

5 ENVIRONMENTAL ASSESSMENT

5.1 Noise

5.1.1 Existing Environment

Noise related considerations have been assessed in the development of the Environmental Assessment (EA) for the concept design of the Approved Project. Blasting for tunnelling activities at St Helena Hill is described in Sections 15.1.5 and 15.3.3 and in Working Paper No. 8 of the EA. In addition, further assessment of the impacts of noise due to blasting has been undertaken in the preparation of the PLAN-ENV-001 Construction Environmental Management Plan (CEMP) and can be found as part of PLAN-ENV-006 Noise and Vibration Management Sub-Plan (NVMSP), which is a Sub-Plan to the PLAN-ENV-001 CEMP for the Project including pre-construction noise monitoring (attended and non-attended). A Noise and Vibration Impact Assessment (NVIA) is included as Appendix A to the PLAN-ENV-006 NVMSP. The impact assessment identified seven sensitive receivers within 200 metres of the tunnel construction footprint. These sensitive receivers are detailed within Table 25.

Noise impacts as a result of the proposed modification were not assessed within the EA for the Project or as part of the PLAN-ENV-006 NVMSP. However, potential noise impacts have been discussed within Section 5.1.2 below.

The noise from blasting would likely be audible to the nearby residences. However, this noise would occur in short, infrequent events as part of the general construction of the Project. Appropriate monitoring and reasonable and feasible measures to mitigate noise impacts would also be implemented during blasting activities. These management measures are described in Section 5.1.3.

Noise monitoring was undertaken at 16 locations along the Project route as part of the PLAN-ENV-006 NVMSP. This data has been filtered for adverse weather conditions using data obtained from the Project North and Project South RMS weather stations, using whichever station was closest to each monitoring location. Of the 16 locations monitored, three of these locations are within the vicinity of the St Helena Tunnel. The results of monitoring at these receivers are shown within Table 24 below.

Table 24 - Noise monitoring data

Logger Location ID.	Location	Nearest Receiver ID	Approximate Chainage	Rating background level (RBL)		
				Day (7:00am to 6:00pm)	Evening (6:00pm to 10:00pm)	Night (10:00pm to 7:00am)
RT4	[REDACTED]	[REDACTED]	28050	49	46	35
L15	[REDACTED]	[REDACTED]	28000	36	37	37
L3	[REDACTED]	[REDACTED]	28200	38	39	39

The sensitive receivers around the St Helena Hill tunnel works likely to be affected by noise from blasting works are identified in Table 25.

Table 25 - Nearest sensitive receivers - St Helena tunnel works

Receiver ID	Lot Address	DP/Lot	Minimum Distance to St Helena works (m)	Minimum Distance to St Helena tunnel control centre works (m)	Comments
1119-HO1	[REDACTED]	[REDACTED]	170	65	
1120-HO1	[REDACTED]	[REDACTED]	160	30	Located above Tunnel. NB: This structure is a cattle feeding shed, not a residence.
1120-HO2	[REDACTED]	[REDACTED]	160	92	
1122-HO1	[REDACTED]	[REDACTED]	170	200	
1146-HO1	[REDACTED]	[REDACTED]	200	151	
1153-HO1	[REDACTED]	[REDACTED]	180	93	
1162-HO1	[REDACTED]	[REDACTED]	160	35	
1122-H01	[REDACTED]	[REDACTED]	168	197	
[REDACTED] Farm	[REDACTED]	[REDACTED]	430	610	

The geographical location of each of the above sensitive receivers is detailed within Figure 32 below.

