



Figure 7: Cultural Heritage Protection Areas

APPENDIX 2

Registered Aboriginal Stakeholders (on behalf of their families):

Name	Address	Phone Number
Bartie, John	15 Turpentine Place, Tyalgum, NSW, 2484	
Boyd, Harry	C/O Bo Lourey PO Box 862, Murwillumbah, NSW, 2484	
Browning, Marcia	4 Letitia Road, FINGAL HEAD NSW 2487	
Cora, Mark	218 Kirkwood Road, Tweed Heads South, NSW, 2486	
Currie, Deidre	11 Flamingo Place, West Tweed Heads, NSW, 2485	
Dawney, Carol	3 / 2 Seymour Street, Tweed Heads South, NSW, 2486	
Ford, Maxwell	21 Hector Road, HOLLAND PARK QLD 4121	
Lena, Kathleen	18 Water Street, TWEED HEADS SOUTH NSW 2486	
Logan, Russell	C/O WICEEDO 9 Tathra Street, Pottsville Beach, NSW, 2489	
McDonald, Jackie	On behalf of Jason McDonald, Levi McDonald, Adam Mazzarella, Peter Buxton and Paul Buxton. 63 Tringa Street, Tweed Heads West, NSW, 2485	
Morgan, Christine	3 Duffy Street, TWEED HEADS SOUTH, NSW 2486	
Mye, Lesley	Lot 4 Birrigan Close, NOBBY'S CREEK NSW 2424	
Slabb, Kyle	C/O Tweed Byron LALC PO Box 1410, Kingscliff, NSW, 2487	
Summers, Joyce	26 Brier Crescent, Varsity Lakes, QLD, 4227	
Tweed Aboriginal Co-op	C/O Desare Rotumah PO Box 6231, Tweed Heads South, NSW, 2486	
Tweed Byron LALC	21/25 Ourimbah, Road, Tweed Heads, NSW, 2485 PO Box 1410, Kingscliff, NSW, 2487	

Williams, Doug	6/45 Mirrabooka Cr, LITTLE BAY NSW 2036	
Yuke, Kym	PO Box 1233, COORPAROO DC QLD 4151	

Developers Cultural Heritage Contact:

Name	Address	Phone Number
Mr Reg van Rij	PO Box 1914, Gold Coast Surfers Paradise, QLD, 4217	(07) 5570 5500

Cultural Heritage Advisor:

Name	Address	Phone Number
Tim Robins Everick Heritage Consultants	47 Arthur Terrace, Red Hill, QLD, 4059 PO Box 146, Red Hill, QLD, 4059	0432 816 460 (07) 3368 2660

APPENDIX 3

PROPOSED MONITORING PROTOCOLS

Monitors will:

- Participate in Cultural Heritage Monitoring and sub-contract works.
- Assist in Construction works as directed by the Development Construction Manager, provided it does not interfere with their Monitoring duties.
- Report to the Development Construction Manager at a brief daily meeting to discuss all work to be undertaken by them during that day, completed by them on the previous day, and otherwise relating to their performance of the duties of Monitors in accordance with this CHMP.
- Provide preliminary determination of the extent of any previously unidentified Finds and approximate determination of the appropriate Exclusion Zone for any identified Aboriginal Cultural Heritage Object or Site.
- Report back to the Project Construction Manager and Registered Aboriginal Stakeholders with regard to Monitoring activities and any Finds.
- Attend the Site within 4 hours of an Aboriginal Cultural Heritage Object or Site being discovered.
- Undertake the Developers specific Workplace Health and Safety Induction training.
- Wear safety clothes and equipment as required by the Developer, including but not limited to steel capped boots (to be provided by the Monitor) and safety vest and hard hat (to be provided by the Developer).
- Not impede the operations of Construction Staff.
- Complete time sheets at the beginning and end of each day or part day that the Monitor is on Site as reasonably required by the Developer.
- Comply with any protocols and procedures for visitation to the Development Area.
- Immediately inform the Development Construction Manager of the location and nature of any Cultural Heritage Find during Monitoring.
- In the event that skeletal material is found, follow procedures detailed in **Appendix 6**.
- At the end of each relevant working day, finalise a Monitoring Clearance Sheet which will be provided by the Developer.
- Ensure that they arrive at the designated part of the Development Area at the designated time.
- Collect Monitors Kit at the beginning of each day and return them at the end of each day (See below).
- Undertake Monitoring Activities as required in Paragraph 7.3.
- Be available to work on 96 hours' notice.
- Remain at their assigned locations except in an emergency.

