	2.625	0	0
Link77	20	Trapezoidal	0.03	10	1	2	3	3
Link78	40	Circular	0.014	0	0.6	0.89	0	0
Link76	20	Trapezoidal	0.03	2	1	7.095	1	1
Link90	75	Trapezoidal	0.03	3	1.5	0	2	2
SWCul	31.2	Circular	0.014	0	1.05	0.801	0	0
FFCul	34	Circular	0.014	0	1.05	0.265	0	0
gateOF	10	Circular	0.014	0	0.05	0	0	0
G8OF	10	Circular	0.014	0	0.05	0	0	0
Link96	39	Trapezoidal	0.03	4.6	1	-0.333	3	3
HighFlow	10	Circular	0.014	0	0.05	0	0	0
HIGHF Weir	10	Circular	0.014	0	0.05	0	0	0
Link98	67	Trapezoidal	0.05	1.5	1	0.045	4	4
Link105	45	Trapezoidal	0.03	3	1.5	0	2	2
Link75	164	Trapezoidal	0.03	1	1.5	0.717	1	1
highfcu	24.8	Circular	0.014	0	1.05	0.605	0	0
highfOF	10	Circular	0.014	0	0.05	0	0	0
highfOF	10	Circular	0.014	0	0.05	0	0	0
Link100	291	Trapezoidal	0.03	3	1	0.704	3	3
Link101	170	Trapezoidal	0.03	1	0.8	1.053	5	5
Link102	103	Trapezoidal	0.03	3.5	0.65	0.728	6	6
newcul	32.5	Circular	0.014	0	1.2	0.462	0	0
new weir	10	Circular	0.014	0	0.05	0	0	0
newweir	10	Circular	0.014	0	0.05	0	0	0

Appendix C

Oberon IFD

Appendix D - OBERON
IFD ANALYSIS BASED ON AUSTRALIAN RAINFALL & RUNOFF (1987)

Site name: township

Site latitude = 33.70 degrees S
 longitude = 149.85 degrees E
 skewness = .16

2-year ARI, 1 hour intensity = 24.00 mm/hr
 12 hour intensity = 4.75 mm/hr
 72 hour intensity = 1.40 mm/hr

50-year ARI, 1 hour intensity = 46.00 mm/hr
 12 hour intensity = 8.00 mm/hr
 72 hour intensity = 2.50 mm/hr

IFD Table for Various ARIs and Durations

Duration	1 yr	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr
5 min	61.89	79.55	105.73	122.20	143.85	173.47	196.97	221.59	256.11
6 min	57.92	74.41	98.71	113.96	134.04	161.48	183.22	206.00	237.90
10 min	47.21	60.52	79.82	91.86	107.75	129.41	146.53	164.42	189.43
12 min	43.58	55.83	73.45	84.43	98.93	118.67	134.26	150.54	173.28
15 min	39.32	50.32	66.01	75.76	88.65	106.17	119.99	134.41	154.52
18 min	36.01	46.05	60.25	69.05	80.70	96.53	109.00	121.99	140.10
20 min	34.17	43.67	57.06	65.34	76.32	91.21	102.93	115.15	132.16
24 min	31.13	39.75	51.80	59.23	69.09	82.46	92.97	103.91	119.13
30 min	27.66	35.28	45.81	52.29	60.90	72.56	81.71	91.22	104.44
45 min	22.09	28.11	36.26	41.24	47.90	56.87	63.89	71.18	81.28
1.0 hr	18.70	23.76	30.51	34.61	40.10	47.49	53.27	59.25	67.52
1.5 hr	14.50	18.37	23.39	26.41	30.48	35.93	40.18	44.57	50.62
2.0 hr	12.06	15.25	19.29	21.71	24.99	29.36	32.76	36.26	41.08
3.0 hr	9.28	11.69	14.66	16.42	18.83	22.02	24.49	27.03	30.51
4.5 hr	7.13	8.96	11.13	12.41	14.16	16.49	18.28	20.12	22.63
6.0 hr	5.91	7.41	9.16	10.17	11.58	13.43	14.86	16.32	18.31
9.0 hr	4.55	5.69	6.96	7.69	8.72	10.07	11.11	12.16	13.60
12.0 hr	3.78	4.71	5.73	6.31	7.14	8.22	9.04	9.88	11.01
18.0 hr	2.91	3.63	4.44	4.91	5.56	6.42	7.08	7.74	8.65
24.0 hr	2.41	3.01	3.70	4.09	4.65	5.38	5.93	6.50	7.28
30.0 hr	2.08	2.60	3.20	3.55	4.03	4.67	5.16	5.66	6.35
36.0 hr	1.83	2.30	2.84	3.15	3.58	4.16	4.60	5.05	5.66
48.0 hr	1.50	1.88	2.33	2.59	2.95	3.43	3.80	4.18	4.70
72.0 hr	1.10	1.39	1.73	1.93	2.21	2.57	2.86	3.15	3.54

IFD Polynomial: $\ln I = a + b \cdot \ln(D) + c \cdot \ln(D)^2 + d \cdot \ln(D)^3 + e \cdot \ln(D)^4 + f \cdot \ln(D)^5 + g \cdot \ln(D)^6$

where duration D is in hrs and average intensity I is in

mm/hr

ARI	g	a Max % error	b	c	d	e	f
1	2.9237773		-.6030622	-.0359619	.0083954	.0007065	-.0003096
-.0000065		.48					
2	3.1633818		-.6092024	-.0374183	.0081530	.0009521	-.0002618
-.0000210		.47					
5	3.4137657		-.6272701	-.0415871	.0074453	.0016614	-.0001217
-.0000634		.42					
10	3.5400373		-.6370379	-.0438409	.0070626	.0020448	-.0000460
-.0000863		.56					
20	3.6876110		-.6452721	-.0457409	.0067400	.0023681	.0000178
-.0001056		.71					
50	3.8569763		-.6547223	-.0479214	.0063698	.0027391	.0000911

Appendix D - OBERON

-.0001277		.88							
100		3.9718790	-.6611335	-.0494006	.0061187	.0029908	.0001408		
-.0001428		1.00							
200		4.0784338	-.6670789	-.0507725	.0058858	.0032242	.0001868		
-.0001567		1.11							
500		4.2093725	-.6743849	-.0524582	.0055996	.0035110	.0002435		
-.0001738		1.25							

Overland Flow Travel Time Aid

Table of $t \cdot I^{0.4}$ where t = time in min and I = intensity in mm/h

Duration	1 yr	2 yr	5 yr	10 yr	20 yr	50 yr	100 yr	200 yr	500 yr
5 min	26.05	28.80	32.27	34.19	36.49	39.32	41.37	43.37	45.95
6 min	30.42	33.62	37.66	39.89	42.57	45.86	48.24	50.56	53.56
7 min	34.65	38.30	42.86	45.39	48.42	52.16	54.85	57.48	60.87
8 min	38.77	42.84	47.92	50.72	54.10	58.25	61.24	64.16	67.93
9 min	42.79	47.27	52.83	55.91	59.61	64.16	67.44	70.64	74.77
10 min	46.71	51.59	57.63	60.96	64.98	69.92	73.48	76.95	81.43
12 min	54.30	59.96	66.90	70.73	75.36	81.04	85.14	89.13	94.28
14 min	61.61	68.01	75.82	80.12	85.32	91.72	96.32	100.80	106.59
16 min	68.68	75.78	84.43	89.18	94.94	102.01	107.11	112.06	118.46
18 min	75.53	83.33	92.77	97.95	104.25	111.98	117.54	122.95	129.94
20 min	82.19	90.66	100.87	106.48	113.29	121.65	127.67	133.52	141.08
22 min	88.69	97.81	108.77	114.78	122.10	131.07	137.53	143.81	151.91
24 min	95.03	104.79	116.48	122.88	130.69	140.26	147.15	153.84	162.47
26 min	101.24	111.62	124.01	130.80	139.08	149.23	156.54	163.63	172.79
28 min	107.32	118.31	131.39	138.55	147.30	158.01	165.72	173.21	182.87
30 min	113.29	124.87	138.63	146.15	155.35	166.62	174.72	182.59	192.75
40 min	141.69	156.08	172.99	182.21	193.53	207.38	217.34	227.01	239.47

Appendix D

PRM calculations

CHH Oberon

Hydraulic Assessment

Rational Method Hydrologic Calculations

Project No. 2106252A
Client Ref.
Date: 10-Dec-07

ARI	1	$t_{t1} =$	34.6	mm/h
C_{t10}	0.20	Min Tc	5	
Rainfall Data for: OBERON				

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional $t_c=0.76A^{0.38}$ (Small Rural)

3 = Kinematic Wave

ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Subcatchment	Subcatchment Data				Runoff Coefficient		Subcatchment t _c				Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW		
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby/W	Regional	Kinematic	t _c	L	v	t	u/s	Min.	mm/hr	ha	m ³ /s
Catchment 1	ha	%	m	m/m	-	-	-	ha	Min.	Min.	Min.		m	m/s	Min.	Min. <td>Min.<td></td><td>ha</td><td></td></td>	Min. <td></td> <td>ha</td> <td></td>		ha	
	S1	2.90 0.30	90.0% 90.0%	270 20	0.020 0.020	0.01 0.01	0.8 0.8	0.666 0.666	1.9 0.2	11.9 5.0	10.7 1.7	10.7 5.0						48.1 48.1	1.93 2.13	0.3 0.3
	Node27	3.90 1.80	90.0% 90.0%	260 140	0.010 0.030	0.01 0.01	0.8 0.8	0.666 0.666	2.6 1.2	13.3 9.9	13.3 5.8	13.3 5.8						43.6 61.6	2.60 1.20	0.3 0.2
	Node 47	0.50 1.30	70.0% 70.0%	70 120	0.012 0.010	0.01 0.01	0.8 0.8	0.559 0.559	0.3 0.7	6.1 8.8	4.9 7.6	5.0 7.6	5.0 0.0					64.9 55.3	0.28 1.01	0.1 0.2
	Node332												50 50 210	1 0.8 0.8	0.8 1.0 4.4	5.0 15.0 10.7	5.0 7.6 15.0	40.0 41.3	6.94 5.93	0.8 0.7
	Node 5												50	0.8	1.0	16.1	17.1	38.8	7.73	0.8
	Node6	1.20	90.0%	165	0.010	0.014	0.8	0.666	0.8	8.5	9.6	9.6	9.6	50	0.6	17.1	6.5	59.0	0.53	0.1
	Node8	0.80	90.0%	95	0.010	0.014	0.8	0.666	0.5	7.3	6.5	6.5	6.5	50	0.6	17.1	17.7	38.2	8.47	0.9
	Node7	0.30	90.0%	103	0.036	0.014	0.8	0.666	0.2	5.0	4.4	4.4	5.0	155	1.5	17.7	19.4	36.5	9.93	1.0
	Node9	2.20	90.0%	315	0.010	0.014	0.8	0.666	1.5	10.7	15.4	15.4	15.4	300	2	2.5	19.4	21.9	9.93	0.9
Catchment 2	culvert																			
	Sp1	3.50	80.0%	190	0.030	0.014	0.8	0.612	2.1	12.8	7.2	7.2						34.4	9.94	0.9
	Node12	1.10	90.0%	70	0.015	0.014	0.8	0.666	0.7	8.2	4.5	5.0						34.4	10.68	1.0
	Node13	0.70	90.0%	140	0.015	0.014	0.8	0.666	0.5	6.9	7.4	7.4	210	1	3.5	21.9	25.4	31.8	11.14	1.0
	Node29	1.50	90.0%	260	0.010	0.014	0.8	0.666	1.0	9.2	13.3	13.3	90	1.1	1.4	25.4	26.8	31.0	12.14	1.0
	Dump	0.60	50.0%				0.8	0.451	0.3	6.5	6.5	6.5				26.8	22.2	34.1	12.41	1.2
	Node30	2.00	90.0%	260	0.01	0.014	0.8	0.666	1.3	10.3	13.3	13.3	70	1.1	1.1	22.2	23.3	33.3	13.75	1.3
	Node31	2.00	90.0%	260	0.010	0.014	0.8	0.666	1.3	10.3	13.3	13.3	90	1.1	1.4	23.3	24.6	32.3	15.08	1.4
	Node19	1.80	90.0%	140	0.05	0.014	0.8	0.666	1.2	9.9	4.8	5.0						64.9	1.20	0.2
	Node20	0.4	90.0%	90	0.01	0.014	0.8	0.666	0.3	5.6	6.2	6.2						59.9	1.47	0.2
Node21	0.30	90.0%	90	0.01	0.014	0.8	0.666	0.2	5.0	6.2	6.2						56.8	1.67	0.3	
	SP4	3.8	90.0%	240	0.01	0.014	0.8	0.666	2.5	13.2	12.6	12.6						44.8	2.5	0.3
	SP3	4.1	90.0%	280	0.05	0.014	0.8	0.666	2.7	13.5	7.9	7.9	305	1	5.1	12.6	17.7	38.2	5.3	0.6
	SP2	1	50.0%	70	0.1	0.014	0.8	0.451	0.5	7.9	2.3	5.0						32.3	19.3	1.7
Dis Pond	0.7	0.0%				0.52	0.104	0.1		6.9		6.9	210	1.2	2.9	24.6	27.5	30.5	24.7	2.1

CHH Oberon

Hydraulic Assessment

Rational Method Hydrologic Calculations

ARI	5	$t_{D1} =$	34.6	mm/h
C_{10}	0.20	Min Tc	5	
Rainfall Data for: OBERON				

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional tc=0.76A^{0.38} (Small Rural)

3 = Kinematic Wave

ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Rural:

Urban:

Subcatchment	Subcatchment Data				Runoff Coefficient			Subcatchment t _c				Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW		
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby/W	Regional	Kinematic	t _c	L	v	t	u/s	Min.	mm/hr	ha	m ³ /s	
	ha	%	m	m/m	-	-	-	ha	Min.	Min.	Min.		m	m/s	Min.		Min.				
Catchment 1	S1	2.90 90.0%	270	0.020	0.01	0.95	0.791	2.3		11.9	8.4	8.4						88.1	2.29	0.6	
	Node2	0.30 90.0%	20	0.020	0.01	0.95	0.791	0.2		5.0	1.4	5.0						88.1	2.53	0.6	
	Node27	3.90 90.0%	260	0.010	0.01	0.95	0.791	3.1		13.3	10.5	10.5						79.8	3.09	0.7	
	Sump2	1.80 90.0%	140	0.030	0.01	0.95	0.791	1.4		9.9	4.5	5.0						108.1	1.42	0.4	
	Node47	0.50 70.0%	70	0.012	0.01	0.95	0.663	0.3		6.1	3.9	5.0		1	0.8	5.0	5.0	108.1	0.33	0.1	
	Node33	1.30 70.0%	120	0.010	0.01	0.95	0.663	0.9		8.8	6.0	6.0		0.8	1.0	12.7	6.0	101.0	1.19	0.3	
	Node32											0.0		210	0.8	4.4	8.4	12.7	70.1	8.24	1.6
	Node5													50	0.8	1.0	13.8	12.7	72.8	7.04	1.4
	Node6	1.20 90.0%	165	0.010	0.014	0.95	0.791	0.9		8.5	7.5	7.5		50	0.8	1.0	13.8	14.8	67.6	9.18	1.7
	Node8	0.80 90.0%	95	0.010	0.014	0.95	0.791	0.6		7.3	5.1	5.1		50	1.5	0.6	14.8	5.1	107.5	0.63	0.2
Node7	0.30 90.0%	103	0.036	0.014	0.95	0.791	0.2		5.0	3.4	5.0		50	1.5	0.6	14.8	15.4	66.4	10.05	1.9	
Node9	2.20 90.0%	315	0.010	0.014	0.95	0.791	1.7		10.7	12.1	12.1		155	1.5	1.7	15.4	17.1	63.0	11.80	2.1	
culvert													300	2	2.5	17.1	19.6	58.7	11.80	1.9	
Catchment 2	Sp1	3.50 80.0%	190	0.030	0.014	0.95	0.727	2.5		12.8	5.6	5.6						58.7	11.81	1.9	
	Node12	1.10 90.0%	70	0.015	0.014	0.95	0.791	0.9		8.2	3.6	5.0						58.7	12.68	2.1	
	Node13	0.70 90.0%	140	0.015	0.014	0.95	0.791	0.6		6.9	5.8	5.8		210	1	3.5	19.6	19.6	53.8	13.23	2.0
	Node29	1.50 90.0%	260	0.010	0.014	0.95	0.791	1.2		9.2	10.5	10.5		90	1.1	1.4	23.1	24.5	52.1	14.42	2.1
	Dump	0.60 50.0%				0.95	0.536	0.3		6.5	10.5	6.5						54.9	14.74	2.3	
	Node30	2.00 90.0%	260	0.01	0.014	0.95	0.791	1.6		10.3	10.5	10.5		70	1.1	1.1	22.2	23.3	53.6	16.32	2.4
	Node31	2.00 90.0%	260	0.010	0.014	0.95	0.791	1.6		10.3	10.5	10.5		90	1.1	1.4	23.3	24.6	51.9	17.91	2.6
	Node19	1.80 90.0%	140	0.05	0.014	0.95	0.791	1.4		9.9	3.8	5.0						108.1	1.42	0.4	
	Node20	0.4 90.0%	90	0.01	0.014	0.95	0.791	0.3		5.6	4.9	5.0		70	1.5	0.8	5.0	5.8	102.5	1.74	0.5
	Node21	0.30 90.0%	90	0.01	0.014	0.95	0.791	0.2		5.0	4.9	5.0		55	1	0.9	5.8	6.7	96.7	1.98	0.5
SP4	3.8 90.0%	240	0.01	0.014	0.95	0.791	3.0		13.2	9.9	9.9						81.9	3.0	0.7		
SP3	4.1 90.0%	280	0.05	0.014	0.95	0.791	3.2		13.5	6.2	6.2		305	1	5.1	9.9	15.0	67.3	6.3	1.2	
SP2	1 50.0%	70	0.1	0.014	0.95	0.536	0.5		7.9	1.9	5.0						51.9	23.0	3.3		
Dis Pond	0.7 0.0%				0.82	0.164	0.1		6.9		6.9		210	1.2	2.9	24.6	24.6	48.8	29.3	4.0	

CHH Oberon

Hydraulic Assessment

Rational Method Hydrologic Calculations

ARI	10	$t_{t1} =$	34.6	mm/h
C_{t10}	0.20	Min Tc	5	
Rainfall Data for:	OBERON			

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional $t_c=0.76A^{0.38}$ (Small Rural)

3 = Kinematic Wave

ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Rural:

Urban:

Subcatchment	Subcatchment Data				Runoff Coefficient			Subcatchment t_c			Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW		
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby,W	Regional	Kinematic	t_c	L	v	t	u/s	this	mm/hr	ha	m^3/s
Catchment 1	ha	%	m	m/m	-	-	-	ha	Mn.	Mn.	Mn.		m	m/s	Min.	Min.	Min.		ha	
	S1	2.90 90.0%	270 20	0.020 0.020	0.01 0.01	1 1	0.833 0.833	2.4 0.2		11.9 5.0	7.8 1.4	7.8 5.0				7.8	7.8	104.3 104.3	2.42 2.66	0.7 0.8
	Node2	0.30 90.0%																		
	Node27	3.90 90.0%	260 140	0.010 0.030	0.01 0.01	1 1	0.833 0.833	3.2 1.5		13.3 9.9	9.8 4.3	9.8 5.0				9.8 5.0	9.8 5.0	94.4 124.6	3.25 1.50	0.9 0.5
	Sump2	1.80 90.0%																		
	Node 47	0.50 70.0%	70	0.012	0.01	1	0.698	0.3		6.1	3.6	5.0			0.8	5.0	5.0	124.6	0.35	0.1
	Node33	1.30 70.0%	120	0.010	0.01	1	0.698	0.9		8.8	5.6	5.6		0.8	1.0	12.2	5.8	117.7	1.26	0.4
	Node32											0.0	210	0.8	4.4	7.8	13.2	81.7	8.67	2.0
	Node 5														1.0	13.2	14.3	85.1	7.41	1.8
	Node6	1.20 90.0%	165	0.010	0.014	1	0.833	1.0		8.5	7.0	7.0		50	0.8	13.2	14.3	78.7	9.67	2.1
Node8	0.80 90.0%	95	0.010	0.014	1	0.833	0.7		7.3	4.8	5.0		50	0.6	14.3	5.0	124.6	0.67	0.2	
Node7	0.30 90.0%	103	0.036	0.014	1	0.833	0.2		5.0	3.2	5.0		50	1.5	14.3	14.8	77.2	10.58	2.3	
Node9	2.20 90.0%	315	0.010	0.014	1	0.833	1.8		10.7	11.3	11.3		155	1.7	14.8	16.6	73.0	12.42	2.5	
culvert													300	2	2.5	16.6	19.1	67.8	12.42	2.3
Catchment 2	Sp1	3.50 80.0%	190	0.030	0.014	1	0.766	2.7		12.8	5.3	5.3				19.1	19.1	67.8	12.43	2.3
	Node12	1.10 90.0%	70	0.015	0.014	1	0.833	0.9		8.2	3.4	5.0				19.1	19.1	67.8	13.35	2.5
	Node13	0.70 90.0%	140	0.015	0.014	1	0.833	0.6		6.9	5.4	5.4	210	1	3.5	19.1	22.6	61.9	13.93	2.4
	Node29	1.50 90.0%	260	0.010	0.014	1	0.833	1.2		9.2	9.8	9.8	90	1.1	1.4	22.6	23.9	59.9	15.18	2.5
	Dump	0.60 50.0%				1	0.564	0.3		6.5	6.5	6.5				23.9	22.2	62.4	15.52	2.7
	Node30	2.00 90.0%	260	0.01	0.014	1	0.833	1.7		10.3	9.8	9.8	70	1.1	1.1	22.2	23.3	60.9	17.18	2.9
	Node31	2.00 90.0%	260	0.010	0.014	1	0.833	1.7		10.3	9.8	9.8	90	1.1	1.4	23.3	24.6	59.0	18.85	3.1
	Node19	1.80 90.0%	140	0.05	0.014	1	0.833	1.5		9.9	3.6	5.0				5.0	5.0	124.6	1.50	0.5
	Node20	0.4 90.0%	90	0.01	0.014	1	0.833	0.3		5.6	4.6	5.0	70	1.5	0.8	5.0	5.8	118.1	1.83	0.6
	Node21	0.30 90.0%	90	0.01	0.014	1	0.833	0.2		5.0	4.6	5.0	55	1	0.9	5.8	6.7	111.4	2.08	0.6
SP4	3.8 90.0%	240	0.01	0.014	1	0.833	3.2		13.2	9.2	9.2			5.1	9.2	9.2	97.0	3.2	0.9	
SP3	4.1 90.0%	280	0.05	0.014	1	0.833	3.4		13.5	5.8	5.8	305	1		9.2	14.3	78.6	6.6	1.4	
SP2	1 50.0%	70	0.1	0.014	1	0.564	0.6		7.9	1.8	5.0				24.6	24.6	59.0	24.2	4.0	
Dis Pond	0.7 0.0%				1	0.200	0.1		6.9		6.9	210	1.2	2.9	24.6	27.5	55.4	30.9	4.8	

CHH Oberon

Hydraulic Assessment

Rational Method Hydrologic Calculations

Project No. 2106252A
Client Ref.
Date: 10-Dec-07

ARI	20	$t_{t1} =$	34.6	mm/h
C_{t10}	0.20	Min Tc	5	
Rainfall Data for: OBERON				

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional tc=0.76A^{0.38} (Small Rural)

3 = Kinematic Wave

ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Rural:
Urban:

Subcatchment	Subcatchment Data				Runoff Coefficient			Subcatchment t _c				Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW		
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby/W	Regional	Kinematic	t _c	L	v	t	u/s	Min.	mm/hr	ha	m ³ /s	
Catchment 1	ha	%	m	m/m	-	-	-	ha	Min.	Min.	Min.		m	m/s	Min.		Min.				
	S1	90.0%	270	0.020	0.01	1.05	0.874	2.5		11.9	7.2	7.2						126.8	2.54	0.9	
	Node2	90.0%	20	0.020	0.01	1.05	0.874	0.3		5.0	1.3	5.0		1	0.8	5.0	5.8	126.8	2.80	1.0	
	Node27	90.0%	260	0.010	0.01	1.05	0.874	3.4		13.3	9.1	9.1						114.8	3.41	1.1	
	Sump2	90.0%	140	0.030	0.01	1.05	0.874	1.6		9.9	3.9	5.0						146.7	1.57	0.6	
	Node 47	70.0%	70	0.012	0.01	1.05	0.733	0.4		6.1	3.4	5.0						146.7	0.37	0.1	
	Node33	70.0%	120	0.010	0.01	1.05	0.733	1.0		8.8	5.2	5.2	50	1	0.8	5.0	5.8	138.5	1.32	0.5	
	Node32												0.0	50	0.8	1.0	11.6	12.7	97.8	9.10	2.5
	Node 5													210	0.8	4.4	7.2	11.6	102.0	7.78	2.2
	Node6	90.0%	165	0.010	0.014	1.05	0.874	1.0		8.5	6.5	6.5	50	0.8	1.0	12.7	13.7	93.9	10.15	2.7	
Node8	90.0%	95	0.010	0.014	1.05	0.874	0.7		7.3	4.4	5.0	50	1.5	0.6	13.7	14.2	146.7	0.70	0.3		
Node7	90.0%	103	0.036	0.014	1.05	0.874	0.3		5.0	3.0	5.0	50	1.5	0.6	13.7	14.2	92.0	11.11	2.8		
Node9	90.0%	315	0.010	0.014	1.05	0.874	1.9		10.7	10.4	10.4	155	1.5	1.7	14.2	16.0	86.8	13.04	3.1		
culvert												300	2	2.5	16.0	18.5	80.3	13.04	2.9		
Catchment 2	Sp1	80.0%	190	0.030	0.014	1.05	0.804	2.8		12.8	4.9	5.0						80.3	13.05	2.9	
	Node12	90.0%	70	0.015	0.014	1.05	0.874	1.0		8.2	3.1	5.0	210	1	3.5	18.5	18.5	80.3	14.01	3.1	
	Node13	90.0%	140	0.015	0.014	1.05	0.874	0.6		6.9	5.0	5.0						73.0	14.63	3.0	
	Node29	90.0%	260	0.010	0.014	1.05	0.874	1.3		9.2	9.1	9.1	90	1.1	1.4	22.0	23.3	70.6	15.94	3.1	
	Dump	50.0%	0.60			1.05	0.592	0.4		6.5	6.5	6.5						72.6	16.29	3.3	
	Node30	90.0%	260	0.01	0.014	1.05	0.874	1.7		10.3	9.1	9.1	70	1.1	1.1	22.2	23.3	70.8	18.04	3.5	
	Node31	90.0%	260	0.010	0.014	1.05	0.874	1.7		10.3	9.1	9.1	90	1.1	1.4	23.3	24.6	68.5	19.79	3.8	
	Node19	90.0%	140	0.05	0.014	1.05	0.874	1.6		9.9	3.3	5.0						146.7	1.57	0.6	
	Node20	90.0%	90	0.01	0.014	1.05	0.874	0.3		5.6	4.2	5.0	70	1.5	0.8	5.0	5.8	139.0	1.92	0.7	
	Node21	90.0%	90	0.01	0.014	1.05	0.874	0.3		5.0	4.2	5.0	55	1	0.9	5.8	6.7	131.0	2.19	0.8	
SP4	90.0%	240	0.01	0.014	1.05	0.874	3.3		13.2	8.5	8.5	305	1	5.1	8.5	8.5	117.9	3.3	1.1		
SP3	90.0%	280	0.05	0.014	1.05	0.874	3.6		13.5	5.4	5.4						94.2	6.9	1.8		
SP2	50.0%	70	0.1	0.014	1.05	0.592	0.6		7.9	1.7	5.0						68.5	25.4	4.8		
Dis Pond	0.0%	0.7			1.21	0.242	0.2		6.9		6.9	210	1.2	2.9	24.6	24.6	64.3	32.4	5.8		

CHH Oberon

Hydraulic Assessment

Project No. 2106252A

Client Ref.

Rational Method Hydrologic Calculations

Date: 10-Dec-07

ARI	50	$t_{t1} =$	34.6	mm/h
C_{t10}	0.20	Min Tc	5	
Rainfall Data for: OBERON				

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional $t_c=0.76A^{0.38}$ (Small Rural)

3 = Kinematic Wave

ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
Urban:							
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Subcatchment	Subcatchment Data				Runoff Coefficient		Subcatchment t _c				Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW			
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby/W	Regional	Kinematic	t _c	L	v	t	u/s	Min.	mm/hr	ha	m ³ /s	
Catchment 1	ha	%	m	m/m	-	-	-	ha	Min.	Min.	Min.		m	m/s	Min.	Min. <td>Min.<td></td><td>ha</td><td></td></td>	Min. <td></td> <td>ha</td> <td></td>		ha		
	S1	2.90	90.0%	270	0.020	0.01	1.15	0.958	2.8	11.9	6.6	6.6	50	1	0.8	5.0	5.0	159.1	2.78	1.2	
	Node2	0.30	90.0%	20	0.020	0.01	1.15	0.958	0.3	5.0	1.3	5.0	50	0.8	1.0	6.6	6.6	159.1	3.06	1.4	
	Node27	3.90	90.0%	260	0.010	0.01	1.15	0.958	3.7	13.3	8.3	8.3	210	0.8	4.4	6.6	8.3	144.2	3.74	1.5	
	Sump2	1.80	90.0%	140	0.030	0.01	1.15	0.958	1.7	9.9	3.6	5.0	50	0.8	1.0	12.0	5.0	177.4	1.72	0.8	
	Node47	0.50	70.0%	70	0.012	0.01	1.15	0.803	0.4	6.1	3.1	5.0	50	1	0.8	5.0	5.0	177.4	0.40	0.2	
	Node33	1.30	70.0%	120	0.010	0.01	1.15	0.803	1.0	8.8	4.8	5.0	50	0.8	1.0	11.0	5.8	167.4	1.45	0.7	
	Node32												0.0	50	0.8	4.4	6.6	120.4	9.97	3.3	
	Node5													210	0.8	1.0	6.6	11.0	126.0	8.52	3.0
	Node6	1.20	90.0%	165	0.010	0.014	1.15	0.958	1.1	8.5	5.9	5.9	5.9	50	0.8	1.0	12.0	13.1	115.4	11.12	3.6
	Node8	0.80	90.0%	95	0.010	0.014	1.15	0.958	0.8	7.3	4.0	5.0	5.0	50	1.5	0.6	13.1	5.0	177.4	0.77	0.4
	Node7	0.30	90.0%	103	0.036	0.014	1.15	0.958	0.3	5.0	2.8	5.0	5.0	50	1.5	0.6	13.1	13.6	112.9	12.17	3.8
	Node9	2.20	90.0%	315	0.010	0.014	1.15	0.958	2.1	10.7	9.5	9.5	9.5	155	1.5	1.7	13.6	15.3	106.0	14.28	4.2
	culvert													300	2	2.5	15.3	17.8	97.7	14.28	3.9
Catchment 2	Sp1	3.50	80.0%	190	0.030	0.014	1.15	0.880	3.1	12.8	4.5	5.0	210			17.8	17.8	97.7	14.30	3.9	
	Node12	1.10	90.0%	70	0.015	0.014	1.15	0.958	1.1	8.2	2.9	5.0	70			17.8	17.8	97.7	15.35	4.2	
	Node13	0.70	90.0%	140	0.015	0.014	1.15	0.958	0.7	6.9	4.6	5.0	210	1	3.5	17.8	21.3	88.5	16.02	3.9	
	Node29	1.50	90.0%	260	0.010	0.014	1.15	0.958	1.4	9.2	8.3	8.3	90	1.1	1.4	21.3	22.7	85.4	17.46	4.1	
	Dump	0.60	50.0%				1.15	0.648	0.4	6.5	8.3	6.5				22.7	22.2	86.5	17.84	4.3	
	Node30	2.00	90.0%	260	0.01	0.014	1.15	0.958	1.9	10.3	8.3	8.3	70	1.1	1.1	22.2	23.3	84.3	19.76	4.6	
	Node31	2.00	90.0%	260	0.010	0.014	1.15	0.958	1.9	10.3	8.3	8.3	90	1.1	1.4	23.3	24.6	81.6	21.68	4.9	
	Node19	1.80	90.0%	140	0.05	0.014	1.15	0.958	1.7	9.9	3.1	5.0	70	1.5	0.8	5.0	5.0	177.4	1.72	0.8	
	Node20	0.4	90.0%	90	0.01	0.014	1.15	0.958	0.4	5.6	3.9	5.0	5.0	55	0.8	0.9	5.8	5.8	168.0	2.11	1.0
	Node21	0.30	90.0%	90	0.01	0.014	1.15	0.958	0.3	5.0	3.9	5.0	5.0		0.9		5.8	6.7	158.3	2.39	1.1
	SP4	3.8	90.0%	240	0.01	0.014	1.15	0.958	3.6	13.2	7.8	7.8	305	1	5.1	7.8	7.8	148.1	3.6	1.5	
	SP3	4.1	90.0%	280	0.05	0.014	1.15	0.958	3.9	13.5	4.9	5.0				7.8	12.9	116.2	7.6	2.4	
	SP2	1	50.0%	70	0.1	0.014	1.15	0.648	0.6	7.9	1.6	5.0				24.6	24.6	81.6	27.8	6.3	
	Dis Pond	0.7	0.0%				1.52	0.304	0.2	6.9			6.9	210	1.2	2.9	24.6	27.5	76.5	35.6	7.6

CHH Oberon

Hydraulic Assessment

Rational Method Hydrologic Calculations

ARI	100	$t_{t_1} =$	34.6	mm/h
C_{t0}	0.20	Min Tc	5	
Rainfall Data for: OBERON				

Minimum tc	5
Method for tc	3

1 = Bransby Williams (Rural with main channel > 1000m)

2 = Regional $t_c=0.76A^{0.38}$ (Small Rural)

3 = Kinematic Wave

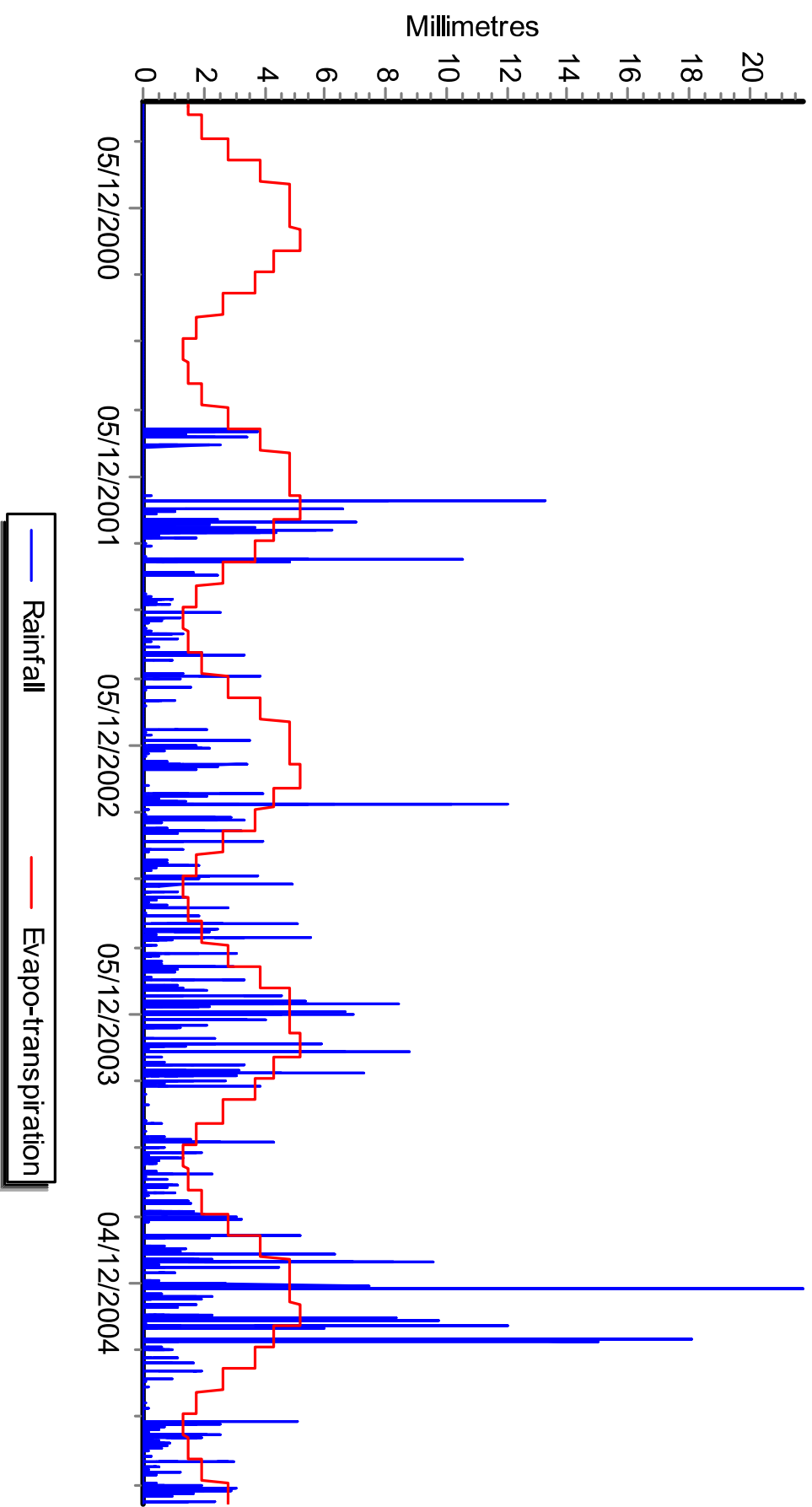
ARI	1	2	5	10	20	50	100
FFy	0.52	0.64	0.82	1	1.21	1.52	1.78
FFy	0.8	0.85	0.95	1	1.05	1.15	1.2

Subcatchment	Subcatchment Data				Runoff Coefficient			Subcatchment t_c				Channel Data			TIME OF CONC.		RAINFALL INTENSITY	CA	FLOW			
	Area	%Imperv.	L	S	n	FFy	C	CA	Bransby/W	Regional	Kinematic	t_c	L	v	t	u/s	Min.	mm/hr	ha	m^3/s		
Catchment 1	ha	%	m	m/m	-	-	-	ha	Min.	Min.	Min.		m	m/s	Min.		Min.					
	S1	2.90 90.0%	270 20	0.020 0.020	0.01 0.01	1.2 1.2	0.999 0.999	2.9 0.3		11.9 5.0	6.2 1.2	6.2 5.0						185.9 185.9	2.90 3.20	1.5 1.7		
	Node27	3.90 90.0%	260 140	0.010 0.030	0.01 0.01	1.2 1.2	0.999 0.999	3.9 1.8		13.3 9.9	7.8 3.4	7.8 5.0						168.7 202.0	3.90 1.80	1.8 1.0		
	Sump2	1.80 90.0%																				
	Node47	0.50 70.0%	70 120	0.012 0.010	0.01 0.01	1.2 1.2	0.838 0.838	0.4 1.1		6.1 8.8	2.9 4.5	5.0 5.0		1	0.8	5.0	5.0	202.0 190.6	0.42 1.51	0.2 0.8		
	Node33	1.30 70.0%											0.0	50 210	0.8 0.8	1.0 4.4	10.6 6.2	11.6 10.6	138.8 145.6	10.40 8.89	4.0 3.6	
	Node5												5.6	50	0.8	1.0	11.6	12.7	132.8	11.60	4.3	
	Node6	1.20 90.0%	165 95	0.010 0.010	0.014 0.014	1.2 1.2	0.999 0.999	1.2 0.8		8.5 7.3	5.6 3.8	5.6 5.0	5.6	50	0.8	0.6	12.7	5.0	202.0	0.80	0.4	
	Node8	0.80 90.0%	103	0.036	0.014	1.2	0.999	0.3		5.0	2.7	5.0	5.0	50	1.5	0.6	12.7	13.2	129.9	12.70	4.6	
	Node7	0.30 90.0%												155	1.5	1.7	13.2	14.9	121.7	14.90	5.0	
	Node9	2.20 90.0%	315	0.010	0.014	1.2	0.999	2.2		10.7	8.9	8.9		300	2	2.5	14.9	17.4	111.8	14.90	4.6	
	Catchment 2	culvert																				
Sp1		3.50 80.0%	190 70	0.030 0.015	0.014 0.014	1.2 1.2	0.919 0.999	3.2 1.1		12.8 8.2	4.2 2.7	5.0 5.0						17.4 17.4	17.4	111.8 111.8	14.92 16.02	4.6 5.0
Node12		1.10 90.0%	140	0.015	0.014	1.2	0.999	0.7		6.9	4.3	5.0		210	1	3.5	17.4	20.9	100.9	16.72	4.7	
Node13		0.70 90.0%	260	0.010	0.014	1.2	0.999	1.5		9.2	7.8	7.8		90	1.1	1.4	20.9	22.3	97.3	18.21	4.9	
Node29		1.50 90.0%																				
Dump		0.60 50.0%																				
Node30		2.00 90.0%	260	0.01	0.014	1.2	0.999	2.0		6.5	7.8	6.5		70	1.1	1.1	22.2	23.3	95.0	20.62	5.4	
Node31		2.00 90.0%	260	0.010	0.014	1.2	0.999	2.0		10.3	7.8	7.8		90	1.1	1.4	23.3	24.6	91.9	22.62	5.8	
Node19		1.80 90.0%	140	0.05	0.014	1.2	0.999	1.8		9.9	2.9	5.0							202.0	1.80	1.0	
Node20		0.4 90.0%	90	0.01	0.014	1.2	0.999	0.4		5.6	3.7	5.0		70	1.5	0.8	5.0	5.8	191.3	2.20	1.2	
Node21		0.30 90.0%	90	0.01	0.014	1.2	0.999	0.3		5.0	3.7	5.0		55	1	0.9	5.8	6.7	180.1	2.50	1.3	
SP4		3.8 90.0%	240	0.01	0.014	1.2	0.999	3.8		13.2	7.3	7.3							173.3	3.8	1.8	
SP3	4.1 90.0%	280	0.05	0.014	1.2	0.999	4.1		13.5	4.6	5.0		305	1	5.1	7.3	12.4	134.3	7.9	2.9		
SP2	1 50.0%	70	0.1	0.014	1.2	0.677	0.7		7.9	1.6	5.0							91.9	29.0	7.4		
Dis Pond	0.7 0.0%				1.78	0.356	0.2		6.9		6.9		210	1.2	2.9	24.6	24.6	86.1	37.1	8.9		

Appendix E

MUSIC rainfall graph

101001 Developed



Appendix F

Existing subcatchment data

Borg Oberon

Hydrologic and Hydraulic Analysis

Project No. 2103481A

Client Ref.