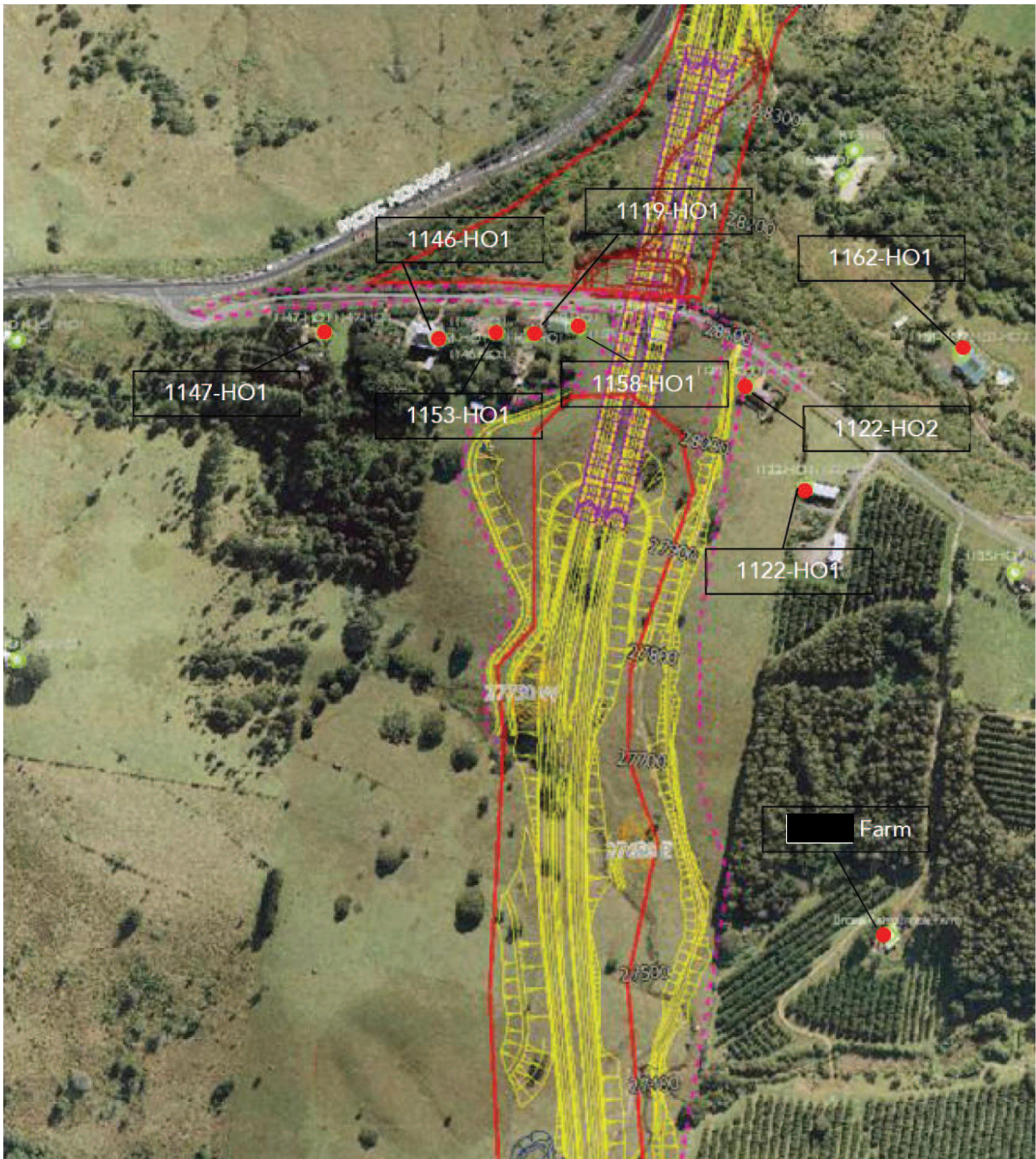


Figure 32 – Location of Nearby Sensitive Receivers

5.1.2 Potential noise impacts

The noise expected from controlled blasts will likely be audible at nearby residences. However, it will be minimal and will only last for a few seconds.

There are 15 residences nearby to the St Helena tunnel works that are expected to experience some noise disturbance from the works. The degree of disturbance varies depending on the respective proximity to the works themselves. These residences are identified within the Project PLAN-ENV-006 NVMS. These properties, as well as the wider community have been consulted with regard to the proposed modification. Details relating to the dissemination of this information are detailed within Section 3 of this report.

No additional residences would be expected to be impacted upon as a result of the proposed modification.

It is also noted that there are no educational, health or other facilities located near St Helena Hill or along St Helena Road that would be affected by the proposed modification to the blasting hours or increase in vibration and overpressure limits.

There is livestock pasture and a cattle feeding yard within the proximity of the St Helena tunnel works. While blasting has the potential to "spook" livestock in the initial stages of the blasting program, it is unlikely to have any significant impact based upon the level of noise and vibration generated from the blasts. Relevant landholders have been consulted in initial face-to-face meetings regarding potential impacts to livestock, management strategies have been detailed in the tunnel blasting fact sheet that has been distributed to all potentially affected residents. Information about livestock and blasting was included in the presentation to residents and discussed at the street meeting on 21 May 2012 and it was noted that the Project team will provide specific timing details to those residents with nearby animals in paddocks on an individual basis prior to blasting.

It should be noted that under the proposed modification to the MCoA, the number of blasts to be undertaken on Mondays to Fridays would not change from the planned (up to) three (3) per day per each tunnel. However, the total number of blasts would reduce with the corresponding reduction in the total duration at which construction may be causing disturbance to nearby residences.

In considering whether the permissible hours for blasting should be extended, an assessment of the potential impacts has been undertaken within this report. The assessment has concluded that with the implementation of the mitigation measures specified within the PLAN-ENV-006 NVMSP and within this report, the proposed extended blasting hours would not significantly impact on sensitive receivers in relation to noise. Rather, the subject modification would benefit the community by enabling works to proceed at a more efficient rate. This would enable a reduction in disruptive hydraulic rock breakage, blast events and total construction duration for the subject works.

Furthermore, the increase in blast hours is consistent with the approved hours for construction which would already be undertaken during the hours specified within the current MCoA.

As described in Section 4 of this report, the proposed modification would result in approximately 20 days reduction in disturbance caused by noise from rock breakage using hydraulic hammers. Furthermore, Section 4 details that there would be a reduction in noise generated from the drilling activities associated with the tunnelling works and the box cuts. This would significantly decrease the overall impact of noise generating activity on surrounding residences. Combined with a predicted reduction in the total duration of construction for the St Helena tunnel works, the proposed modification is predicted to result in a significant overall reduction in noise impacts generated. The benefits for residences and other external stakeholders from these reductions are also detailed in Section 4 of this report.

5.1.3 Proposed management measures

The proposed extension to blasting hours is consistent with current approved construction hours which are 7.00am to 6.00pm Monday to Fridays, inclusive.

The PLAN-ENV-006 NVMSP has been prepared in accordance with Condition 6.5(d) of the Project Instrument of Approval. Pre-construction noise monitoring (attended and non-attended) and modelling has also been completed as part of the development of the PLAN-ENV-006 NVMSP (refer Appendix A of the PLAN-ENV-006 Noise and Vibration Impact Assessment (NVIA)). The PLAN-ENV-006 NVMSP forms part of the overarching PLAN-ENV-001 Construction Environmental Management Plan (CEMP) and details the mitigation measures and monitoring required during the construction phase to manage potential noise and vibration related impacts associated with the construction of the Project.

The PLAN-ENV-006 NVMSP also addresses the following requirements:

- *Protection of the Environment Operations Act 1997* (POEO Act),
- Statement of Commitments (SoC);
- RTA D&C G36 Design and Construction Environmental Protection (Management System) (G36).

The PLAN-ENV-006 NVMSPP:

- Details proposed mitigation measures and best practice procedures to be adopted in the design and construction phases of the Project to ensure noise and vibration impacts associated with construction activities are avoided or minimised,
- Outlines the roles and responsibilities of site personnel with regard to noise and vibration management on site,
- Details the management procedures with regard to the implementation, monitoring, auditing and reporting requirements of the PLAN-ENV-006 NVMSPP;
- Provides an efficient and proactive approach to addressing noise and vibration for the duration of the Project.