On-site Monitoring Procedure

- If the Monitors are late on-site, work will proceed whether they are present or not.
- The Development Construction Manager will inform the Monitors of the type of work that will be carried out during the day.
- Once this has been established, the Monitors will begin monitoring for Cultural Heritage (e.g. stone artefacts, shell material, bone, etc) unearthed during the clearing work.
- Monitors will stay at the designated Monitoring location unless the Development Construction Manager advises or requests otherwise.
- Monitors will be introduced to the driver(s) of the earthmoving equipment who will be undertaking the clearing. The driver and Monitor are to come to a mutual arrangement regarding procedures they will follow (e.g. hand signals) when the Monitor wishes the driver to temporarily stop so that he can inspect any suspected Cultural Heritage material that may have been exposed.
- When working in proximity to large earthmoving equipment, such as bulldozers, graders or excavators, stringent safety rules are to be observed.
- Monitors will check-in any Cultural Heritage (e.g. stone artefacts, shell material, bone etc) collected during the day's work, along with the Collection Record Sheets, any completed Clearance Sheets and their Monitoring Kits. Cultural Heritage Objects will be stored by the Developer until such time as it can be handed into the care and control of the Tweed Byron LALC.

Raising Issues

If the Monitors wish to raise any issues, or report incidents or accidents that may have occurred while they were monitoring that day, they should contact the Development Construction Manager or the Cultural Heritage Advisor.

Monitoring Kits

Monitors will receive Monitoring Kits when undertaking their work. It is their duty to ensure that the Monitoring Kits are complete with the required contents each day.

The Cultural Heritage Advisor will prepare the Monitoring Kits and deliver them to the site office. The Development Construction Manager will be responsible for issuing the kits and having available in the site office additional materials required for restocking them.

Monitoring Kits will contain at least the following:

- Collection Record Sheets x 3
- Clearance Sheet x 1
- Collection Bags x 3
- CHMP x 1
- Daily Time Sheet
- Stop Work Forms x 2
- Contact Details Form x 1
- Back pack/carry bag x 1
- Clipboard / ring binder x 1
- Pen x 1
- Marker x 1
- Safety Vest
- Hard Hat

The Developer will also provide the lead Monitor with a camera and a GPS as required.

Monitors are to ensure that these kits are stocked sufficiently, and that they are returned at day's end in an appropriate state. Cameras are to be only used for photographing Cultural Heritage Objects and Sites.

Monitors must wear prescribed safety equipment and abide by the following rules:

- Never walk in front of a moving or operating machine.
- Never be in the close vicinity when trees are being felled or pushed or pulled.
- Observe a safety zone distance of at least twenty (20) metres between the Monitor and the machine.
- Machinery such as bobcats can be approached reasonably safely, provided that the bobcat operator is aware at all times of the position of the Monitor and that eye contact is maintained between the Monitor and the operator.

APPENDIX 4

CONDITIONS OF EMPLOYMENT FOR ABORIGINAL MONITORS

- Monitors shall be employed by the Developer. The Developer will oversee the employment, management, administration and remuneration of the Monitors, including the provision of workers compensation, superannuation, tax contributions and insurance cover.
- Monitors must comply with all relevant legislation including all Workplace Health and Safety Regulations.
- Monitors shall be nominated by the Registered Aboriginal Stakeholders based on their qualifications, experience and availability.
- Taxation provisions will govern the net dollar figure paid for every Monitor engaged in Monitoring the Development. The Remuneration as outlined in Paragraph 7.4 is to be made clear to the Monitors before the commencement of the Cultural Heritage Monitoring.
- Time sheets must be signed by each Monitor before payments are processed. It is not necessary for the Developer to provide a copy of the time sheet to the Monitor unless he/she requests it.
- Transport to and from the relevant Site will not be provided by the Developer.
- No alcohol or non-prescription drugs will be allowed in the Development Area. Persons found in possession of, or on reasonable grounds suspected of being under the influence of alcohol or non-prescription drugs, will be summarily dismissed and not paid for that day.
- Monitors will work only as required by the Developer under the terms of this CHMP.