Existing XP-SWMM Subcatchment Data

Date: 15/03/2011

Node	Area (ha)	Impervious Percentage %	Slope	Infiltration Type
Sump1	2.9	90	0.02	Hardstand
Node2	0.3	90	0.01	Hardstand
Sump2	1.8	90	0.03	Hardstand
Node6	1.2	90	0.01	Hardstand
Node7	0.3	90	0.04	Hardstand
Node8	0.8	90	0.01	Hardstand
Node9	1.65	90	0.01	Hardstand
Sed pond1	3.36	90	0.01	Hardstand
Node11	0.8	90	0.02	Hardstand
Node11	0.3	0	0.10	Pervious
Node11	2.2	90	0.04	Hardstand
Node11	1	0	0.10	Pervious
Node11	0.3	100	0.10	Hardstand
sed pond2	0.3	90	0.01	Hardstand
sed pond2	0.4	0	0.20	Pervious
sed pond2	0.3	100	0.10	Open water
dis pond	0.61	0	0.04	Pervious
dis pond	0.09	100	0.10	Open water
Sed pond3	4.1	90	0.05	Hardstand
Node19	1.8	90	0.05	Hardstand
Node20	0.31	90	0.01	Hardstand
Node20	0.09	0	0.30	Pervious
Node21	0.24	90	0.01	Hardstand
Node21	0.06	0	0.30	Pervious
Node27	3.9	90	0.01	Hardstand
Node29	1.5	90	0.01	Hardstand
Node29	0.6	10	0.07	Pervious
Node30	2	90	0.01	Hardstand
Node31	2	90	0.01	Hardstand
Node33	0.1	90	0.01	Hardstand
Node34	3.8	90	0.01	Hardstand
Node36	0.55	90	0.01	Hardstand
Node47	0.2	80	0.03	Hardstand
Node47	0.2	80	0.03	Hardstand
Node47	0.15	100	0.03	Hardstand
Node51	0.106	100	0.01	Hardstand
Node52	0.096	100	0.01	Hardstand
Node54	0.11	100	0.01	Hardstand
Node55	3.42	90	0.01	Hardstand
Node57	20.25	5	0.02	Pervious
Node59	1.34	10	0.01	Pervious
Node65	1.09	5	0.01	Pervious
	66.6			

Appendix G

Developed subcatchment data

Borg Oberon

Hydrologic and Hydraulic Analysis

Project No. 2103481A

Client Ref.

Developed XP-SWMM Subcatchment Data

Date: 15/03/2011

Node	Area (ha)	Impervious Percentage %	Slope	Infiltration Type
Sump1	2.9	90	0.02	Hardstand
Node2	0.3	90	0.01	Hardstand
Sump2	1.8	90	0.03	Hardstand
Node6	1.2	90	0.01	Hardstand
Node7	0.3	90	0.036	Hardstand
Node8	0.8	90	0.01	Hardstand
Node9	1.65	90	0.01	Hardstand
Sed pond1	3.36	90	0.01	Hardstand
Node11	1.1	100	0.02	Hardstand
Node11	0.654	100	0.01	Hardstand
Node11	0.436	0	0.01	Pervious
sed pond2	0.3	90	0.01	Hardstand
sed pond2	0.4	0	0.2	Pervious
sed pond2	0.3	100	0.1	Open water
dis pond	0.61	0	0.04	Pervious
dis pond	0.09	100	0.1	Open water
Sed pond3	4.1	90	0.05	Hardstand
Node19	1.8	90	0.05	Hardstand
Node20	0.31	90	0.01	Hardstand
Node20	0.09	0	0.3	Pervious
Node21	0.24	90	0.01	Hardstand
Node21	0.06	0	0.3	Pervious
Node27	3.9	90	0.01	Hardstand
Node29	1.5	90	0.01	Hardstand
Node29	0.6	10	0.07	Pervious
Node30	2	90	0.01	Hardstand
Node31	2	90	0.01	Hardstand
Node33	0.1	90	0.01	Hardstand
Node34	3.8	90	0.01	Hardstand
Node36	0.55	90	0.01	Hardstand
Node47	0.2	80	0.025	Hardstand
Node47	0.2	80	0.025	Hardstand
Node47	0.15	100	0.025	Hardstand
Node51	0.106	100	0.01	Hardstand
Node52	0.096	100	0.01	Hardstand
Node54	0.11	100	0.01	Hardstand
Node55	3.42	90	0.01	Hardstand
Node57	20.25	5	0.02	Pervious
Node59	0.554	100	0.01	Hardstand
Node59	0.786	0	0.01	Pervious
Node60	3.5	100	0.035	Hardstand
	66.6			

LEGEND:

NEW SWALE

 VALVE

BORG
CONSTRUCTION

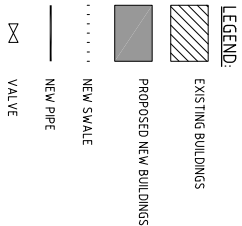
OFFICE:
2 WELLA WAY SOMERSBY, N.S.W. 2250 AUSTRALIA
Tel: 02 4340 9800 Fax: 02 4340 8293

Project	PROPOSED PARTICLE BOARD MANUFACTURING PLANT AND ADDITIONAL WORKS.
---------	---

Drawing

NEW ADDITIONAL SWALE

Scale	Stage
APPROX 1:1000 (@ A1)	DA
Project Number	Issue
19	A
Drawing Number	
DA 101	



BORG
CONSTRUCTION

OFFICE:
2 WELLS WAY SOMERSETSY N.S.W. 2250 AUSTRALIA
Tel: 02 540 9800 Fax: 02 440 8293



THIS DRAWING AND THE INFORMATION CONTAINED ARE THE PROPERTY OF THE COPYRIGHT OWNER BORG CONSTRUCTIONS Pty. Ltd. AND MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION

Project
PROPOSED PARTICLE BOARD MANUFACTURING
PLANT & ADDITIONAL WORKS.

Location
124 LOWES MOUNT ROAD, OBERON
NEW SOUTH WALES

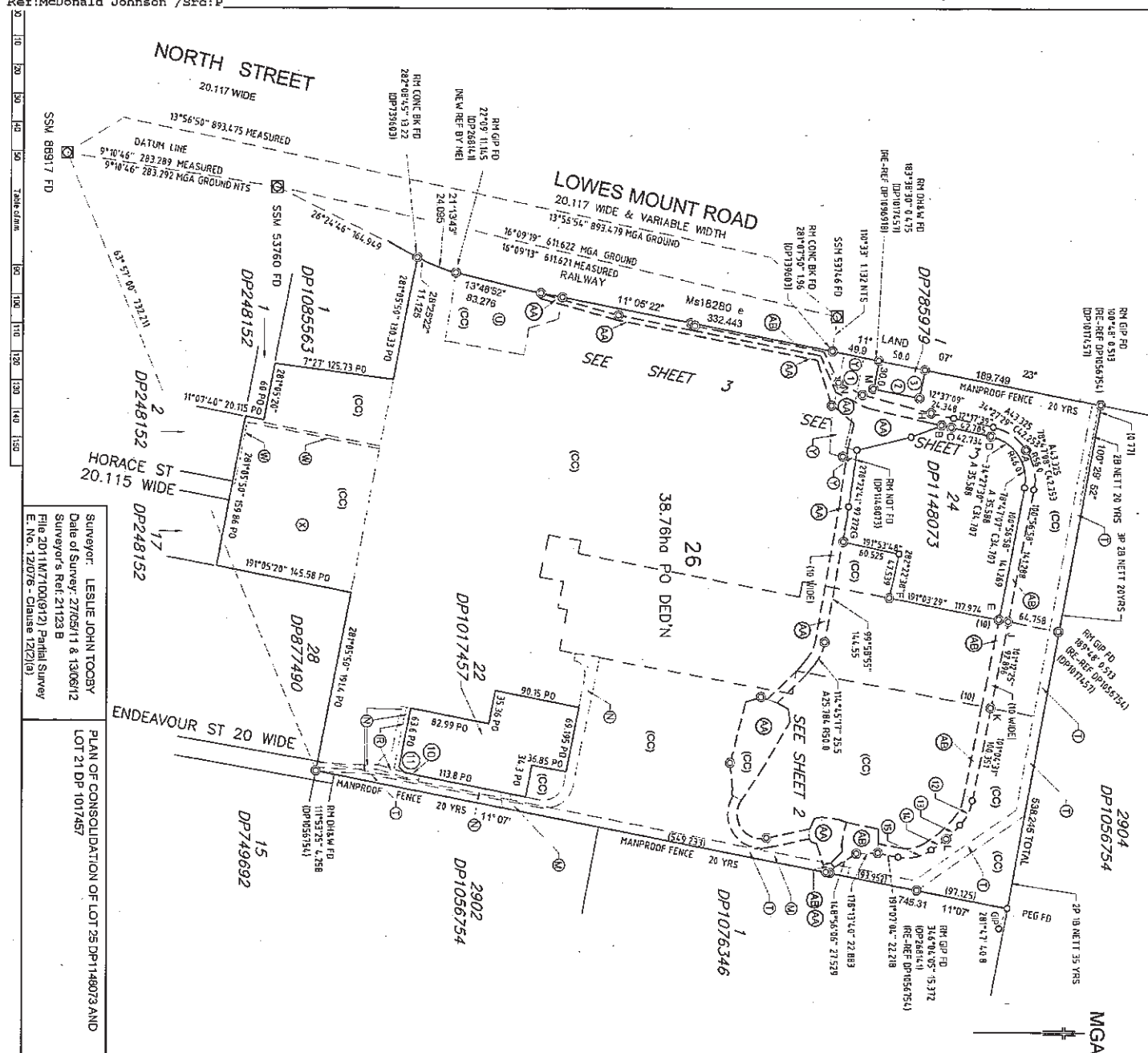
Scale	Stage
-------	-------

APPROX 1:1750 (@A1)

Project Number	Drawing Number
----------------	----------------

19 DA 02

၁၁



WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

Sheet 1 of 3 Sheets

- AA EASEMENT TO DRAIN WATER 5 WIDE 10 WIDE & VARIABLE WIDTH
- AB EASEMENT TO DRAIN WATER 5 WIDE 10 WIDE & VARIABLE WIDTH
- AC EASEMENT TO DRAIN WATER 10 WIDE
- AD RIGHT OF WAY VARIABLE WIDTH (VDE DP1017457) (No. 13)
- AE EASEMENT FOR SERVICES 5 WIDE (VDE DP1017457)
- AF EASEMENT FOR OVERHEAD ELECTRICITY CABLE TO WIDE (VDE DP268141)
- AG EASEMENT FOR ELECTRICITY SUBSTATION VARIABLE WIDTH (VDE DP268141)
- AH EASEMENT FOR SEWER 3 WIDE & VARIABLE (VDE 7938045 & DP641955)
- AI COVENANT R925114
- AJ RIGHT OF CARRIAGE WIDE TO WIDE & VARIABLE WIDTH (VDE DP1148073)

COR BEARING		DIST		FROM		PLACED BY		REFERENCE MARK TABLE	
A	97°56.62"	7.885	SP-6 FD	DP14.0073					
B	174°7.20"	9.995	SP-6 FD	DP14.0073					
C	212°14"	0.014	SP-6 FD	DP14.0073					
D	315°45"	0.016	SP-6 FD	DP14.0073					
E	355°59"	0.003	SP-6 FD	DP14.0073					
F	355°59"	3.986	SP-6 FD	DP14.0073					
G	124°33.25"	9.176	GP-9 FD	DP10.6518					
H	265°27.87"	9.176	GP-9 FD	DP10.6518					
I	55°4.6	12.86	GP-6 FD	DP10.6518					
J	50°13.30"	17.318	GP-6 FD	DP10.6518					
K	134°17.25"	6.908	GP-6 FD	DP10.6518					
M	55°31.55"	19.93	GP-6 FD	DP10.6518					
N	30°15°30"	2.659	GP-6 FD	DP10.6518					

TABLE OF SHORT LINES		
No	BEARING	DISTANCE
1	26°30'05"	3188.6
2	114°47'33"	50.0
3	281°07'34"	30.0
4		PQ
5	114°19'33"	8.475
6		PQ
7	131°33'46"	A23.341 1953.0
8	154°42'31"	
9	167°45'32"	35.665
10	193°40'20"	A36.693 745.0
11	223°30'	8.745

(CC) BENEFITED BY -

- EASEMENT TO DRAIN WATER 2 & 5 WIDE - DP1017457
- EASEMENT TO DRAIN WATER 5 WIDE - DP1017457
- EASEMENT FOR SEWAGE OVER EXISTING
LINE OF PIPES - DP1017457

SURVEYING REGULATION 2006 (CLASSISE 35THIN 34512)				
MARK	MGA COORDINATES		HURD	HURD
	MGA EASTING	MGA NORTHING		
55M 53746	764 682 515	6 168 641 729	a	U
55M 53760	764 697 288	6 167 817 090	b	U
55M 88917	764 647 083	6 167 594 746	c	U

SOURCE: SURVEY DATE: 29.05.2001 ZONE: 55
MEAN COMBINED SCALE FACTOR: 1.002870

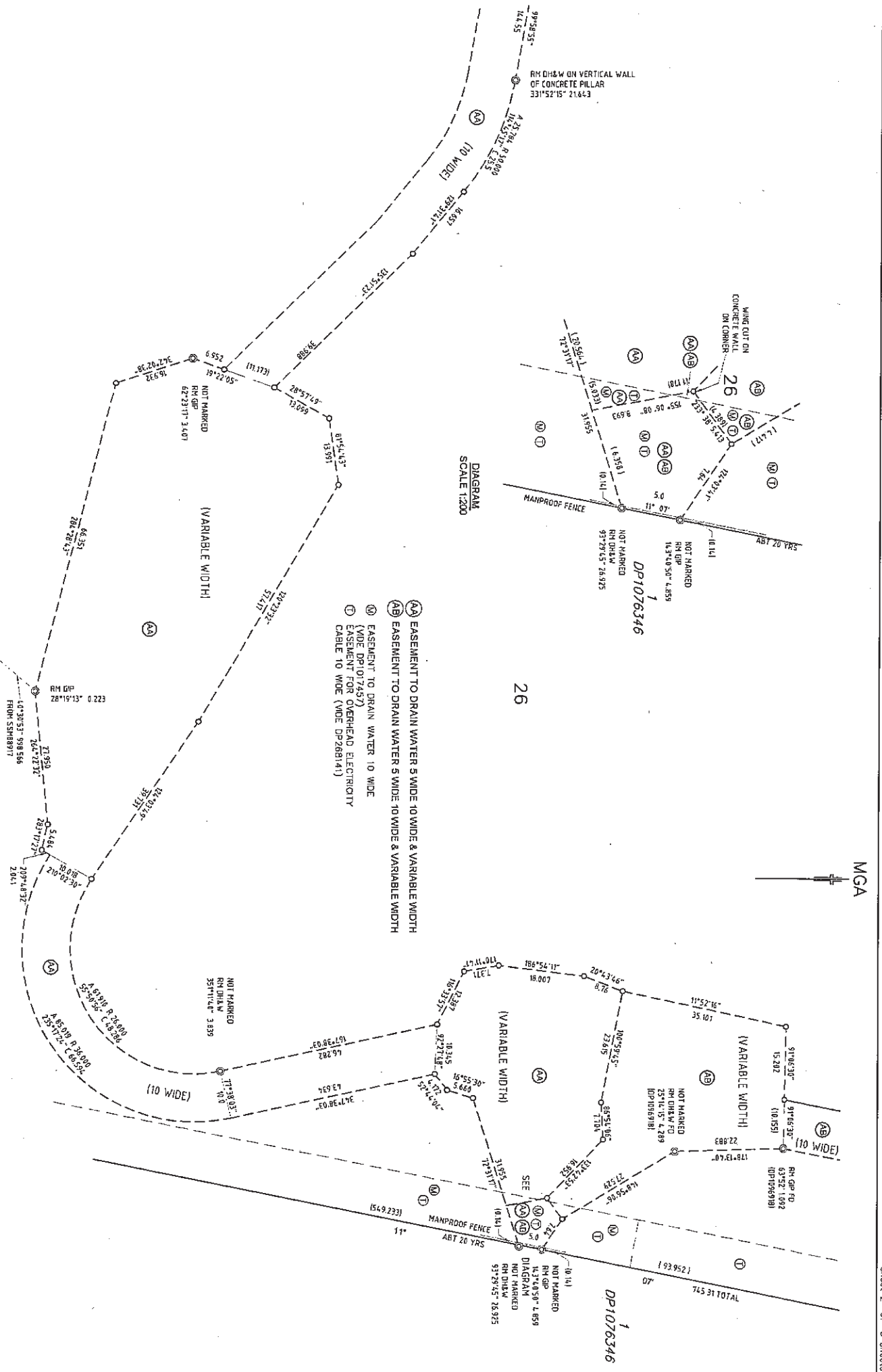
MEAN COMBINED SCALE FACTOR: 1.000287

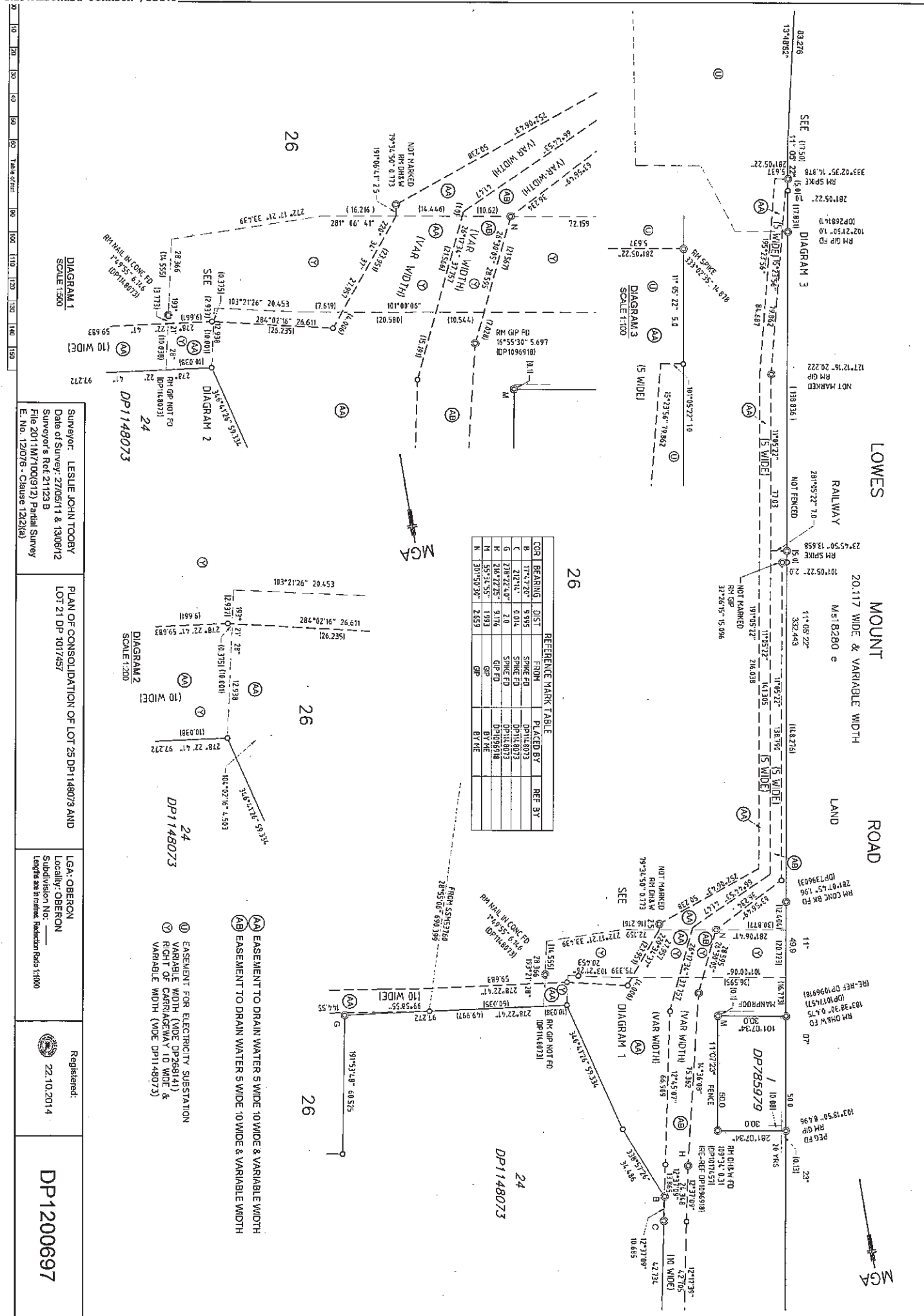
Surveyor: LESLIE JOHN TOCBOY Date of Survey: 27/05/11 & 13/06/12 Surveyor's Ref: 21123 B File: 2011M71001(912) Partial Survey E. No. 12/076 - Clause 12(2)(a)	PLAN OF CONSOLIDATION OF LOT 25 DP1148073 AND LOT 21 DP 1017457
---	--

LGA: OBERON
Locality: OBERON
Subdivision No: _____
Lengths are in mils. (see Production Ratio 1:3000)

Registered:
22.10.2014

DP1200697





Victor Bendevski

From: Kavalieros, Spiro <Spiro.Kavalieros@chhwoodproducts.com.au>
Sent: Thursday, 25 August 2016 10:52 AM
To: Victor Bendevski
Subject: RE: Site catch-up 19/8/16

Hi Victor and thanks for the response.

I will review and come back to you.

Initially, can you clarify the easement proposal for me? Are you suggesting one agreement covering CHH, HPP and Boral?

Regards,

sk

Spiro Kavalieros | Northern Region Environment Manager

Carter Holt Harvey Woodproducts Australia

Group of Companies

Oberon Timber Complex

Gate 3, Albion st Oberon NSW 2787

PMB 1005 Oberon NSW 2787

T +61 2 63366333 | **F** +61 2 63366309

E spiro.kavalieros@chhwoodproducts.com.au | **M** +61 418889420

W chhwoodproducts.com.au

From: Victor Bendevski [mailto:bendevskiv@borgs.com.au]
Sent: Wednesday, 24 August 2016 12:57 PM
To: Kavalieros, Spiro
Subject: Site catch-up 19/8/16

Hi Spiro,

Thanks for your time on Friday. I hope our meeting addressed some of your concerns with our development.

Please review the easement and emergency control plan provided to you during our meeting when you have a chance. I am also happy to hear that you as a business are committed to resolving our joint Surface Water Management issues. I proposed your easement solution (joining all swales together) to John Borg on Friday and he was not too keen on the idea. However he proposes the option of re-directing Structaflor swale into the Highland Pine Products swale, thus eliminating us from the shared services agreement and only burdening our Lot 24 with one easement. This will work from a water quality perspective also and is probably a better option when you start looking at the peak water flows and issues that may occur when combining all swales and scouring. Let us know whether this idea has any interest and we will put some more work into the concept design.

Regarding the other points you raised.

1. Previous Contamination of Lot 24, DP 1148073. As discussed this has been remediated and if required Borg will sample the area that will be excavated for the new swale prior to commencement of any works. If the warehouse is to proceed this will involve the importation of fill and then concrete slab installed over the top for the base of the warehouse and driveway.
2. Contrary to your observations 'Borrow pits' located on Lot 1, DP 1076346 are located well outside the development area for the new water quality ponds. Borg will ensure these are accurately plotted prior to commencement of works. Regardless Borg proposes to perform shallow or surface soil sampling to validate the area prior to commencing any construction works for the ponds.

3. The fuel depot located on Lot 1, DP 1085563 will be decommissioned appropriately and underground tanks removed as required. However once again this area will require fill ultimately being covered over so I do not believe there is any ongoing concerns. This process will be overseen by a third party.
4. On site fuel tank disused fuel tank has been removed and the area validated as required by regulations.
5. Destruction efficiency of formaldehyde in heat plant will be validated by a third party.
6. Thus the Air Quality Impact assessment is also being updated.
7. Untreated wood Pallets, MDF wood yard waste, Reject and waste particleboard will be used in low percentages as part of the Particleboard manufacturing process not for fuel. Borg is aware that this process will require further approvals from the EPA (specifically for this process). However, we don't see these wood sources creating impacts on the air quality from the process.
8. We believe the noise report is accurate in depicting the projects contribution to the overall Borg noise levels.
9. Traffic assessment is representative of the increase to the Borg operations, the traffic flow remains largely unchanged in terms of the site access points used for particular activities. The report will be updated to better reflect the concerns of all parties.
10. Water impacts on downstream users are negligible because of very sharp increase to catchment area post our development. The new plant does not have a high water consumption and its impact on existing approved usage levels are minimal.

Further details will be provided to the governing bodies as part of our Return to Submission regarding the project.

If there is anything you would like to add please feel free to get back to me.



Victor Bendeovski
Environmental and Regulatory Compliance

p:02 4340 9827 | m:0410 327 635
e:bendeovskiv@borgs.com.au | w:www.Borgs.com.au
a:2 Wella Way Somersby NSW 2250

DISCLAIMER: This electronic message together with any attachments is confidential. If you are not the intended recipient, do not copy, disclose or use the contents in any way. Please also advise us by return e-mail that you have received the message and then please destroy. Carter Holt Harvey is not responsible for any changes made to this message and / or any attachments after sending by Carter Holt Harvey. We use virus scanning software but exclude all liability for viruses or anything similar in this email or any attachment.

12 September 2016

Head Office
4 Park Avenue
Blackheath, NSW, 2785
Australia
E: mark@sustainabilityworkshop.com
T +61 (2) 4787 8428
www.sustainabilityworkshop.com

Dear Tim,

RE: Proposed State Significant Development (SSD 7016) – Borg Panels Timber Processing Facility

Thank you for your letter dated 27 July, 2016. Please find following our responses to the questions raised in your letter.

- 1) The demand for stormwater from both the existing and future pond would be regulated at 400m³/day, i.e. 200m³/day from each pond. This demand can't always be met as the ponds may or may not have a volume of water in them. This is the theoretical demand which is entered into the MUSIC model and it is the demand which will be drawn from the ponds assuming there is sufficient volume available.
- 2) The theoretical demand of 400 m³/day has been validated against a rigorous and recent water balance prepared by Borgs. The water balance is based on the average consumption, production, recycling and reuse of water that has occurred in the plant since July 2016. The water balance shows that the current demand for town water is approximately 338 m³/day. The proposed new particle board facility is extremely efficient and after recovery and reuse of as much water as is feasible, requires a further 50 m³/day. The total predicted future daily demand for town water on the site is therefore 388m³/day. This is very close to the 400m³/day which has been assumed for the purposes of modelling. This demand fluctuates daily and is an average daily demand based on the most recent operational performance of the existing plant. Some days more water may be harvested, if required, and on other days less water may be harvested.
- 3) There is currently some, irregular, stormwater harvesting occurring on the site however it is not a core component of the water cycle at the current time. Borgs has been testing the viability of stormwater harvesting and is now satisfied that it is a viable option which is compatible with its current water treatment system. This project and approval process presents an opportunity to formally adopt the technology and to make it a core component of the water cycle management on the site. In this heavy industrial context, this brings numerous benefits in terms of reduced export of pollution, protection of the creek geomorphically and ecologically and reduced demand for town potable water.
- 4) While the theoretical daily demand for harvested water is 400 m³/day, the predicted yield from harvesting has been modelled using MUSIC and is estimated at 120 ML/year. We clarify that in the conclusion of the report, it was noted the yield would be 133ML/year though elsewhere throughout

the report the yield was reported as 120 ML/year. This value of 133 ML/year is not correct (it was a typographical error) and the predicted yield is in fact 120 ML/year. 400m³/day demand for stormwater expressed as an annualised demand equates to 146 ML/year. The proposed scheme can't however supply 100% of the theoretical demand for stormwater, it can only supply (120/146) 82% of the theoretical demand for stormwater.

- 5) The existing plant's water cycle management is a highly complex arrangement, largely driven by the need to balance salt loads in effluent discharged from the site, with water sourced from various sources including a spring dam (licensed through an existing WAL) other groundwater sources (also licensed through an existing WAL), town potable supply, recycling of desalinated process waste water and some irregular harvesting of stormwater in recent times for proof of concept of the harvesting potential.
- 6) After allowing for an increase in demand from the new plant and stormwater harvesting, the future demand for town water would on average diminish from 141.6 ML/year (388m³/day) down to 21.6ML/year. This represents a substantial net average reduction in demand for town water though during dry times when stormwater was not available there would be a demand on the town's water supply equivalent to the daily demand from the Borgs combined plant.

On average, the stormwater harvesting could supply about 85% of the current plus future water demand. In wet periods it could supply 100% of the demand and in dry periods it would not be able to supply any water and there would then be reliance initially on the licensed spring dam and bore water (up to WAL limits) followed by reliance on the town's water supply.

The reduction in demand for town water should see Oberon dam remain fuller for longer and spill more frequently. Thus any harvesting on the Borg's site is offset by increased frequency of flows leaving Oberon dam.

- 7) Currently, town water is occasionally imported to help dilute salty effluent to ensure it meets Council's trade waste requirements. It makes a great deal of sense to dilute salty effluent with low salt stormwater in lieu of importing (at significant cost) Council's high quality potable supply only to return it to trade waste and noting that water will be further treated to a high standard in Council's wastewater treatment plant and then discharged back into the catchment.
- 8) We confirm that only runoff from operational areas and roof runoff would be harvested. No runoff from the undeveloped rural land (on the western side of Lowes Mount Road) which also feeds into this catchment will be harvested. The unpolluted rural runoff is separated from the polluted industrial runoff (refer to the report for details) and directed around the ponds in its own existing swale. This clean runoff is also to be directed around the proposed sampling point.
- 9) Given that clean/unpolluted runoff is not to be harvested, in accordance with your advice, there is no need to calculate or exercise any harvestable rights as the only water to be harvested will be from industrial land uses. We reiterate the proposal only includes harvesting of runoff from existing roads, hard stands, car parks and roofs as well as future industrial buildings, hardstands and car parks.
- 10) The proposed 6 ML water quality dam will be constructed at least 40m from the top of bank of the nearest watercourse. If during detailed design, it needs to be moved closer to the first order creek, a controlled activity permit will be obtained from DPI. We note that if the proposed pond were to be moved closer there would not be a loss of riparian vegetation and impacts on either stream ecology or geomorphology would be negligible.

- 11) In light of the letter from DPI and following further discussion with Borgs and review of the pollution control licence, the existing V notch weir is no longer proposed for removal – we have resolved that the pollution licence conditions do not actually require a flow measurement point and so there is no need to remove the weir. Therefore the proposal would be amended as follows:
- a. The existing V notch weir would not be impacted by the works and left in place
 - b. No new V notch weir is proposed
 - c. It will be necessary to construct new swales to connect overflows from the proposed pond with the existing creek line and these will all be carried out in accordance with any Controlled Activity guidelines/permits or conditions of consent. Essentially these will be grass lined swales. Once detailed designs have been developed Borgs will lodge an application and request a Controlled Activity permit. Again we note that there is no riparian vegetation that will be removed, the area is devoid of trees and it will be stabilised and revegetated as soon as practical during construction.
- 12) In terms of defining the impact of the proposed harvesting scheme including on biota: Appendix J identifies that in line with work by some of Australia's most eminent scientists, reported in Fletcher et al (2004), that a decrease in catchment imperviousness, which is a result of the proposed harvesting scheme, would see an improvement in creek ecological health, that is, an increase in indicator species which is indicative of an increase in biota. This statement of course presumes, substantial flow will remain in the creek, i.e. that there is not a threat to low flows also commonly called environmental flows. Through the use of flow duration curves which are a way of summarising the entire flow regime, the report demonstrates that even after harvesting, the level of flows would remain above "rural" runoff conditions, i.e. similar to that which would occur if there was no development on the site and it remained in a theoretical rural state of development without extensive impervious areas. The key point to appreciate here is that the development of extensive impervious areas at Oberon would be linked to a decline in biota and the harvesting scheme seeks to reverse this while simultaneously providing an alternative source of water and reducing reliance on the town's water supply.

The proposed harvesting scheme also reduces the chemical and physical pollutant load on the receiving waters. It will help to reduce the load of suspended solids, total nitrogen and total phosphorus leaving the site. The reduction in pollutants, i.e. a reduction in the export of nutrients and suspended solids leaving the site, combined with a reduction in excessive flows is likely to have a beneficial effect on water quality and positive impacts on native biota.

In terms of impacts on human downstream users, the flow duration analysis presented in the report shows the impact on flows at the point of discharge from the site. It can be seen that 85% of the time (15th percentile on the graph) there is no impact on flows leaving the site. For less frequent flow percentiles such as the 10th percentile (flow value is exceeded only 10% of the time) there will be a reduction in flows from 9 l/s (rural state) to about 6 l/s (with harvesting).

Within 3 km of the site, Kings Stockyard Creek joins the Fish River. Here the Borgs industrial catchment becomes part of a much larger rural and urban catchment (which includes substantial parts of the township of Oberon with its substantial residential and industrial impervious areas) where this impact would not be discernible. Within 15 km of the site, the Fish River is joined by the 27 km long Duckmaloi River where it is more likely that existing users have active WALs to extract directly from the river/creek. Here the impact would be even further reduced because the Borgs and CHH catchment which is about 1 km² would become a very small fraction of a catchment which is hundreds of square kilometres (at least 300 km²), that is, less than 0.33% of the catchment is impacted. Without

examining the specific impact on any existing WALs, it is highly unlikely that there will be any discernible impacts on downstream land users and it is considered that a detailed examination of impacts on individual WALs is therefore not warranted.

In conclusion the proposed harvesting scheme, when taken in its industrial context of extensive impervious areas, is most likely to result in an improvement in creek health and therefore lead to an improvement in the diversity and abundance of biota downstream of the site. It is highly improbable that any downstream human water users would be impacted by any change in the flow regime.

- 13) DPI noted that it was reported that the volume of runoff would remain above rural levels despite harvesting 120 ML/year of polluted water from the site. We again reiterate that harvesting of clean, undeveloped rural areas will not occur. There is a 40-hectare rural catchment which drains through the site and the runoff from this catchment will not be harvested. In terms of total volumes of runoff – as was reported – the total volume of runoff, after harvesting remains about double (287 ML/year) the rural volume of runoff (140 ML/year).

It is recommended that further analysis is unwarranted especially because DPI agree that there is a legal right to harvest roof runoff (under the Water Management Act) and a duty to harvest polluted industrial runoff and harvesting of other runoff is not part of the proposal.

Please do not hesitate to contact the undersigned if you need any further clarification.