The PLAN-ENV-006 NVMSPP, addresses the noise and ground borne vibration issues that would arise during the construction activities for the Project and, in particular, the blasting to be undertaken for the tunnelling at St Helena Hill.

The PLAN-ENV-006 NVMSPP specifies that prior to blasting commencing at a site, sensitive receivers will be identified and appropriate measures taken to ensure overpressure and vibration emissions are within required levels. This will be achieved through the preparation of a Blast Management Plan as detailed in PLAN-ENV-006 NVMSPP mitigation measure NV22. The Blast Management Plan prepared addresses potential risks and control measures and has been prepared in accordance with Section 4 of AS 2187.2-2006 Australian Standard Explosives – Storage and Use, Part 2: Use of Explosives. The Blast Management Plan addresses the following issues:

- Administration and legislation,
- Safety and security,
- Blast history and consultation,
- Physical characteristics and geology,
- Responsibilities,
- Environmental impacts,
- General safety precautions,
- Special precautions;
- Blast design.

In addition to the PLAN-ENV-006 NVMSPP, a Controlled Blasting Communications Plan has been developed to ensure the community is informed and any concerns are addressed. This Plan is included as Appendix 3 to this report.

The mitigation measures that will be put in place to manage noise impacts of the blasting works during construction include the following:

- The implementation of the Blast Management Plan in accordance with AS 2187.2-2006 Australian Standard Explosives – Storage and Use, Part 2: Use of Explosives to formalise procedures so that blasting activities are undertaken in accordance with each blast design and necessary mitigation measures for a particular blast are put in place.
- Monitoring of airblast overpressure and vibration levels from all blasting activities. The results of this monitoring will be made available online in accordance with the Project Instrument of Approval and Environment Protection Licence.
- Careful blast design based on results from a trial blast as well as information from subsequent blasts. This will include steps to determine if additional mitigation measures other than those relating to charge weights and blast initiation sequencing are required. These measures include placing additional fill or the use of blast mats if deemed appropriate.
- Formalised post-blast review procedures in accordance with AS 2187.2-2006 Australian standard Explosives – Storage and Use, Part 2: Use of Explosives to ensure that the design of any subsequent blasts reflects the performance of previous blasting activities.
- Using appropriate explosives such as electronic detonators in areas of particular sensitivity to ensure accurate blasthole initiation sequences.
- Livestock owners will be informed of blasting activities that have the potential to significantly impact upon livestock.

- Additional monitoring would be undertaken to verify noise levels associated with the subject blasting as detailed within this report.

The implementation of the above mitigation measures would result in ensuring that excessive noise levels are not experienced as a result of the proposed modification.

5.2 Vibration and Overpressure

5.2.1 Existing environment

Vibration and overpressure as the result of blasting has been assessed in the development of the EA for the concept design of the Project. Blasting for tunnelling activities at St Helena Hill is described in Sections 15.1.5 and 15.3.3 and in Working Paper No. 8 of the EA. The EA states that ground vibration and air blast (blast overpressure) are the environmental impacts caused by blasting activities for the tunnel construction.

It can be noted that the subject location is exposed to existing levels of overpressure in excess of the limits specified within the Project Instrument of Approval as detailed within Section 4.5 of this report.

5.2.2 Potential airblast overpressure and vibration impacts

Blasting produces ground-borne vibration and air blast overpressure, both of which can cause discomfort and, at higher levels, damage to property. Airblast overpressure is a pressure wave in the atmosphere which is caused by the detonation of explosives, but can also be caused by natural phenomena such as wind. As stated within AS 2187.2 Cl. J5.2 Human comfort limits, "...the factors that contribute to annoyance by impulsive sounds such as airblast are loudness, duration and number of events plus the time of day and nature of disturbance". Considering the number of events may be the most significant factor, implementation of the proposed limits would reduce the number of events and have negligible effect on each of the other factors thus directly and significantly improving human comfort.

Overpressure consists of both an audible (noise) and inaudible energy and is measured in dB (Lin Peak). Ground vibration is the motion of the ground caused by the passage of seismic waves originating from a blast – measured as peak particle velocity (PPV).

Clause 6.8 of the RTA D&C G36 requires adoption of the Australian and New Zealand Environment Conservation Council (ANZECC) *technical basis for guidelines to minimise noise annoyance due to blasting over pressure and ground vibration (September 1990)* for all blasting activities on site. It is proposed to increase the airblast overpressure and vibration limits specified within this guideline for the St Helena Tunnel works so that the benefits to the nearby community and external stakeholders outlined in Section 4.6 of this report can be realised.

As a component of this modification report, the impacts of vibration on nearby residential receivers as a result of increased blasting limits has been modelled and assessed.

Blasting vibration contours modelled as a result of blasting under a 5mm/s maximum and 15mm/s maximum are shown within Figure 33 and 34 below.

Explosive Quantities			LEGEND	
■	<1 kilogram	1%	---	Expected 20mm/s Vibration Contour
■	Between 1 and 2 kilograms	18%	---	Expected 15mm/s Vibration Contour
■	Between 2 and 3 kilograms	23%	---	Expected 10mm/s Vibration Contour
■	Between 3 and 4 kilograms	14%	---	Expected 5mm/s Vibration Contour
■	Between 4 and 5 kilograms	12%	---	Expected 2mm/s Vibration Contour
■	>5 kilograms	32%		