The Developer recognises that certain protocols or cultural events may exist or occur within the Registered Aboriginal Stakeholders' community (particularly in relation to family issues and bereavement) that may within reason affect the ability of the Monitors to perform in accordance with the terms of the CHMP. In such cases the Registered Aboriginal Stakeholders will communicate with the Contractor as soon as possible, and use their best endeavours to avoid any cessation of Monitors' activities and thereby avoid disruption of Construction. Failure of the Monitors to be on site at an agreed time without prior notification will not constitute a reason for the Developer to cease work. The Developer will assume that the Registered Aboriginal Stakeholders has decided that no monitors are required on that day or at that location. Where notification is provided, the Developer accepts that operations if Monitors are required will cease where necessary for the period agreed between the Parties.

APPENDIX 5

MONITOR LIST:

Name:	Group/Organisation:	Address:	Contact Numbers:

APPENDIX 6

HUMAN REMAINS POLICY: MANAGEMENT OF ABORIGINAL BURIAL REMAINS

The following principles have been developed to conform with the National Parks and Wildlife Service “*Standards for Archaeological Practice in Aboriginal Heritage – Aboriginal Ancestral Remains*” published in September of 1997.

1.1 Guiding Principals

Death in all human societies is a significant event. It occurs on a regular, but unpredictable basis, removing individuals from family, close relations and friends. Death is often associated with complex rituals. This was and still is the case with Aboriginal people. Disturbance to burials is therefore of major concern to them, as it is for other people in the community.

Aboriginal and Torres Strait Islander people have been in New South Wales for more than 40,000 years. In that time they have buried hundreds of thousands of their dead in a variety of ways. In some cases people were cremated, in others their bones were placed in hollowed-out logs or trees or wrapped in bark cylinders and placed in rock shelters. Many were also buried in the ground with grave goods. Burials commonly occur in sand dunes and alluvial deposits which were easy to dig. Wind and water easily erode such locations and frequently these natural processes expose remains. Other common burial locations are rock shelters, rocky overhangs and hollow trees. The close proximity of scarred or carved trees and stone arrangements and the remains of fireplaces, stone artefacts and food refuse may be suggestive of an Aboriginal burial.

When acting under this CHMP, the Cultural Heritage Advisor will follow the following Principles and Rules contained in the *Code of Ethics of the Australian Archaeological Association*:

Principle 3: ‘To acknowledge the special importance of indigenous ancestral human remains, and Sites containing and/or associated with such remains, to the indigenous people.’

Rule 5: ‘Members shall not interfere with and/or remove human remains of indigenous peoples without the written consent of representatives authorised by the indigenous people whose cultural heritage is the object of investigation.’

1.2 Legislation and Regulations Background

The *National Parks and Wildlife Act 1974* (NSW) gives protection to all 'Aboriginal remains' except those occurring within cemeteries in which non-Aboriginals are also buried and those being dealt with in a forensic or related context (e.g., by a Coroner). The relevant paragraph of the Act [Part 1 Paragraph 5(1)] reads:

"Aboriginal remains" means the body or the remains of the body of a deceased Aboriginal, but does not include:

- a) a body or the remains of a body buried in a cemetery in which non-Aboriginals are also buried, or
- b) a body or the remains of a body dealt with or to be dealt with in accordance with a law of the State relating to medical treatment or the examination, for forensic or other purposes, of the bodies of deceased persons"

The Police Commissioner's Instruction 120.08 is intended to help police deal sensitively with the skeletal remains of Aboriginal people. It states:

If any material is suspected of being of Aboriginal origin and there are no suspicious circumstances, then the Site must be secured and a National Parks and Wildlife Officer contacted to identify the remains. Police are also asked to contact the nearest Aboriginal Community Liaison Officer (ACOL).

1.3 Procedure for when Aboriginal remains are Located

Where human remains are found, the Site should be cordoned off and the remains themselves should remain untouched. Efforts should then be made to notify the New South Wales Police Service.

The remains should be examined by a physical anthropologist or medical practitioner in order to establish their ancestry (as Aboriginal or European). The antiquity of the remains should also be determined by a physical anthropologist.