Yours sincerely



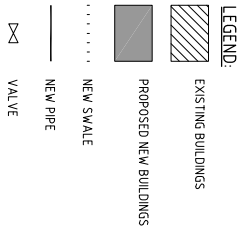
Mark Liebman

Director, Principle Engineer

Waste Streams used for Fuel - Majority processed in the existing wood waste processing area.							
	ON Site		Off site				
	Tonnes/m3 pa		Fuel Type				
Operational waste	Existing	Proposed	Standard	Non-Std.	Location	Disposal method.	Provider
Downgrade product generated from process upsets out of spec material	6000	9000		√	Wood and reject board processing area	Fuel additive for heat plant if suitable otherwise re used for bearer manufacturing.	On site
WESP and scrubber Solids which are captured small wood particles.	N/A	3000		√	Wood and reject board processing area	Fuel additive for grate fired heat plant on site, material is wet wood dust. Similar non standard fuel as currently approved.	On site
Bark from processing logs	22,000	44,000	√		Wood and reject board processing area	Standard Fuel for Existing solids fuel heat plants.	On site
Sander Dust and process dust	40,000	44,000		√	Sander dust Silo	Fuel for dust burners (hot gas generators)- Energy for new particle board flake drying process and existing heat plants	On site
Offcuts large virgin wood and other fresh wood process reject materials.	5000	2000	√		Wood and reject board processing area	Standard fuel for existing solid fuel heat plants.	On site
Wood fines screened out during MDF manufacturing process	5000	N/A	√		Materials Handling Area	Was previously used as standard fuel, will be used in particleboard manufacturing	On site

<u>Other Waste streams</u>						
	<u>ON site</u>		<u>Off site</u>			
	Tonnes/m3 pa		Tonnes/m3 pa			
Operational waste	<u>Existing</u>	<u>Proposed</u>	<u>Existing</u>	<u>Proposed</u>	Disposal method.	Provider
Site Maintenance and process oils, e.g.. hydraulic and heat transfer fluid.			20	20	Recycling-western Oil	Recycling-western Oil
Spadeable Resin- Resin which is partly solidified			10	10	Waste facility with leachate pits	Bathurst tip
Reject Liquid Waste Resin			10	10	Waste facility able to handle liquids.	Bathurst/transpacific
Bottom Ash from furnaces/dust burners			2500		Land fill, currently reviewing alternatives. Characterisation reports available.	Oberon council waste facility
New Particle board dust burner				500	Very small quantities generated from a dust burner	Oberon council waste facility

Recycled components- to be processed in the Materials handling building					
Operational waste Identification	Tonnes/m3 pa		Consumption method.	Storage location	Provider
	Existing	Proposed			
Virgin Wood, Fines and oversize	N/A	5000	Raw material for particle board manufacturing process	Materials Handling Area	MDF process by product, Borg Oberon MDf plant
Reject particle board.	N/A	30000	Raw material for particle board manufacturing process	Materials Handling Area	This stream is currently going to land fill and will be redirected from within Borg business.
Untreated, Wood Pallets	N/A	10000	Raw material for particle board manufacturing process	Materials Handling Area	Sourced from various providers but clean and verified by Borg
Virgin Wood Sawdust.	N/A	30000	Raw material for particle board manufacturing process	Materials Handling Area	Sourced from various sawmills around NSW.



BORG
CONSTRUCTION

OFFICE:
2 WELLS WAY SOMERSETSBY, N.S.W. 2250 AUSTRALIA
Tel: 02 4340 9800 Fax: 02 4340 8203



THIS DRAWING AND THE INFORMATION CONTAINED ARE THE PROPERTY OF THE COPYRIGHT OWNER BORG CONSTRUCTIONS P.V. LTD. AND MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION

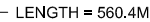
Project
PROPOSED PARTICLE BOARD MANUFACTURING
PLANT & ADDITIONAL WORKS.

Location
124 LOWES MOUNT ROAD, OBERON
NEW SOUTH WALES

WASTE MANAGEMENT PLAN

Scale	Stage
APPROX 1:1750 (@A1)	DA
Project Number	Issue
19	A
Drawing Number	
DA 10	

PLANT & EQUIPMENT WITHIN BUILDINGS ARE NOT SHOWN ON THIS PLAN (FOR CLARITY) - REFER LARGER SCALE DRAWINGS FOR DETAIL

 SOIL TESTING AREA

Issue	Description	Date	Drawn	Auth
-------	-------------	------	-------	------

Tel: 02 4340 9800 Fax: 02 4340 8293

NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION

PLANT & ADDITIONAL WORKS

NEW SOUTH WALES

SOIL TESTING PLAN

5

Borg Panel Manufacturing – Oberon

Response to Request for Further Information (RFI) - Response

Technical Note

Date: 21 September 2016

Background

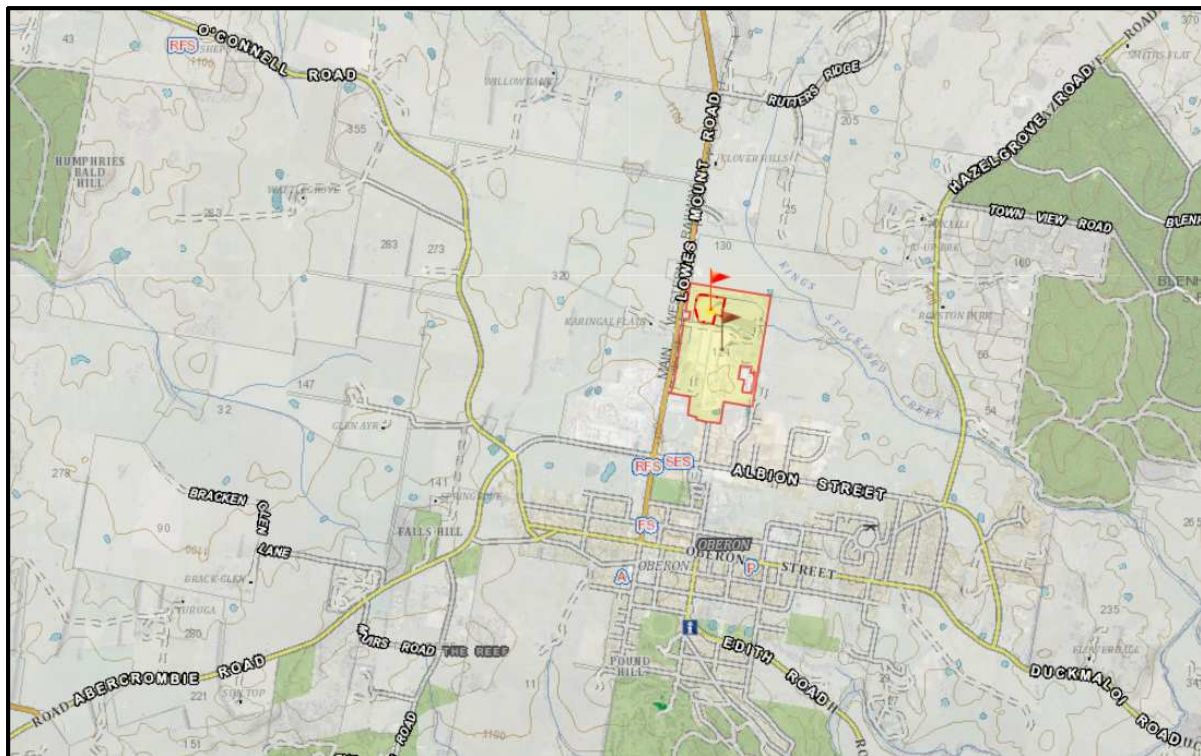
SMEC was commissioned by Borg Panels to carry out a Traffic Impact Assessment (TIA) to support the Environmental Impact Statement (EIS) for the Borg Panels timber panel processing facility expansion in Oberon. A TIA report dated 6 May 2016 was submitted to the Department of Planning as part of the supporting documentation for the DA.

Upon review of the TIA, and following review of public submissions made during the exhibition period, the Department of Planning requested further information to provide clarification in relation to the traffic assessment, stipulating the following:

“The Traffic Impact Assessment does not consider the cumulative traffic impacts of nearby industrial developments including Highland Pine Products. A cumulative assessment of traffic impacts should be carried out to include other developments along Lowes Mount Road.”

The site's location is shown in the figure below.

Figure 1: Site Location



Source: Sixmaps

Purpose

The purpose of this Technical Note is to address the Department of Planning's Request for Information (RFI) which was provided in response to a Development Application (DA) submission. This report will provide sufficient information to satisfy the Department of Planning that the cumulative traffic impacts of nearby developments are taken into consideration from a traffic perspective, such that the proposed development will be supported from a traffic perspective.

Comments on Previous Assessment

The previous assessment undertaken involved determining the performance of various intersections within close proximity to the site during peak periods under the following scenarios:

1. Existing Conditions (i.e. 2015 traffic without development);
2. Conditions post development (i.e. 2019 with development); and
3. Future Conditions 10 years post development (i.e. 2029 with development).

In the above scenarios, traffic count data generated for this TIA includes movements of all vehicles moving through the nominated intersections, including traffic generated by Highland Pine Products, Carter Holt Harvey Structaflor and other industry located within the Oberon Industrial precinct. The traffic counts included all existing traffic on the road and was not limited to traffic currently generated by Borg Panel Manufacturing. It was assumed that the background traffic growth in Oberon would be negligible such that there would be no additional traffic in the future with the exception of the proposed development. This is considered a reasonable assumption based on the table below which indicates that there has been practically no population growth over a 10 year period to 2011.

Table 1: Oberon Population Growth

	2001	2006	2011
Resident Population	4,982	5,031	5,012
Increase from previous Census (No.)	-	+49	-19
Increase from previous Census (%)	-	0.98%	-0.38%
Increase over 10 years (No.)	-	-	+30
Increase over 10 years (%)	-	-	+0.6%

It is acknowledged that there may be some developments in the future that may result in an increase in population or background traffic growth. However, there are no known significant developments that are currently proposed within close proximity to the site.

The results of the assessment indicate that all significant intersections within close proximity to the site will continue to operate well within their notional capacity during peak periods such that the will continue to operate with a Level of Service (LoS) A. This is ample spare capacity allowing for a substantial traffic growth.

Notwithstanding the above, the new assessment interrogates various traffic increase scenarios, which while conservatively unrealistic, highlight the extent to which traffic would need to grow in order to require upgrades to the surrounding road network.

Methodology

The new assessment interrogates the following 3 scenarios:

Assessment Scenario 1 – 5% annual growth rate to all movements through the intersection to determine the year in which each intersection will fail. The assessment will also provide a comparison of the traffic volumes through the intersection in the year of failure to the current 2015 traffic volumes during each peak period;

This Sidra assessment was undertaken using existing 2015 traffic volumes and applying a 5% annual growth factor to each movement. 2 key performance indicators are used to determine the intersection's capacity, namely the Degree of Saturation (DoS) and the Level of Service (LoS). For the purpose of this assessment, the capacity of an intersection based on the LoS is LoS E. For give-way and roundabouts the LoS for the worst movement is measured while for signalised intersections, the average LoS for all movements is measured. The capacity of an intersection based on the DoS depends on the control type of the intersection as follows:

- Give-Way Intersection: DoS 0.8;
- Roundabout Intersection: DoS 0.85; and
- Signalised Intersection: DoS 0.90.

It should be noted that an intersection can be operating beyond capacity from a LoS perspective while its DoS is within capacity and vice versa. For the purpose of this assessment, each intersection's "failure" point is taken to be whichever is reached first. Given the conservative nature of the assessment, the queuing has not been assessed.

Assessment Scenario 2 - 5% annual growth rate to all movements through the intersection to determine the year in which each intersection's performance transitions from LoS A to LoS B. The assessment will also provide a comparison of the traffic volumes through the intersection in the year where the intersection is performing with LoS B (i.e. an average delay time of 14.5 seconds) to the current 2015 traffic volumes during each peak period; and

Assessment Scenario 3 - 10% annual growth rate to the current 2015 traffic generation for the site to determine the year in which each intersection's performance transitions from LoS A to LoS B. The assessment provides a comparison of the traffic volumes through the intersection in the year where the intersection is performing with LoS B to the current 2015 traffic volumes during each peak period.

The anticipated trip generation distribution has been taken from the previous assessment as detailed in the TIA. The 3 assessments were only undertaken by the intersections in which there is anticipated to be an increase in traffic during peak periods which includes the following intersections:

- The Lowes Mount Road / Albion Street / North Street intersection;
- The O'Connell Road / Albion Street / Abercrombie Road intersection;
- The Albion Street / Horace Street intersection;
- The Albion Street / Endeavour Street intersection; and
- The Albion Street / Duckmaloi Street intersection.

It should be noted that an annual growth rate of 5% is considered to be exceptionally high, noting that a suburban area with significant growth would generally be represented by a 2% annual growth rate. Results for each assessment are provided below.

Assessment Scenario 1 – 5% Annual Growth on All Movements to Capacity

Peak Period	DoS	LoS	Comments
Lowes Mount Rd / Albion St / North St Intersection (Roundabout)			
AM Peak	0.708	B	Capacity not reached in 100 years
PM Peak	0.847	B	Capacity reached at 78 years
O'Connell Rd / Albion St / Abercrombie Rd Intersection			
AM Peak	0.511	A	Capacity not reached in 100 years
PM Peak	0.552	A	Capacity not reached in 100 years
Albion St / Horace St Intersection			
AM Peak	0.357	A	Capacity not reached in 100 years
PM Peak	0.434	B	Capacity not reached in 100 years
Albion St / Endeavour St Intersection			
AM Peak	0.302	B	Capacity not reached in 100 years
PM Peak	0.436	B	Capacity not reached in 100 years
Albion St / Duckmaloi Rd Intersection			
AM Peak	0.197	A	Capacity not reached in 100 years
PM Peak	0.231	A	Capacity not reached in 100 years

The results of this assessment indicates that applying a conservatively high annual growth rate of 5% on all movements as observed in the 2015 traffic volumes will not cause any of the intersections assessed to fail for at least 78 years. This demonstrates that all intersections are operating well within their notional capacity with ample spare capacity to accommodate the proposed development with no adverse impact to the road network.

Assessment Scenario 2 – 5% Annual Growth on All Movements to LoS B

Peak Period	DoS	LoS	Comments
Lowes Mount Rd / Albion St / North St Intersection (Roundabout)			
AM Peak	62.8	B	LoS B reached in 90 years
PM Peak	61.0	B	LoS B reached in 61 years
O'Connell Rd / Albion St / Abercrombie Rd Intersection			
AM Peak	0.511	A	LoS B not reached in 100 years
PM Peak	0.552	A	LoS B not reached in 100 years
Albion St / Horace St Intersection			
AM Peak	0.357	A	LoS B not reached in 100 years
PM Peak	0.383	B	LoS B reached in 86 years
Albion St / Endeavour St Intersection			
AM Peak	0.256	B	LoS B reached in 82 years
PM Peak	0.342	B	LoS B reached in 74 years
Albion St / Duckmaloi Rd Intersection			
AM Peak	0.197	A	LoS B not reached in 100 years
PM Peak	0.231	A	LoS B not reached in 100 years

The results of Assessment 2 indicate that LoS B will not be reached on any intersection for 61 years, which again indicates the extent of spare capacity on the surrounding road network.

Assessment Scenario 3 – 10% Annual Growth on Trip Generation to LoS B

Peak Period	Year LoS B is Reached	Avg. Delay	DoS	Assumed Trip Gen. through intersection
Lowes Mount Rd / Albion St / North St Intersection				
AM Peak	2051	15.2	0.607	894
PM Peak	2050	15.5	0.626	814
O'Connell Rd / Albion St / Abercrombie Rd Intersection				
AM Peak	2070	13.9	0.850	1520
PM Peak	2070	13.8	0.863	1520
Albion St / Horace St Intersection				
AM Peak	2055	14.5	0.472	926
PM Peak	2053	14.9	0.414	768
Albion St / Endeavour St Intersection				
AM Peak	2048	15.1	0.266	484
PM Peak	2051	15.4	0.357	638
Albion St / Duckmaloi Rd Intersection				
AM Peak	2051	15.6	0.420	638
PM Peak	2052	15.1	0.470	700

Assessment 3 was based on a 10% annual growth rate applied to the anticipated trip generation which is made up solely of heavy vehicles. In this assessment the growth rate was compounded annually.

It is acknowledged that the O'Connell Road / Albion Street / Abercrombie Road intersection does not reach LoS B. However, the intersection is assumed to be at capacity given that it is operating with DoS 0.85.

The results of the assessment indicates that based on the conservative trip generation growth rate, the earliest an intersection will reach LoS B (i.e. where one movement at an intersection experiences an average delay of 14.5 seconds) is 2048. This is 33 years after 2015. In addition, the adopted trip generation through each intersection at the point in which LoS B is achieved at each intersection is considered to be extremely high, demonstrating the conservative nature of the intersection as well as the extent to which the traffic generation can grow without any adverse impact on the surrounding road network.

Summary & Recommendation

The 3 assessments undertaken all indicate that the key intersections on the surrounding road network consist of ample spare capacity to accommodate a substantial amount of additional traffic. In addition, Assessment 3 indicates that the estimated traffic generation can be exaggeratedly substantially and it will still not result in the need to introduce upgrades to the surrounding road network. As such, it is concluded that the proposed development will not have any significant adverse impact on the surrounding road network.

Attachments – Trip Generation & Distribution Estimates

2015 Morning Peak (Existing Without Development)
(Light Vehicles Only)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	5			6	right
	through	17			27	through
	right	20			42	left
		21	26	34		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			37	46	83
North St south of Albion St			81	91	172
Albion St west of Lowes Mount Rd	42	57			99
Albion St east of Lowes Mount Rd	59	75			134

		Horace St				
		right		left		
Albion St	left	11			8	right
	through	41			58	through
						left

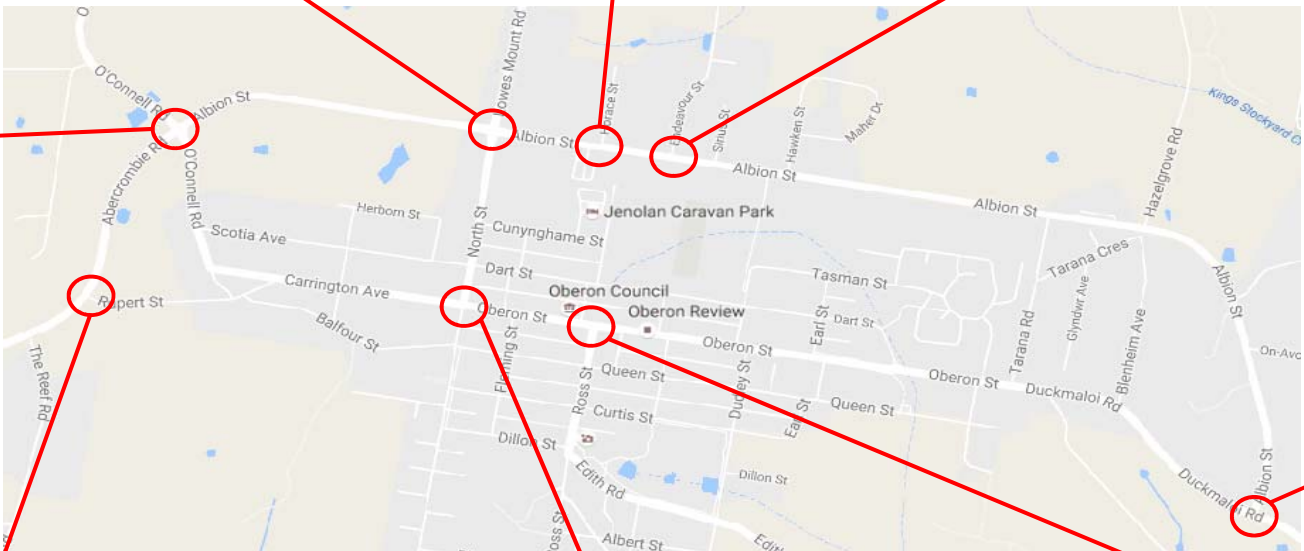
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			19	12	31
Albion St west of Horace St	52	67			119
Albion St east of Horace St	44	66			110

		Endeavour St				
		right		left		
Albion St	left	3			1	right
	through	41			60	through
						left

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			4	2	6
Albion St west of Endeavour St	44	61			105
Albion St east of Endeavour St	42	61			103

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	5			26	right
	through	4			5	through
	right	1			4	left
		1	52	5		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			83	88	171
O'Connell Rd south of Abercrombie Rd			58	51	109
Abercrombie Rd west of O'Connell Rd	10	12			22
Albion St east of O'Connell Rd	45	35			80



		Albion St				
		right		left		
Duckmaloi Rd	left	3			15	right
	through	22			46	through
						left

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			18	11	29
Duckmaloi Rd west of Albion St	25	51			76
Duckmaloi Rd east of Albion St	28	61			89

		Abercrombie Rd				
		through	left			
			11	1	1	right
					23	left
						through
			14	42		
		through	right			
		Abercrombie Rd				

Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			15	12	27
Abercrombie Rd south of Rupert St			56	34	90
Rupert St east of Abercrombie Rd	43	24			67

		North St				
		right	through	left		
Carrington Ave	left	13			46	right
	through	73			61	through
	right	11			31	left
		11	17	28		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			76	72	148
North St south of Carrington Ave			56	64	120
Carrington Ave west of North St	97	80			177
Oberon St east of North St	143	138			281

		Un-named St				
		right	through	left		
Oberon St	left	27			13	right
	through	66			94	through
	right	21			22	left
		48	21	10		
		left	through	right		
		Ross St				

Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			61	24	85
Ross St south of Oberon St			79	49	128
Oberon St west of Un-named St	114	150			264
Oberon St east of Un-named St	86	129			215

2015 Morning Peak (Existing Without Development)
(Heavy Vehicles Only)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	0			6	right
	through	11			12	through
	right	3			3	left
		1	0	12		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			6	13	19
North St south of Albion St			13	7	20
Albion St west of Lowes Mount Rd	14	14			28
Albion St east of Lowes Mount Rd	34	21			55

		Horace St				
		right		left		
Albion St	left	0		0	0	right
	through	23			24	through

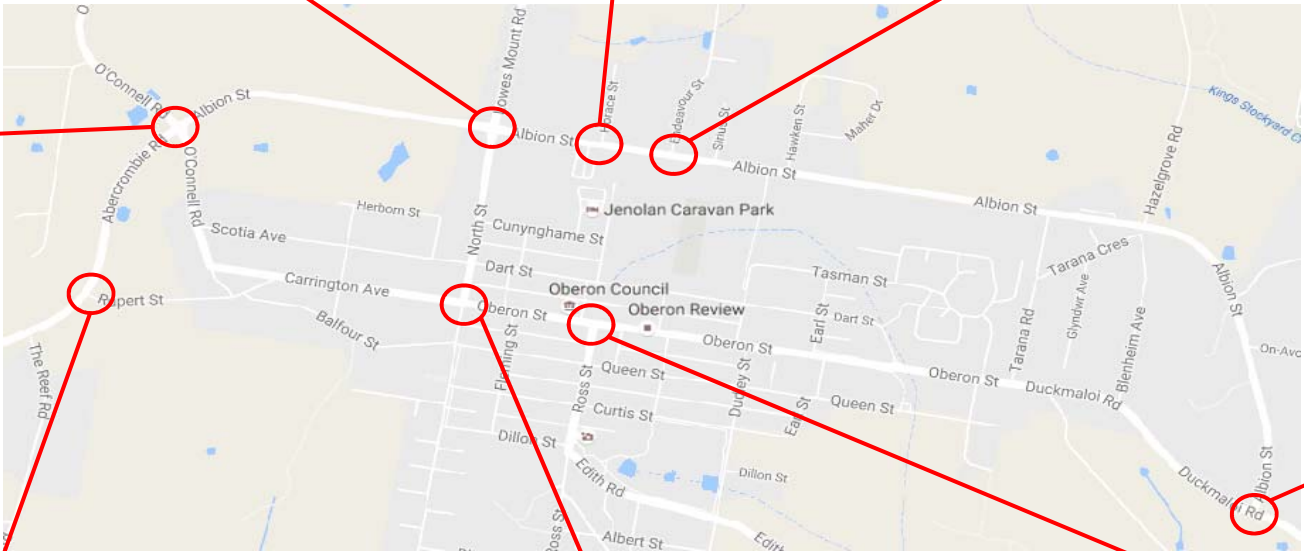
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	23	24			47
Albion St east of Horace St	23	24			47

		Endeavour St				
		right		left		
Albion St	left	8			0	right
	through	14			18	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			8	6	14
Albion St west of Endeavour St	22	23			45
Albion St east of Endeavour St	15	18			33

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	0			10	right
	through	5			8	through
	right	0			0	left
		0	2	0		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			12	15	27
O'Connell Rd south of Abercrombie Rd			2	4	6
Abercrombie Rd west of O'Connell Rd	5	8			13
Albion St east of O'Connell Rd	16	18			34



		Abercrombie Rd				
		through	left			
			6	0	0	right
					2	left
			8	6		
		through	right			
		Abercrombie Rd				

Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			8	6	14
Abercrombie Rd south of Rupert St			14	8	22
Rupert St east of Abercrombie Rd	6	2			8

		North St				
		right	through	left		
Carrington Ave	left	1			4	right
	through	2			5	through
	right	3			2	left
		1	1	0		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			6	8	14
North St south of Carrington Ave			2	8	10
Carrington Ave west of North St	6	9			15
Oberon St east of North St	4	11			15

		Un-named St				
		right	through	left		
Oberon St	left	1			0	right
	through	2			4	through
	right	3			1	left
		1	0	0		
		left	through	right		
		Ross St				

Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			1	0	1
Ross St south of Oberon St			1	4	5
Oberon St west of Un-named St	6	5			11
Oberon St east of Un-named St	2	5			7

		Albion St				
		right		left		
Duckmaloi Rd	left	0			11	right
	through	0			4	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			11	10	21
Duckmaloi Rd west of Albion St	0	5			5
Duckmaloi Rd east of Albion St	9	15			24

2015 Morning Peak (Existing Without Development)
(All Vehicles)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	5			12	right
	through	28			39	through
	right	23			45	left
		22	26	46		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			43	59	102
North St south of Albion St			94	98	192
Albion St west of Lowes Mount Rd	56	71			127
Albion St east of Lowes Mount Rd	93	96			189

		Horace St				
		right		left		
Albion St	left	11			8	right
	through	64			82	through

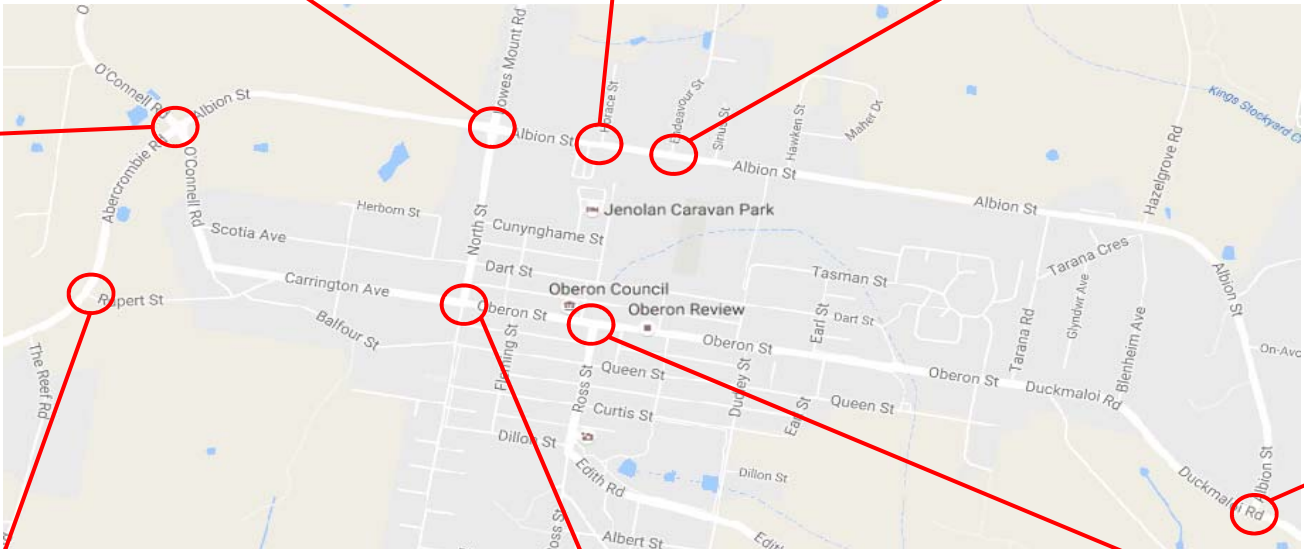
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			19	12	31
Albion St west of Horace St	75	91			166
Albion St east of Horace St	67	90			157

		Endeavour St				
		right		left		
Albion St	left	11			1	right
	through	55			78	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			12	8	20
Albion St west of Endeavour St	66	84			150
Albion St east of Endeavour St	57	79			136

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	5			36	right
	through	9			13	through
	right	1			4	left
		1	54	5		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			95	103	198
O'Connell Rd south of Abercrombie Rd			60	55	115
Abercrombie Rd west of O'Connell Rd	15	20			35
Albion St east of O'Connell Rd	61	53			114



		Albion St				
		right		left		
Duckmaloi Rd	left	3			26	right
	through	22			50	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			29	21	50
Duckmaloi Rd west of Albion St	25	56			81
Duckmaloi Rd east of Albion St	37	76			113

		Abercrombie Rd				
		through	left			
			17	1	1	right
					25	left
			22	48		
		through	right			
		Abercrombie Rd				

Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			23	18	41
Abercrombie Rd south of Rupert St			70	42	112
Rupert St east of Abercrombie Rd	49	26			75

		North St				
		right	through	left		
Carrington Ave	left	14			50	right
	through	75			66	through
	right	14			33	left
		12	18	28		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			82	80	162
North St south of Carrington Ave			58	72	130
Carrington Ave west of North St	103	89			192
Oberon St east of North St	147	149			296

		Un-named St				
		right	through	left		
Oberon St	left	28			13	right
	through	68			98	through
	right	24			23	left
		49	21	10		
		left	through	right		
		Ross St				

Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			62	24	86
Ross St south of Oberon St			80	53	133
Oberon St west of Un-named St	120	155			275
Oberon St east of Un-named St	88	134			222

2015 Evening Peak (Existing Without Development)
(Light Vehicles Only)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	8			6	right
	through	31			17	through
	right	36			57	left
		26	39	54		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			53	75	128
North St south of Albion St			119	145	264
Albion St west of Lowes Mount Rd	75	57			132
Albion St east of Lowes Mount Rd	94	80			174

		Horace St				
		right		left		
Albion St	left	5			10	right
	through	84			68	through

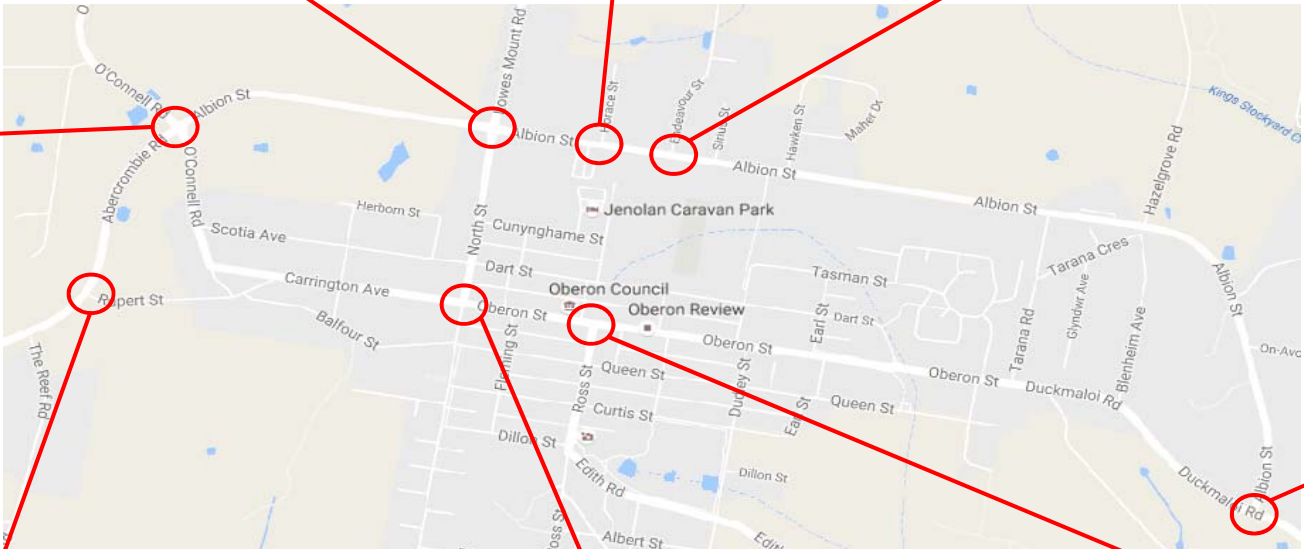
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			15	17	32
Albion St west of Horace St	89	78			167
Albion St east of Horace St	91	78			169

		Endeavour St				
		right		left		
Albion St	left	6			1	right
	through	84			72	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			7	11	18
Albion St west of Endeavour St	90	80			170
Albion St east of Endeavour St	87	73			160

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	6			13	right
	through	11			4	through
	right	4			1	left
		2	44	1		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			63	82	145
O'Connell Rd south of Abercrombie Rd			47	61	108
Abercrombie Rd west of O'Connell Rd	21	13			34
Albion St east of O'Connell Rd	31	18			49



		Albion St				
		right		left		
Duckmaloi Rd	left	8			10	right
	through	41			35	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			18	22	40
Duckmaloi Rd west of Albion St	49	44			93
Duckmaloi Rd east of Albion St	54	45			99

		Abercrombie Rd				
		through	left			
			23	1	2	right
					53	left
			10	38		
		through	right			
		Abercrombie Rd				

Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			12	24	36
Abercrombie Rd south of Rupert St			48	76	124
Rupert St east of Abercrombie Rd	39	55			94

		North St				
		right	through	left		
Carrington Ave	left	9			59	right
	through	82			75	through
	right	11			43	left
		8	12	32		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			80	168	248
North St south of Carrington Ave			52	96	148
Carrington Ave west of North St	102	99			201
Oberon St east of North St	224	177			401

		Un-named St				
		right	through	left		
Oberon St	left	45			10	right
	through	140			97	through
	right	69			18	left
		55	5	14		
		left	through	right		
		Ross St				

Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			60	47	107
Ross St south of Oberon St			74	98	172
Oberon St west of Un-named St	254	175			429
Oberon St east of Un-named St	167	125			292

2015 Evening Peak (Existing Without Development)
(Heavy Vehicles Only)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	3			7	right
	through	24			9	through
	right	1			6	left
		1	6	5		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			16	12	28
North St south of Albion St			12	7	19
Albion St west of Lowes Mount Rd	28	14			42
Albion St east of Lowes Mount Rd	37	22			59

		Horace St				
		right		left		
Albion St	left	1			1	right
	through	26			21	through
		left	through	right		

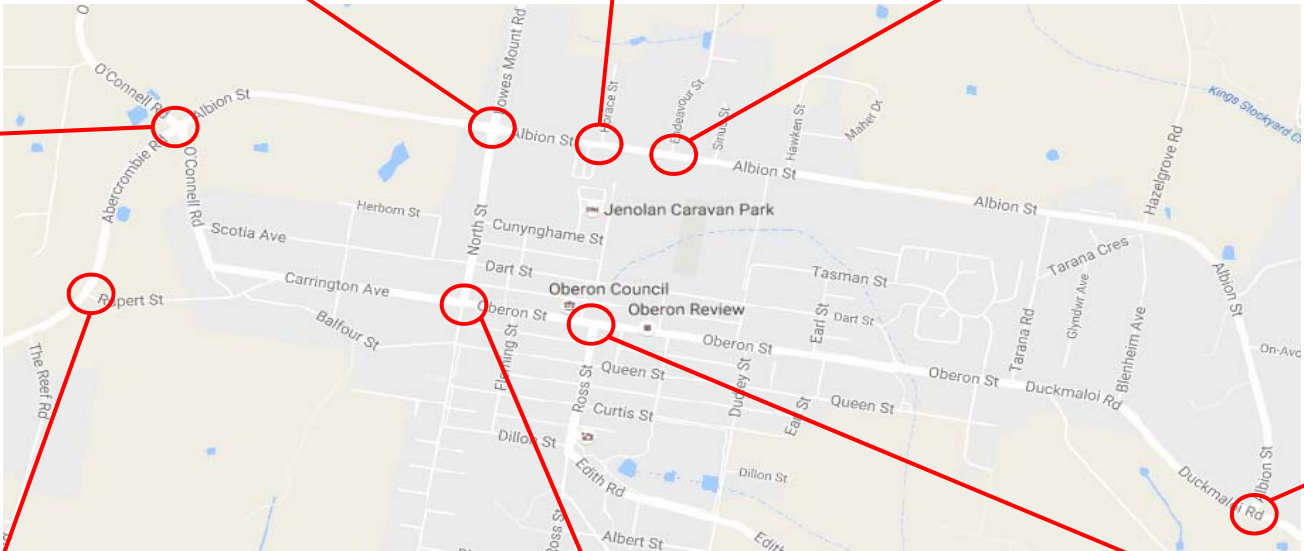
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			2	2	4
Albion St west of Horace St	27	23			50
Albion St east of Horace St	26	22			48

		Endeavour St				
		right		left		
Albion St	left	10			0	right
	through	16			16	through
		left	through	right		

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			10	9	19
Albion St west of Endeavour St	26	22			48
Albion St east of Endeavour St	19	16			35

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	1			1	right
	through	11			1	through
	right	0			1	left
		0	7	0		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			9	15	24
O'Connell Rd south of Abercrombie Rd			7	7	14
Abercrombie Rd west of O'Connell Rd	12	2			14
Albion St east of O'Connell Rd	19	3			22



		Abercrombie Rd				
		through	left			
			1	0	0	right
					0	left
		12	3			
		through	right			
		Abercrombie Rd				

Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			12	1	13
Abercrombie Rd south of Rupert St			15	1	16
Rupert St east of Abercrombie Rd	3	0			3

		North St				
		right	through	left		
Carrington Ave	left	0			6	right
	through	0			1	through
	right	0			0	left
		0	0	0		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			6	0	6
North St south of Carrington Ave			0	0	0
Carrington Ave west of North St	0	1			1
Oberon St east of North St	0	7			7

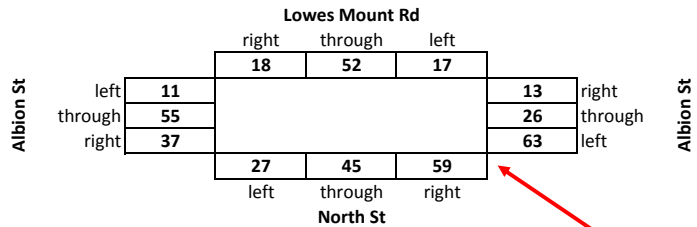
		Un-named St				
		right	through	left		
Oberon St	left	1			0	right
	through	4			4	through
	right	0			0	left
		1	0	0		
		left	through	right		
		Ross St				

Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			1	0	1
Ross St south of Oberon St			1	0	1
Oberon St west of Un-named St	5	5			10
Oberon St east of Un-named St	4	4			8

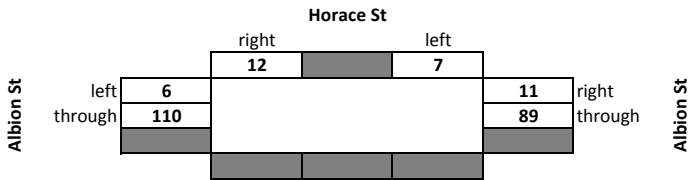
		Albion St				
		right		left		
Duckmaloi Rd	left	1			12	right
	through	1			4	through
		left	through	right		

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			13	3	16
Duckmaloi Rd west of Albion St	2	4			6
Duckmaloi Rd east of Albion St	4	16			20

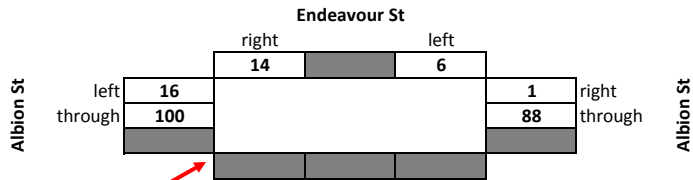
2015 Evening Peak (Existing Without Development)
(All Vehicles)