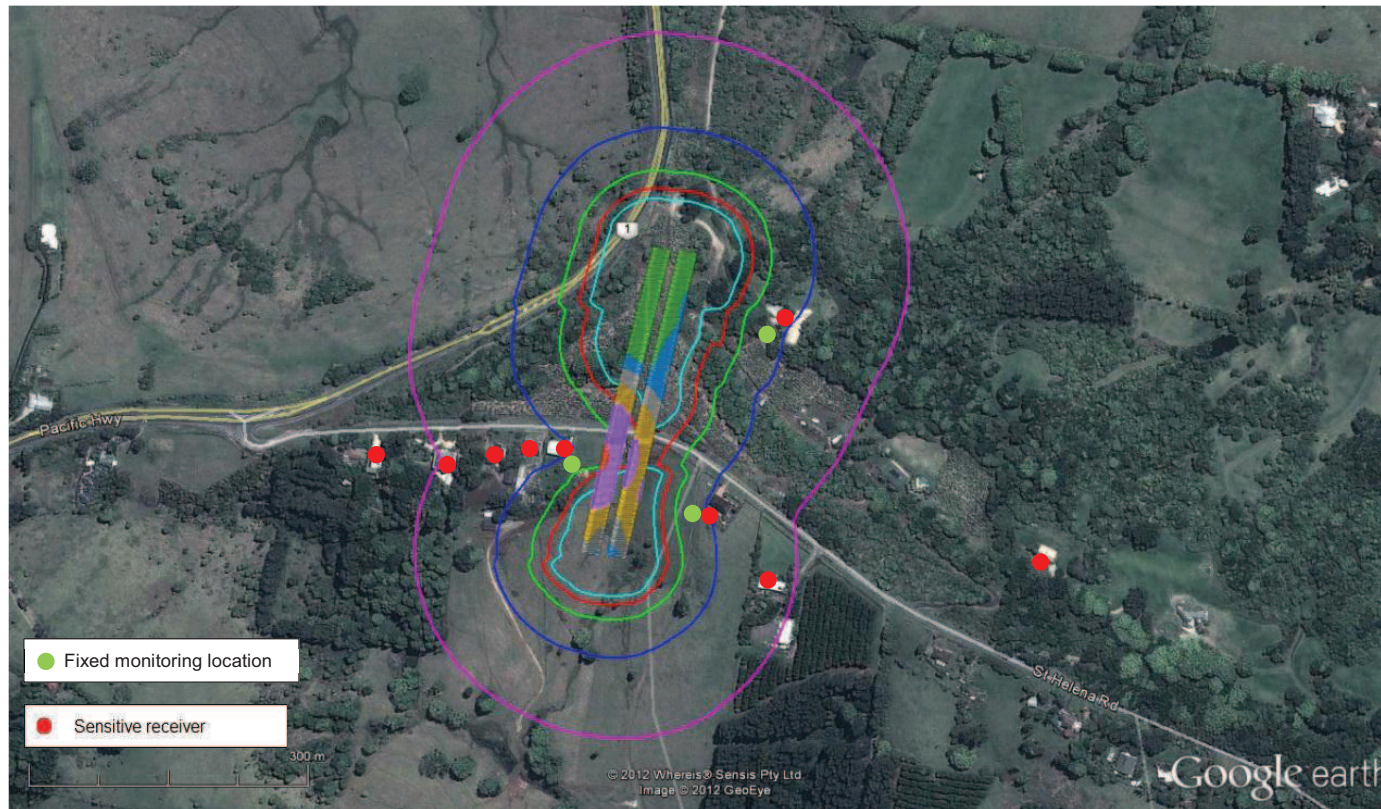


Figure 33 - Blast impact zone to 5mm/s with current MCoA

Explosive Quantities		LEGEND	
■	<1 kilogram	0%	--- Expected 20mm/s Vibration Contour
■	Between 1 and 2 kilograms	0%	--- Expected 15mm/s Vibration Contour
■	Between 2 and 3 kilograms	0%	--- Expected 10mm/s Vibration Contour
■	Between 3 and 4 kilograms	1%	--- Expected 5mm/s Vibration Contour
■	Between 4 and 5 kilograms	5%	--- Expected 2mm/s Vibration Contour
■	>5 kilograms	94%	