The Find should then be reported to the Registered Aboriginal Stakeholders. Any report should use respectful language, treating them as the remains of Aboriginal people rather than as scientific specimens, and be written in plain English.

K4 - Noise Environmental impact Assessment



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In association with CRG Traffic Pty Ltd

Proposed Earthworks for Central Open Spaces
Stages 9 and 11, Cobaki Development
Cobaki, NSW

ENVIRONMENTAL NOISE IMPACT REPORT

Prepared for:

Leda Developments Pty Ltd

11 December 2013

crgref: 13212a report



1.0 INTRODUCTION

This report is in response to a request by Leda Developments Pty Ltd for an environmental noise impact assessment of earthworks activities at the Cobaki Development at Cobaki.

In undertaking the above, noise monitoring was conducted; and through noise modeling, predictions of earthworks activity noise emissions were produced. Based upon the predicted noise impact levels, recommendations regarding acoustic treatment and management controls have been provided.

2.0 SITE & DEVELOPMENT DESCRIPTION

The proposal is to obtain a Section 75W approval for the winning of fill material from Precinct 9 and Precinct 11 sufficient to complete the bulk earthworks in the Central Open Space of the Cobaki Development. Refer to Appendix A of this report for the site location and Appendix B of this report for the earthworks strategy plans.

In-situ material will initially be ripped and heaped with a CAT D11 dozer, assisted by a 75t excavator (CAT 375). Once heaps are created, 65t (CAT 365) and 75t (CAT 375) excavators will be perched on top of the heaps and load six-wheeled drive (6WD) articulated dump trucks (CAT 740) at a rate of approximately one truck per five minutes. Dump trucks (CAT 740) have the capacity to carry 20-22m³ of fill and can haul loads to the deposition site at a speed of around 20km/hr. On return they can travel at speeds of around 50km/hr, with an empty tray.

The fill material will be dumped and then spread and compacted with a 32t bladed double drum sheep's foot compactor (CAT 825G). Water is applied as necessary for dust suppression and maintenance of moisture content during compaction. The water truck is based on a 6WD articulated dump truck (CAT 730) with a 25,000 litre tank.

It is noted that in-situ material in a portion of Precinct 9 is classified as very hard Greywacke rock, which will require blasting. At this stage, the location of blasting and the amount of blasting is unknown.

Indicative cut and fill volumes and time frames are as follows:

Precinct 9:	332,843m ³ for Central Open Space Stage 1 (133 days).
Precinct 11:	7,289m ³ for Central Open Space Stage 3 (3 days); and 86,051m ³ for Central Open Space Stage 2 (35 days).

Onsite earthwork noise / equipment noise has been assessed in accordance with the Department of Environment and Climate Change NSW (DECC) "*Interim Construction Noise Guideline*" to ensure an acceptable noise amenity can be achieved at the nearest offsite noise sensitive receivers (i.e. dwellings). It is noted that the Guideline is not mandatory but "*specifies noise management levels that guide the need to apply work practices to minimise noise impacts*". The Department of Planning and local councils may find the Guideline useful when dealing with noise from construction works that require planning approval.

Refer to Figure 2 in Appendix A of this report for the assessed noise sensitive receiver locations.

3.0 AMBIENT NOISE SURVEY

The following equipment was used to record ambient noise conditions at the subject site location:

- Rion NC 73 Calibrator; and
- Rion 29E Octave Band Sound Analyser.

All instrumentation hold current calibration certificates from a certified NATA calibration laboratory.

Background L_{A90} noise measurements were conducted between 8am and 9am on Wednesday 5th December 2013. Measurements were conducted at two locations with the microphone in free-field locations and approximately 1.5m above ground. It is noted that two additional locations were chosen for measurement; however, the sites were adversely affected by extraneous noise sources (i.e. distant drop saw cutting noise) and insect (cicada) noise. Refer to Figure 1 in Appendix A of this report for the measurement locations.

All measurements were conducted generally in accordance with Australian Standard AS 1055:1997 – “Acoustics-Description and measurement of environmental noise”. The operation of the sound level meter was field calibrated before and after the measurement session with no significant drift from the reference signal recorded.

Weather conditions during the noise monitoring period were fine, with a temperature of approximately 25°C and local wind speeds at the measurement positions at or below 5m/s.