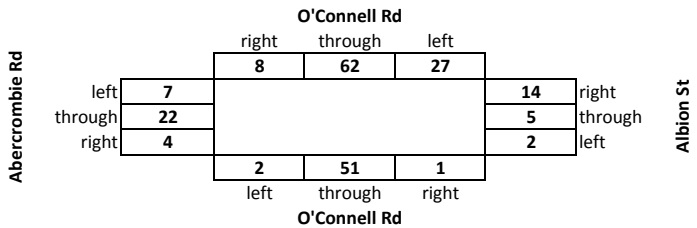
Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			69	87	156
North St south of Albion St			131	152	283
Albion St west of Lowes Mount Rd	103	71			174
Albion St east of Lowes Mount Rd	131	102			233



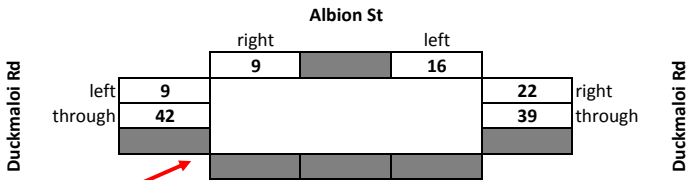
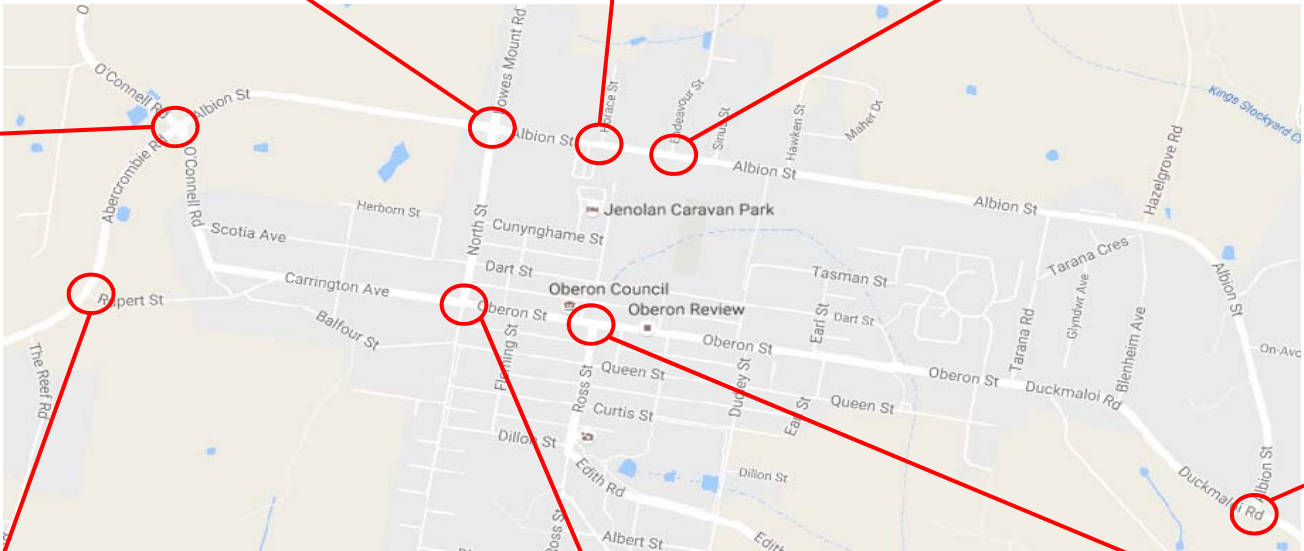
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			17	19	36
Albion St west of Horace St	116	101			217
Albion St east of Horace St	117	100			217



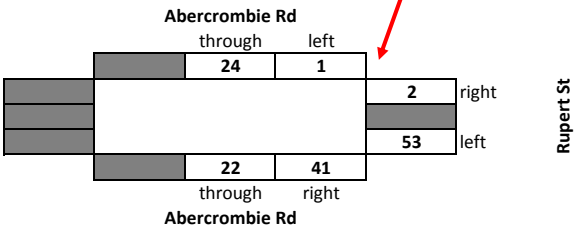
Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			17	20	37
Albion St west of Endeavour St	116	102			218
Albion St east of Endeavour St	106	89			195



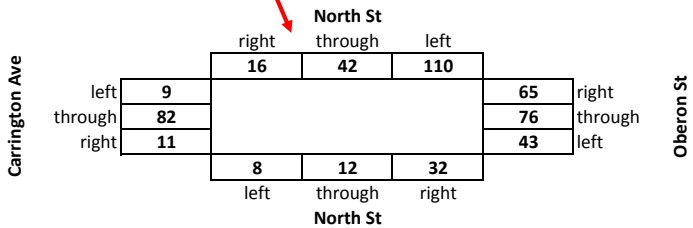
Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			72	97	169
O'Connell Rd south of Abercrombie Rd			54	68	122
Abercrombie Rd west of O'Connell Rd	33	15			48
Albion St east of O'Connell Rd	50	21			71



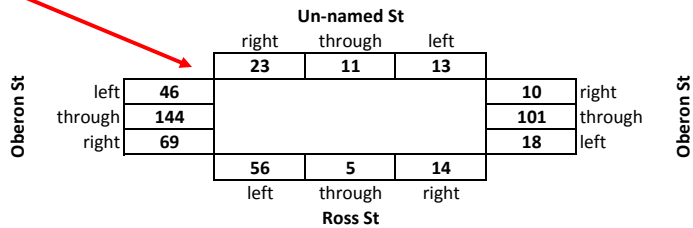
Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			31	25	56
Duckmaloi Rd west of Albion St	51	48			99
Duckmaloi Rd east of Albion St	58	61			119



Location	EB	WB	NB	SB	Total
Abercrombie Rd north of Rupert St			24	25	49
Abercrombie Rd south of Rupert St			63	77	140
Rupert St east of Abercrombie Rd	42	55			97



Location	EB	WB	NB	SB	Total
North St north of Carrington Ave			86	168	254
North St south of Carrington Ave			52	96	148
Carrington Ave west of North St	102	100			202
Oberon St east of North St	224	184			408



Location	EB	WB	NB	SB	Total
Un-named St north of Oberon St			61	47	108
Ross St south of Oberon St			75	98	173
Oberon St west of Un-named St	259	180			439
Oberon St east of Un-named St	171	129			300

2019 AM Peak Anticipated Trip Generation
(Only Heavy Vehicle Trips Generated during peak periods)

Lowes Mount Rd									
		right	through	left			right	through	left
Albion St	left	3	0	7	Albion St	right	7		
	through	0				through	0		
	right	0				left	0		
		0	0	0					
		left	through	right					
North St									

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			10	10	20
North St south of Albion St			0	0	0
Albion St west of Lowes Mount Rd	3	3			6
Albion St east of Lowes Mount Rd	7	7			14

Horace St									
		right					left		
Albion St	left	0					0	right	
	through	7					7	through	

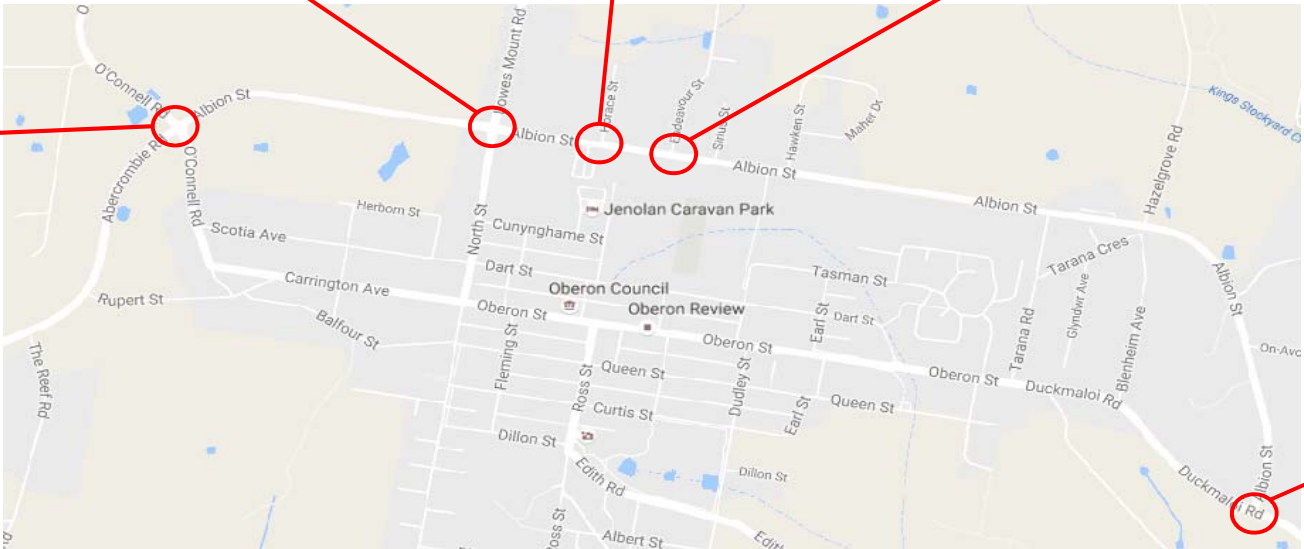
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	7	7			14
Albion St east of Horace St	7	7			14

Endeavour St									
		right					left		
Albion St	left	0	0				0	right	
	through	7					7	through	

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			0	0	0
Albion St west of Endeavour St	7	7			14
Albion St east of Endeavour St	7	7			14

O'Connell Rd									
		right	through	left			right	through	left
Abercrombie Rd	left	0			Albion St	right	3		
	through	0				through	0		
	right	0				left	0		
		left	through	right			left	through	right
O'Connell Rd									
		0	0	0					

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			3	3	6
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	3	3			6



Albion St									
		right		left			right		left
Duckmaloi Rd	left	0						7	right
	through	0						0	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			7	7	14
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	7	7			14

2019 AM Peak Operational (2015 traffic + trip generation)
(All Vehicles)

Albion St		Lowes Mount Rd						Albion St	
		right		through		left			
		13		30		26			
		19		39		45			
left		8						right	
through		28						through	
right		23						left	
				22		26		46	
				left		through		right	

2019 PM Peak Anticipated Trip Generation
(Only Heavy Vehicle Trips Generated during peak periods)

		Lowes Mount Rd								
		right		through		left				
		3		0		7				
		0				0				
Albion St	left	3				7		right	Albion St	
	through	0				0		through		
	right	0				0		left		
		0		0		0				
		left		through		right				

2019 PM Peak Operational (2015 traffic + trip generation)
(All Vehicles)

		Lowes Mount Rd					
		right	through	left			
Albion St	left	14			20	right	
	through	55			26	through	
	right	37			63	left	
			27	45	59		
		left	through	right			
		North St					

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			79	97	176
North St south of Albion St			131	152	283
Albion St west of Lowes Mount Rd	106	74			180
Albion St east of Lowes Mount Rd	138	109			247

		Horace St					
		right			left		
Albion St	left	6				11	right
	through	117				96	through

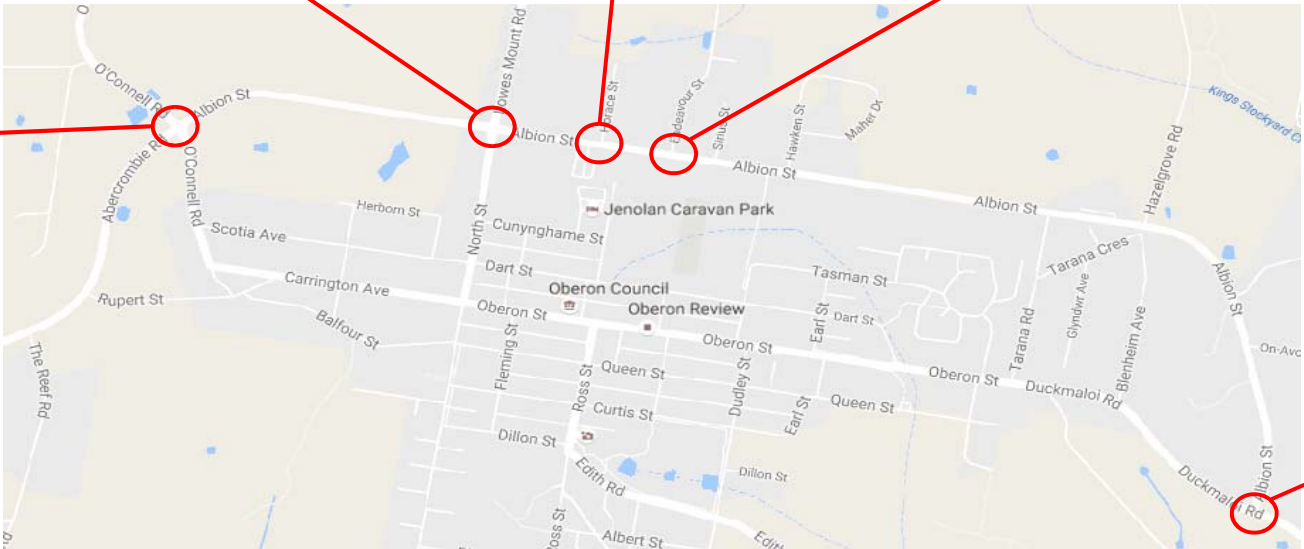
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			17	19	36
Albion St west of Horace St	123	108			231
Albion St east of Horace St	124	107			231

		Endeavour St					
		right			left		
Albion St	left	16				1	right
	through	107				95	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			17	20	37
Albion St west of Endeavour St	123	109			232
Albion St east of Endeavour St	113	96			209

		O'Connell Rd					
		right	through	left			
Abercrombie Rd	left	7				17	right
	through	22				5	through
	right	4				2	left
			2	51	1		
		left	through	right			
		O'Connell Rd					

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			75	100	175
O'Connell Rd south of Abercrombie Rd			54	68	122
Abercrombie Rd west of O'Connell Rd	33	15			48
Albion St east of O'Connell Rd	53	24			77



		Albion St					
		right			left		
Duckmaloi Rd	left	9				29	right
	through	42				39	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			38	32	70
Duckmaloi Rd west of Albion St	51	48			99
Duckmaloi Rd east of Albion St	65	68			133

2029 AM Peak Anticipated Trip Generation
(Only Heavy Vehicle Trips Generated during peak periods)

Lowes Mount Rd										
Albion St	left through right	right		through		left		10 0 0	right through left	Albion St
		4		0		10				
		0		0		0				
North St										

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			14	14	28
North St south of Albion St			0	0	0
Albion St west of Lowes Mount Rd	4	4			8
Albion St east of Lowes Mount Rd	10	10			20

Horace St									
Albion St	left through	right			left			right through	Albion St
		0	0	0	0				
		10					10		

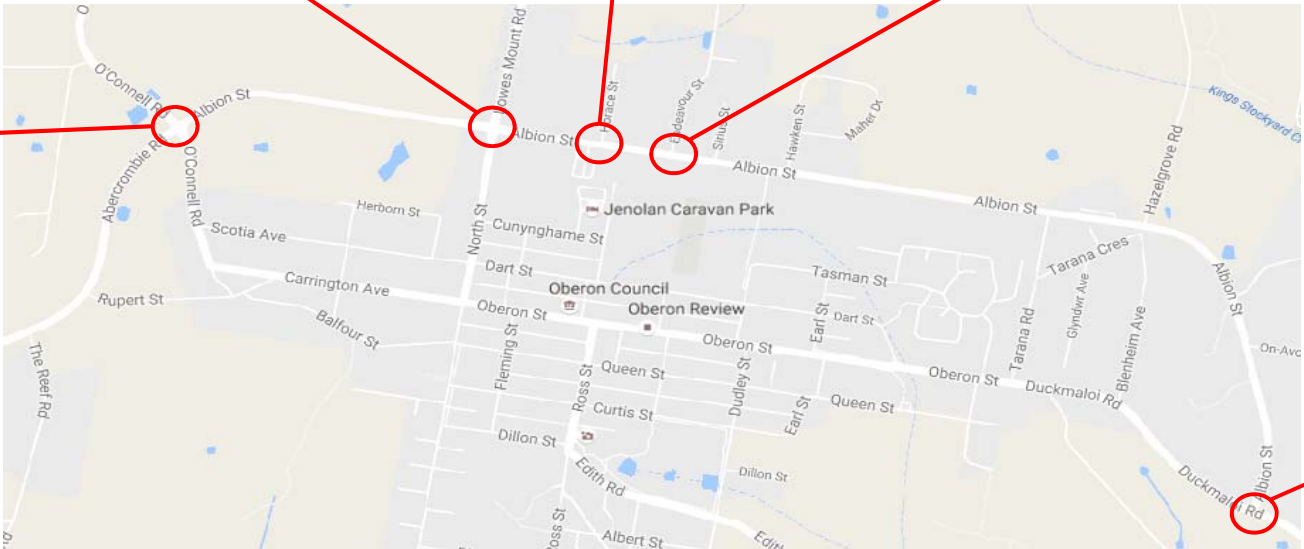
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	10	10			20
Albion St east of Horace St	10	10			20

Endeavour St									
Albion St	left through	right			left			right through	Albion St
		0	0	0	0				
		10					10		

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			0	0	0
Albion St west of Endeavour St	10	10			20
Albion St east of Endeavour St	10	10			20

O'Connell Rd										
		right		through		left				
		0		0		4				
Abercrombie Rd	left	0						4		right
	through	0						0		through
	right	0						0		left
		0		0		0				
		left		through		right				
O'Connell Rd										
Albion St										

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			4	4	8
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	4	4			8



Albion St									
Duckmaloi Rd	left through	right			left			10	right through
		0			0				
		0			10				
		0			0				
		0			0				

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			10	10	20
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	10	10			20

2029 AM Peak Operational (2015 traffic + trip generation)
(All Vehicles)

		Lowes Mount Rd					
		right	through	left			
Albion St	left	14	30	29			
	through				22	right	
					39	through	
	right				45	left	
		22	26	46			
		left	through	right			
		North St					

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			57	73	130
North St south of Albion St			94	98	192
Albion St west of Lowes Mount Rd	60	75			135
Albion St east of Lowes Mount Rd	103	106			209

		Horace St					
		right		left			
Albion St	left	11				8	right
	through	74				92	through

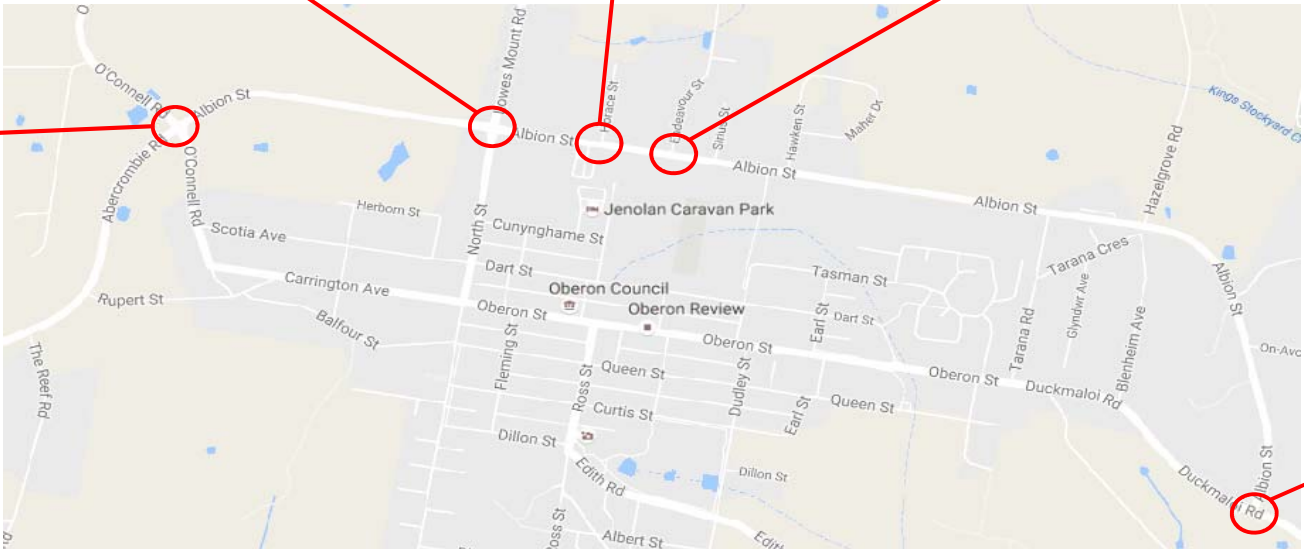
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			19	12	31
Albion St west of Horace St	85	101			186
Albion St east of Horace St	77	100			177

		Endeavour St					
		right		left			
Albion St	left	11				1	right
	through	65				88	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			12	8	20
Albion St west of Endeavour St	76	94			170
Albion St east of Endeavour St	67	89			156

		O'Connell Rd						
		right	through	left				
Abercrombie Rd	left	5				40	right	
	through	9				13	through	
	right	1				4	left	
			1	54	5			
		left	through	right				
		O'Connell Rd						

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			99	107	206
O'Connell Rd south of Abercrombie Rd			60	55	115
Abercrombie Rd west of O'Connell Rd	15	20			35
Albion St east of O'Connell Rd	65	57			122



		Albion St					
		right		left			
Duckmaloi Rd	left	3				36	right
	through	22				50	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			39	31	70
Duckmaloi Rd west of Albion St	25	56			81
Duckmaloi Rd east of Albion St	47	86			133

2029 PM Peak Anticipated Trip Generation
(Only Heavy Vehicle Trips Generated during peak periods)

		Lowes Mount Rd					
		right	through	left			
Albion St	left	4	0	10	10	right	
	through	0			0	through	
	right	0			0	left	
		0	0	0			
		left	through	right			
		North St					

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			14	14	28
North St south of Albion St			0	0	0
Albion St west of Lowes Mount Rd	4	4			8
Albion St east of Lowes Mount Rd	10	10			20

		Horace St					
		right			left		
Albion St	left	0	0	0		0	right
	through	10				10	through

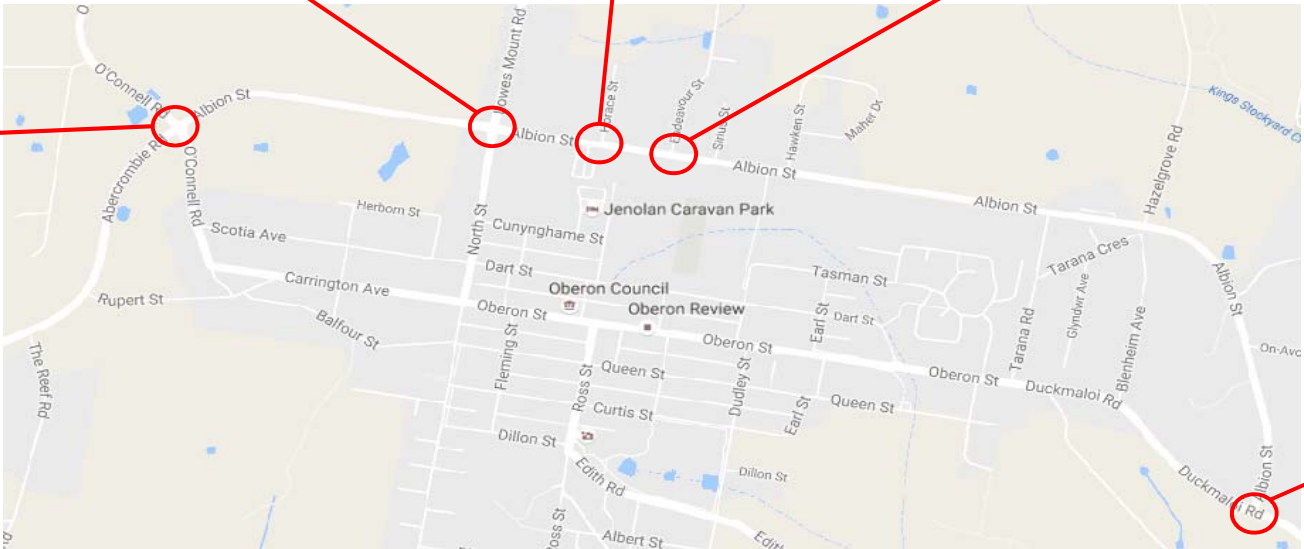
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	10	10			20
Albion St east of Horace St	10	10			20

		Endeavour St					
		right			left		
Albion St	left	0	0	0		0	right
	through	10				10	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			0	0	0
Albion St west of Endeavour St	10	10			20
Albion St east of Endeavour St	10	10			20

		O'Connell Rd					
		right	through	left			
Abercrombie Rd	left	0	0	4		4	right
	through	0				0	through
	right	0				0	left
		0	0	0			
		left	through	right			
		O'Connell Rd					

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			4	4	8
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	4	4			8



		Albion St					
		right			left		
Duckmaloi Rd	left	0	0	10		10	right
	through	0				0	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			10	10	20
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	10	10			20

2029 PM Peak Operational (2015 traffic + trip generation)
(All Vehicles)

		Lowes Mount Rd				
		right	through	left		
Albion St	left	15			23	right
	through	55			26	through
	right	37			63	left
		27	45	59		
		left	through	right		
		North St				

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			83	101	184
North St south of Albion St			131	152	283
Albion St west of Lowes Mount Rd	107	75			182
Albion St east of Lowes Mount Rd	141	112			253

		Horace St				
		right		left		
Albion St	left	6			11	right
	through	120			99	through

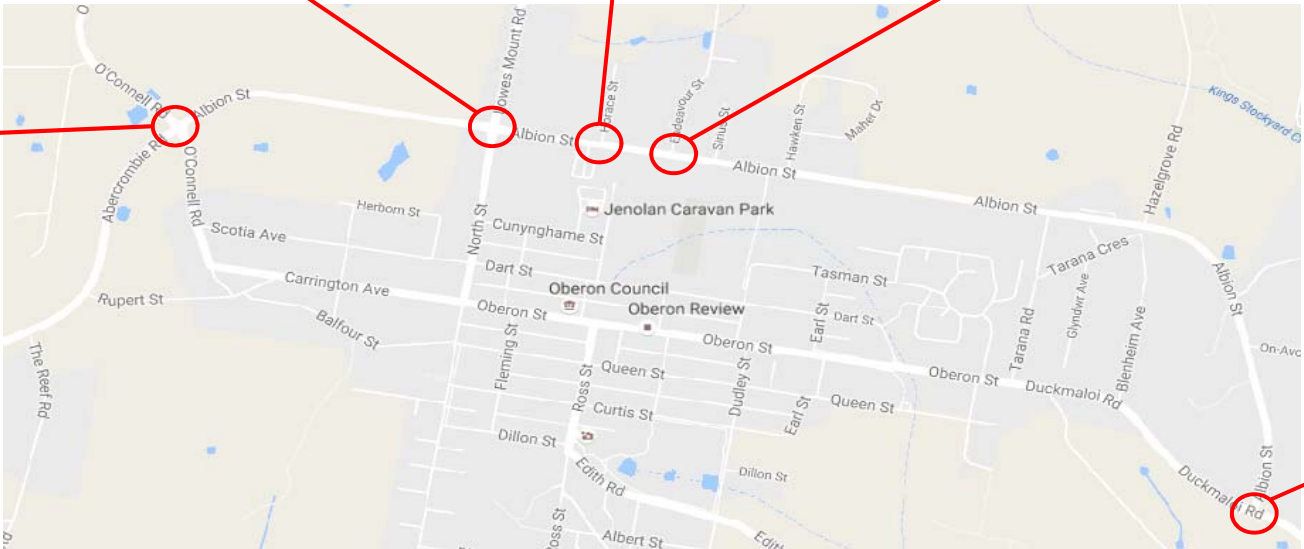
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			17	19	36
Albion St west of Horace St	126	111			237
Albion St east of Horace St	127	110			237

		Endeavour St				
		right		left		
Albion St	left	16			1	right
	through	110			98	through

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			17	20	37
Albion St west of Endeavour St	126	112			238
Albion St east of Endeavour St	116	99			215

		O'Connell Rd				
		right	through	left		
Abercrombie Rd	left	7			18	right
	through	22			5	through
	right	4			2	left
		2	51	1		
		left	through	right		
		O'Connell Rd				

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			76	101	177
O'Connell Rd south of Abercrombie Rd			54	68	122
Abercrombie Rd west of O'Connell Rd	33	15			48
Albion St east of O'Connell Rd	54	25			79



		Albion St				
		right		left		
Duckmaloi Rd	left	9			32	right
	through	42			39	through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			41	35	76
Duckmaloi Rd west of Albion St	51	48			99
Duckmaloi Rd east of Albion St	68	71			139

Assessment 1 (AM Peak)

Year and traffic volumes in which each intersection reaches its limit based on Level of Service (LoS) or Degree of Saturation (DoS) (whichever reached first) assuming an annual growth rate of 5% on all movements applied to 2015 traffic volumes.

Lowes Mount Rd					
Albion St	left	right	through	left	right
		63	189	120	
	through	Year: 2115 Avg. Delay: 16.2 DoS: 0.708			left
	right				through
	left	32	76	2115	284

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			272	372	644
North St south of Albion St			594	618	1212
Albion St west of Lowes Mount Rd	354	448			802
Albion St east of Lowes Mount Rd	588	606			1194

Horace St					
Albion St	left	right	through	left	right
		57		19	
	through	Year: 2115 Avg. Delay: 10.9 DoS: 0.357			left
	right				through
	left	69	51	2115	518

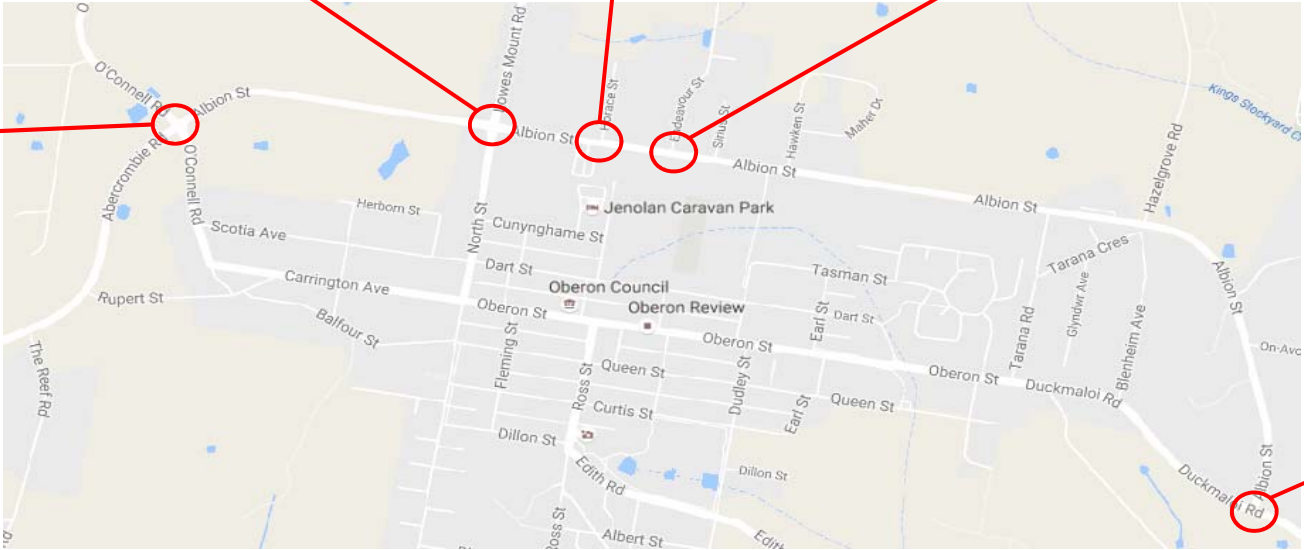
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			120	76	196
Albion St west of Horace St	473	575			1048
Albion St east of Horace St	423	569			992

Endeavour St					
Albion St	left	right	through	left	right
		38		13	
	through	Year: 2115 Avg. Delay: 17.1 DoS: 0.302			left
	right				through
	left	69	6	2115	493

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			75	51	126
Albion St west of Endeavour St	416	531			947
Albion St east of Endeavour St	360	499			859

O'Connell Rd					
Abercrombie Rd	left	right	through	left	right
		38	316	297	
	through	Year: 2115 Avg. Delay: 11.6 DoS: 0.511			left
	right				through
	left	32	227	2115	82

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			600	651	1251
O'Connell Rd south of Abercrombie Rd			379	347	726
Abercrombie Rd west of O'Connell Rd	95	126			221
Albion St east of O'Connell Rd	386	334			720



Albion St					
Duckmaloi Rd	left	right	through	left	right
		38		95	
	through	Year: 2115 Avg. Delay: 12.9 DoS: 0.197			left
	right				through
	left	19	164	2115	316

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			183	133	316
Duckmaloi Rd west of Albion St	158	354			512
Duckmaloi Rd east of Albion St	234	480			714

Assessment 1 (PM Peak)

Year and traffic volumes in which each intersection reaches its limit based on Level of Service (LoS) or Degree of Saturation (DoS) (whichever reached first) assuming an annual growth rate of 5% on all movements applied to 2015 traffic volumes.

Lowes Mount Rd					
Albion St	left	right	through	left	right
		93	268	88	
		57	Year: 2093	67	
	through	284	Avg. Delay: 20.7	134	through
	right	191	DoS: 0.847	325	left
North St					
Albion St	left	139	232	304	right
	through				through
	right				left

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			356	449	805
North St south of Albion St			675	784	1459
Albion St west of Lowes Mount Rd	532	366			898
Albion St east of Lowes Mount Rd	676	526			1202

Horace St					
Albion St	left	right		left	right
		76		44	
		38	Year: 2115	69	
	through	695	Avg. Delay: 17.5	562	through
			DoS: 0.434		
Albion St					
Albion St	left				right
	through				through
	right				left

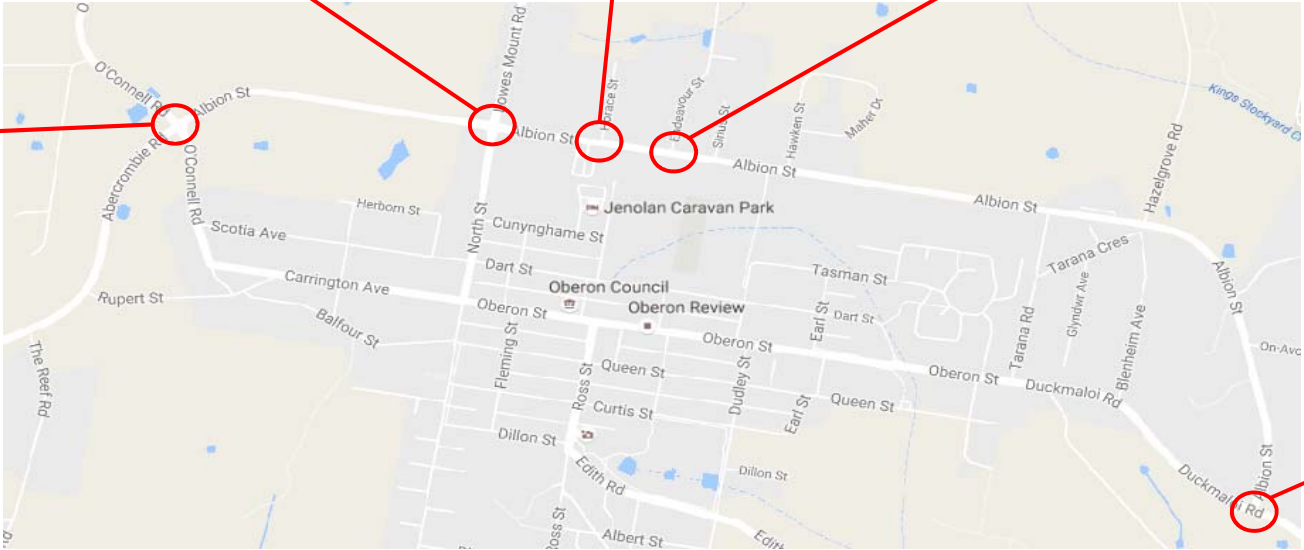
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			107	120	227
Albion St west of Horace St	733	638			1371
Albion St east of Horace St	739	631			1370

Endeavour St					
Albion St	left	right		left	right
		88		38	
		101	Year: 2115	6	
	through	632	Avg. Delay: 21.1	556	through
			DoS: 0.436		
Albion St					
Albion St	left				right
	through				through
	right				left

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			107	126	233
Albion St west of Endeavour St	733	644			1377
Albion St east of Endeavour St	670	562			1232

O'Connell Rd					
Abercrombie Rd	left	right	through	left	right
		51	392	171	
		44	Year: 2115	88	
	through	139	Avg. Delay: 10.8	32	through
	right	25	DoS: 0.552	13	left
O'Connell Rd					
Albion St	left	13	322	6	right
	through				through
	right				left

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			454	614	1068
O'Connell Rd south of Abercrombie Rd			341	430	771
Abercrombie Rd west of O'Connell Rd	208	96			304
Albion St east of O'Connell Rd	316	133			449



Albion St					
Duckmaloi Rd	left	right		left	right
			Year: N/A		
	through		Avg. Delay: N/A		through
			DoS: N/A		
Duckmaloi Rd					
Duckmaloi Rd	left				right
	through				through
	right				left

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			0	0	0
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	0	0			0

Assessment 2 (AM Peak)
Year and traffic volumes in which each intersection reaches Level of Service (LoS) B assuming an annual growth rate of 5% on all movements.

Lowes Mount Rd							
Albion St	right		through		left		
	58		174		110		
	left	29	Year:		2105	69	right
	through	162	Avg. Delay:		14.5	226	through
	right	133	DoS:		0.628	261	left
	127		151		266		
	left		through		right		
North St							

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			249	342	591
North St south of Albion St			544	568	1112
Albion St west of Lowes Mount Rd	324	411			735
Albion St east of Lowes Mount Rd	538	556			1094

Horace St						
		right		left		
left through		Year:		N/A		
		Avg. Delay:		N/A		
		DoS:		N/A		
		right		left		

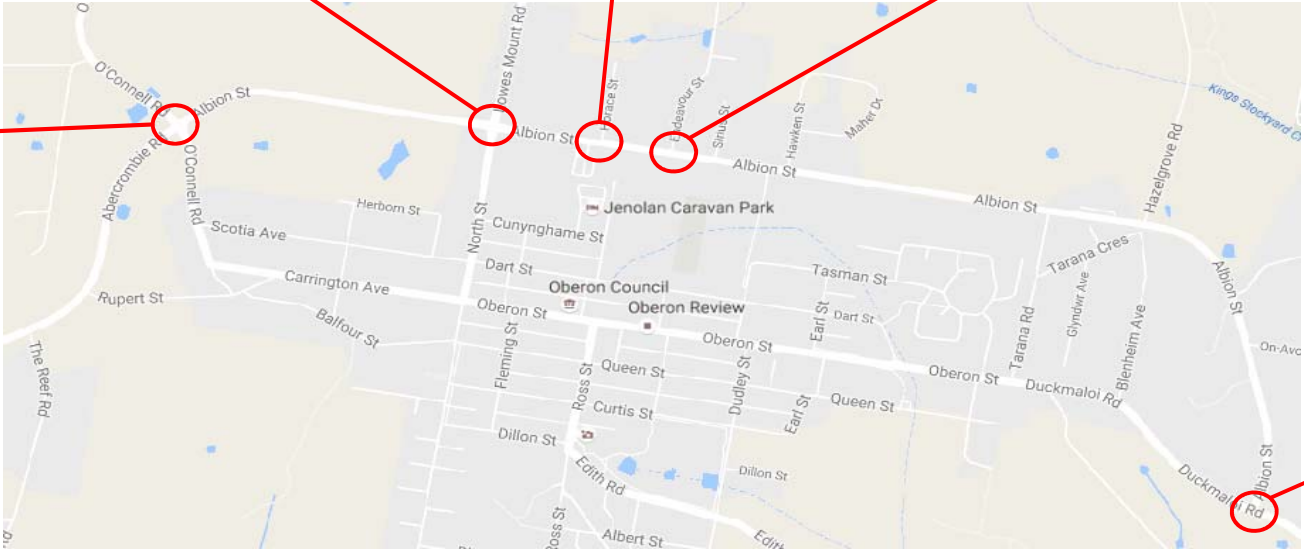
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	0	0			0
Albion St east of Horace St	0	0			0

Endeavour St							
Albion St	right		left		Albion St		
	32		11				
	left	59	Year:	2097		5	right
	through	295	Avg. Delay:	14.5		419	through
			DoS:	0.256			

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			64	43	107
Albion St west of Endeavour St	354	451			805
Albion St east of Endeavour St	306	424			730

O'Connell Rd						
Abercrombie Rd	right		through		left	
	38		316		297	
	left	32	Year: 2115		227	right
	through	57	Avg. Delay: 11.6		82	through
	right	6	DoS: 0.511		25	left
	6		341		32	
	left		through		right	
O'Connell Rd						

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			600	651	1251
O'Connell Rd south of Abercrombie Rd			379	347	726
Abercrombie Rd west of O'Connell Rd	95	126			221
Albion St east of O'Connell Rd	386	334			720



Albion St					
Duckmaloi Rd	right		left		Duckmaloi Rd
	Year:		N/A		
	Avg. Delay:		N/A		
	DoS:		N/A		
	left		right		

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			0	0	0
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	0	0			0

Assessment 2 (PM Peak)
Year and traffic volumes in which each intersection reaches Level of Service (LoS) B assuming an annual growth rate of 5% on all movements.