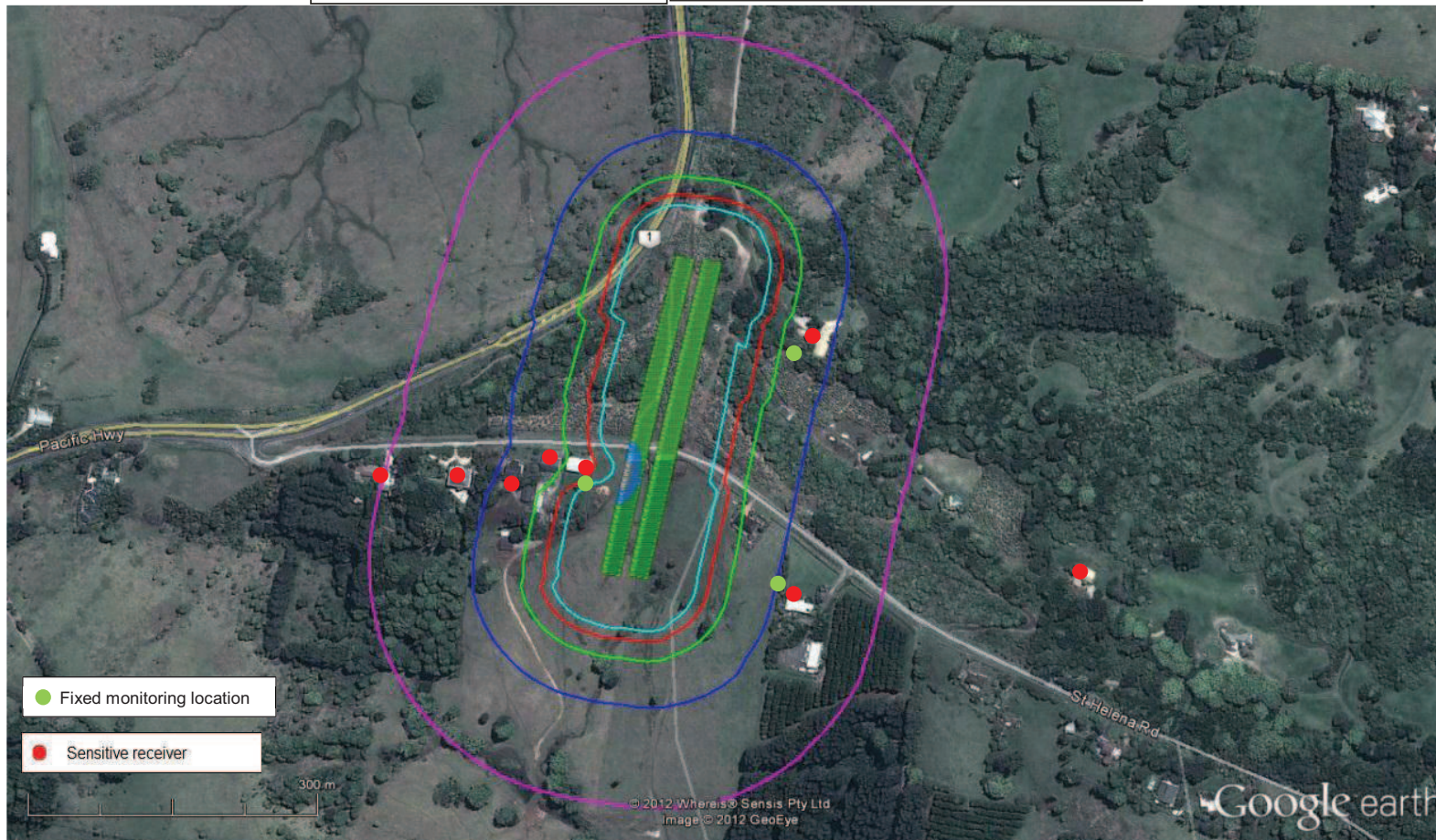


Figure 34 - Blast impact zone to 15mm/s with proposed changes to MCoA

A comparison between the expected five millimetres per second vibration contour between the expected blasting operations to be undertaken with the current MCoA and the proposed changes made to the MCoA is illustrated in Figure 35 below.

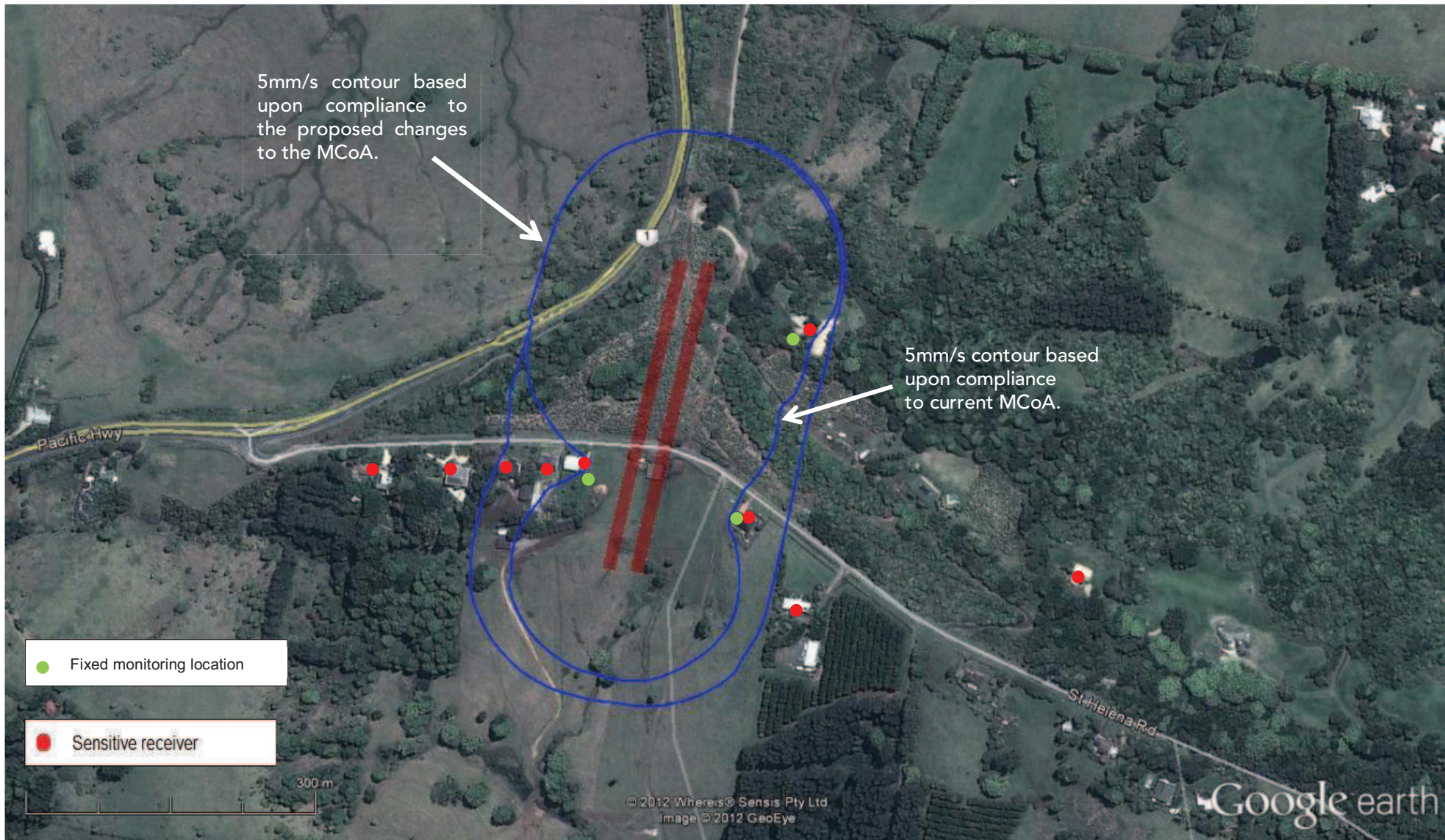


Figure 35 - Comparison of expected 5mm/s contour between current and proposed MCoA

As depicted within Figure 35, five residential receivers are expected to experience ground vibration levels in excess of five millimetres per second as a result of increased blast weights that would be used if the proposed changes to the MCoA were approved and the geological conditions were favourable to extended round lengths. All of these five residences have provided written consent in relation to the increased vibration levels. As detailed within this report, although these residences would have an increased impact from vibration and airblast overpressure, the reduction in the total impact of the construction works from the proposed modification significantly outweighs these impacts.