Table 1 below presents the measured ambient background L_{A90} noise levels at the measurement locations.

Measurement Location	SPL dB(A) Hz Octave Band Centre Frequencies									
	31.5	63	125	250	500	1k	2k	4k	8k	AP
Location A	14	23	29	30	31	33	37	33	29	42
Location B	17	26	27	24	28	31	31	30	31	38
Location C	Adversely affected by distant drop saw cutting noise									
Location D	Adversely affected by insect (cicada) noise									

Table 1: Measured noise levels at the attended measurement locations.

4.0 NOISE CRITERIA

4.1 Earthworks Activity Noise Criteria

As a guide to quantifying impacts, the Department of Environment and Climate Change NSW (DECC) “Interim Construction Noise Guideline” (referred to in this report as “the guideline”) has been used. The guideline states the following in respect to management of noise impacts:

“Where noise from construction is above the ‘noise affected’ levels presented below, the proponent should apply all feasible and reasonable work practices to minimise noise. The proponent should also inform potentially affected parties of the activities to be carried out, the expected noise impacts and duration.”

Under the guideline, the criteria applied to construction noise impact assessment are as follows:

Time of day	Management level L_{Aeq} (15 min) *	How to apply	Residential status
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected $RBL + 10$ dB	The noise affected level represents the point above which there may be some community reaction to noise. - Where the predicted or measured L_{Aeq} (15 min) is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. - The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.	Residential status
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. - Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: - times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) - if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.	
Noise affected $RBL + 5$ dB	- A strong justification would typically be required for works outside the recommended standard hours. - The proponent should apply all feasible and reasonable work practices to meet the noise affected level. - Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. - For guidance on negotiating agreements see section 7.2.2.	Outside recommended standard hours	

* Noise levels apply at the property boundary 1.5 m above ground level. If the property is measuring or predicting noise levels is at a different height, noise levels may be higher at upper floors or lower at ground level.

Based upon the noise criterion presented above and the measured background noise levels the following applies to onsite construction and earthworks noise:

Noise Level L_{Aeq} dB(A)
Noise Affected Level: 48 ($L_{A90} 38 + 10$ dB(A))
Highly Noise Affected Level: 75

Table 2: Construction and earthworks activity noise limits.

It is also noted that Australian Standard AS 2436 – 1981 “Guide to noise control on construction, maintenance and demolition sites” provides extra guidance for management of on-site noise.

4.2 Operational Hours

Condition 49 of the Project Approval refers to the following operational hours:

Noise And Vibration Management

49. Hours of Work

The hours of construction for the project, including the delivery of materials to and from the site,

shall be restricted as follows:

a. between 7:00 am and 5:00 pm, Mondays to Saturdays inclusive;

b. no work is to be undertaken on Sundays and public holidays.

Works may be undertaken outside these hours where:

c. the delivery of materials is required outside these hours by the Police or other authorities;

d. it is required in an emergency to avoid the loss of life, damage to property and/or to

prevent environmental harm;

e. the work is approved through the CEMP; and

f. residents likely to be affected by the works are notified of the timing and duration of these

works as soon as possible.

The proponent is responsible for instructing and controlling contractors and sub-contractors

regarding hours of work.

4.3 Blast Overpressure and Vibration Criteria

Given the uncertainty of the extent and location of blasting operations, we provide a set of blasting overpressure and vibration criteria, and recommend that a specialist blast overpressure and vibration consultant be involved in producing the blasting plan when the specific need for blasting has been determined. The Australian and New Zealand Environmental Council's "*Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration*" (ANZEC1990) sets the following limits for blasting overpressure and vibration:

- Maximum level for airblast is 115 dB(L). The level of 115 dB(L) may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 120 dB(L) at any time;
- Maximum for ground vibration is 5 mm/s, PVS vibration velocity. The PVS level of 5 mm/s may be exceeded on up to 5% of the total number of blasts over a period of 12 months. The level should not exceed 10 mm/s at any time.

5.0 RESULTS & CALCULATIONS

5.1 Assumed Noise Source Levels

Noise source levels used in the assessment have been collected from similar previous assessments. A source height of 2.5m has been assumed for all plant. Existing ground levels were obtained in 3D, dxf file format from a Lidar aerial survey completed in February 2010 over the subject site and surrounding parcels of land, which was obtained from Leda. Source levels were assessed above existing ground as a worst case scenario. Measured “A” Weight sound pressure dB(A) levels have been converted into Linear sound power dB(L) levels for use in the 3D noise model.