Albion St		Lowes Mount Rd						Albion St	
		right		through		left			
		158		234		72			
		left	47	Year:	2076	55	right		
		through	234	Avg. Delay:	14.6	111	through		
		right	158	DoS:	0.61	269	left		
		115		192		252			
		left		through		right			
		North St							

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			294	464	758
North St south of Albion St			559	661	1220
Albion St west of Lowes Mount Rd	439	384			823
Albion St east of Lowes Mount Rd	558	435			993

left through		Horace St						right through	
		right				left			
		67				39			
		33	Year:	2101	61				
		614	Avg. Delay:	14.6	497				
				DoS:		0.383			

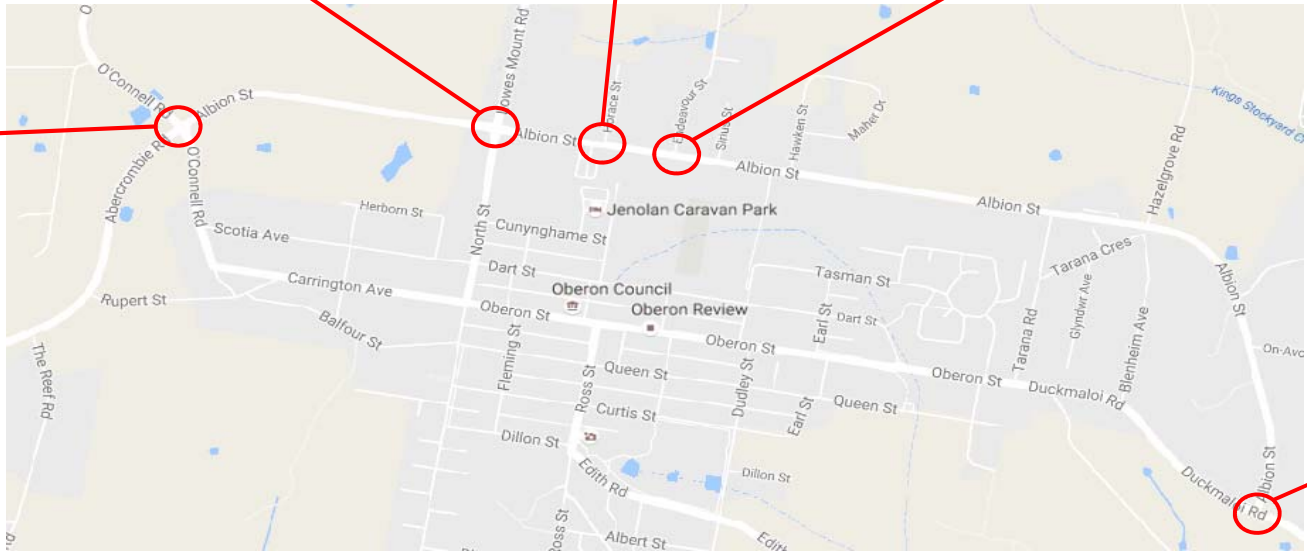
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			94	106	200
Albion St west of Horace St	647	564			1211
Albion St east of Horace St	653	558			1211

Albion St		Endeavour St						Albion St			
		right				left					
		69				30					
		left	79	Year: 2089						5	right
		through	495	Avg. Delay: 14.6						435	through
				DoS: 0.342							

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			84	99	183
Albion St west of Endeavour St	574	504			1078
Albion St east of Endeavour St	525	440			965

Abercrombie Rd		O'Connell Rd						Albion St	
		right		through		left			
		left		Year:	N/A		right		
		through		Avg. Delay:	N/A		through		
		right		DoS:	N/A		left		
		left		through		right			
		O'Connell Rd							

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			0	0	0
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	0	0			0



Duckmaloi Rd		Albion St						Duckmaloi Rd	
		right				left			
		57				101			
		left	57	Year: 2115		139	right		
		through	265	Avg. Delay: 12.3		246	through		
				DoS: 0.231					

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			196	158	354
Duckmaloi Rd west of Albion St	322	303			625
Duckmaloi Rd east of Albion St	366	385			751

Assessment 3 (AM Peak)
Year and trip generation in which each intersection reaches Level of Service (LoS) B assuming an annual growth rate of 10% applied only to the existing 2015 traffic generation.

Albion St	Growth: 10%		Lowes Mount Rd				Albion St
	Years: 36		right	through	left		
			128		319		
	left	128	Avg. Delay: 15.2		319	right	
	through		DoS: 0.607			through	
	right					left	
		left	through	right	North St		

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			447	447	894
North St south of Albion St			0	0	0
Albion St west of Lowes Mount Rd	128	128			256
Albion St east of Lowes Mount Rd	319	319			638

Growth:	10%	Horace St				
Years:	40	right			left	
left		Avg. Delay: 14.5				right
through	463	DoS: 47.2				463 through

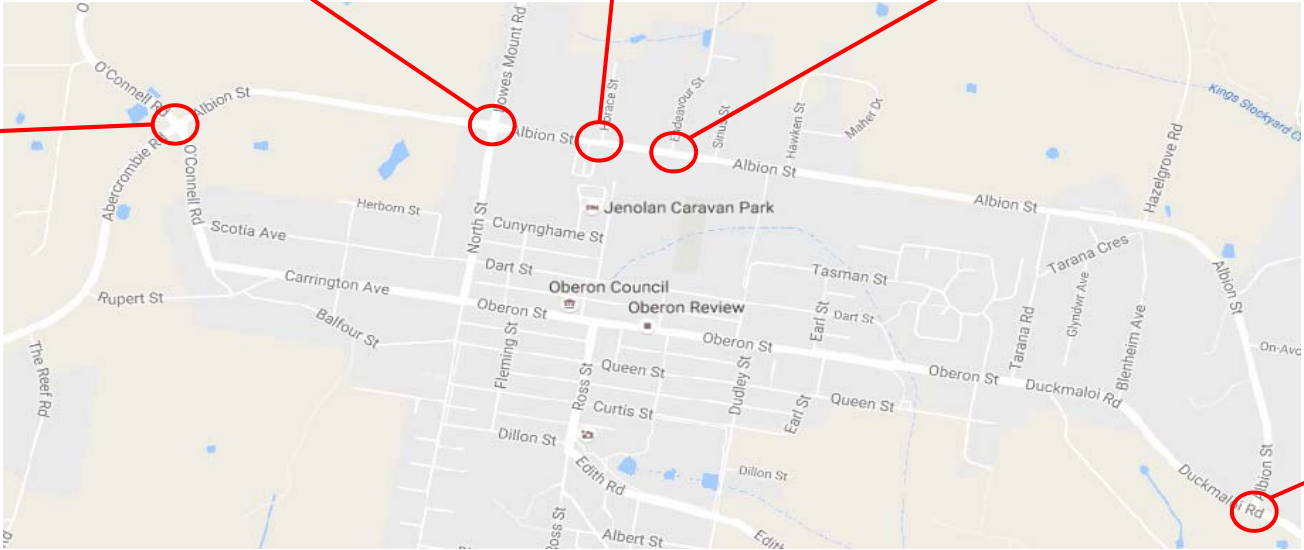
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	463	463			926
Albion St east of Horace St	463	463			926

Albion St	Growth: 10%		Endeavour St				Albion St	
	Years: 33							
			right			left		
	left		Avg. Delay: 15.1					right
	through	242	DoS: 0.266					242

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			0	0	0
Albion St west of Endeavour St	242	242			484
Albion St east of Endeavour St	242	242			484

Abercrombie Rd	Growth: 10%		O'Connell Rd				Albion St
	Years: 55		right	through	left		
					760		
	left		Avg. Delay: 13.9		760	right	
	through		DoS: 0.85			through	
	right					left	
			left	through	right		
		O'Connell Rd					

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			760	760	1520
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	760	760			1520



Duckmaloi Rd	Growth: 10%		Albion St				
	Years: 36		right		left		
					319		
	left	Avg. Delay: 15.6				319	right
	through	DoS: 0.419					through

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			319	319	638
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	319	319			638

Assessment 3 (PM Peak)
Year and trip generation in which each intersection reaches Level of Service (LoS) B assuming an annual growth rate of 10% applied only to the existing 2015 traffic generation.

Albion St	Growth: 10%		Lowes Mount Rd				Albion St
	Years: 35		right	through	left		
			116		291		
	left	116	Avg. Delay: 15.5		291	right	
	through		DoS: 0.626			through	
	right					left	
		left	through	right	North St		

Location	EB	WB	NB	SB	Total
Lowes Mount Rd north of Albion St			407	407	814
North St south of Albion St			0	0	0
Albion St west of Lowes Mount Rd	116	116			232
Albion St east of Lowes Mount Rd	291	291			582

Growth:	10%	Horace St				
Years:	38	right			left	
left		Avg. Delay: 14.9				right
through	384	DoS: 0.414				384 through

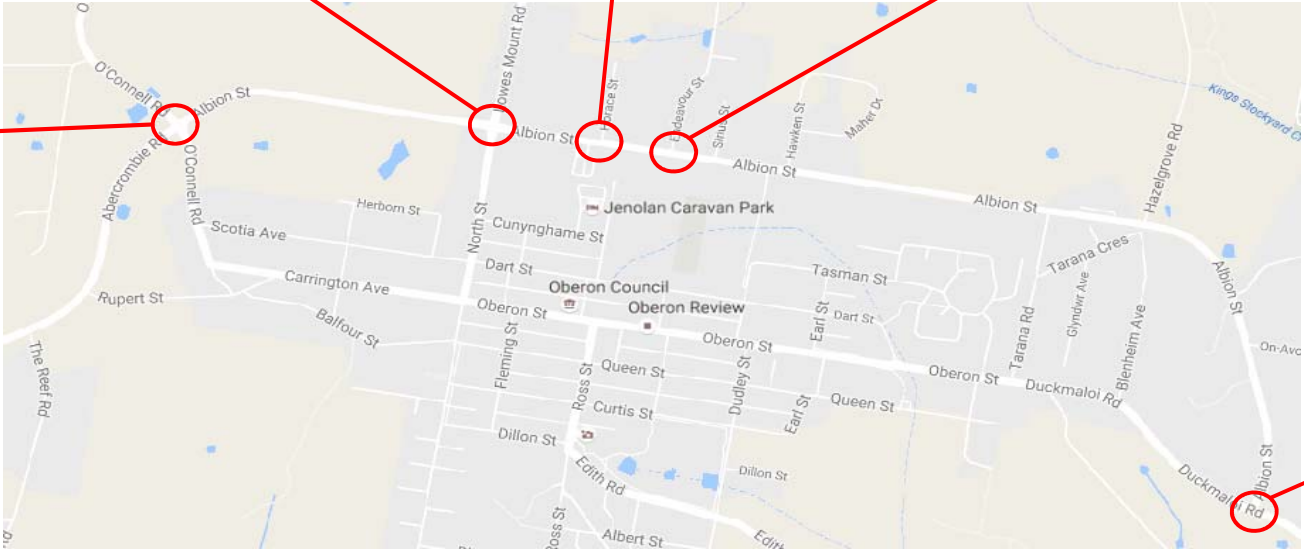
Location	EB	WB	NB	SB	Total
Horace St north of Albion St			0	0	0
Albion St west of Horace St	384	384			768
Albion St east of Horace St	384	384			768

Albion St	Growth: 10%		Endeavour St				Albion St	
	Years: 36							
			right			left		
	left		Avg. Delay: 15.4					right
	through	319	DoS: 0.357					319

Location	EB	WB	NB	SB	Total
Endeavour St north of Albion St			0	0	0
Albion St west of Endeavour St	319	319			638
Albion St east of Endeavour St	319	319			638

Abercrombie Rd	Growth: 10%		O'Connell Rd				
	Years: 55		right	through	left		
					760		
	left		Avg. Delay: 13.8			760	right
	through		DoS: 86.3				through
	right						left
			left	through	right		
	O'Connell Rd						

Location	EB	WB	NB	SB	Total
O'Connell Rd north of Abercrombie Rd			760	760	1520
O'Connell Rd south of Abercrombie Rd			0	0	0
Abercrombie Rd west of O'Connell Rd	0	0			0
Albion St east of O'Connell Rd	760	760			1520



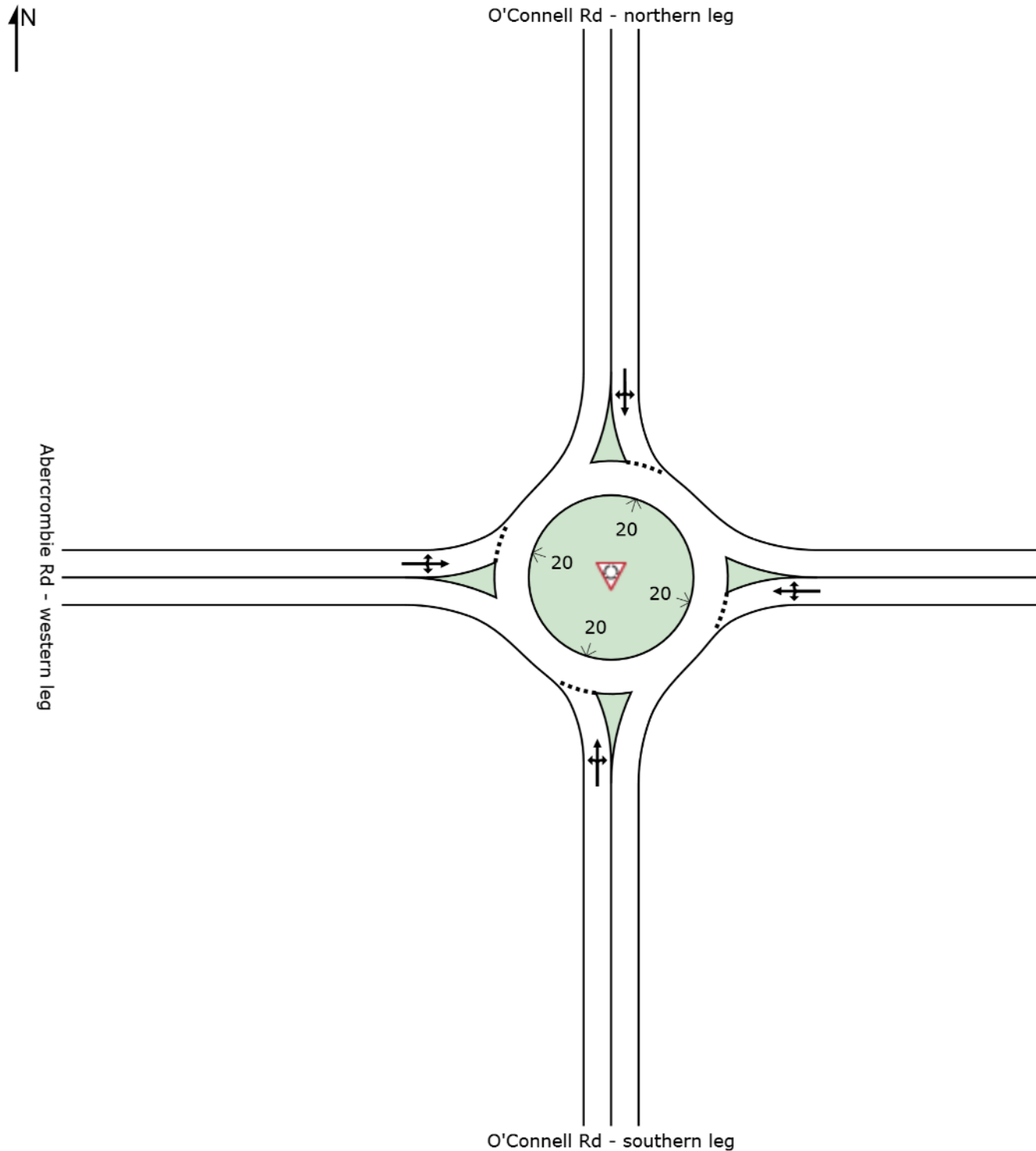
Duckmaloi Rd	Growth: 10%		Albion St				Duckmaloi Rd
	Years: 37						
		right			left		
					350		
	left		Avg. Delay: 15.1		350	right	
	through		DoS: 0.473			through	

Location	EB	WB	NB	SB	Total
Albion St north of Duckmaloi Rd			350	350	700
Duckmaloi Rd west of Albion St	0	0			0
Duckmaloi Rd east of Albion St	350	350			700

SITE LAYOUT

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing
Roundabout



Project: \AUSYFP01\Group\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY



Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing]

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: O'Connell Rd - southern leg											
1	L2	1	0.0	0.049	4.1	LOS A	0.2	1.6	0.20	0.43	54.3
2	T1	57	3.7	0.049	4.4	LOS A	0.2	1.6	0.20	0.43	55.6
3	R2	5	0.0	0.049	9.0	LOS A	0.2	1.6	0.20	0.43	55.6
Approach		63	3.3	0.049	4.8	LOS A	0.2	1.6	0.20	0.43	55.6
East: Albion St - eastern leg											
4	L2	4	0.0	0.050	4.1	LOS A	0.2	2.1	0.20	0.55	52.3
5	T1	14	61.5	0.050	5.0	LOS A	0.2	2.1	0.20	0.55	52.2
6	R2	38	27.8	0.050	9.4	LOS A	0.2	2.1	0.20	0.55	52.5
Approach		56	34.0	0.050	7.9	LOS A	0.2	2.1	0.20	0.55	52.4
North: O'Connell Rd - northern leg											
7	L2	49	23.4	0.077	4.2	LOS A	0.4	3.0	0.10	0.44	54.2
8	T1	53	8.0	0.077	4.2	LOS A	0.4	3.0	0.10	0.44	56.1
9	R2	6	0.0	0.077	8.8	LOS A	0.4	3.0	0.10	0.44	56.3
Approach		108	14.6	0.077	4.5	LOS A	0.4	3.0	0.10	0.44	55.2
West: Abercrombie Rd - western leg											
10	L2	5	0.0	0.015	4.3	LOS A	0.1	0.6	0.26	0.44	54.2
11	T1	9	55.6	0.015	5.2	LOS A	0.1	0.6	0.26	0.44	54.2
12	R2	1	0.0	0.015	9.1	LOS A	0.1	0.6	0.26	0.44	55.5
Approach		16	33.3	0.015	5.1	LOS A	0.1	0.6	0.26	0.44	54.3
All Vehicles		243	17.3	0.077	5.4	LOS A	0.4	3.0	0.16	0.46	54.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC Australia | Processed: Thursday, 15 September 2016 9:23:13 AM

Project: \\AUSYFP01\Group\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing A1]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Assessment 1

Roundabout

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: O'Connell Rd - southern leg											
1	L2	6	0.0	0.398	5.9	LOS A	2.3	16.7	0.65	0.64	52.4
2	T1	341	3.7	0.398	6.2	LOS A	2.3	16.7	0.65	0.64	53.5
3	R2	32	0.0	0.398	10.7	LOS A	2.3	16.7	0.65	0.64	53.6
Approach		379	3.3	0.398	6.6	LOS A	2.3	16.7	0.65	0.64	53.5
East: Albion St - eastern leg											
4	L2	25	0.0	0.411	5.8	LOS A	2.3	21.0	0.65	0.79	50.9
5	T1	82	61.5	0.411	8.0	LOS A	2.3	21.0	0.65	0.79	50.7
6	R2	227	27.8	0.411	11.6	LOS A	2.3	21.0	0.65	0.79	51.0
Approach		335	34.0	0.411	10.2	LOS A	2.3	21.0	0.65	0.79	50.9
North: O'Connell Rd - northern leg											
7	L2	297	23.4	0.511	5.0	LOS A	4.4	34.4	0.47	0.51	52.8
8	T1	316	8.0	0.511	4.9	LOS A	4.4	34.4	0.47	0.51	54.6
9	R2	38	0.0	0.511	9.4	LOS A	4.4	34.4	0.47	0.51	54.7
Approach		651	14.6	0.511	5.2	LOS A	4.4	34.4	0.47	0.51	53.7
West: Abercrombie Rd - western leg											
10	L2	32	0.0	0.145	6.1	LOS A	0.6	5.4	0.62	0.75	52.5
11	T1	57	55.6	0.145	8.5	LOS A	0.6	5.4	0.62	0.75	52.5
12	R2	6	0.0	0.145	11.0	LOS A	0.6	5.4	0.62	0.75	53.7
Approach		95	33.3	0.145	7.9	LOS A	0.6	5.4	0.62	0.75	52.6
All Vehicles		1459	17.3	0.511	6.9	LOS A	4.4	34.4	0.57	0.62	52.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:21:39 AM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing A2]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Assessment 2

Roundabout

Design Life Analysis (Level of Service Target (Worst Lane)): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: O'Connell Rd - southern leg											
1	L2	6	0.0	0.398	5.9	LOS A	2.3	16.7	0.65	0.64	52.4
2	T1	341	3.7	0.398	6.2	LOS A	2.3	16.7	0.65	0.64	53.5
3	R2	32	0.0	0.398	10.7	LOS A	2.3	16.7	0.65	0.64	53.6
Approach		379	3.3	0.398	6.6	LOS A	2.3	16.7	0.65	0.64	53.5
East: Albion St - eastern leg											
4	L2	25	0.0	0.411	5.8	LOS A	2.3	21.0	0.65	0.79	50.9
5	T1	82	61.5	0.411	8.0	LOS A	2.3	21.0	0.65	0.79	50.7
6	R2	227	27.8	0.411	11.6	LOS A	2.3	21.0	0.65	0.79	51.0
Approach		335	34.0	0.411	10.2	LOS A	2.3	21.0	0.65	0.79	50.9
North: O'Connell Rd - northern leg											
7	L2	297	23.4	0.511	5.0	LOS A	4.4	34.4	0.47	0.51	52.8
8	T1	316	8.0	0.511	4.9	LOS A	4.4	34.4	0.47	0.51	54.6
9	R2	38	0.0	0.511	9.4	LOS A	4.4	34.4	0.47	0.51	54.7
Approach		651	14.6	0.511	5.2	LOS A	4.4	34.4	0.47	0.51	53.7
West: Abercrombie Rd - western leg											
10	L2	32	0.0	0.145	6.1	LOS A	0.6	5.4	0.62	0.75	52.5
11	T1	57	55.6	0.145	8.5	LOS A	0.6	5.4	0.62	0.75	52.5
12	R2	6	0.0	0.145	11.0	LOS A	0.6	5.4	0.62	0.75	53.7
Approach		95	33.3	0.145	7.9	LOS A	0.6	5.4	0.62	0.75	52.6
All Vehicles		1459	17.3	0.511	6.9	LOS A	4.4	34.4	0.57	0.62	52.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:22:04 AM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Existing A3]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (AM) Peak - Assessment 3
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: O'Connell Rd - southern leg											
1	L2	1	0.0	0.165	9.0	LOS A	0.7	5.2	0.80	0.89	51.2
2	T1	57	3.7	0.165	9.5	LOS A	0.7	5.2	0.80	0.89	52.3
3	R2	5	0.0	0.165	13.9	LOS A	0.7	5.2	0.80	0.89	52.3
Approach		63	3.3	0.165	9.9	LOS A	0.7	5.2	0.80	0.89	52.2
East: Albion St - eastern leg											
4	L2	4	0.0	0.850	4.8	LOS A	17.9	227.7	0.96	0.52	49.8
5	T1	14	61.5	0.850	6.1	LOS A	17.9	227.7	0.96	0.52	49.7
6	R2	838	96.7	0.850	11.8	LOS A	17.9	227.7	0.96	0.52	47.7
Approach		856	95.7	0.850	11.6	LOS A	17.9	227.7	0.96	0.52	47.7
North: O'Connell Rd - northern leg											
7	L2	849	95.5	0.792	5.3	LOS A	17.5	216.4	0.47	0.39	50.7
8	T1	53	8.0	0.792	4.4	LOS A	17.5	216.4	0.47	0.39	54.5
9	R2	6	0.0	0.792	9.0	LOS A	17.5	216.4	0.47	0.39	54.7
Approach		908	89.8	0.792	5.3	LOS A	17.5	216.4	0.47	0.39	50.9
West: Abercrombie Rd - western leg											
10	L2	5	0.0	0.055	8.2	LOS A	0.2	1.9	0.81	0.90	50.2
11	T1	9	55.6	0.055	12.7	LOS A	0.2	1.9	0.81	0.90	50.2
12	R2	1	0.0	0.055	13.1	LOS A	0.2	1.9	0.81	0.90	51.4
Approach		16	33.3	0.055	11.2	LOS A	0.2	1.9	0.81	0.90	50.3
All Vehicles		1843	89.1	0.850	8.4	LOS A	17.9	227.7	0.72	0.47	49.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:22:15 AM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Existing]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Existing
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: O'Connell Rd - southern leg											
1	L2	2	0.0	0.043	4.0	LOS A	0.2	1.6	0.12	0.40	54.9
2	T1	54	13.7	0.043	4.3	LOS A	0.2	1.6	0.12	0.40	55.9
3	R2	1	0.0	0.043	8.8	LOS A	0.2	1.6	0.12	0.40	56.2
Approach		57	13.0	0.043	4.4	LOS A	0.2	1.6	0.12	0.40	55.9
East: Albion St - eastern leg											
4	L2	2	50.0	0.018	4.8	LOS A	0.1	0.6	0.21	0.56	50.9
5	T1	5	20.0	0.018	4.6	LOS A	0.1	0.6	0.21	0.56	53.1
6	R2	15	7.1	0.018	9.1	LOS A	0.1	0.6	0.21	0.56	53.2
Approach		22	14.3	0.018	7.7	LOS A	0.1	0.6	0.21	0.56	53.0
North: O'Connell Rd - northern leg											
7	L2	28	29.6	0.077	4.3	LOS A	0.4	3.0	0.14	0.43	53.7
8	T1	65	9.7	0.077	4.3	LOS A	0.4	3.0	0.14	0.43	55.8
9	R2	8	12.5	0.077	9.0	LOS A	0.4	3.0	0.14	0.43	55.4
Approach		102	15.5	0.077	4.7	LOS A	0.4	3.0	0.14	0.43	55.2
West: Abercrombie Rd - western leg											
10	L2	7	14.3	0.032	4.3	LOS A	0.1	1.3	0.21	0.45	53.6
11	T1	23	50.0	0.032	5.0	LOS A	0.1	1.3	0.21	0.45	54.2
12	R2	4	0.0	0.032	9.0	LOS A	0.1	1.3	0.21	0.45	55.3
Approach		35	36.4	0.032	5.3	LOS A	0.1	1.3	0.21	0.45	54.2
All Vehicles		216	18.0	0.077	5.0	LOS A	0.4	3.0	0.16	0.44	54.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Monday, 12 September 2016 12:32:24 PM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Existing A1]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Assessment 1

Roundabout

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: O'Connell Rd - southern leg											
1	L2	13	0.0	0.301	4.8	LOS A	1.8	13.9	0.44	0.51	53.4
2	T1	322	13.7	0.301	5.2	LOS A	1.8	13.9	0.44	0.51	54.4
3	R2	6	0.0	0.301	9.6	LOS A	1.8	13.9	0.44	0.51	54.7
Approach		341	13.0	0.301	5.3	LOS A	1.8	13.9	0.44	0.51	54.4
East: Albion St - eastern leg											
4	L2	13	50.0	0.162	7.4	LOS A	0.8	5.9	0.59	0.75	49.9
5	T1	32	20.0	0.162	6.6	LOS A	0.8	5.9	0.59	0.75	51.9
6	R2	88	7.1	0.162	10.8	LOS A	0.8	5.9	0.59	0.75	52.1
Approach		133	14.3	0.162	9.5	LOS A	0.8	5.9	0.59	0.75	51.8
North: O'Connell Rd - northern leg											
7	L2	171	29.6	0.552	5.9	LOS A	4.5	35.6	0.64	0.60	51.7
8	T1	392	9.7	0.552	5.6	LOS A	4.5	35.6	0.64	0.60	53.6
9	R2	51	12.5	0.552	10.4	LOS A	4.5	35.6	0.64	0.60	53.3
Approach		613	15.5	0.552	6.1	LOS A	4.5	35.6	0.64	0.60	53.1
West: Abercrombie Rd - western leg											
10	L2	44	14.3	0.273	6.2	LOS A	1.3	11.9	0.60	0.71	52.0
11	T1	139	50.0	0.273	7.6	LOS A	1.3	11.9	0.60	0.71	52.5
12	R2	25	0.0	0.273	10.6	LOS A	1.3	11.9	0.60	0.71	53.6
Approach		208	36.4	0.273	7.7	LOS A	1.3	11.9	0.60	0.71	52.5
All Vehicles		1295	18.0	0.552	6.5	LOS A	4.5	35.6	0.58	0.61	53.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:22:39 AM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Existing A3]**

Site 2: O'Connell Rd - Abercrombie Rd - Albion St (PM) Peak - Assessment 3
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
South: O'Connell Rd - southern leg											
1	L2	2	0.0	0.163	8.9	LOS A	0.7	5.5	0.81	0.89	51.0
2	T1	54	13.7	0.163	10.2	LOS A	0.7	5.5	0.81	0.89	51.9
3	R2	1	0.0	0.163	13.8	LOS A	0.7	5.5	0.81	0.89	52.1
Approach		57	13.0	0.163	10.2	LOS A	0.7	5.5	0.81	0.89	51.8
East: Albion St - eastern leg											
4	L2	2	50.0	0.863	6.1	LOS A	17.6	226.1	1.00	0.58	48.4
5	T1	5	20.0	0.863	5.6	LOS A	17.6	226.1	1.00	0.58	50.4
6	R2	815	98.3	0.863	12.3	LOS A	17.6	226.1	1.00	0.58	47.5
Approach		822	97.7	0.863	12.3	LOS A	17.6	226.1	1.00	0.58	47.5
North: O'Connell Rd - northern leg											
7	L2	828	97.6	0.826	5.9	LOS A	19.9	246.9	0.76	0.40	49.5
8	T1	65	9.7	0.826	4.7	LOS A	19.9	246.9	0.76	0.40	53.1
9	R2	8	12.5	0.826	9.4	LOS A	19.9	246.9	0.76	0.40	52.8
Approach		902	90.4	0.826	5.8	LOS A	19.9	246.9	0.76	0.40	49.8
West: Abercrombie Rd - western leg											
10	L2	7	14.3	0.124	9.4	LOS A	0.5	4.6	0.83	0.91	49.4
11	T1	23	50.0	0.124	12.5	LOS A	0.5	4.6	0.83	0.91	49.8
12	R2	4	0.0	0.124	13.3	LOS A	0.5	4.6	0.83	0.91	50.8
Approach		35	36.4	0.124	11.9	LOS A	0.5	4.6	0.83	0.91	49.8
All Vehicles		1816	90.3	0.863	9.0	LOS A	19.9	246.9	0.87	0.51	48.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

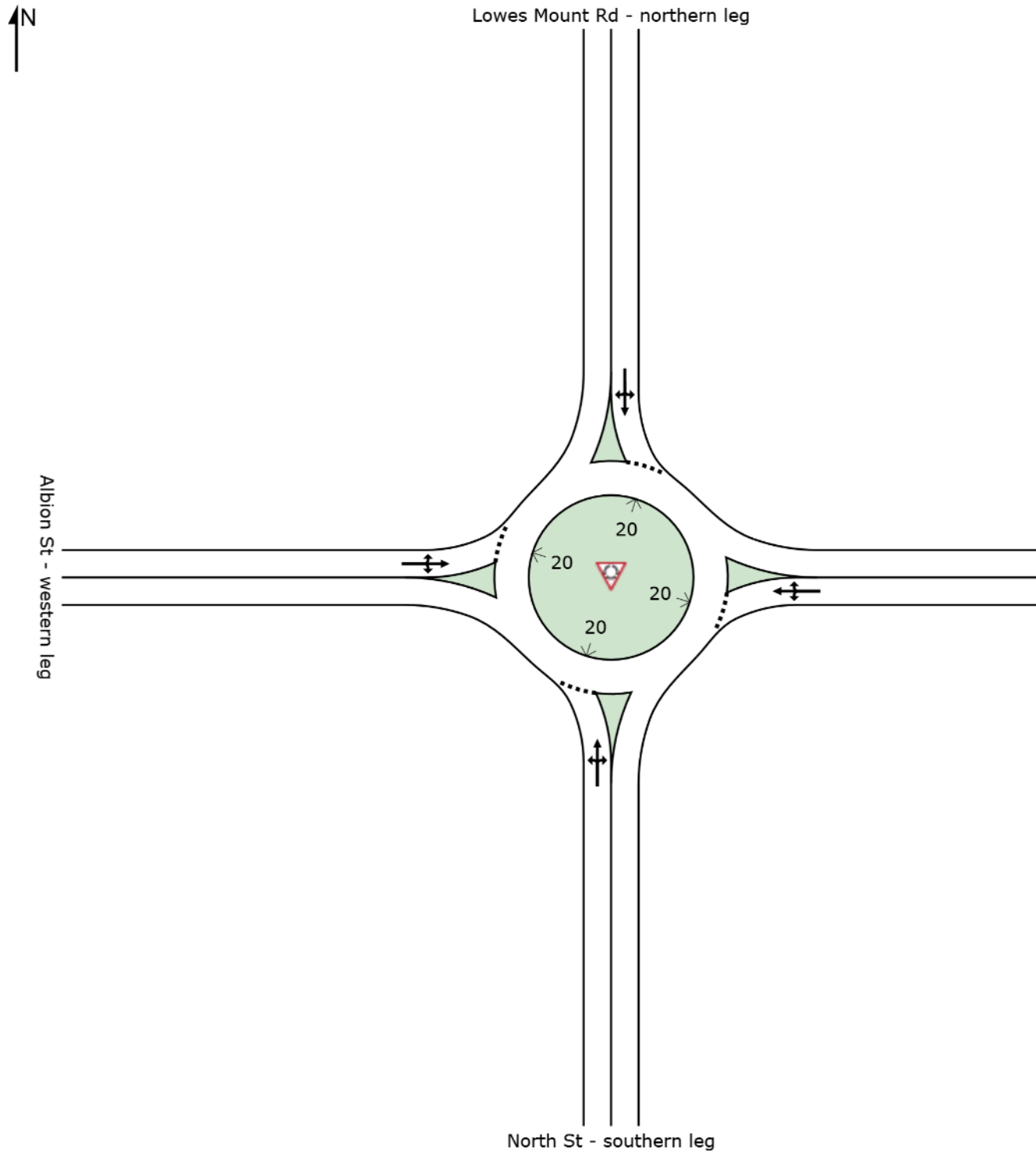
Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:22:59 AM

Project: \\AUSYFP01\Group\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 2 - O'Connell Rd - Abercrombie Rd - Albion St FR.sip7

SITE LAYOUT

Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Existing]

Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Existing
Roundabout



Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY

Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Existing]

Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Existing
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	23	4.5	0.080	4.2	LOS A	0.4	3.0	0.22	0.53	53.2
2	T1	27	0.0	0.080	4.4	LOS A	0.4	3.0	0.22	0.53	54.6
3	R2	48	26.1	0.080	9.4	LOS A	0.4	3.0	0.22	0.53	53.5
Approach		99	13.8	0.080	6.8	LOS A	0.4	3.0	0.22	0.53	53.7
East: Albion St - eastern leg											
4	L2	47	6.7	0.084	4.2	LOS A	0.4	3.4	0.21	0.46	54.3
5	T1	41	30.8	0.084	4.7	LOS A	0.4	3.4	0.21	0.46	55.1
6	R2	13	50.0	0.084	9.7	LOS A	0.4	3.4	0.21	0.46	53.7
Approach		101	21.9	0.084	5.1	LOS A	0.4	3.4	0.21	0.46	54.5
North: Lowes Mount Rd - northern leg											
7	L2	20	57.9	0.055	5.2	LOS A	0.2	2.1	0.27	0.48	52.1
8	T1	32	3.3	0.055	4.6	LOS A	0.2	2.1	0.27	0.48	55.0
9	R2	11	10.0	0.055	9.3	LOS A	0.2	2.1	0.27	0.48	54.6
Approach		62	22.0	0.055	5.6	LOS A	0.2	2.1	0.27	0.48	53.9
West: Albion St - western leg											
10	L2	5	0.0	0.052	4.3	LOS A	0.2	2.0	0.25	0.52	53.0
11	T1	29	39.3	0.052	5.0	LOS A	0.2	2.0	0.25	0.52	53.3
12	R2	24	13.0	0.052	9.3	LOS A	0.2	2.0	0.25	0.52	53.7
Approach		59	25.0	0.052	6.7	LOS A	0.2	2.0	0.25	0.52	53.5
All Vehicles		321	20.0	0.084	6.0	LOS A	0.4	3.4	0.23	0.50	54.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - A1 Existing to Final year]**

Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Assessment 1

Roundabout

Design Life Analysis (Final Year): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	139	4.5	0.702	9.3	LOS A	6.9	53.9	0.91	1.05	49.8
2	T1	164	0.0	0.702	9.3	LOS A	6.9	53.9	0.91	1.05	51.1
3	R2	291	26.1	0.702	15.1	LOS B	6.9	53.9	0.91	1.05	50.1
Approach		594	13.8	0.702	12.1	LOS A	6.9	53.9	0.91	1.05	50.3
East: Albion St - eastern leg											
4	L2	284	6.7	0.708	9.4	LOS A	7.1	58.8	0.89	1.03	50.6
5	T1	246	30.8	0.708	10.6	LOS A	7.1	58.8	0.89	1.03	51.3
6	R2	76	50.0	0.708	16.2	LOS B	7.1	58.8	0.89	1.03	50.1
Approach		606	21.9	0.708	10.7	LOS A	7.1	58.8	0.89	1.03	50.8
North: Lowes Mount Rd - northern leg											
7	L2	120	57.9	0.554	11.7	LOS A	3.5	28.8	0.80	0.97	49.1
8	T1	189	3.3	0.554	9.0	LOS A	3.5	28.8	0.80	0.97	51.7
9	R2	63	10.0	0.554	13.9	LOS A	3.5	28.8	0.80	0.97	51.4
Approach		373	22.0	0.554	10.7	LOS A	3.5	28.8	0.80	0.97	50.8
West: Albion St - western leg											
10	L2	32	0.0	0.522	7.8	LOS A	3.4	28.7	0.80	0.96	50.4
11	T1	177	39.3	0.522	9.7	LOS A	3.4	28.7	0.80	0.96	50.7
12	R2	145	13.0	0.522	13.2	LOS A	3.4	28.7	0.80	0.96	51.0
Approach		354	25.0	0.522	11.0	LOS A	3.4	28.7	0.80	0.96	50.8
All Vehicles		1926	20.0	0.708	11.2	LOS A	7.1	58.8	0.86	1.01	50.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Friday, 9 September 2016 2:47:25 PM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - A2 Existing to LoS B]**

Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Assessment 2

Roundabout

Design Life Analysis (Practical Capacity): Results for 90 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	127	4.5	0.617	7.8	LOS A	5.2	41.0	0.82	0.94	50.7
2	T1	151	0.0	0.617	7.9	LOS A	5.2	41.0	0.82	0.94	52.0
3	R2	266	26.1	0.617	13.5	LOS A	5.2	41.0	0.82	0.94	51.0
Approach		544	13.8	0.617	10.6	LOS A	5.2	41.0	0.82	0.94	51.2
East: Albion St - eastern leg											
4	L2	261	6.7	0.628	7.9	LOS A	5.4	45.0	0.80	0.91	51.6
5	T1	226	30.8	0.628	9.0	LOS A	5.4	45.0	0.80	0.91	52.3
6	R2	69	50.0	0.628	14.5	LOS B	5.4	45.0	0.80	0.91	51.1
Approach		556	21.9	0.628	9.2	LOS A	5.4	45.0	0.80	0.91	51.8
North: Lowes Mount Rd - northern leg											
7	L2	110	57.9	0.482	10.5	LOS A	2.8	23.2	0.75	0.92	49.8
8	T1	174	3.3	0.482	8.0	LOS A	2.8	23.2	0.75	0.92	52.5
9	R2	58	10.0	0.482	13.0	LOS A	2.8	23.2	0.75	0.92	52.1
Approach		342	22.0	0.482	9.7	LOS A	2.8	23.2	0.75	0.92	51.5
West: Albion St - western leg											
10	L2	29	0.0	0.451	6.9	LOS A	2.7	22.8	0.74	0.89	50.9
11	T1	162	39.3	0.451	8.7	LOS A	2.7	22.8	0.74	0.89	51.2
12	R2	133	13.0	0.451	12.3	LOS A	2.7	22.8	0.74	0.89	51.5
Approach		324	25.0	0.451	10.0	LOS A	2.7	22.8	0.74	0.89	51.3
All Vehicles		1766	20.0	0.628	9.9	LOS A	5.4	45.0	0.78	0.92	51.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Friday, 9 September 2016 2:54:49 PM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY



Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - A3]

Site 3: Lowes Mount Rd - Albion St - North St (AM) Peak - Assessment 3
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	23	4.5	0.152	6.7	LOS A	0.7	5.1	0.66	0.82	51.4
2	T1	27	0.0	0.152	6.7	LOS A	0.7	5.1	0.66	0.82	52.7
3	R2	48	26.1	0.152	12.5	LOS A	0.7	5.1	0.66	0.82	51.7
Approach		99	13.8	0.152	9.6	LOS A	0.7	5.1	0.66	0.82	51.9
East: Albion St - eastern leg											
4	L2	47	6.7	0.607	7.2	LOS A	5.2	61.6	0.77	0.83	51.3
5	T1	41	30.8	0.607	8.1	LOS A	5.2	61.6	0.77	0.83	52.0
6	R2	348	98.2	0.607	15.2	LOS B	5.2	61.6	0.77	0.83	49.1
Approach		437	81.9	0.607	13.7	LOS A	5.2	61.6	0.77	0.83	49.6
North: Lowes Mount Rd - northern leg											
7	L2	356	97.6	0.592	6.6	LOS A	5.3	65.9	0.60	0.57	49.8
8	T1	32	3.3	0.592	5.0	LOS A	5.3	65.9	0.60	0.57	53.6
9	R2	145	93.5	0.592	11.5	LOS A	5.3	65.9	0.60	0.57	50.2
Approach		533	90.9	0.592	7.9	LOS A	5.3	65.9	0.60	0.57	50.1
West: Albion St - western leg											
10	L2	141	96.3	0.407	11.8	LOS A	2.1	24.2	0.75	0.92	47.1
11	T1	29	39.3	0.407	9.0	LOS A	2.1	24.2	0.75	0.92	49.7
12	R2	24	13.0	0.407	12.6	LOS A	2.1	24.2	0.75	0.92	50.0
Approach		195	77.3	0.407	11.5	LOS A	2.1	24.2	0.75	0.92	47.8
All Vehicles		1263	79.7	0.607	10.5	LOS A	5.3	65.9	0.69	0.73	49.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:53:24 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY

Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (PM) Peak - Existing]

Site 3: Lowes Mount Rd - Albion St -North St (PM) Peak - Existing
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	28	3.7	0.107	4.2	LOS A	0.5	4.0	0.21	0.53	53.1
2	T1	47	13.3	0.107	4.5	LOS A	0.5	4.0	0.21	0.53	54.2
3	R2	62	8.5	0.107	9.1	LOS A	0.5	4.0	0.21	0.53	54.1
Approach		138	9.2	0.107	6.5	LOS A	0.5	4.0	0.21	0.53	53.9
East: Albion St - eastern leg											
4	L2	66	9.5	0.096	4.5	LOS A	0.5	3.8	0.29	0.49	54.0
5	T1	27	34.6	0.096	5.0	LOS A	0.5	3.8	0.29	0.49	54.8
6	R2	14	53.8	0.096	10.1	LOS A	0.5	3.8	0.29	0.49	53.4
Approach		107	21.6	0.096	5.4	LOS A	0.5	3.8	0.29	0.49	54.1
North: Lowes Mount Rd - northern leg											
7	L2	18	47.1	0.083	5.4	LOS A	0.4	3.0	0.34	0.52	52.1
8	T1	55	0.0	0.083	4.8	LOS A	0.4	3.0	0.34	0.52	54.8
9	R2	19	22.2	0.083	9.8	LOS A	0.4	3.0	0.34	0.52	53.8
Approach		92	13.8	0.083	6.0	LOS A	0.4	3.0	0.34	0.52	54.0
West: Albion St - western leg											
10	L2	12	27.3	0.101	4.9	LOS A	0.5	4.1	0.31	0.53	52.0
11	T1	58	43.6	0.101	5.3	LOS A	0.5	4.1	0.31	0.53	53.0
12	R2	39	2.7	0.101	9.3	LOS A	0.5	4.1	0.31	0.53	53.9
Approach		108	27.2	0.101	6.7	LOS A	0.5	4.1	0.31	0.53	53.2
All Vehicles		445	17.5	0.107	6.2	LOS A	0.5	4.1	0.28	0.52	53.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

 **Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (PM) Peak - A1 Existing to Final year]**

Site 3: Lowes Mount Rd - Albion St -North St (PM) Peak - Assessment 1

Roundabout

Design Life Analysis (Practical Capacity): Results for 78 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	139	3.7	0.685	8.0	LOS A	7.1	53.5	0.86	0.92	50.5
2	T1	232	13.3	0.685	8.6	LOS A	7.1	53.5	0.86	0.92	51.5
3	R2	304	8.5	0.685	13.0	LOS A	7.1	53.5	0.86	0.92	51.4
Approach		676	9.2	0.685	10.5	LOS A	7.1	53.5	0.86	0.92	51.2
East: Albion St - eastern leg											
4	L2	325	9.5	0.723	10.9	LOS A	6.5	54.2	0.91	1.10	49.5
5	T1	134	34.6	0.723	12.4	LOS A	6.5	54.2	0.91	1.10	50.2
6	R2	67	53.8	0.723	18.2	LOS B	6.5	54.2	0.91	1.10	49.0
Approach		526	21.6	0.723	12.2	LOS A	6.5	54.2	0.91	1.10	49.6
North: Lowes Mount Rd - northern leg											
7	L2	88	47.1	0.757	15.5	LOS B	5.9	46.4	0.93	1.13	47.1
8	T1	268	0.0	0.757	12.7	LOS A	5.9	46.4	0.93	1.13	49.3
9	R2	93	22.2	0.757	18.7	LOS B	5.9	46.4	0.93	1.13	48.5
Approach		449	13.8	0.757	14.5	LOS A	5.9	46.4	0.93	1.13	48.7
West: Albion St - western leg											
10	L2	57	27.3	0.847	17.2	LOS B	9.4	81.1	1.00	1.29	44.7
11	T1	284	43.6	0.847	18.4	LOS B	9.4	81.1	1.00	1.29	45.5
12	R2	191	2.7	0.847	20.7	LOS B	9.4	81.1	1.00	1.29	46.1
Approach		531	27.2	0.847	19.1	LOS B	9.4	81.1	1.00	1.29	45.6
All Vehicles		2182	17.5	0.847	13.8	LOS A	9.4	81.1	0.92	1.10	48.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Friday, 9 September 2016 2:48:06 PM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (PM) Peak - A2 Existing to LoS B]**

Site 3: Lowes Mount Rd - Albion St -North St (PM) Peak - Assessment 2

Roundabout

Design Life Analysis (Practical Capacity): Results for 61 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	115	3.7	0.533	5.9	LOS A	4.0	30.1	0.68	0.72	51.6
2	T1	192	13.3	0.533	6.4	LOS A	4.0	30.1	0.68	0.72	52.6
3	R2	252	8.5	0.533	10.9	LOS A	4.0	30.1	0.68	0.72	52.6
Approach		558	9.2	0.533	8.3	LOS A	4.0	30.1	0.68	0.72	52.4
East: Albion St - eastern leg											
4	L2	269	9.5	0.541	7.7	LOS A	3.8	31.3	0.76	0.91	51.8
5	T1	111	34.6	0.541	8.9	LOS A	3.8	31.3	0.76	0.91	52.5
6	R2	55	53.8	0.541	14.6	LOS B	3.8	31.3	0.76	0.91	51.2
Approach		435	21.6	0.541	8.9	LOS A	3.8	31.3	0.76	0.91	51.9
North: Lowes Mount Rd - northern leg											
7	L2	72	47.1	0.534	10.8	LOS A	3.3	25.8	0.80	0.96	49.8
8	T1	222	0.0	0.534	8.6	LOS A	3.3	25.8	0.80	0.96	52.3
9	R2	77	22.2	0.534	14.3	LOS A	3.3	25.8	0.80	0.96	51.4
Approach		371	13.8	0.534	10.2	LOS A	3.3	25.8	0.80	0.96	51.6
West: Albion St - western leg											
10	L2	47	27.3	0.610	9.8	LOS A	4.5	39.2	0.83	1.01	49.1
11	T1	234	43.6	0.610	10.7	LOS A	4.5	39.2	0.83	1.01	50.0
12	R2	158	2.7	0.610	13.5	LOS A	4.5	39.2	0.83	1.01	50.8
Approach		439	27.2	0.610	11.6	LOS A	4.5	39.2	0.83	1.01	50.2
All Vehicles		1803	17.5	0.610	9.6	LOS A	4.5	39.2	0.76	0.88	51.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Friday, 9 September 2016 2:58:10 PM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

MOVEMENT SUMMARY

 **Site: 1 [Site 3: Lowes Mount Rd - Albion St - North St (PM) Peak - A3]**

Site 3: Lowes Mount Rd - Albion St -North St (PM) Peak - Assessment 3
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North St - southern leg											
1	L2	28	3.7	0.193	6.6	LOS A	0.9	6.5	0.66	0.81	51.4
2	T1	47	13.3	0.193	7.2	LOS A	0.9	6.5	0.66	0.81	52.4
3	R2	62	8.5	0.193	11.6	LOS A	0.9	6.5	0.66	0.81	52.4
Approach		138	9.2	0.193	9.0	LOS A	0.9	6.5	0.66	0.81	52.2
East: Albion St - eastern leg											
4	L2	66	9.5	0.597	7.4	LOS A	4.9	57.7	0.78	0.86	51.0
5	T1	27	34.6	0.597	8.4	LOS A	4.9	57.7	0.78	0.86	51.7
6	R2	320	98.0	0.597	15.5	LOS B	4.9	57.7	0.78	0.86	48.9
Approach		414	79.6	0.597	13.8	LOS A	4.9	57.7	0.78	0.86	49.4
North: Lowes Mount Rd - northern leg											
7	L2	324	97.1	0.626	8.1	LOS A	5.8	70.0	0.72	0.67	49.2
8	T1	55	0.0	0.626	5.9	LOS A	5.8	70.0	0.72	0.67	53.1
9	R2	141	89.6	0.626	12.9	LOS A	5.8	70.0	0.72	0.67	49.8
Approach		520	84.8	0.626	9.2	LOS A	5.8	70.0	0.72	0.67	49.8
West: Albion St - western leg											
10	L2	134	93.7	0.442	11.9	LOS A	2.4	26.1	0.76	0.93	47.3
11	T1	58	43.6	0.442	9.4	LOS A	2.4	26.1	0.76	0.93	49.8
12	R2	39	2.7	0.442	12.4	LOS A	2.4	26.1	0.76	0.93	50.5
Approach		231	65.8	0.442	11.4	LOS A	2.4	26.1	0.76	0.93	48.4
All Vehicles		1302	71.8	0.626	11.0	LOS A	5.8	70.0	0.74	0.79	49.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

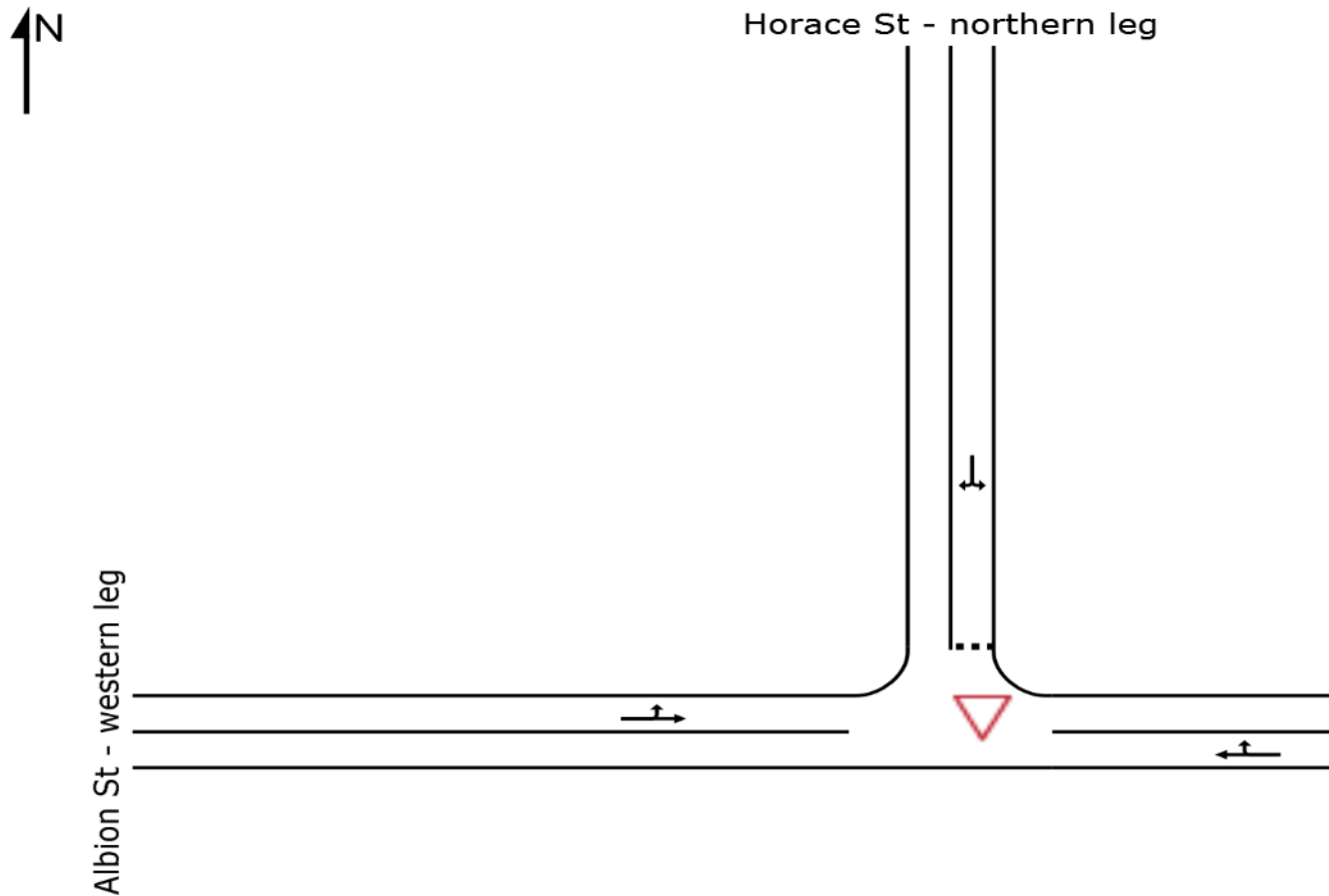
Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 9:54:09 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 3 - Lowes Mount Rd - North St - Albion St FR.sip7

SITE LAYOUT

▽ Site: 1 [Site 4: Horace St - Albion St (AM) Peak - Existing]

Site 4: Horace St - Albion St (AM) Peak - Existing
Giveaway / Yield (Two-Way)



SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Created: Thursday, 15 September 2016 10:15:04 AM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 4 - Horace St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (AM) Peak - Existing]

Site 4: Horace St - Albion St (AM) Peak - Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	86	29.3	0.057	0.0	LOS A	0.1	0.4	0.04	0.05	59.2
6	R2	8	0.0	0.057	5.7	LOS A	0.1	0.4	0.04	0.05	57.0
Approach		95	26.7	0.057	0.5	NA	0.1	0.4	0.04	0.05	59.0
North: Horace St - northern leg											
7	L2	3	0.0	0.011	5.7	LOS A	0.0	0.2	0.20	0.56	53.1
9	R2	9	0.0	0.011	6.0	LOS A	0.0	0.2	0.20	0.56	52.6
Approach		13	0.0	0.011	5.9	LOS A	0.0	0.2	0.20	0.56	52.7
West: Albion St - western leg											
10	L2	12	0.0	0.049	5.5	LOS A	0.0	0.0	0.00	0.09	57.3
11	T1	67	35.9	0.049	0.0	LOS A	0.0	0.0	0.00	0.09	58.9
Approach		79	30.7	0.049	0.8	NA	0.0	0.0	0.00	0.09	58.6
All Vehicles		186	26.6	0.057	1.0	NA	0.1	0.4	0.03	0.10	58.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (AM) Peak - Existing A1]

Site 4: Horace St - Albion St (AM) Peak - Assessment 1

Giveway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	518	29.3	0.357	0.4	LOS A	0.8	6.6	0.15	0.06	58.7
6	R2	51	0.0	0.357	8.2	LOS A	0.8	6.6	0.15	0.06	56.5
Approach		568	26.7	0.357	1.1	NA	0.8	6.6	0.15	0.06	58.5
North: Horace St - northern leg											
7	L2	19	0.0	0.133	7.0	LOS A	0.4	3.0	0.57	0.80	50.3
9	R2	57	0.0	0.133	10.9	LOS A	0.4	3.0	0.57	0.80	49.9
Approach		76	0.0	0.133	10.0	LOS A	0.4	3.0	0.57	0.80	50.0
West: Albion St - western leg											
10	L2	69	0.0	0.293	5.6	LOS A	0.0	0.0	0.00	0.09	57.2
11	T1	404	35.9	0.293	0.0	LOS A	0.0	0.0	0.00	0.09	58.8
Approach		474	30.7	0.293	0.9	NA	0.0	0.0	0.00	0.09	58.6
All Vehicles		1118	26.6	0.357	1.6	NA	0.8	6.6	0.12	0.12	57.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:00:02 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 4 - Horace St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (AM) Peak - Existing A3]

Site 4: Horace St - Albion St (AM) Peak - Assessment 3
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	574	89.4	0.472	0.2	LOS A	0.2	2.8	0.04	0.01	59.1
6	R2	8	0.0	0.472	11.1	LOS A	0.2	2.8	0.04	0.01	56.9
Approach		582	88.1	0.472	0.3	NA	0.2	2.8	0.04	0.01	59.1
North: Horace St - northern leg											
7	L2	3	0.0	0.034	8.2	LOS A	0.1	0.7	0.71	0.85	48.4
9	R2	9	0.0	0.034	14.5	LOS B	0.1	0.7	0.71	0.85	47.9
Approach		13	0.0	0.034	12.9	LOS A	0.1	0.7	0.71	0.85	48.0
West: Albion St - western leg											
10	L2	12	0.0	0.461	5.6	LOS A	0.0	0.0	0.00	0.01	57.1
11	T1	555	92.2	0.461	0.1	LOS A	0.0	0.0	0.00	0.01	58.7
Approach		566	90.3	0.461	0.2	NA	0.0	0.0	0.00	0.01	58.6
All Vehicles		1161	88.2	0.472	0.4	NA	0.2	2.8	0.03	0.02	58.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (PM) Peak - Existing]

Site 4: Horace St - Albion St (PM) Peak - Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	94	23.6	0.063	0.1	LOS A	0.1	0.7	0.06	0.07	59.1
6	R2	12	9.1	0.063	6.0	LOS A	0.1	0.7	0.06	0.07	56.4
Approach		105	22.0	0.063	0.7	NA	0.1	0.7	0.06	0.07	58.8
North: Horace St - northern leg											
7	L2	7	0.0	0.018	5.9	LOS A	0.1	0.5	0.24	0.57	52.9
9	R2	13	16.7	0.018	6.5	LOS A	0.1	0.5	0.24	0.57	51.7
Approach		20	10.5	0.018	6.3	LOS A	0.1	0.5	0.24	0.57	52.1
West: Albion St - western leg											
10	L2	6	16.7	0.072	5.7	LOS A	0.0	0.0	0.00	0.03	57.2
11	T1	116	23.6	0.072	0.0	LOS A	0.0	0.0	0.00	0.03	59.7
Approach		122	23.3	0.072	0.3	NA	0.0	0.0	0.00	0.03	59.5
All Vehicles		247	21.7	0.072	1.0	NA	0.1	0.7	0.05	0.09	58.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (PM) Peak - Existing A1]

Site 4: Horace St - Albion St (PM) Peak - Assessment 1

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	562	23.6	0.414	1.3	LOS A	1.8	14.9	0.26	0.09	57.7
6	R2	69	9.1	0.414	11.0	LOS A	1.8	14.9	0.26	0.09	55.1
Approach		632	22.0	0.414	2.4	NA	1.8	14.9	0.26	0.09	57.4
North: Horace St - northern leg											
7	L2	44	0.0	0.303	9.3	LOS A	1.1	8.5	0.73	0.93	47.4
9	R2	76	16.7	0.303	17.5	LOS B	1.1	8.5	0.73	0.93	46.4
Approach		120	10.5	0.303	14.5	LOS B	1.1	8.5	0.73	0.93	46.8
West: Albion St - western leg											
10	L2	38	16.7	0.434	5.8	LOS A	0.0	0.0	0.00	0.03	57.1
11	T1	695	23.6	0.434	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		733	23.3	0.434	0.4	NA	0.0	0.0	0.00	0.03	59.4
All Vehicles		1484	21.7	0.434	2.4	NA	1.8	14.9	0.17	0.13	57.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:00:36 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 4 - Horace St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (PM) Peak - Existing A2]

Site 4: Horace St - Albion St (PM) Peak - Assessment 2

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 86 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	497	23.6	0.360	0.9	LOS A	1.3	10.5	0.23	0.08	58.1
6	R2	61	9.1	0.360	9.8	LOS A	1.3	10.5	0.23	0.08	55.5
Approach		558	22.0	0.360	1.9	NA	1.3	10.5	0.23	0.08	57.8
North: Horace St - northern leg											
7	L2	39	0.0	0.230	8.2	LOS A	0.8	6.1	0.67	0.86	48.9
9	R2	67	16.7	0.230	14.6	LOS B	0.8	6.1	0.67	0.86	47.8
Approach		106	10.5	0.230	12.3	LOS A	0.8	6.1	0.67	0.86	48.2
West: Albion St - western leg											
10	L2	33	16.7	0.383	5.8	LOS A	0.0	0.0	0.00	0.03	57.2
11	T1	614	23.6	0.383	0.1	LOS A	0.0	0.0	0.00	0.03	59.6
Approach		647	23.3	0.383	0.4	NA	0.0	0.0	0.00	0.03	59.4
All Vehicles		1311	21.7	0.383	2.0	NA	1.3	10.5	0.15	0.12	57.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:00:59 AM

Project: I:\projects\30011699 - Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 4 - Horace St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 4: Horace St - Albion St (PM) Peak - Existing A3]

Site 4: Horace St - Albion St (PM) Peak - Assessment 3
 Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - western leg											
5	T1	498	85.6	0.408	0.2	LOS A	0.3	3.2	0.05	0.02	59.0
6	R2	12	9.1	0.408	10.4	LOS A	0.3	3.2	0.05	0.02	56.4
Approach		509	83.9	0.408	0.4	NA	0.3	3.2	0.05	0.02	59.0
North: Horace St - northern leg											
7	L2	7	0.0	0.049	7.9	LOS A	0.1	1.1	0.66	0.81	48.8
9	R2	13	16.7	0.049	14.9	LOS B	0.1	1.1	0.66	0.81	47.8
Approach		20	10.5	0.049	12.3	LOS A	0.1	1.1	0.66	0.81	48.2
West: Albion St - western leg											
10	L2	6	16.7	0.414	5.8	LOS A	0.0	0.0	0.00	0.01	57.1
11	T1	520	83.0	0.414	0.1	LOS A	0.0	0.0	0.00	0.01	59.5
Approach		526	82.2	0.414	0.2	NA	0.0	0.0	0.00	0.01	59.5
All Vehicles		1056	81.7	0.414	0.5	NA	0.3	3.2	0.04	0.03	59.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

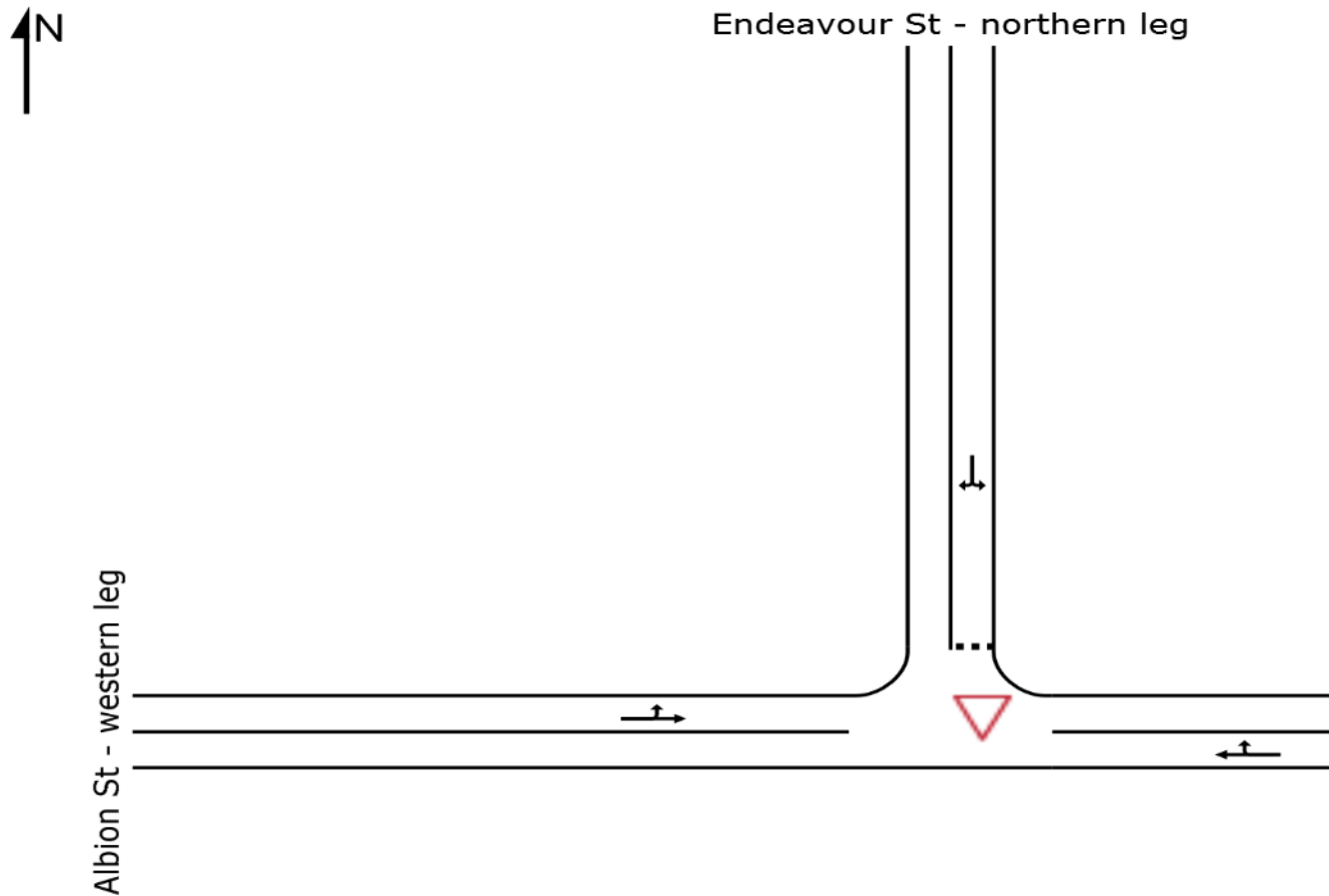
Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

▽ Site: 1 [Site 5: Endeavour St - Albion St (AM) Peak - Existing]

Site 5: Endeavour St - Albion St (AM) Peak - Existing
Giveway / Yield (Two-Way)



SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Created: Thursday, 15 September 2016 10:21:37 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 5 - Endeavour St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (AM) Peak - Existing]

Site 5: Endeavour St - Albion St (AM) Peak - Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	82	23.1	0.050	0.0	LOS A	0.0	0.1	0.01	0.02	59.9
6	R2	1	100.0	0.050	6.6	LOS A	0.0	0.1	0.01	0.02	55.0
Approach		83	24.1	0.050	0.2	NA	0.0	0.1	0.01	0.02	59.8
North: Endeavour St - northern leg											
7	L2	2	50.0	0.010	6.4	LOS A	0.0	0.4	0.21	0.56	51.0
9	R2	6	83.3	0.010	7.4	LOS A	0.0	0.4	0.21	0.56	49.0
Approach		8	75.0	0.010	7.2	LOS A	0.0	0.4	0.21	0.56	49.5
West: Albion St - western leg											
10	L2	12	72.7	0.044	6.4	LOS A	0.0	0.0	0.00	0.10	54.5
11	T1	58	25.5	0.044	0.0	LOS A	0.0	0.0	0.00	0.10	59.6
Approach		69	33.3	0.044	1.1	NA	0.0	0.0	0.00	0.10	58.7
All Vehicles		161	30.7	0.050	0.9	NA	0.0	0.4	0.02	0.08	58.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (AM) Peak - Existing A1]

Site 5: Endeavour St - Albion St (AM) Peak - Assessment 1

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	493	23.1	0.302	0.2	LOS A	0.2	1.7	0.03	0.02	59.7
6	R2	6	100.0	0.302	11.4	LOS A	0.2	1.7	0.03	0.02	54.9
Approach		499	24.1	0.302	0.4	NA	0.2	1.7	0.03	0.02	59.6
North: Endeavour St - northern leg											
7	L2	13	50.0	0.151	8.0	LOS A	0.5	5.5	0.65	0.79	46.1
9	R2	38	83.3	0.151	17.1	LOS B	0.5	5.5	0.65	0.79	44.5
Approach		51	75.0	0.151	14.8	LOS B	0.5	5.5	0.65	0.79	44.9
West: Albion St - western leg											
10	L2	69	72.7	0.264	6.4	LOS A	0.0	0.0	0.00	0.10	54.5
11	T1	347	25.5	0.264	0.0	LOS A	0.0	0.0	0.00	0.10	59.6
Approach		417	33.3	0.264	1.1	NA	0.0	0.0	0.00	0.10	58.7
All Vehicles		966	30.7	0.302	1.4	NA	0.5	5.5	0.05	0.09	58.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:19:46 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 5 - Endeavour St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (AM) Peak - Existing A2]

Site 5: Endeavour St - Albion St (AM) Peak - Assessment 2

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 82 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	419	23.1	0.256	0.1	LOS A	0.1	1.1	0.03	0.02	59.8
6	R2	5	100.0	0.256	10.1	LOS A	0.1	1.1	0.03	0.02	54.9
Approach		424	24.1	0.256	0.3	NA	0.1	1.1	0.03	0.02	59.7
North: Endeavour St - northern leg											
7	L2	11	50.0	0.108	7.7	LOS A	0.3	4.0	0.57	0.75	47.3
9	R2	32	83.3	0.108	14.5	LOS B	0.3	4.0	0.57	0.75	45.6
Approach		43	75.0	0.108	12.8	LOS A	0.3	4.0	0.57	0.75	46.0
West: Albion St - western leg											
10	L2	59	72.7	0.225	6.4	LOS A	0.0	0.0	0.00	0.10	54.5
11	T1	295	25.5	0.225	0.0	LOS A	0.0	0.0	0.00	0.10	59.6
Approach		354	33.3	0.225	1.1	NA	0.0	0.0	0.00	0.10	58.7
All Vehicles		821	30.7	0.256	1.3	NA	0.3	4.0	0.04	0.09	58.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:20:01 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 5 - Endeavour St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (AM) Peak - Existing A3]

Site 5: Endeavour St - Albion St (AM) Peak - Assessment 3
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	337	81.3	0.266	0.0	LOS A	0.0	0.3	0.01	0.00	59.9
6	R2	1	100.0	0.266	10.9	LOS A	0.0	0.3	0.01	0.00	55.0
Approach		338	81.3	0.266	0.1	NA	0.0	0.3	0.01	0.00	59.9
North: Endeavour St - northern leg											
7	L2	2	50.0	0.024	8.2	LOS A	0.1	0.8	0.61	0.74	46.9
9	R2	6	83.3	0.024	15.1	LOS B	0.1	0.8	0.61	0.74	45.2
Approach		8	75.0	0.024	13.4	LOS A	0.1	0.8	0.61	0.74	45.7
West: Albion St - western leg											
10	L2	12	72.7	0.260	6.4	LOS A	0.0	0.0	0.00	0.02	54.5
11	T1	313	86.2	0.260	0.0	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		324	85.7	0.260	0.3	NA	0.0	0.0	0.00	0.02	59.3
All Vehicles		671	83.4	0.266	0.3	NA	0.1	0.8	0.01	0.02	59.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (PM) Peak - Existing]

Site 5: Endeavour St - Albion St (PM) Peak - Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	93	18.2	0.054	0.0	LOS A	0.0	0.1	0.01	0.01	59.9
6	R2	1	0.0	0.054	5.8	LOS A	0.0	0.1	0.01	0.01	57.6
Approach		94	18.0	0.054	0.1	NA	0.0	0.1	0.01	0.01	59.9
North: Endeavour St - northern leg											
7	L2	6	50.0	0.023	6.6	LOS A	0.1	0.7	0.26	0.58	50.9
9	R2	15	42.9	0.023	7.0	LOS A	0.1	0.7	0.26	0.58	50.6
Approach		21	45.0	0.023	6.9	LOS A	0.1	0.7	0.26	0.58	50.7
West: Albion St - western leg											
10	L2	17	62.5	0.073	6.3	LOS A	0.0	0.0	0.00	0.08	55.0
11	T1	105	16.0	0.073	0.0	LOS A	0.0	0.0	0.00	0.08	59.6
Approach		122	22.4	0.073	0.9	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		237	22.7	0.073	1.1	NA	0.1	0.7	0.03	0.10	58.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (PM) Peak - Existing A1]

Site 5: Endeavour St - Albion St (PM) Peak - Assessment 1

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	556	18.2	0.325	0.1	LOS A	0.1	1.1	0.03	0.01	59.8
6	R2	6	0.0	0.325	9.8	LOS A	0.1	1.1	0.03	0.01	57.5
Approach		562	18.0	0.325	0.2	NA	0.1	1.1	0.03	0.01	59.8
North: Endeavour St - northern leg											
7	L2	38	50.0	0.397	12.3	LOS A	1.6	15.2	0.78	0.99	43.9
9	R2	88	42.9	0.397	21.1	LOS B	1.6	15.2	0.78	0.99	43.6
Approach		126	45.0	0.397	18.5	LOS B	1.6	15.2	0.78	0.99	43.7
West: Albion St - western leg											
10	L2	101	62.5	0.436	6.3	LOS A	0.0	0.0	0.00	0.08	54.9
11	T1	632	16.0	0.436	0.1	LOS A	0.0	0.0	0.00	0.08	59.5
Approach		733	22.4	0.436	0.9	NA	0.0	0.0	0.00	0.08	58.8
All Vehicles		1421	22.7	0.436	2.2	NA	1.6	15.2	0.08	0.13	57.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:20:33 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 5 - Endeavour St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (PM) Peak - Existing A2]

Site 5: Endeavour St - Albion St (PM) Peak - Assessment 2

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 74 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	435	18.2	0.254	0.1	LOS A	0.1	0.5	0.02	0.01	59.8
6	R2	5	0.0	0.254	8.3	LOS A	0.1	0.5	0.02	0.01	57.6
Approach		440	18.0	0.254	0.1	NA	0.1	0.5	0.02	0.01	59.8
North: Endeavour St - northern leg											
7	L2	30	50.0	0.233	9.3	LOS A	0.8	8.0	0.65	0.86	46.9
9	R2	69	42.9	0.233	14.6	LOS B	0.8	8.0	0.65	0.86	46.6
Approach		99	45.0	0.233	13.0	LOS A	0.8	8.0	0.65	0.86	46.7
West: Albion St - western leg											
10	L2	79	62.5	0.342	6.3	LOS A	0.0	0.0	0.00	0.08	55.0
11	T1	495	16.0	0.342	0.0	LOS A	0.0	0.0	0.00	0.08	59.5
Approach		574	22.4	0.342	0.9	NA	0.0	0.0	0.00	0.08	58.9
All Vehicles		1113	22.7	0.342	1.7	NA	0.8	8.0	0.07	0.12	57.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:20:50 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 5 - Endeavour St - Albion St FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 5: Endeavour St - Albion St (PM) Peak - Existing A3]