Due to the theoretically continuous nature of blast induced vibration, all nearby sensitive receivers in principle would experience increased vibration levels. However, other than the five receivers that experience vibration levels in excess of five millimetres per second, the vibration level experienced is still expected to be below the limit for human comfort detailed in the ANZECC guidelines. This would result in negligible impact to these receivers. Notwithstanding, all nearby receivers have been involved in the consultation process regarding the proposed modification as detailed within Section 2 of this report. Furthermore, these residents would benefit from the decreased construction duration and decreased total impact of the works on the area affected by the St Helena tunnel works. In particular, these residents would benefit from the reduction in the amount of rock breakage using hydraulic hammers on the TCC, tunnel portal and box cut works which would occur if the proposed modification was approved from both a noise and dust perspective.

While the total impact of vibration would increase at nearby sensitive receivers, this document has outlined that this increased impact is far outweighed by the subsequent decrease in other impacts as a result of the modification.

In relation to overpressure, it is recognised that complaints registered from blasting activities often relate to this element. However, such complaints may commonly be related back to unexpected audible components of overpressure. Given the extent of community consultation that has been undertaken in regard to this modification, the implementation of the Controlled Blasting Communications Plan (CBCP) (included as Appendix 3 to this report) and the selection of proposed limits far below those that may have significant negative effects, it is not expected that complaints will arise from the airblast induced from the blasting activities related to the St Helena tunnel works.

Whilst it is expected that the increase in blast weights that result from the proposed modifications would increase the perceptibility of the blasting activities for the St Helena tunnel works, the positive benefits detailed in Section 4.6 of this report would far outweigh these impacts.

Internationally accepted levels of overpressure in the literature considered to represent the on-set of damage to buildings, taken as the breakage of glass panes, may occur at levels in excess of 136 decibels. Similarly, according to the Committee on Hearing, Bioacoustics and Biomechanics, ear protection is only considered necessary when levels reach 139 decibels. The Committee on Hearing, Bioacoustics and Biomechanics is part of the National Academy of Sciences based in the United States of America to act as independent advisors on scientific matters. As previously explained, the proposed modified levels for airblast overpressure are approximately 400 per cent lower than these and as such are not expected to have any adverse structural or biological effects. Furthermore, the proposed limits for airblast overpressure are below the overpressure levels induced by naturally occurring events such as wind and are only expected to have a duration of several seconds over the duration of a blast event. As such, while the overpressure may be perceptible, it would still be below levels caused by natural phenomenon that persons experience regularly as part of everyday life.

As detailed above, the proposed overpressure limit of 130 dB(L) is significantly less than the 136 dB(L) damage for structures criteria prescribed by AS 2187.2 where damage to window frames may occur. It can also be noted that as the dB scale is logarithmic, 136dB(L) is approximately 400 per cent the pressure difference experienced at 130 dB(L).

It is possible that livestock and pets may react adversely to the increase in charge weights. To manage this, on-going communication between BPL and the local community will be employed to manage these issues on a case by case basis as they may arise. However, as vibration can be perceived by humans and other animals at levels far below even those in the current MCoA, it is likely that if adverse reaction was to occur in livestock, it would occur regardless of the proposed modification.

From the above assessment it has been determined that the proposed increases in overpressure and vibration would be well below the Australian Standard for cosmetic (property) damage. It has also been determined that the increased impacts to adjacent residential receivers at the proposed limits would be far outweighed by the decreases to other sources of disruption. Furthermore, management procedures would be in place to ensure compliance with the proposed limits as is outlined in the following Section of this report.

5.2.3 Proposed mitigation measures

Further assessment of the impacts of airblast overpressure and vibration due to blasting has been undertaken in the detailed design for the Project and in the preparation of the PLAN-ENV-006 NVSMP. The PLAN-ENV-006 NVSMP has been prepared in accordance with Condition 6.5(d) of the Instrument of Approval for the Project and has also examined noise and vibration issues due to blasting activities for the tunnelling at St Helena Hill. Pre-construction noise monitoring (attended and non-attended) and modelling has also been completed as part of the development of the PLAN-ENV-006 NVMSMP.

As previously mentioned, the PLAN-ENV-006 NVMSMP forms part of the PLAN-ENV-001 CEMP which details the mitigation measures and monitoring required during the construction phase of the Project to manage potential noise and vibration related impacts associated with the construction of the St Helena tunnels.

Mitigation measures that relate specifically to blasting for the Project as taken from the PLAN-ENV-006 NVMSMP, RTA D&C G36 and the Project Scope of Works and Technical Criteria include:

- Before blasting commences at a site, sensitive receivers will be identified and appropriate measures taken to ensure overpressure and vibration emissions are within required levels.

This will be achieved through the preparation of a Blast Management Plan. The plan prepared will address potential risks and control measures, will be in accordance with Section 4 of AS 2187.2-2006 Australian Standard Explosives – Storage and Use, Part 2: Use of Explosives, and address the following issues:

- Administration and legislation,
- Safety and security,
- Blast history and consultation,
- Physical characteristics and geology,
- Responsibilities,
- Environmental impacts,
- General safety precautions,
- Special precautions;
- Blast design.

Compliance monitoring of blasting activities will be undertaken in accordance with Table 11 [of the PLAN-ENV-006 NVMSMP].

All of the above requirements have been integrated into the PLAN-ENV-001 NVSMP for the Project in order to effectively manage the impacts of blasting on surrounding environs in accordance with Project Approvals and other relevant standards and guidelines.