Noise Source	Sound Power Level SWL dB(A)									
	63	125	250	500	1k	2k	4k	8k	dB(A)	dB(L)
Dozer	99	108	106	112	115	116	114	111	121	131
Excavator	80	88	95	100	100	104	98	85	107	112
6WD articulated dump truck (and water truck)	70	77	81	92	96	94	89	84	100	102
Compactor	80	95	105	106	107	105	99	91	112	118
Grader	92	96	100	112	111	110	101	94	116	122
Loader	88	100	96	103	99	96	90	82	107	119

Table 3: Typical noise source levels associated with the operation of a sand quarry.

For each Precinct (i.e. 9 and 11) the PEN3D model includes a dozer and two excavators at the fill winning area which were digitised into the model as point noise sources. The modelling includes 6WD articulated dump trucks (including a water truck) along the length of the haul roads and connecting the winning area to the dumping areas (digitised as line sources). At each dumping area (Central Open Spaces) the PEN3D model includes a compactor (CAT 825G) digitised as point source.

For Precinct 9, as noted in Section 4.2 of this report, blasting overpressure and vibration will need to be assessed once the specific blasting requirements have been determined.

All source levels are assumed to occur at the same time and for the full 15 minute assessment period, which is considered a worst case scenario. All equipment, including haul trucks will not need to leave the subject site to transport material from the winning area to the dump site.

5.2 Modelled Earthworks Activity Noise Impact Levels

5.2.1 Noise Prediction Model

The PEN3D General Prediction Model (GPM) is based on the method contained in the book “Engineering Noise Control - Theory and Practice” by David Bies & Colin H Hansen of the Department of Mechanical Engineering, University Of Adelaide, Publisher Unwin Hyman 1988. Chapter 5.9 Pages 117 to 127 describes the model.

The basic equation adopted by the GPM is:
$$L_p = L_w - 20 \log_{10}(r) - 10 \log_{10}(4\pi) + AE$$

Where: L_p is the sound pressure level at an observer

L_w is the sound power level of the source

$20 \log_{10}r - 10 \log_{10}(4\pi)$ is the Distance attenuation

AE is the excess attenuation factors and is determined as the sum of the contributions

Refer to Appendix C for a detailed explanation of the Pen3D model and the attenuation factors.

5.2.2 Meteorology

To define the impacts of local winds and the noise environment, the following is a paraphrased extract from the “Industrial Noise Policy”, Section 5.0:

“When wind near the ground increases its speed it can increase ambient noise levels by rustling foliage and creating turbulence when passing over or around structures. At higher wind speeds, the noise produced by wind will drown out noise from most industrial and transportation sources. A default wind speed of 3 m/s (at 10m height) is proposed for assessing noise impacts caused by gradient winds. This wind speed can noticeably increase noise received down-wind of a noise source, but may not increase ambient noise levels to the point where they mask noise from the source and make it unnoticeable. A 10m wind of 3m/s is also unlikely to be associated with near-surface winds of a strength able to cause increased ambient noise levels that would mask increased levels of noise from the source.

Wind is considered to be a feature where source-to-receiver wind speeds (at 10m height) of 3 m/s or below occur for 30 per cent of the time or more in any assessment period (day, evening, night) in any season.”

Wind rose data for both 9am and 3pm was obtained from the Coolangatta weather station (refer to Appendix C of this report for wind rose data sheets). The data indicates that monthly wind does not occur for greater than 30% at or below 3m/s (approximately 10 km/hr) in any direction.

Further, as earthworks activity will operate during the daytime period, temperature inversions have not been assessed.

5.2.3 Predicted Earthwork Activity Noise Impact Levels

Based upon the location of the proposed earthworks activities in relation to surrounding noise sensitive receivers, we predict the following earthworks noise impact levels as presented in Table 4 (Precinct 9) and Table 5 (Precinct 11) over the page.

For each Precinct we have assessed three fill winning locations (Locations A, B and C which are indicated in Appendix B of this report.