Site 5: Endeavour St - Albion St (PM) Peak - Assessment 3
 Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Albion St - eastern leg											
5	T1	428	82.3	0.338	0.0	LOS A	0.0	0.2	0.00	0.00	59.9
6	R2	1	0.0	0.338	8.7	LOS A	0.0	0.2	0.00	0.00	57.6
Approach		429	82.1	0.338	0.0	NA	0.0	0.2	0.00	0.00	59.9
North: Endeavour St - northern leg											
7	L2	6	50.0	0.058	9.3	LOS A	0.2	1.7	0.66	0.84	46.6
9	R2	15	42.9	0.058	15.4	LOS B	0.2	1.7	0.66	0.84	46.3
Approach		21	45.0	0.058	13.6	LOS A	0.2	1.7	0.66	0.84	46.4
West: Albion St - western leg											
10	L2	17	62.5	0.357	6.3	LOS A	0.0	0.0	0.00	0.02	54.9
11	T1	441	80.0	0.357	0.1	LOS A	0.0	0.0	0.00	0.02	59.5
Approach		458	79.3	0.357	0.3	NA	0.0	0.0	0.00	0.02	59.3
All Vehicles		908	79.8	0.357	0.5	NA	0.2	1.7	0.02	0.03	59.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

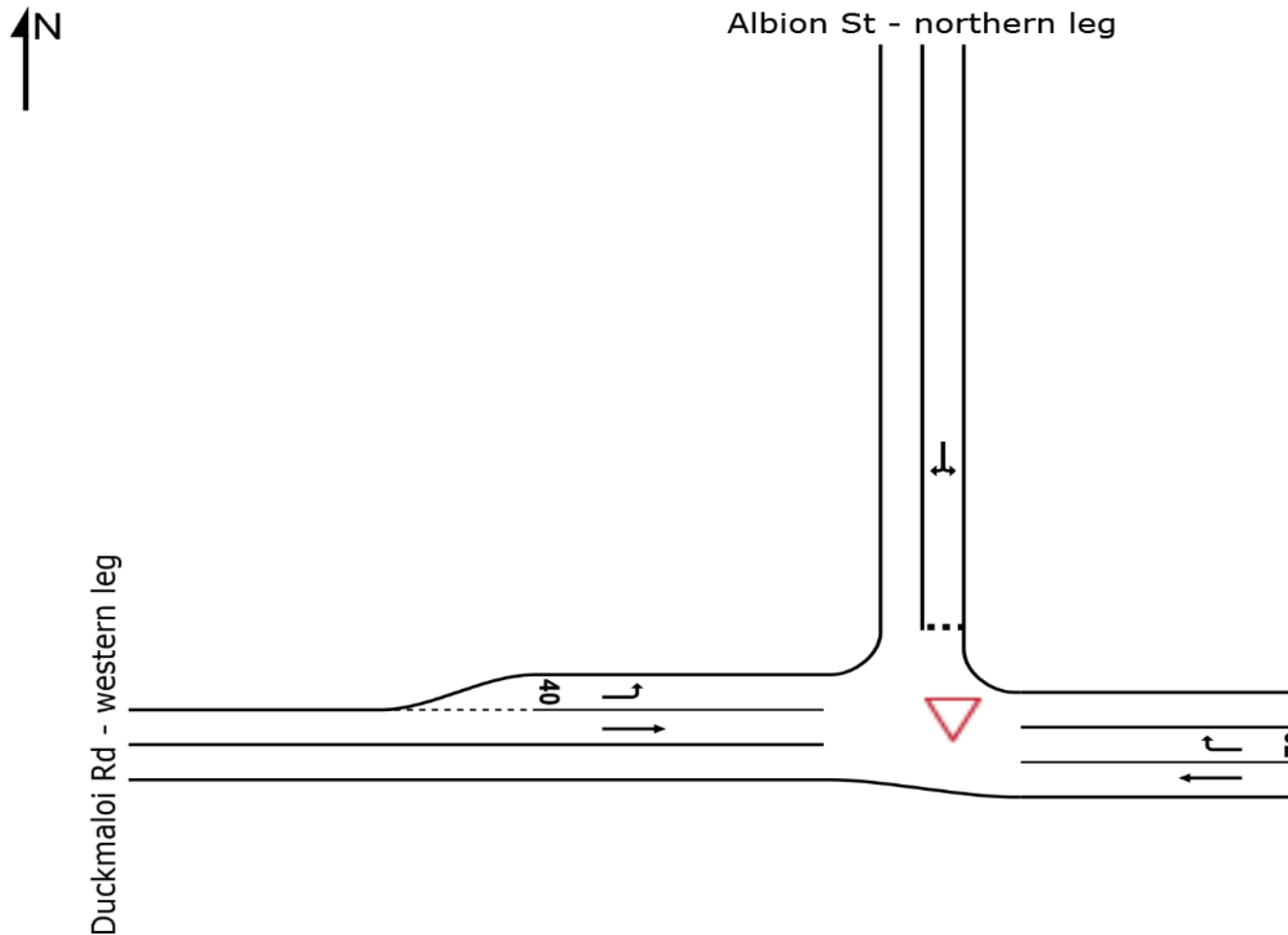
Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 1 [Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing]

Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing
Giveaway / Yield (Two-Way)



SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Created: Thursday, 15 September 2016 10:50:32 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 8 - Albion St - Duckmaloi Rd FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing]

Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Duckmaloi Rd - eastern leg											
5	T1	53	8.0	0.028	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	27	42.3	0.024	6.1	LOS A	0.1	0.9	0.10	0.57	51.0
Approach		80	19.7	0.028	2.1	NA	0.1	0.9	0.03	0.19	56.6
North: Albion St - northern leg											
7	L2	16	60.0	0.023	6.4	LOS A	0.1	0.8	0.09	0.55	50.9
9	R2	6	16.7	0.023	6.4	LOS A	0.1	0.8	0.09	0.55	52.4
Approach		22	47.6	0.023	6.4	LOS A	0.1	0.8	0.09	0.55	51.3
West: Duckmaloi Rd - western leg											
10	L2	3	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	23	0.0	0.012	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		26	0.0	0.012	0.7	NA	0.0	0.0	0.00	0.07	59.2
All Vehicles		128	20.5	0.028	2.5	NA	0.1	0.9	0.04	0.23	56.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing A1]

Site 8: Albion St - Duckmaloi Rd (AM) Peak - Assessment 1

Giveaway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Duckmaloi Rd - eastern leg											
5	T1	316	8.0	0.170	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	164	42.3	0.164	6.9	LOS A	0.7	6.9	0.32	0.60	50.5
Approach		480	19.7	0.170	2.4	NA	0.7	6.9	0.11	0.21	56.3
North: Albion St - northern leg											
7	L2	95	60.0	0.197	7.2	LOS A	0.8	7.7	0.34	0.65	49.3
9	R2	38	16.7	0.197	12.9	LOS A	0.8	7.7	0.34	0.65	50.7
Approach		133	47.6	0.197	8.8	LOS A	0.8	7.7	0.34	0.65	49.7
West: Duckmaloi Rd - western leg											
10	L2	19	0.0	0.010	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	139	0.0	0.071	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		158	0.0	0.071	0.7	NA	0.0	0.0	0.00	0.07	59.1
All Vehicles		771	20.5	0.197	3.1	NA	0.8	7.7	0.13	0.25	55.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:49:34 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 8 - Albion St - Duckmaloi Rd FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (AM) Peak - Existing A3]

Site 8: Albion St - Duckmaloi Rd (AM) Peak - Assessment 3
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Duckmaloi Rd - eastern leg											
5	T1	53	8.0	0.028	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	374	95.8	0.398	6.9	LOS A	2.5	31.8	0.18	0.56	48.7
Approach		426	84.9	0.398	6.1	NA	2.5	31.8	0.16	0.49	49.8
North: Albion St - northern leg											
7	L2	352	98.2	0.419	7.0	LOS A	2.4	31.1	0.15	0.57	49.3
9	R2	6	16.7	0.419	15.6	LOS B	2.4	31.1	0.15	0.57	52.2
Approach		358	96.8	0.419	7.1	LOS A	2.4	31.1	0.15	0.57	49.4
West: Duckmaloi Rd - western leg											
10	L2	3	0.0	0.002	5.5	LOS A	0.0	0.0	0.00	0.58	53.6
11	T1	23	0.0	0.012	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		26	0.0	0.012	0.7	NA	0.0	0.0	0.00	0.07	59.2
All Vehicles		811	87.4	0.419	6.4	NA	2.5	31.8	0.15	0.51	49.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (PM) Peak - Existing]

Site 8: Albion St - Duckmaloi Rd (PM) Peak - Existing
 Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Queue Distance	Prop. Queued	Effective Stop Rate	Average Speed
		Total veh/h	HV %	v/c	sec		veh	m		per veh	km/h
East: Duckmaloi Rd - eastern leg											
5	T1	41	10.3	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	23	54.5	0.022	6.4	LOS A	0.1	0.9	0.16	0.56	50.4
Approach		64	26.2	0.022	2.3	NA	0.1	0.9	0.06	0.20	56.1
North: Albion St - northern leg											
7	L2	17	18.8	0.024	5.9	LOS A	0.1	0.7	0.14	0.55	52.4
9	R2	9	0.0	0.024	6.2	LOS A	0.1	0.7	0.14	0.55	53.0
Approach		26	12.0	0.024	6.0	LOS A	0.1	0.7	0.14	0.55	52.6
West: Duckmaloi Rd - western leg											
10	L2	9	11.1	0.006	5.7	LOS A	0.0	0.0	0.00	0.57	53.2
11	T1	44	2.4	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		54	3.9	0.023	1.0	NA	0.0	0.0	0.00	0.10	58.7
All Vehicles		144	15.3	0.024	2.5	NA	0.1	0.9	0.05	0.23	56.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (PM) Peak - Existing A2]

Site 8: Albion St - Duckmaloi Rd (PM) Peak - Assessment 2

Giveway / Yield (Two-Way)

Design Life Analysis (Practical Capacity): Results for 100 years

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Duckmaloi Rd - eastern leg											
5	T1	246	10.3	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	139	54.5	0.180	8.4	LOS A	0.8	7.8	0.47	0.70	49.2
Approach		385	26.2	0.180	3.0	NA	0.8	7.8	0.17	0.25	55.6
North: Albion St - northern leg											
7	L2	101	18.8	0.231	7.1	LOS A	0.9	7.1	0.47	0.71	50.4
9	R2	57	0.0	0.231	12.3	LOS A	0.9	7.1	0.47	0.71	51.0
Approach		158	12.0	0.231	8.9	LOS A	0.9	7.1	0.47	0.71	50.6
West: Duckmaloi Rd - western leg											
10	L2	57	11.1	0.033	5.7	LOS A	0.0	0.0	0.00	0.57	53.1
11	T1	265	2.4	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		322	3.9	0.138	1.0	NA	0.0	0.0	0.00	0.10	58.6
All Vehicles		865	15.3	0.231	3.4	NA	0.9	7.8	0.16	0.28	55.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SIDRA INTERSECTION 7.0 | Copyright © 2000-2016 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: SMEC AUSTRALIA PTY LTD (SYDNEY) | Processed: Thursday, 15 September 2016 10:50:07 AM

Project: I:\projects\30011699 – Borg Panel Oberon TIA\SIDRA\Models\20160416\160905 FR\Site 8 - Albion St - Duckmaloi Rd FR.sip7

MOVEMENT SUMMARY

▽ Site: 1 [Site 8: Albion St - Duckmaloi Rd (PM) Peak - Existing A3]

Site 8: Albion St - Duckmaloi Rd (PM) Peak - Assessment 3
Giveway / Yield (Two-Way)

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Duckmaloi Rd - eastern leg											
5	T1	41	10.3	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
6	R2	392	97.3	0.435	7.3	LOS A	2.8	36.1	0.29	0.57	48.4
Approach		433	89.1	0.435	6.6	NA	2.8	36.1	0.26	0.52	49.3
North: Albion St - northern leg											
7	L2	385	96.4	0.473	7.2	LOS A	2.9	36.9	0.24	0.59	49.1
9	R2	9	0.0	0.473	15.1	LOS B	2.9	36.9	0.24	0.59	52.7
Approach		395	94.1	0.473	7.4	LOS A	2.9	36.9	0.24	0.59	49.2
West: Duckmaloi Rd - western leg											
10	L2	9	11.1	0.006	5.7	LOS A	0.0	0.0	0.00	0.57	53.2
11	T1	44	2.4	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		54	3.9	0.023	1.0	NA	0.0	0.0	0.00	0.10	58.7
All Vehicles		881	86.1	0.473	6.6	NA	2.9	36.9	0.24	0.52	49.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

11 August 2016

Borg Construction Pty Ltd
2 Wella Way
Somersby NSW 2250
Attention: Victor Bendeviski

Dear Victor,

Regarding: Borg Panels Timber Processing Facility Expansion - Submissions

Public exhibition of the development application, including the Environmental Impact Statement (EIS), for the above mentioned proposal ended on 27 July 2016. This letter provides additional information in response to a public submission regarding the Noise Impact Assessment (NIA) received from Cart Holt Harvey Pty Limited (CHH) and Highland Pine Products Pty Limited (HPP). The NIA was included as Appendix H to the EIS.

The submission makes reference to Section 2.3 of the NIA, and states that attended measurement results presented in that section are not indicative of noise levels at the site, as the sample size is too small.

Attended measurement results included in the NIA were never intended to form the basis of establishing baseline noise data as inferred. The purpose of the survey was to obtain data to inform a model validation assessment. Methodology and results of the validation assessment are provided in Section 4 of the NIA.

The following points are made in relation to the validation assessment:

1. At the time of the survey, the Borg facility was operating at full capacity across the site;
2. Meteorological conditions on the night of monitoring were generally consistent with the prevailing wind condition used for the modelling assessment, and are considered strongly enhancing for receivers in the Oberon Township, including Oberon Caravan Park and Oberon High School;
3. A site specific noise model was developed, and processed for the specific meteorological conditions occurring during the survey; and
4. An exact correlation between measured and predicted levels resulted.

On this basis, attended monitoring data presented in the NIA are considered adequate for the intended purpose.

The submission also makes reference to cumulative noise levels, and states the EIS fails to provide an adequate cumulative noise impact assessment.

As noted in the NIA, predictions for the proposed expansion are typically the same as, or slightly lower than, predictions for the existing site. As no significant change is predicted relative to the existing situation, no significant change to cumulative noise levels should result. Predictions are based on a validated noise model.

The NIA indicates operation of both the existing site and the proposed expansion are predicted to comply with current EPL operational noise criteria when recommended management strategies are implemented. This being the case, contributions to the cumulative noise environment from the Borg facility should, by default, be acceptable as the site should operate within approved noise limits.

I trust this information meets your requirements. If you have any questions or need further details please contact me.

Regards,

A handwritten signature in black ink, appearing to read 'J Welbourne', followed by a period.

Jeremy Welbourne
Acoustics Engineer

18 August 2016

Borg Construction Pty Ltd
2 Wella Way
Somersby NSW 2250
Attention: Victor Bendeviski

Dear Victor,

Regarding: Borg Panels Timber Processing Facility Expansion – EPA Comments

Public exhibition of the development application, including the Environmental Impact Statement (EIS), for the above mentioned proposal ended on 27 July 2016. The NSW Environment Protection Authority (EPA) has provided comment on the EIS, dated 2 August 2016.

This letter provides advice regarding the EPA's recommended conditions of project consent. It is recommended additional clarity be sought regarding two dot points within the recommended conditions of project consent.

Mobile Wood Chipper Operation

Dot point 6 of the recommended conditions of project consent relates to operation of mobile wood chippers on the premises. Relevant text is reproduced below:

- The EPA recommends that the following specific conditions be applied to the use of mobile wood chippers on the premises:-
 - The operation of mobile wood chippers are not permissible on the premises from six (6) months following the commissioning of the Particle Board factory unless the mobile wood chipper(s) operates within an acoustically treated enclosure.
 - No mobile wood chipper can be operated in the open when winds are from the northern hemisphere (i.e. when winds are from the west through to the east or winds from 270°, through 0°, to 90°).
 - Two or more mobile wood chippers are not to operate simultaneously when winds are from the south-west through to the south-east (i.e. 225°, through 0°, to 135°).
 - The preparation of a mobile wood chipper operation management plan. The plan would include the documentation of the above requirements and other measures that will be implemented (prior to the cessation of all mobile wood chipper operations on the premises) to limit their operation to periods of breakdown or maintenance of the permanent wood debarkers/chippers.

Point one states an acoustic enclosure is required for any mobile wood chipper to be utilised from six months following commissioning of the particle board factory. This point appears definitive, and implies that an acoustic enclosure is required at all times, regardless of meteorological conditions.

However, Point 2 states mobile wood chippers cannot be operated “in the open” during certain wind direction conditions. It is not clear if the words “in the open” are intended to negate the requirement for an acoustic enclosure during certain wind direction conditions, or, if this is an additional condition to be applied cumulatively with Point 1. If the former is the case, the requirement for an acoustic enclosure would only apply when winds are from the northern hemisphere (from 90⁰, through 0⁰, to 270⁰), and would not apply when winds are from the southern hemisphere. Clarification from the EPA regarding the intent of the words “in the open” is recommended. If acoustic enclosure is not required during certain meteorological conditions, it is recommended Point 1 be modified to reflect that certain conditions apply where acoustic enclosure is not required, and, Point 2 be revised to remove any possible ambiguity.

Point 3 provides further wind direction limitations for simultaneous operation of two mobile wood chippers, but does not make reference to acoustic enclosure, or, operation “in the open”. It is assumed clarification of Point 1 and 2 will determine requirements for acoustic enclosure, and additional wind direction constraints listed in Point 3 will apply cumulatively with those requirements.

Further to seeking the above clarification regarding wording of the most recent recommended conditions of project consent, it is noted that any requirement to operate mobile chippers within acoustic enclosures may not be either reasonable or feasible.

Model predictions presented in Table 18 of the Noise Impact Assessment (NIA) indicate that compliance can be achieved during the day period when operating mobile chippers, without acoustic enclosures, during non-enhancing meteorological conditions (neutral atmospheric conditions). Table 19 of the NIA indicates minor exceedance during prevailing wind conditions. This indicates that weather management controls should be sufficient to control noise from mobile chippers. As such, acoustic enclosures for mobile chippers should not be required.

As discussed, Borg agree that conditions relating to use of mobile chippers during enhancing meteorological conditions are both reasonable and feasible. It should be noted that mobile chippers will only be used as a back-up if electric plant fails. As such, mobile chippers should not present a significant, ongoing noise generating activity.

It is not considered reasonable that a requirement for acoustic enclosure is included in the conditions of project consent given the NIA indicates management controls should be sufficient to effectively control mobile chipper noise emission. Managing mobile chipper noise emission during the limited periods they will be required is considered a cost effective solution, that should provide compliance with relevant noise limits. It is suggested that any requirement for acoustic enclosure of mobile chippers only be included in the event that non-compliance is identified.

Site Noise Model Update

Dot point 9 of the recommended conditions of project consent relates to updating the site noise model. Relevant text is reproduced below:

- Updating the site noise model (as described in the NIA) based on the results of the compliance monitoring and the implementation of all feasible and reasonable mitigation measures, to the satisfaction of the DPE and the EPA, if the updated model indicates non-compliance with the noise limits for the premises. This report must be provided to the DPE and the EPA within six (6) months of commissioning of all elements of the proposal.

It is not clear if this point is referring to “results of compliance monitoring” (as in off site attended compliance monitoring), or, results of sound power compliance testing. The intent of relevant text in the NIA was for sound power compliance testing to be undertaken upon commissioning, with a requirement for the site noise model to be updated should any sound power non-compliance be identified. In that case, the site noise model would be updated with commissioned sound power levels (as measured) to establish whether predicted compliance with relevant noise criteria can be maintained. It is recommended clarification be sought from the EPA as to whether an update to the site noise model is required if compliance with modelled sound power levels is achieved, or, if reporting results of compliance testing would be sufficient..

I trust this information meets your requirements. If you have any questions or need further details please contact me.

Regards,



Jeremy Welbourne
Acoustics Engineer



Stephenson

Environmental Management Australia

FORMALDEHYDE DESTRUCTION PROOF OF PERFORMANCE TESTS

CONTI 2 HEAT PLANT

BORG PANELS PTY LIMITED

OBERON, NSW

PROJECT NO.: 5707/S24371B/16

DATE OF SURVEY: 1 SEPTEMBER 2016

DATE OF FINAL ISSUE: 24 OCTOBER 2016



Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

52A Hampstead Road
Auburn NSW 2144 Australia
Tel: (02) 9737 9991

E-Mail: info@stephensonenv.com.au

FORMALDEHYDE DESTRUCTION PROOF OF PERFORMANCE TESTS

CONTI 2 HEAT PLANT

BORG PANELS PTY LIMITED

OBERON, NSW

PROJECT NO.: 5707/S24371B/16

DATE OF SURVEY: 1 SEPTEMBER 2016

DATE OF FINAL ISSUE: 24 OCTOBER 2016

PW STEPHENSON

J WEBER

A NAGHIZADEH

TABLE OF CONTENTS

1	INTRODUCTION	1
2	PRODUCTION CONDITIONS.....	2
3	RESULTS AND DISCUSSION.....	3
	3.1 INTRODUCTION	3
	3.2 FORMALDEHYDE (HCHO)	3
	3.3 CARBON DIOXIDE	4
	3.4 CARBON MONOXIDE	4
	3.5 OXYGEN (O ₂).....	4
	3.6 OXIDES OF NITROGEN (NO _x).....	4
4	CONCLUSIONS.....	6
5	TEST METHODS	7
	5.1 EXHAUST GAS VELOCITY	7
	5.2 EXHAUST GAS TEMPERATURE	7
	5.3 FORMALDEHYDE.....	7
	5.4 CONTINUOUS GASEOUS ANALYSIS	7
	5.5 ACCURACY	8
	APPENDIX A – EMISSION TEST RESULTS	1
	APPENDIX B – CONTINUOUS LOGS.....	1
	APPENDIX C – NATA ENDORSED EMISSION TEST REPORT.....	1
	APPENDIX D – INSTRUMENT CALIBRATION DETAILS	1
	APPENDIX E – SAMPLE LOCATIONS.....	1
	APPENDIX F – PRODUCTION INFORMATION.....	1

TABLE OF TABLES

TABLE 1-1 SCOPE OF WORK.....	1
TABLE 3-1 SUMMARY OF AVERAGE EMISSION CONCENTRATION RESULTS	5
TABLE 5-1 ESTIMATION OF MEASUREMENT UNCERTAINTY	8

TABLE OF TABLES – APPENDICES

TABLE A-1 EMISSION TEST RESULTS, FLOW – INLET 1 (PAPER TREATER)	II
TABLE A-2 EMISSION TEST RESULTS, FLOW – INLET 2 (WET SCRUBBER)	III
TABLE A-3 EMISSION TEST RESULTS, FLOW – OUTLET (CONTI-2 HEAT PLANT)	IV

TABLE OF FIGURES – APPENDICES

FIGURE B-1 CONTINUOUS LOG RECORD - NO _x , CO, CO ₂ & O ₂ INLET LOCATION 1, SEPTEMBER 1, 2016	II
FIGURE B-2 CONTINUOUS LOG RECORD - NO _x , CO, CO ₂ & O ₂ INLET LOCATION 2, SEPTEMBER 1, 2016...	III
FIGURE B-3 CONTINUOUS LOG RECORD - NO _x , CO, CO ₂ & O ₂ OUTLET LOCATION, SEPTEMBER 1, 2016..	IV
FIGURE E-1 INLET LOCATION 1 – PAPER TREATER DUCT	II
FIGURE E-2 INLET LOCATION 2 – WET SCRUBBER DUCT	II
FIGURE E-3 OUTLET LOCATION – CONTI-2 HEAT PLANT OUTLET	III
FIGURE E-4 CONTI-2 HEAT PLANT OUTLET BYPASS DAMPER CONTROLS (DAMPER SHUT)	III

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was requested by Borg Panels Pty Ltd to conduct a Proof of Performance (PoP) emission trial on their Conti 2 Heat Plant at Oberon, New South Wales (NSW). This trial was undertaken on 1st September, 2016 in response to the request of the NSW EPA, reference EF13/3921; DOC16/282523-01 of the 2 August 2016.

The objective of the PoP trial was to determine the Formaldehyde (HCHO) removal efficiency from the gas stream being thermally treated in the Conti 2 Heat Plant.

Formaldehyde gas samples were taken at two Heat Plant inlet locations, namely the Inlet 1 (Paper Treater) and Inlet 2 (Scrubber) and at the Conti 2 Heat Plant outlet location. The scope of work is presented in Table 1-1.

TABLE 1-1 SCOPE OF WORK

Parameter	Conti 2 Heat Plant			Test Method
	Inlet Location 1 Paper Treater	Inlet Location 2 Wet Scrubber	Outlet Duct to Dryers	
Velocity and flow	✓	✓	✓	TM-2
CO ₂	Continuous analyser	Continuous analyser	Continuous analyser	TM 24
CO	Continuous analyser	Continuous analyser	Continuous analyser	TM 32
HCHO	Duplicate samples	Duplicate samples	Duplicate samples	TM-34
NO _x	Continuous analyser	Continuous analyser	Continuous analyser	TM 11
O ₂	Continuous analyser	Continuous analyser	Continuous analyser	TM-25

Key:

CO ₂	=	Carbon Dioxide
CO	=	Carbon Monoxide
HCHO	=	Formaldehyde
NO _x	=	Oxides of Nitrogen
O ₂	=	Oxygen
TM	=	NSW approved test method

2 PRODUCTION CONDITIONS

Borg Panels personnel considered the facility was operating under typical conditions on the day of testing. Refer to Appendix F for detailed production records.

Combustion chamber in Heat Plant was operating in range of 920C to 950C with a residence time greater than 0.7 seconds during the PoP emission test works.

All other relevant production records are held by Borg Panels and are available upon request.

3 RESULTS AND DISCUSSION

3.1 INTRODUCTION

SEMA completed all the sampling and analysis for flow, temperature, moisture, CO, CO₂ and NO_x. SEMA is NATA accredited (No.15043) for this work. All sampling and analysis was conducted in accordance with the Office of Environment and Heritage (OEH) Approved Methods for the Sampling and Analysis of Air Pollutants in New South Wales. Refer to SEMA's NATA endorsed Emission Test Report in Appendix C which includes the laboratory Certificates of Analysis. The formaldehyde samples were analysed by the NATA accredited (No. 3726) TestSafe Australia laboratory, Report No.2016-2756.

The results of the stack emission tests are presented in Sections 3.2 to 3.6 and detailed in Appendix A. Appendix B presents a graphical logged record of CO, CO₂ and NO_x continuous emission analysis.

Appendix D details the most recent calibration of each instrument used to take measurements. Appendix E presents photographic reference and information on emission sampling point locations.

3.2 FORMALDEHYDE (HCHO)

Inlet 1: The emission concentrations of HCHO from the Inlet Location 1 (Paper Treater) for the two sampling runs were 26.6 milligrams per cubic metre (mg/m³) and 26.3 mg/m³ respectively. The average HCHO emission concentration was 26.5 mg/m³. The HCHO mass emission rate from the Inlet Location 1 for the two sampling runs was 0.17 grams per second (g/s) and 0.16 g/s respectively.

Inlet 2: The emission concentrations of HCHO from the Inlet Location 2 (Wet Scrubber) for the two sampling runs were 3.41 mg/m³ and 4.15 mg/m³ respectively with an average HCHO emission concentration of 3.8 mg/m³. The HCHO mass emission rate from the Inlet Location 2 for the two sampling runs was 0.0021 g/s and 0.0024 g/s respectively.

Outlet: The emission concentration of HCHO from the Outlet (Conti 2 Heat Plant) for the two sampling runs conducted was less than 0.0081 mg/m³. The HCHO mass emission rate from the Outlet for the two sampling runs was less than 0.0003 g/s and less than 0.0003 g/s respectively.

Thermal Destruction Efficiency: The formaldehyde thermal destruction efficiency for both Run 1 and Run 2 was greater than 99.8%.

Refer to Table 3-1 and Appendix A for detailed results.

3.3 CARBON DIOXIDE

During the test period the Inlet Location 1 (Paper Treater) CO₂ emission monitoring concentrations averaged 0.7%, the Inlet Location 2 (Wet Scrubber) CO₂ emission monitoring concentrations averaged zero percent and the Outlet (Conti 2 Heat Plant) CO₂ emission monitoring concentrations averaged 4.2%. Refer Table 3.1 and Appendix B.

3.4 CARBON MONOXIDE

During the test period the Inlet Location 1 (Paper Treater) CO emission monitoring concentrations averaged 30 mg/m³, the Inlet Location 2 (Wet Scrubber) CO emission monitoring concentrations averaged 4 mg/m³ and the Outlet (Conti 2 Heat Plant) CO emission monitoring concentrations averaged 75 mg/m³. Refer Table 3.1 and Appendix B.

3.5 OXYGEN (O₂)

During the test period the Inlet Location 1 (Paper Treater Exhaust) O₂ emission monitoring concentrations averaged 19.8%, the Inlet Location 2 (Scrubber Exhaust) O₂ emission monitoring concentrations averaged 20.9% and the Outlet (Conti 2 Heat Plant) O₂ emission monitoring concentrations averaged 16.0%. Refer Appendix B for details.

3.6 OXIDES OF NITROGEN (NO_x)

During the test period the Inlet Location 1 (Paper Treater) NO_x emission monitoring concentrations averaged 10 mg/m³, the Inlet Location 2 (Wet Scrubber) NO_x emission monitoring concentrations averaged less than 2 mg/m³ and the Outlet (Conti 2 Heat Plant) NO_x emission monitoring concentrations averaged 195 mg/m³. Refer Table 3.1 and Appendix B.

TABLE 3-1 SUMMARY OF AVERAGE EMISSION CONCENTRATION RESULTS

Parameter	Unit of measure	Inlet Location 1 Paper Treater exhaust		Inlet Location 2 Scrubber exhaust		Outlet Conti 2 Heat Plant	
		Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Exhaust gas temperature	°C	62	68	23.9	28.7	260	280
Normal stack gas flow rate	m ³ /min	381	360	36	34	2,545	2,498
Moisture content	%	1.4	2.3	2.4	2.5	4.8	4.8
CO ₂	%	0.7		0.0		4.2	
CO	mg/m ³	30		4		75	
NO _x	mg/m ³	10		< 2		195	
O ₂	%	19.8		21.0		16.0	
HCHO concentration	mg/m ³	26.6	26.3	3.4	4.2	<0.0081	<0.0081
HCHO mass emission rate	g/s	0.17	0.16	0.0021	0.0024	<0.0003	< 0.0003

Key:

<	=	less than the limit of detection for the analytical method
%	=	percentage
°C	=	degrees Celsius
m ³ /min	=	cubic metres per minute @ 0°C and 1 atmosphere
mg/m ³	=	milligrams per cubic metre @ 0°C and 1 atmosphere
g/s	=	grams per second mass emission rate
mg/m ³	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kpa)
CO	=	Carbon monoxide
CO ₂	=	Carbon dioxide
NO _x	=	Oxides of nitrogen
O ₂	=	Oxygen
HCHO	=	expressed as formaldehyde on 1-hour average period

4 CONCLUSIONS

From the data presented and test work conducted during typical production cycles, the following conclusions can be drawn:

- The average Inlet 1 (Paper Treater) Formaldehyde emission concentration was 26.5 mg/m³ and the average Formaldehyde mass emission rate was 0.164 g/s.
- The average Inlet 2 (Wet Scrubber) Formaldehyde emission concentration was 3.8 mg/m³ and the average Formaldehyde mass emission rate was 0.0022 g/s.
- The average Outlet (Conti-2 Heat Plant) Formaldehyde emission concentration was less than 0.0081 mg/m³ and the average mass Formaldehyde emission rate was less than 0.0003 g/s.
- The average Formaldehyde destruction efficiency was 99.8%.

5 TEST METHODS

5.1 EXHAUST GAS VELOCITY

(OEH NSW TM-2)

Velocity profiles were obtained across the stack utilising an Airflow Developments Ltd. S-type pitot tube and inclined manometer.

5.2 EXHAUST GAS TEMPERATURE

(OEH NSW TM-2)

The exhaust gas temperature was measured using a Digital thermometer (0-1200°C) connected to a chromel/alumel (K-type) thermocouple probe.

5.3 FORMALDEHYDE

(OEH NSW TM-34, Workcover, WCA Method 179)

A stack gas sample was drawn into a 37 mm cassette loaded with two glass fibre filters in series impregnated with 2,4-Dinitrophenylhydrazine @ 0.5 litre per minute. This pair of filters is labelled front section and back section but form a total combined sample for aldehyde analysis. Each pair of filter samples was analysed by High Performance Liquid Chromatography (HPLC) by the NATA accredited laboratories of TestSafe Australia.

5.4 CONTINUOUS GASEOUS ANALYSIS

(OEH NSW TM-25)

Sampling and analysis of exhaust gas were performed using a Stephenson Environmental Management Australia's mobile combustion and environmental monitoring laboratory. Emission gases were distributed to the analysers via a manifold. The following components of the laboratory were relevant to this work:

Gas Transfer	Technical Heaters, PTFE sample lines, Temperature Controllers
Carbon Dioxide, Carbon Monoxide, Oxygen and Oxides of Nitrogen	Testo 350XL
Calibration	BOC Special Gas Mixtures relevant for each analyser. Instrument calibrations were performed at the start and finish of sampling on each stack.
QA/QC	Calibration (Zero/Span) checks

Sample line integrity calibration check

5.5 ACCURACY

All results are quoted on a dry basis. SEMA has adopted the following (Table 5-1) uncertainties for various stack testing methods.

TABLE 5-1 ESTIMATION OF MEASUREMENT UNCERTAINTY

Pollutant	Methods	Uncertainty
Carbon Monoxide	TM-32, USEPA 10	15%
Carbon Dioxide	TM-24, USEPA 3A	1% actual
Formaldehyde	TM-34, WCA Method 179	7%
Moisture	AS4323.2, TM-22, USEPA 4	25%
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen	TM-25, USEPA 3A	1% actual
Velocity	AS4323.1, TM-2, USEPA 2	5%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

* = range of uncertainties given

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits* by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m³ which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m³ correlates to 5 mg/m³ with most quoted uncertainties of ± 5.3 mg/m³ @ 6.4 mg/m³. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m³ under lab conditions.