The management measures that will be put in place to manage vibration and overpressure levels induced by the blasting works for the St Helena tunnel works during construction include the following:

- Blast management plans in accordance with AS 2187.2-2006 Australian Standard Explosives – Storage and Use, Part 2: Use of Explosives to formalise procedures so that blasting activities are undertaken in accordance with each blast design and necessary mitigation measures for a particular blast are put in place.
- Monitoring of airblast overpressure and vibration levels from all blasting activities. These results will be made available online in accordance with the Project Instrument of Approval and Environment Protection Licence.
- Careful blast design based on results from a trial blast as well as information from subsequent blasts. This will include steps to determine if additional mitigation measures other than those

relating to charge weights and blast initiation sequencing are required. These measures include placing additional fill or the use of blast mats if deemed appropriate.

- Formalised post-blast review procedures in accordance with AS 2187.2-2006 Australian standard Explosives – Storage and Use, Part 2: Use of Explosives to ensure that the design of any subsequent blasts reflects the performance of previous blasting activities.
- Using appropriate explosives such as electronic detonators in areas of particular sensitivity to ensure accurate blasthole initiation sequences.

Flashing warning lights will be attached to vibration monitors, triggered by vibrations in excess of the maximum Peak Particle Velocity limit as prescribed by the Project Instrument of Approval and Environment Protection Licence to provide a 'real time' visual warning of vibration exceedences.

Additional monitoring would also be undertaken to verify compliance with required vibration and overpressure levels associated with the subject blasting as detailed within this report.

In addition to the above mitigation measures, blasting in relation to the St Helena Tunnel works would be avoided during periods of high winds where it is determined that to proceed may have the potential to result in the blast exceeding in Project overpressure limits or create unreasonable impacts to nearby sensitive receivers.

In determining whether it is appropriate to proceed with the blast, the responsible Project Manager or delegate would consider:

- Wind speed,
- Wind direction,
- The location of nearby sensitive receivers;
- Blast loading and design.

Where it is determined by the responsible Project Manager or delegate that the blast should not proceed due to high winds and risk the potential for the blast to exceed Project overpressure limits, the process of the consideration of the above factors would be documented and reported to the Department of Planning and Infrastructure as part of the Compliance Tracking Program required under Condition 4.1 of the Instrument of Approval issued for the Project.

As explained previously within this report, approval of the modification proposed to the vibration and airblast overpressure limits would significantly reduce the amount of disturbance to residents caused by the construction of the St Helena works. These reductions would significantly outweigh any increased impacts from vibration or overpressure and as such residents would experience an improved 'quality of life' with the modifications approval. Furthermore, Section 4 details positive impacts to stakeholders and the wider community that would result from approval of the modification.

All community consultation and engagement undertaken in relation to blasting will be communicated as detailed within the PSP-ENV-NV-001 Blast Management Plan and the PLAN-CI-002 Controlled Blasting Communications Plan.

In accordance with RTA D&C G36, when undertaking blasting, due care will be taken during the activity to prevent damage to heritage items, adjacent public utilities, structures and buildings resulting from construction vibration and air blast. These requirements have also been integrated into the PLAN-ENV-001 NVMSPP. Utilities in the area have been identified and information on acceptable limits for these has been received by BPL. These limits are above those proposed in this report. The same management procedures to ensure compliance to the MCoA at sensitive receivers will be implemented to ensure compliance at services.

Mitigation measures for the community have been established, including a Controlled Blasting Communication Plan, developed specifically for the St Helena tunnel blasting activities. The primary purpose of the plan is to outline the communications activities that will underpin consultation with the residents living within a 500 metre radius of the St Helena tunnel, who will be potentially affected by tunnel construction, particularly controlled blasting and vibration.

As part of the plan, a damage claim procedure for the St Helena tunnel works was developed. This procedure is included as Appendix 10 to this report.

Letters including the 'letter of non-objection for extension to blasting hours', and 'letter of consent to increase vibration and airblast overpressure limits' for St Helena tunnel construction were delivered to affected residents, which outlined very detailed information about the proposed modification. A tunnel blasting fact sheet was also delivered to residents describing the process for tunnel construction, controlled blasting, and proposed mitigation measures which ensured all affected residents were given adequate information about the tunnel construction prior to commencement of the work.

A complaints management procedure was also developed as part of the Community Communications Strategy (CCS) and included in the Controlled Blasting Communication Plan (CBCP), and details the process for handling community complaints. The Project has a dedicated toll free 24/7 contact line available (1800 882 787), for inquiries and complaints and it is printed on all published material sent to the community, on the website, at every community information session, and on Project signage.

Following the trial blast, on 19 October 2012, sensitive stakeholders in close proximity to the southern tunnel portal (location of the trial blast) were contacted to ascertain whether they, or their livestock, experienced any effects from the trial blast. All residents advised there were no issues.

To minimise risk regarding the unlikely event of potential damage to properties occurring from blasting activities, all properties within a 500 metre radius of the tunnel had detailed property condition reports completed. Further to this, structural assessments were carried out on these properties to assess the structural condition of the property prior to any blasting taking place. An assessment of underground water tanks was also carried out and a copy of the reports were provided to each property owner and the RTA's Representative, prior to the commencement of construction.

In addition, water samples were taken from water tanks prior to blasting to record the quality of the water within 500 metres of the blast zone. These results have been provided to each property owner.

5.3 Air quality

5.3.1 Existing environment

Potential air quality issues associated with the Project have been assessed within Section 19 of the EA.

The EA found that all measured levels of pollutants (with baseline data taken from Coffs Harbour as the most relevant data source) are likely to be below their respective air quality goals. These measured values include emissions from the traffic on the Pacific Highway which will be the major contributor to carbon monoxide and nitrogen dioxide. Particulate matter will have contributions from other sources.

5.3.2 Proposed impacts

The EA found that dust would be generated from earthworks associated with the Project. The total amount of dust would depend on the silt and moisture content in the soil and the types of activities being carried out.

The major sources of dust identified by the EA were bulldozers, excavators and wind erosion from the exposed surfaces. It can be noted that none of these high dust generation activities would be exacerbated as a result of the proposed increase in blasting hours and limits as the subject modification would not require an increase in these activities.

It can be noted that the majority of dust generated by the excavation activities will be caused through the removal of the rock itself. As the excavation would be undertaken regardless of the modification, there is not expected to be an increase in the impact of the works in terms of air quality as a result of the removal of rock.