APPENDIX A – EMISSION TEST RESULTS

Glossary:

%	=	percent
°C	=	Degrees Celsius
am ³ /min	=	cubic metre of gas at actual conditions per minute
Normal Volume (m ³)	=	cubic metre at 0°C and 760 mm pressure and 1 atmosphere
am ³	=	cubic metre of gas at actual conditions
g/g mole	=	grams per gram mole
g/s	=	grams per second
hrs	=	hours
kg/m ³	=	kilograms per cubic metre
kPa	=	kilo Pascals
m ²	=	square metre
m/s	=	metre per second
m ³ /sec	=	cubic metre per second at 0°C and 1 atmosphere
mg	=	milligrams
mg/ m ³	=	milligrams per cubic metre at 0°C and 1 atmosphere
N/A	=	Not Applicable

Abbreviations of Parameters

O ₂	=	Oxygen
CO	=	Carbon Monoxide
CO ₂	=	Carbon Dioxide
NO _x	=	Oxides of Nitrogen
TM	=	NSW OEH Approved Test Method

Abbreviations of Personnel

PWS	=	Peter Stephenson
AN	=	Ali Naghizadeh
JW	=	Jay Weber

TABLE A-1 EMISSION TEST RESULTS, FLOW – INLET 1 (PAPER TREATER)

Emission Test Results	Flow	Flow
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Inlet 1 – Paper Treater	Inlet 1 – Paper Treater
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Inlet 1 – Paper Treater	Inlet 1 – Paper Treater
Stack Temperature (°C)	62.0	68.0
Stack Cross-Sectional area (m ²)	0.866	0.866
Average Stack Gas Velocity (m/s)	10.4	10.1
Actual Gas Flow Volume (am ³ /min)	540	524
Total Normal Gas Flow Volume (m ³ /min)	381	360
Total Normal Gas Flow Volume (m ³ /sec)	6.36	6.00
Total Stack Pressure (kPa)	89.13	89.06
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	1.4	2.3
Molecular Weight Dry Stack Gas (g/g-mole)	28.904	28.904
Dry Gas Density (kg/m ³)	1.29	1.29
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

TABLE A-2 EMISSION TEST RESULTS, FLOW – INLET 2 (WET SCRUBBER)

Emission Test Results	Flow	Flow
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Inlet 2 – Scrubber	Inlet 2 – Scrubber
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Inlet 2 – Scrubber	Inlet 2 – Scrubber
Stack Temperature (°C)	23.9	28.7
Stack Cross-Sectional area (m ²)	0.312	0.312
Average Stack Gas Velocity (m/s)	2.4	2.4
Actual Gas Flow Volume (am ³ /min)	46	44
Total Normal Gas Flow Volume (m ³ /min)	36	34
Total Normal Gas Flow Volume (m ³ /sec)	0.60	0.57
Total Stack Pressure (kPa)	89.14	89.05
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	2.4	2.5
Molecular Weight Dry Stack Gas (g/g-mole)	28.841	28.841
Dry Gas Density (kg/m ³)	1.29	1.29
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

TABLE A-3 EMISSION TEST RESULTS, FLOW – OUTLET (CONTI-2 HEAT PLANT)

Emission Test Results	Flow	Flow
Project Number	5707	5707
Project Name	Borg Manufacturing	Borg Manufacturing
Test Location	Exhaust	Exhaust
Date	1-Sep-2016	1-Sep-2016
RUN	1	2
Sample Start Time (hrs)	11:15	12:52
Sample Finish Time (hrs)	12:15	13:52
Sample Location (Inlet/Exhaust)	Exhaust	Exhaust
Stack Temperature (°C)	260	280
Stack Cross-Sectional area (m²)	4.619	4.619
Average Stack Gas Velocity (m/s)	21	22
Actual Gas Flow Volume (am³/min)	5,922	6,035
Total Normal Gas Flow Volume (m³/min)	2,545	2,498
Total Normal Gas Flow Volume (m³/sec)	42	42
Total Stack Pressure (kPa)	89.3	89.3
Analysis	Flow	Flow
Method	TM-1	TM-1
Moisture Content (% by volume)	4.8	4.8
Molecular Weight Dry Stack Gas (g/g-mole)	29.307	29.307
Dry Gas Density (kg/m³)	1.31	1.31
Sampling Performed by	PWS, JW, AN	PWS, JW, AN
Sample Analysed by (Laboratory)	SEMA	SEMA
Calculations Entered by	JW	JW
Calculations Checked by	AN	AN

APPENDIX B – CONTINUOUS LOGS

REPRESENTATIVE SECTION OF CHARTS - CONCENTRATIONS OF NO_x, CO, CO₂ & O₂

FIGURE B-1 CONTINUOUS LOG RECORD - NO_x, CO, CO₂ & O₂ INLET LOCATION 1, SEPTEMBER 1, 2016

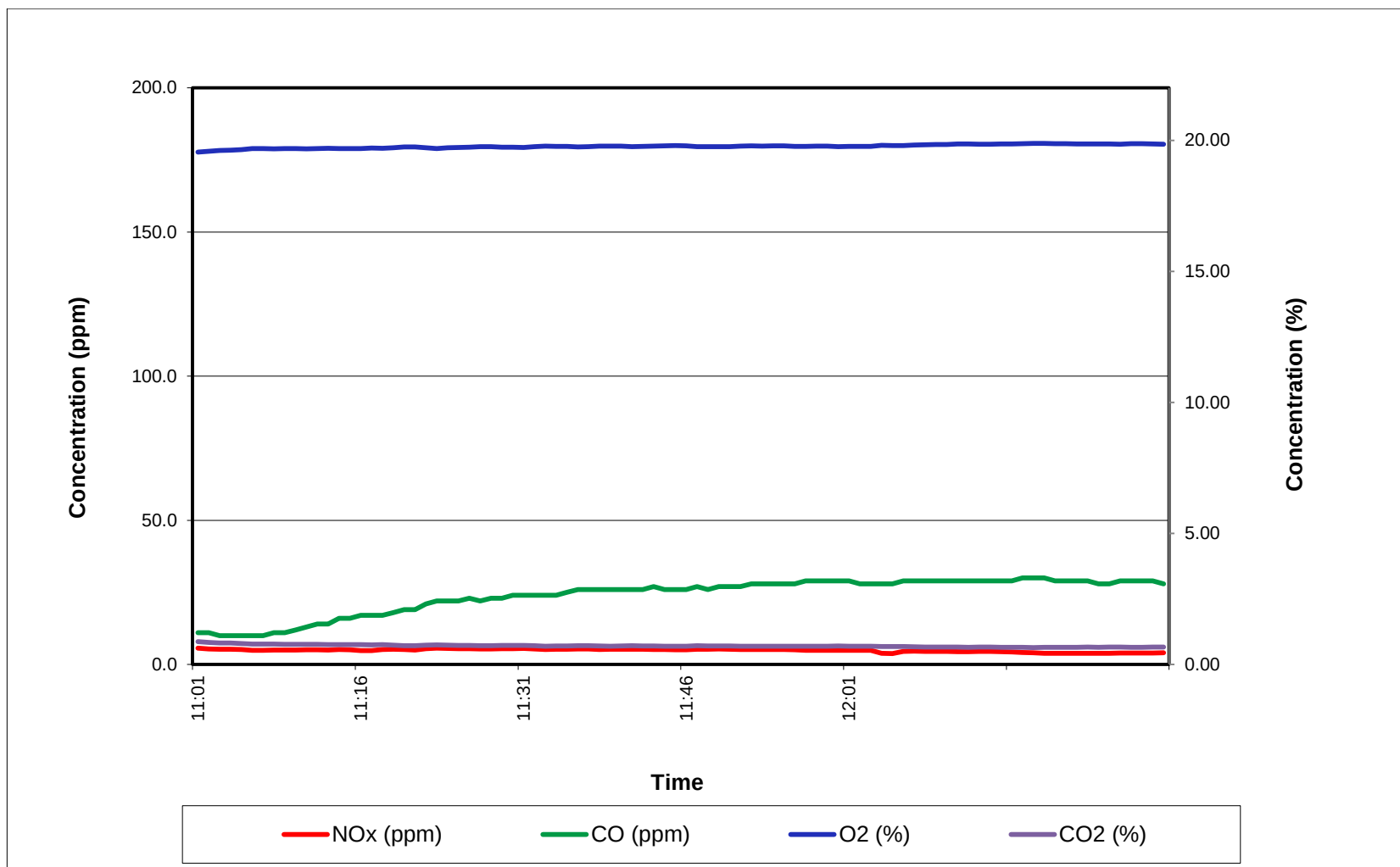


FIGURE B-2 CONTINUOUS LOG RECORD - NO_x, CO, CO₂ & O₂ INLET LOCATION 2, SEPTEMBER 1, 2016

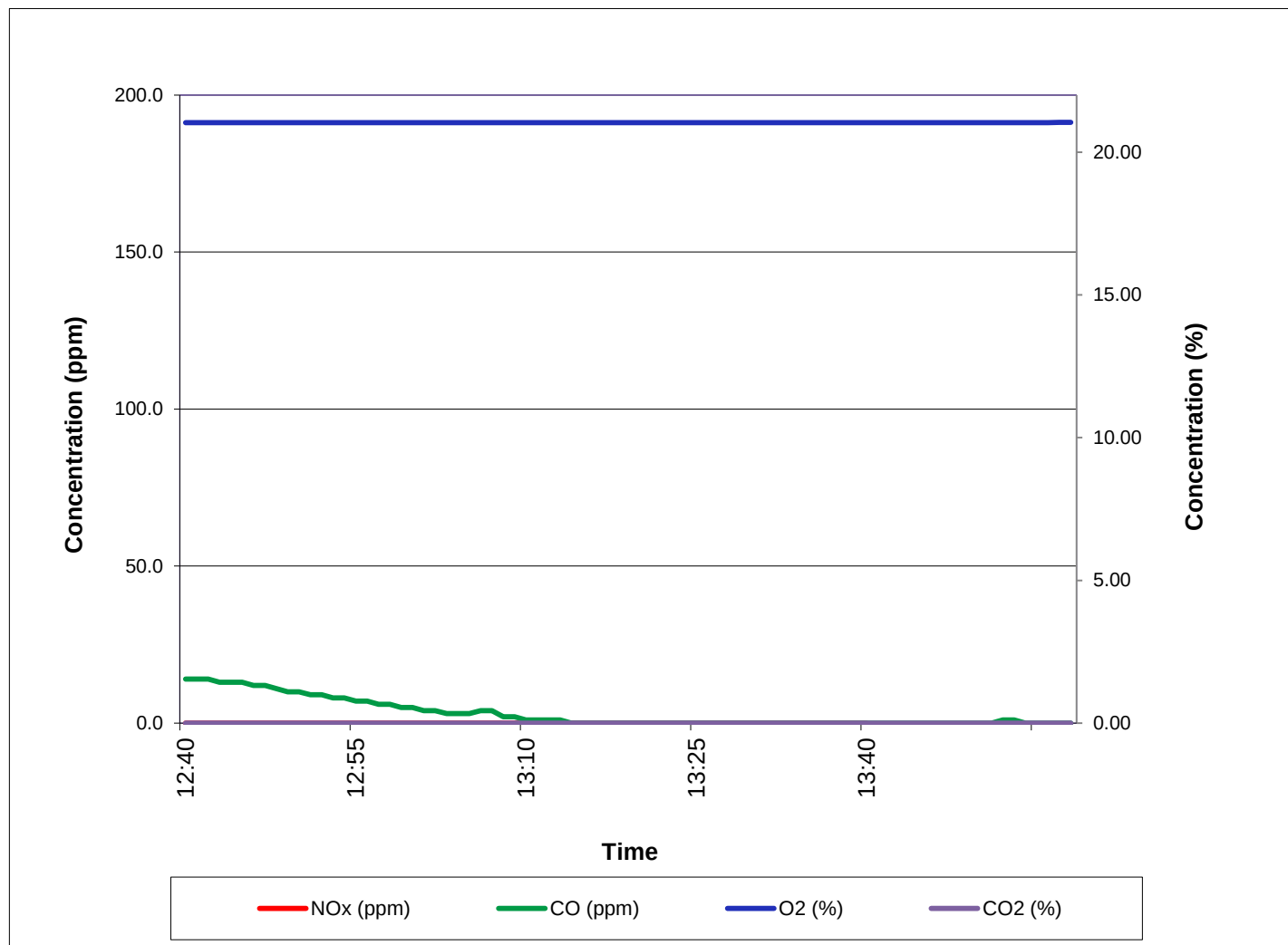
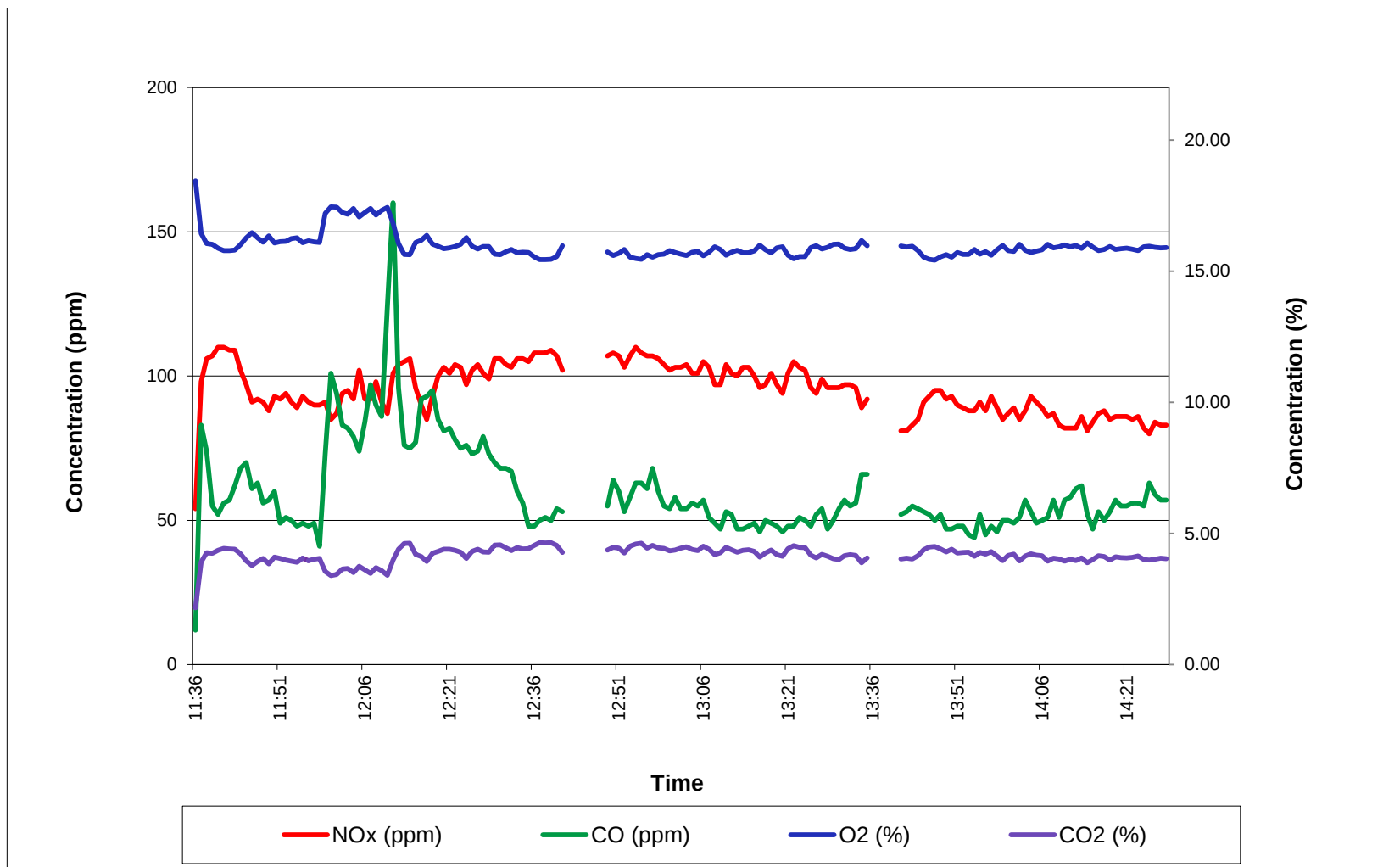


FIGURE B-3 CONTINUOUS LOG RECORD - NO_x, CO, CO₂ & O₂ OUTLET LOCATION, SEPTEMBER 1, 2016



APPENDIX C – NATA ENDORSED EMISSION TEST REPORT



Stephenson

Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

52A Hampstead Road
Auburn NSW 2144 Australia
Tel: (02) 9737 9991
E-Mail: info@stephensonenv.com.au

Emissions Test Report No. 5707

The sampling and analysis was commissioned by:

Client	Organisation:	Borg Manufacturing
	Contact:	Victor Bendeviski
	Address:	Lowes Mount Road, Oberon NSW 2787
	Telephone:	02 4340 8271
	Email:	bendeviski@borgs.com.au
	Project Number:	5707/S24371B/16
	Test Date:	1 September 2016
	Production Conditions:	Normal operating conditions during testing
	Analysis Requested:	Flow, temperature, moisture, Carbon Monoxide, Carbon Dioxide, Nitrogen Oxides, Oxygen and Formaldehyde.
	Sample Locations:	Paper Treater, Wet Scrubber and Conti-2 Heat Plant
	Sample ID Nos.:	See Attachment A

This report cannot be reproduced except in full.

NATA accredited laboratory number 15043.
Accredited for Compliance with ISO/IEC 17025.



Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.	
Test	Test Method Number for Sampling and Analysis	NATA Laboratory Analysis By: NATA Accreditation No. & Report No.
Carbon Monoxide	NSW TM-32	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Carbon Dioxide	NSW TM-24	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Dry Gas Density	NSW TM-23	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Aldehydes/Formaldehyde	NSW TM-34 / WorkCover Method 179	Test Safe Australia, Accreditation No. 3726 Reports No.2016 -2756
Oxides of Nitrogen	NSW TM-11	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043 Emission Test Report No. 5707
Deviations from Test Methods	Nil	
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.	

Reference Conditions

NSW - As per

- (1) Environment Protection Licence conditions, or
- (2) Part 3 of the Protection of the Environment Operations
(Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date

14 September 2016



P W Stephenson

SUMMARY OF THE AVERAGE EMISSION RESULTS – TEST REPORT NO. 5707

Parameter	Unit of measure	Inlet Location 1 Paper Treater exhaust		Inlet Location 2 Scrubber exhaust		Outlet Conti 2 Heat Plant	
		Run 1	Run 2	Run 1	Run 2	Run 1	Run 2
Exhaust gas temperature	°C	62	68	23.9	28.7	260	280
Normal stack gas flow rate	m ³ /min	381	360	36	34	2545	2498
Moisture content	%	1.4	2.3	2.4	2.5	4.8	4.8
Oxygen	%	19.8		21.0		16.0	
Nitrogen Oxides	mg/m ³	10		< 2		195	
Carbon Monoxide	mg/m ³	30		4		75	
Carbon Dioxide	%	0.7		0.0		4.2	
Formaldehyde concentration	mg/m ³	26.6	26.3	3.4	4.15	<0.0081	<0.0081
Formaldehyde mass emission rate	g/s	0.17	0.16	0.0021	0.0024	<0.0003	< 0.0003

Key:

<	=	less than the limit of detection for the analytical method
%	=	percentage
°C	=	degrees Celsius
m ³ /min	=	cubic metres per minute @ 0°C and 1 atmosphere
mg/m ³	=	milligrams per cubic metre @ 0°C and 1 atmosphere
g/s	=	grams per second mass emission rate
mg/m ³	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kpa)

ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Moisture	AS4323.2, TM-22, USEPA 4	25%
Carbon Dioxide	TM-32, USEPA 10	15%
Carbon Monoxide	TM-24, USEPA 3A	1% actual
Nitrogen Oxides	TM-11, USEPA 7E	15%
Oxygen	TM-24, TM-25, USEPA 3A	1% actual
Formaldehyde	OSHA-64 (WCA Method 179)	7%
Velocity	AS4323.1, TM-2, USEPA 2	5%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96)
(Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m³ which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m³ correlates to 5 mg/m³ with most quoted uncertainties of ± 5.3 mg/m³ @ 6.4 mg/m³. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m³ under lab conditions.

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS



Lab. Reference: 2016-2756

Stephenson Environmental Management Australia
PO Box 6398
SILVERWATER NSW 1811

SAMPLE ORIGIN: 5707

DATE OF INVESTIGATION: 01/09/2016

DATE RECEIVED: 5/09/16

ANALYSIS REQUIRED: Aldehyde Screen

REPORT OF ANALYSIS

See attached sheet(s) for sample description and test results.

The results of this report have been approved by the signatory whose signature appears below.

For all administrative or account details please contact the Laboratory.



Martin Mazereeuw
Manager

Date: 12/09/16

TestSafe Australia – Chemical Analysis Branch
Level 2, Building 1, 9-15 Chilvers Road, Thornleigh, NSW 2120, Australia
T: +61 2 9473 4000 E: lab@safework.nsw.gov.au W: testsafe.com.au
ABN 81 913 830 179



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025



Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Formaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	400.2 ± 87.2	433.4 ± 94.5
2016-2756-2	725729	399.0 ± 87.0	423.5 ± 92.3
2016-2756-3	725730	102.5 ± 22.3	ND
2016-2756-4	725731	124.5 ± 27.1	0.29 ± 0.06
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Acetaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	0.89 ± 0.19	1.78 ± 0.39
2016-2756-2	725729	0.64 ± 0.14	1.73 ± 0.38
2016-2756-3	725730	3.74 ± 0.82	0.83 ± 0.18
2016-2756-4	725731	3.76 ± 0.82	0.63 ± 0.14
2016-2756-5	725732	ND	0.51 ± 0.11
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

2016-2756.xlsx
TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

Page 2 of 5



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SW08051 1215



SafeWork NSW



Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Chloroacetaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Acrolein (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

2016-2756.xlsx
TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

Page 3 of 5



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SV08061 1215



Analysis of Aldehydes in Air

Client : Jay Weber
SEMA

Date Sampled : 1-Sep-2016
Project No. : 5707

Reference Number	Sample ID	Crotonaldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

Reference Number	Sample ID	Valeraldehyde (µg/Sample)	
		Front Section	Back Section
2016-2756-1	725728	ND	ND
2016-2756-2	725729	ND	ND
2016-2756-3	725730	ND	ND
2016-2756-4	725731	ND	ND
2016-2756-5	725732	ND	ND
2016-2756-6	725733	ND	ND
2016-2756-7	725734 (Blank)	ND	ND

2016-2756.xlsx
TestSafe Australia – Chemical Analysis Branch
ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

Page 4 of 5



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SW08051 1215



SafeWork NSW



Analysis of Aldehydes in Air

Client : Jay Weber

Date Sampled : 1-Sep-2016

SEMA

Project No. : 5707

ND = Not Detected

Method : Analysis of Aldehydes in Air by HPLC

Method Number : WCA.179

Detection Limit : 0.25 µg Aldehydes/Sample

Brief Description : The aldehyde concentrations in air are determined by drawing a volume of air through a glass fibre filter which has been impregnated with 2,4-dinitrophenylhydrazine (DNPH) derivatizing agent. The aldehyde-DNPH derivative is then eluted from the filter with acetonitrile and analysed by HPLC using 365 nm UV detection.

Measurement Uncertainty

The measurement uncertainty is an estimate that characterises the range of values within which the true value is asserted to lie. The uncertainty estimate is an expanded uncertainty using a coverage factor of 2, which gives a level of confidence of approximately 95%. The estimate is compliant with the "ISO Guide to the Expression of Uncertainty in Measurement" and is a full estimate based on in-house method validation and quality control data.

Sampling Parameters

The measurement uncertainty relates to the analysis of the analyte on the sampling device and does not take into consideration the sampling parameters such as pump flowrate, time, temperature and pressure.

Quality Assurance

In order to ensure the highest degree of accuracy and precision in our analytical results, we undertake extensive intra- and inter-laboratory quality assurance (QA) activities. Within our own laboratory, we analyse laboratory and field blanks and perform duplicate and repeat analysis of samples. Spiked QA samples are also included routinely in each run to ensure the accuracy of the analyses. WorkCover Laboratory Services has participated for many years in several national and international inter-laboratory comparison programs listed below:-

- Workplace Analysis Scheme for Proficiency (WASP) conducted by the Health & Safety Executive UK;
- Quality Management in Occupational and Environmental Medicine QA Program, conducted by the Institute for Occupational, Social and Environmental Medicine, University of Erlangen – Nuremberg, Germany;
- Quality Control Technologies QA Program, Australia;
- Royal College of Pathologists QA Program, Australia.

2016-2756.xlsx

TestSafe Australia – Chemical Analysis Branch

ABN 81 913 830 179 Level 2, Building 1, 9–15 Chilvers Road, Thornleigh, NSW 2120, Australia
Telephone +61 2 9473 4000 Email lab@safework.nsw.gov.au Website testsafe.com.au

Page 5 of 5



Accreditation No. 3726

Accredited for compliance with ISO/IEC 17025

SW08051 1215

APPENDIX D – INSTRUMENT CALIBRATION DETAILS

TABLE D-1 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
859	Digital Temperature Reader	30-Jun-16	30-Dec-16
921	Thermocouple	30-Jun-16	30-Dec-16
894	Thermocouple	30-Jun-16	30-Dec-16
879	Digital Manometer	26-Feb-16	26-Feb-17
613	Barometer	26-Feb-16	26-Feb-17
726	Pitot	03-Jun-16	03-Jun-2017 Visually inspected On-Site before use
928	Balance		Response Check with SEMA Site Mass
646	Stopwatch	25-Jul-16	25-Jan-17
946	Testo 350 (cal check each job)	19-Aug-16	19-Feb-17
655	Testo 350 (cal check each job)	19-Aug-16	19-Feb-17
832	Personal Sampler	22-Mar-16	22-Mar-17
12	Personal Sampler	05-Aug-16	06-Aug-17
833	Personal Sampler	22-Mar-16	22-Mar-17
Gas Mixtures used for Analyser Span Response			
Conc.	Mixture	Cylinder No.	Expiry Date
245 ppm 245 ppm 250 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen Sulphur Dioxide In Nitrogen	ALSB 1372	05-Jan-20
393 ppm 399 ppm	Nitric Oxide Total Oxide Of Nitrogen In Nitrogen	ALSM 1604	25-Oct-18
902 ppm 9.8% 10.4%	Carbon Monoxide Carbon Dioxide Oxygen In Nitrogen	ALSB 4980	07-Feb-18
383 ppm	Sulphur Dioxide In Nitrogen	ALSD 3948	25-Oct-18

APPENDIX E – SAMPLE LOCATIONS

FIGURE E-1 INLET LOCATION 1 – PAPER TREATER DUCT



FIGURE E-2 INLET LOCATION 2 – WET SCRUBBER DUCT



FIGURE E-3 OUTLET LOCATION – CONTI-2 HEAT PLANT OUTLET



FIGURE E-4 CONTI-2 HEAT PLANT OUTLET BYPASS DAMPER CONTROLS (DAMPER SHUT)



APPENDIX F – PRODUCTION INFORMATION

FIGURE F-3 SCREEN SHOT 3 – HEAT PLANT

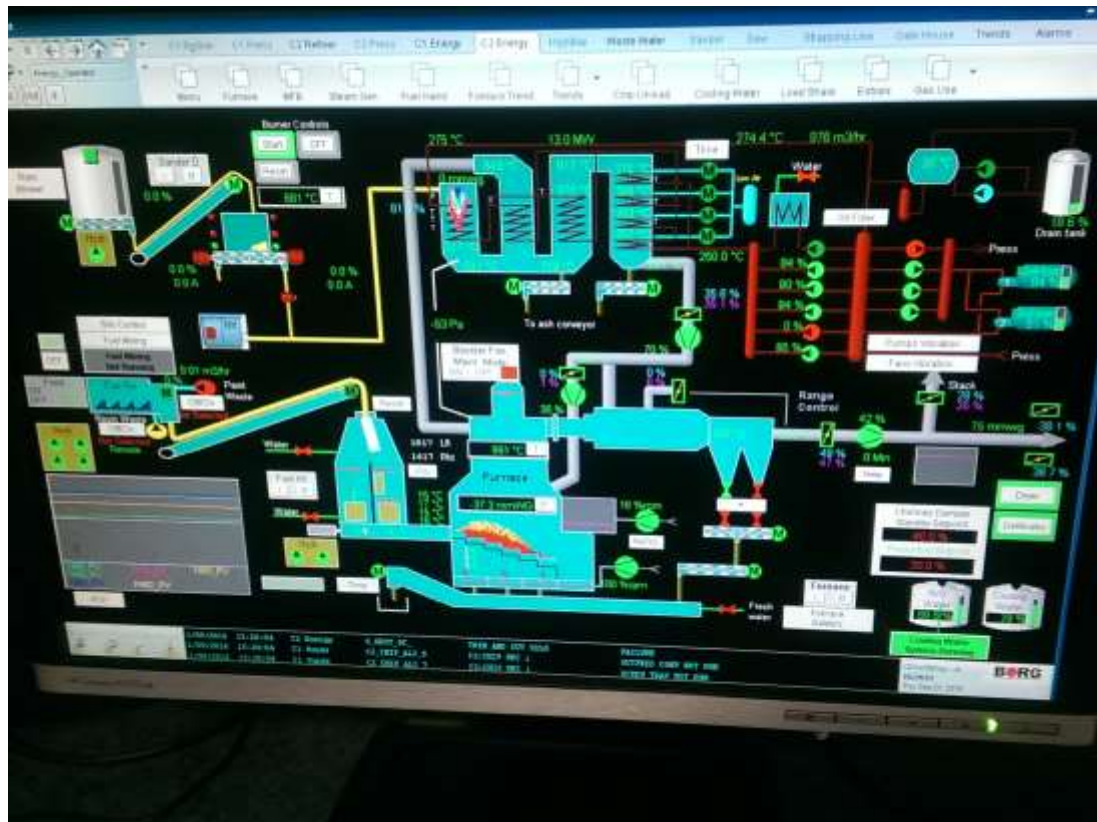


FIGURE F-4 SCREEN SHOT 4 – PAPER TREATER (GRAVURE COATER)

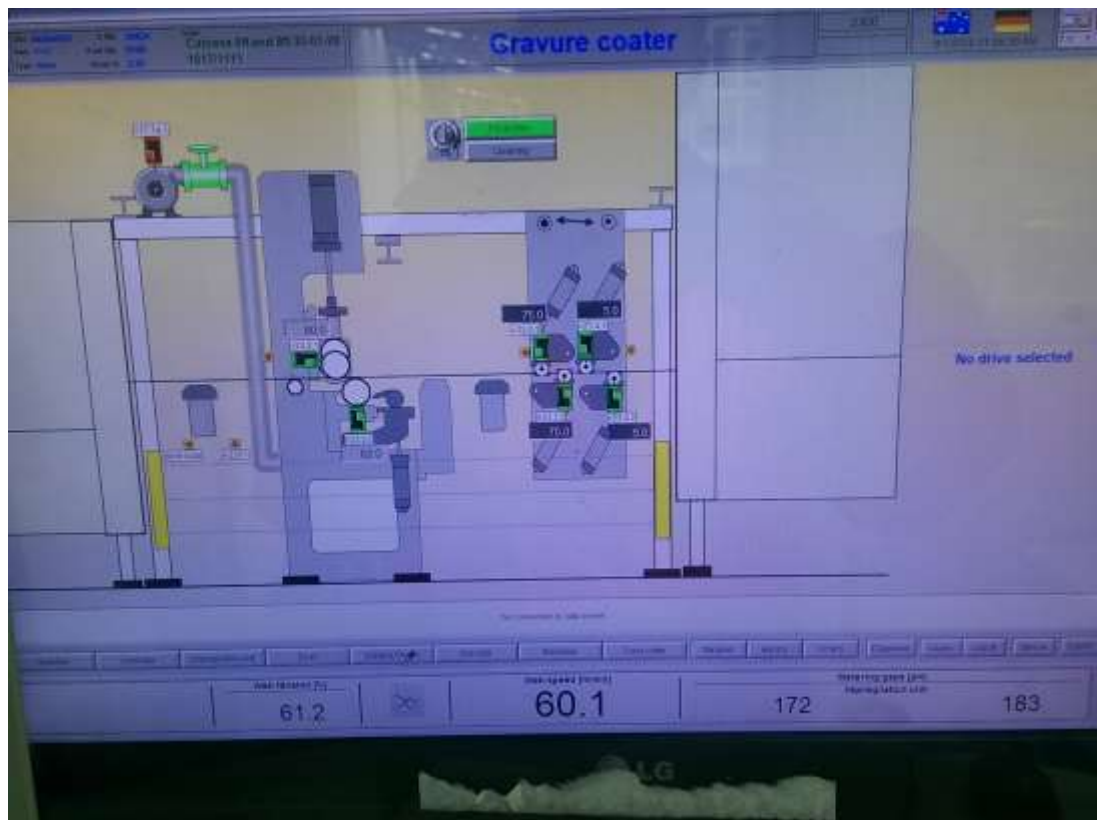


FIGURE F-5 SCREEN SHOT 5 – PAPER TREATER (CROSS CUTTER)

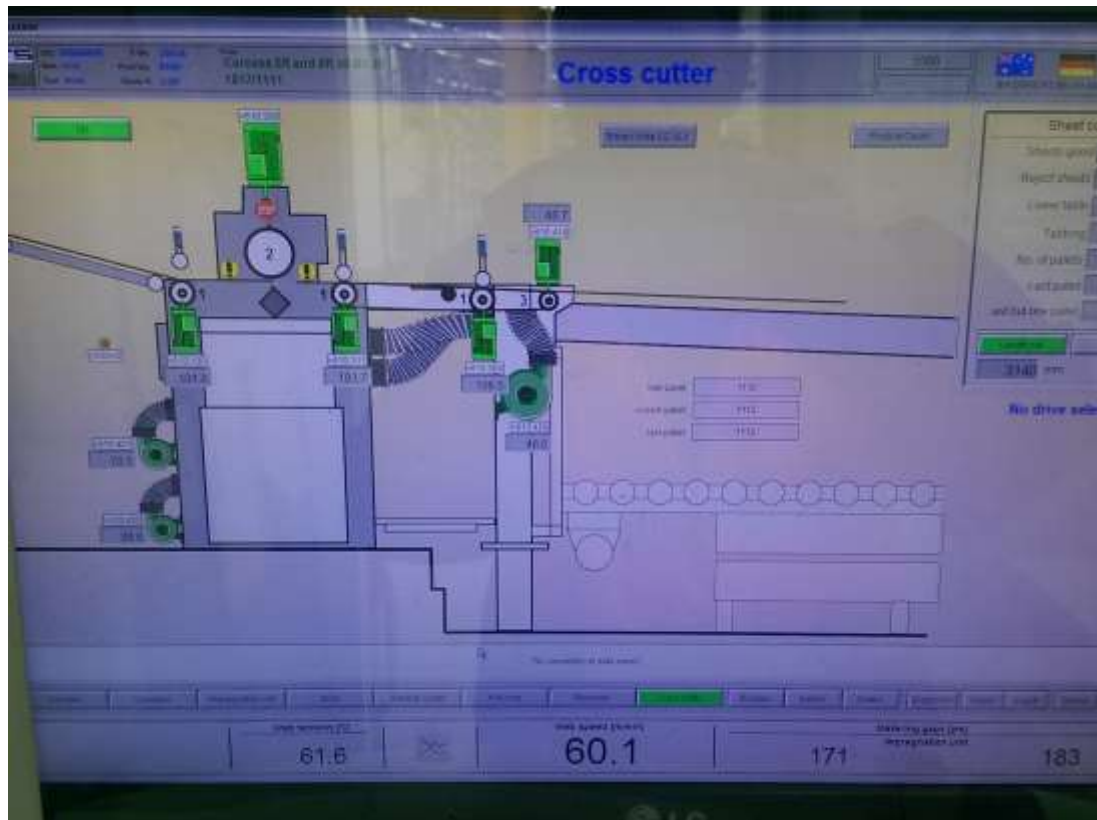


FIGURE F-6 SCREEN SHOT 6 – PAPER TREATER (IMPREGNATION UNIT)



To whom it may concern

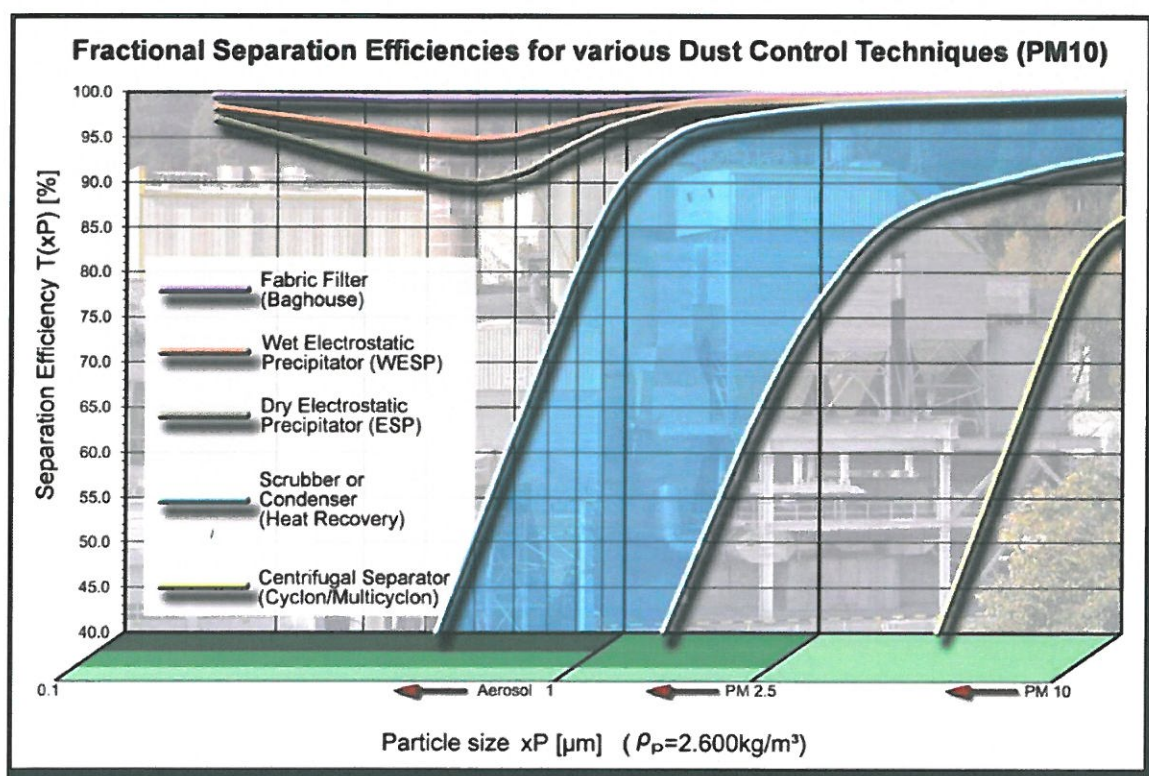
STATE OF THE ART AIR POLLUTION CONTROL SYSTEM FOR DRIERS AND PRESSES IN THE WOOD BASED PANEL INDUSTRY

WET ELECTROSTATIC PRECIPITATOR FOR PB DRIER INCLUDING EMISSIONS FROM THE PRESS

Wet Electrostatic precipitators (WESP) are state of the art technology for cleaning emissions from driers and presses in the wood based panel industry.

The main purpose of a WESP is to remove particulate matter (PM) and consequently blue haze emissions, as blue haze (caused by aerosols) behaves like particulate matter.

The performance of a WESP on PM is best for particle sizes smaller than $0,2 \mu\text{m}$ and larger than $1 \mu\text{m}$, and has a through in the range between $0,2$ to $1 \mu\text{m}$ (see diagram below).



Typical emission limits for particulate matter (PM) for direct heated wood particle driers are in the range of 25 to 50 mg/Nm³dry*. Inlet concentrations typically range between 300 and 700 mg/Nm³dry. The WESP needs to be sized accordingly to constantly meet these requirements.

Other very positive side effects of WESPs are, that heavy metals as well as PCDD/F are efficiently reduced as these substances are either particle bound or condensed at temperatures below 70°, and therefore behave as particulate, which can be efficiently removed.

PRESS SCRUBBER FOR MDF PRESS EMISSIONS (*MEDIUM DENSITY FIBERBOARD*)

Summary of emission measurements from various Press scrubbers (all MDF) show following results.

Formaldehyde	35 - 50 mg/Nm ³ dry
Methanol	30 - 100 mg/Nm ³ dry
VOC	40 - 70 mg/Nm ³ wet (Method 25A –Flame ionization detector)
PM	30 - 50 mg/Nm ³ dry - by installing a WESP, PM emissions may be further reduced to below 15 or 10 mg/Nm ³ dry.
Temp.	30 - 35°C, 100% relative humidity

In addition to that also some acetaldehyde, organic acids, paraffin, and other organic substances (some of these substances can be detected with a flame ionization detector - VOC) can be found. Acetaldehyde, acetic and formic acid, phenols are typically below 15 mg/Nm³dry.

** Please note, that these numbers do not represent the requirements for the USA, as there regenerative thermal oxidizers would be state of the art technology, with a WESP for precleaning.*

Clean gas values are related to the same oxygen concentration as the crude gas values (no reference oxygen).

N..... Normal conditions refer to 0°C and 101,325 Pa.

EMISSIONS AFTER PB PRESS SCRUBBERS (*PARTICLE BOARD*)

Emission Concentrations of press scrubbers for particle board (PB) production are typically up to 20% lower compared to scrubbers installed at MDF presses.

Formaldehyde	20 - 40 mg/Nm ³ dry
Methanol	30 - 80 mg/Nm ³ dry
VOC	30 - 65 mg/Nm ³ wet (Method 25A –Flame ionization detector)
PM	25 - 40 mg/Nm ³ dry - by installing a WESP, PM emissions may be further reduced to below 15 or 10 mg/Nm ³ dry.
Temp.	30 - 35°C, 100% relative humidity

METHODS

PM	USEPA method 5 or EN 13284-1
VOC	USEPA method 25A or EN 12 619
Formaldehyde	NCASI 98.01 or VDI 3862 Sheet 2 or sheet 6,

echeuch
TECHNOLOGY FOR CLEAN AIR
Scheuch GmbH, A-4971 Auroldmünster
Weierfing 68, Phone: +43/7752/905-0, Fax: -65000



Ing. Mag. MBA Thomas Kreuzhuber

Auroldmünster, August 5th, 2016

Head of Sales Panels Industry

Phone ++43 7752 905 5257

e-mail: t.kreuzhuber@scheuch.com

Scheuch GmbH



LOT BOUNDARIES FOR CONSOLIDATION ARE NOT SHOWN ON THIS PLAN (FOR CLARITY) - REFER CONSOLIDATION PLAN FOR DETAIL

EXISTING TREES HAVE MOSTLY BEEN ESTABLISHED FROM AERIAL IMAGERY NOT SURVEY - SIZE AND NUMBER ARE

INDICATIVE ONLY

 EXISTING BUILDINGS

PROPOSED NEW BUILDINGS

EXISTING TREES ON SITE

EXISTING PLANTING - PHOTINIA FRASERI "RED ROBIN" SCREENING HEDGE (TYPICAL GROWTH: UP TO 15m TALL)

PROPOSED NEW PLANTING - PHOTINIA FRASERI
"RED ROBIN" SCREENING HEDGE (TYPICAL)

EXISTING VEGETATION TO BE RETAINED

EXISTING VEGETATION TO BE REMOVED

EXISTING TREES TO BE REMOVED

DENSE LANDSCAPING

[illegible]

BORG
CONSTRUCTION
OFFICE:
2 WELLA WAY SOMERSBY, N.S.W. 2250 AUSTRALIA

OFFICE:
2 WELLS WAY SONERSBY, N.S.W. 2250 AUSTRALIA
Tel: 02 4340 9800 Fax: 02 4340 8293

COPYRIGHT: THIS DRAWING AND THE INFORMATION CONTAINED ARE THE PROPERTY OF THE COPYRIGHT OWNER, BORG CONSTRUCTIONS Pte. Ltd. AND MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION

Project
PROPOSED PARTICLE BOARD MANUFACTURING
PLANT & ADDITIONAL WORKS.

124 LOWES MOUNT ROAD, OBERON
NEW SOUTH WALES

Drawing
LANDSCAPE PLAN

Scale

APPROX 1:1750 (@A1)

Project Number	Drawing Number
----------------	----------------

19 DA 07 B