Dust generated from underground blasting works is controlled as the ventilation is turned off during blasting. Once the ventilation is restarted, it is not expected that the dust will be agitated by the flow of air. This is a result of ventilation velocities being managed so as not to agitate dust as this would create an unsafe working environment during the excavation of the St Helena tunnels.

Further to this, there is expected to be a reduction in the total dust generated during the excavation of the St Helena Tunnel works if the proposed modification is approved. This is due to the fact that the proposed modification would significantly reduce the requirement to use hydraulic rock breakers which would be expected to generate significantly more dust than drilling and blasting activities for excavation. A decrease in dust production would also be attributable to an overall reduction in required drilling.

5.3.3 Proposed management measures

Based upon the above assessment, it has been determined that the proposed management measures outlined within Section 19 of the EA and the subsequent PLAN-ENV-002 Air Quality Management Plan (AQMP) are considered appropriate and relevant in relation to the subject proposal with regard to air quality management.

Mitigation measures that would be implemented if dust is being generated in excessive quantities include the potential wetting of the blast area in especially dry and windy conditions, wetting of the blast area after blasting in dry and windy conditions and the use of stemming. Although stemming is primarily used to control flyrock and to ensure safe blasting practices, it has the added effect of controlling dust generation during blasting. The use of mitigation measures other than stemming for the open cut works would be determined by project staff on a blast by blast basis depending on the conditions present. For the underground works, the location of the blasts underground and the selection of an appropriate air velocity serve to mitigate issues with dust generation.

It can also be noted that blasting in relation to the St Helena Tunnel works would be avoided during periods of high winds where it is determined that to proceed may have the potential to result in the generation of unacceptable dust levels.

In determining whether it is appropriate to proceed with the blast, the responsible Project Manager or delegate would consider:

- Wind speed,
- Wind direction,
- The location of nearby sensitive receivers;
- Blast loading and design.

As with consideration of potential impacts associated with overpressure, where it is determined by the responsible Project Manager or delegate that the blast should not proceed due to high winds and risk the potential for the blast to generate unacceptable dust levels, the process of the consideration of the above factors would be documented and reported to the Department of Planning and Infrastructure as part of the Compliance Tracking Program required under Condition 4.1 of the Instrument of Approval issued for the Project.

In addition to the implementation of the above mitigation measures, real time P10 and depositional dust monitoring would be undertaken to verify compliance with Project dust goals as prescribed by the Project Instrument of Approval and Environment Protection Licence.

5.4 Traffic

Traffic impacts as part of the Project were assessed within Section 13 of the EA. The following section details the potential impact of the proposed modification on traffic in addition to the findings of the EA.

5.4.1 Existing environment

St Helena Road and the Pacific Highway are the main roadways within the vicinity of the tunnel works. The existing traffic on the Pacific Highway is considered to provide a 'D' category level of service displaying unstable flow conditions. St Helena Road is classified as a local road that has low existing volumes and is not likely to be affected by the Approved Project.

5.4.2 Proposed impacts

The EA for the Project found that much of the proposed upgrade would be able to be constructed with minimal disruption to existing highway traffic.

Local roads such as St Helena Road may be subject to short term disruptions during blasting works. Additional road closures would be subject to detailed design and blast management procedures determined prior to and during construction.

Notwithstanding the above, the subject increase in blasting limits and hours would substantially increase productivity associated with the earthworks excavation involved in the tunnel construction. This would significantly decrease the duration of blasting activities and therefore minimise the longer term impact to traffic through fewer blasts, fewer road closures and the duration at which the area near the St Helena tunnelling works is impacted by construction traffic and traffic control measures. Specifically, the proposed modification would result in 50 per cent fewer rolling stoppages of the Pacific Highway reducing traffic delays and 50 per cent and fewer closures of St Helena Road reducing traffic stoppages and delays.

Furthermore, traffic in the area would benefit due to the completion of the St Helena tunnel works in a more timely fashion. Hence, the reduction in the construction schedule would have numerous significant positive effects on local and regional commuters of the Pacific Highway. These include, but are not limited to, commuters being able to use the upgraded highway earlier resulting in improved travel times, improved efficiency for transport companies, significant improvements for heavy vehicles through the avoidance of the current steep grades of the Pacific Highway at the St Helena Hill and importantly, an increase in the safety of the Pacific Highway for all commuters. While these benefits would all eventually be realised by the completion of the Project, the reduction in the construction programme would result in the significant benefits to the Project being realised by Project Stakeholders and the wider community sooner.

Overall, it is expected that the proposed modification would have significant positive effects on traffic conditions for residents as well as commuters, both local and regional on the Pacific Highway.

5.4.3 Proposed management measures

The proposed management measures outlined in Section 13 of the EA and the subsequent PLAN-TM-001 Traffic Management Plan (TMP) for the Project are considered appropriate and relevant to the proposal.

In addition, affected residents would be informed prior to any controlled blast. Public safety and government guidelines require that all people, vehicles and livestock are a safe distance away from the blast zone. To ensure people are at a safe distance from each blast, mitigation measures that would be implemented may include:

- Temporary closure of access locations to local roads, and property accesses (residents would be notified in advance),
- Stopping of traffic on St Helena Road for up to 10 minutes and 'rolling stoppages' on the Pacific Highway. These measures will be coordinated to ensure that they have minimal impact on the local community. Provision will be made to ensure that emergency access is maintained during any road closures,
- For safety reasons, some residents may be asked to remain indoors or be temporarily relocated during controlled blasting. A Project representative would be in contact with these residents in advance.

The above mitigation measures relate to the controlled open cut blasting only. The controlled tunnel blasting is contained within the tunnel and, as such, it is not envisaged that any specific mitigation measures would be required.

In addition to these controls, blasting activities would be scheduled to minimise the impact of road closures to commuters along St Helena Road and the Pacific Highway. However, unforeseen events may result in the road being closed at any time during which blasting is permitted.