Precinct 9 Earthworks Activity for Central Open Space Area Stage 1

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location A		
R1 Receivers	48	42
R2 Receivers		42
R3 Receivers		39
R4 Receivers		50
R5 Receivers		48
R6 Receivers		49
R7 Receivers		46
R8 Receivers		46
R9 Receivers		44
R10 Receivers		44
R11 Receivers		43
R12 Receivers		44
Cobaki Broadwater Village		40

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location B		
R1 Receivers	48	39
R2 Receivers		36
R3 Receivers		35
R4 Receivers		49
R5 Receivers		49
R6 Receivers		50
R7 Receivers		47
R8 Receivers		46
R9 Receivers		45
R10 Receivers		44
R11 Receivers		44
R12 Receivers		45
Cobaki Broadwater Village		39

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location C		
R1 Receivers	48	41
R2 Receivers		39
R3 Receivers		35
R4 Receivers		41
R5 Receivers		38
R6 Receivers		40
R7 Receivers		36
R8 Receivers		38
R9 Receivers		37
R10 Receivers		36
R11 Receivers		34
R12 Receivers		36
Cobaki Broadwater Village		40

Table 4: Predicted noise impact levels from Precinct 9 earthworks.

The predicted levels assume that the recommended treatments detailed in Section 6 are incorporated into the earthworks activities.

For PEN3D point source calculation results for the three fill winning locations for each Precinct and for noise contours for Location A of each Precinct refer to Appendix C of this report.

Precinct 11 Earthworks Activity for Central Open Space Area Stages 2 and 3

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location A		
R1 Receivers	48	41
R2 Receivers		43
R3 Receivers		37
R4 Receivers		49
R5 Receivers		46
R6 Receivers		50
R7 Receivers		47
R8 Receivers		48
R9 Receivers		46
R10 Receivers		46
R11 Receivers		43
R12 Receivers		46
Cobaki Broadwater Village		39

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location B		
R1 Receivers	48	40
R2 Receivers		39
R3 Receivers		35
R4 Receivers		44
R5 Receivers		42
R6 Receivers		46
R7 Receivers		40
R8 Receivers		40
R9 Receivers		39
R10 Receivers		39
R11 Receivers		36
R12 Receivers		37
Cobaki Broadwater Village		39

Receiver Location	Noise Criterion dB(A)	Predicted Noise Impact Levels – (Calm Conditions) dB(A)
Earthworks Location C		
R1 Receivers	48	41
R2 Receivers		43
R3 Receivers		35
R4 Receivers		50
R5 Receivers		45
R6 Receivers		46
R7 Receivers		41
R8 Receivers		42
R9 Receivers		39
R10 Receivers		39
R11 Receivers		35
R12 Receivers		36
Cobaki Broadwater Village		37

Table 5: Predicted noise impact levels from Precinct 11 earthworks.

The predicted levels assume that the recommended treatments detailed in Section 6 are incorporated into the earthworks activities.

For PEN3D point source calculation results for the three fill winning locations for each Precinct and for noise contours for Location A of each Precinct refer to Appendix C of this report.

6.0 RECOMMENDED ACOUSTIC TREATMENTS

6.1 Recommended Acoustic Management Controls and Treatments for Earthworks Noise

It is recommended that the following acoustic management controls and treatments be applied to the earthworks phases of Precinct 9 (Central Open Space Stage 1) and Precinct 11 (Central Open Space Stages 2 and 3) to minimise noise emissions:

- Where possible earthworks should move in a southwest to northeast direction so that a southwest working face provides physical screening to the offsite dwellings to the south.
- All earthworks activities should be limited to the time restrictions presented in Section 4.2.
- Vehicles have a modified beeper installed (commonly termed a “croaker”, as they sound similar to a frog croak).
- No alarm bells/paging systems should be used. Cordless telephones are a suitable substitute.
- Drivers and workers be instructed to operate plant and equipment in a manner that does not generate unnecessary noise, through avoiding excessive revving, and avoidance of impact with solid objects.
- All plant be maintained in good condition; with all reasonable and feasible acoustic treatments (i.e. residential mufflers and plant enclosures) installed and maintained (refer to AS 2436 – 1981 “*Guide to noise control on construction, maintenance and demolition sites*”).
- Siting of equipment (i.e. crusher and screen). By locating noisy equipment as far away from noise sensitive dwellings to the south as is practical, distance separation will reduce potential noise impacts.
- Truck unloading be conducted away from the nearest offsite southern dwellings where possible.
- Plant/equipment which tends to discharge noise in a certain direction should be orientated away from the nearest offsite dwellings to the south.
- Plant/equipment should be turned off when not in use or throttled down to a minimum.
- Assign the task of managing noise emissions to a person (the ‘*responsible person*’) that is contactable at all times and is likely to be present onsite most of the time that activity is occurring. This person would be responsible for handling noise complaints sensitively, and ensuring that work does not commence before the times specified. The ‘*responsible person*’ should maintain a Noise Complaint Record (example provided in Appendix C of this report).
- The ‘*responsible person*’ should also conduct regular observations of noise from the earthworks activities. Should any noise sources be identified as being able to be practically relocated further away from the southern offsite dwelling, the ‘*responsible person*’ should undertake to have the source relocated.
- Providing local residents (the noise sensitive receivers indicate within Figure 2 of this report) with an indicative schedule of the works program, in particular, a clear notification of the times when new or noisy activities are to be conducted. This notification should also include contact details of the ‘*responsible person*’ should residents wish to discuss the onsite activity.
- If complaints arise regarding noise, the complaint will be directed to the ‘*responsible person*’, who will determine the source of the noise, and take immediate steps to mitigate the noise. This may involve moving the noise source further away from affected premises, replacing the equipment, apply earth mounds / berms where possible or in some cases, engaging a qualified acoustic consultant to provide specialist control advice.

6.2 Recommended Blasting Management Controls

Upon determination of the location, extent, type and frequency of blasting requirements, a specialist blast overpressure and vibration consultant should be engaged to produce a blasting plan. The aim of this plan should be to comply with The Australian and New Zealand Environmental Council's *"Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration"* (ANZEC1990).

7.0 DISCUSSION

The proposal is to obtain a Section 75W approval for the winning of fill material from Precinct 9 and Precinct 11 sufficient to complete the bulk earthworks in the Central Open Space of the Cobaki Development, Cobaki.

In-situ material will initially be ripped and heaped with a dozer and assisted by an excavator. Once heaps are created, excavators will be perched on top of the heaps and load 6WD dump trucks. The fill material will be dumped at the Central Open Space areas and then spread and compacted with a 32t bladed double drum sheep's foot compactor.

For each Precinct (i.e. 9 and 11) the PEN3D model has included a dozer and two excavators at the fill winning area (as point noise sources); 6WD articulated dump trucks (including a water truck) along the length of the haul roads (as line sources); and at each dumping area (Central Open Space areas) a compactor as a point source.

Based upon the three assessed earthworks winning locations (Locations A, B and C) for both Precinct 9 and Precinct 11, predicted noise impacts at the nearest assessed offsite noise sensitive receiver locations are within 2 dB of the adopted external noise criterion of 48 dB(A). It is noted that as the average person cannot typically detect a 3 dB variation in sound pressure level, a 2 dB rise is unlikely to be detectable and is typically considered an acceptable outcome.

Further, the noise criterion has been sourced from the Department of Environment and Climate Change NSW (DECC) *"Interim Construction Noise Guideline"*. It is noted that the Guideline is not mandatory but *"specifies noise management levels that guide the need to apply work practices to minimise noise impacts"*.

To minimise the potential for annoyance we have recommended the limitation of hours of operation (7am to 6pm Monday to Saturday and 7am to 5pm, no work on Sundays or public holidays), application of southwest working faces and earth mounds / berms (where possible) and implantation of best practice work methods such as:

- Maintaining equipment;
- Use of residential mufflers and modified beepers;
- Locating equipment as far as possible from offsite receivers (i.e. such as the crusher and screen);
- Turning off equipment when not in use;
- Training personal to be considerate of offsite residents; and
- Assigning a *'responsible person'* to oversee noise emissions and handle noise complaints should they arise.

For construction and earthworks activities, the key to managing noise impacts is to ensure that all practical steps are taken to minimise noise from the site – if the nearby residents are aware that the developer is mindful of noise impacting upon their premises, they will tend to be less annoyed than if they feel no regard is made as to their amenity. Good communication is an important factor in managing noise from the site, as a good relationship between the developer and the residents will further ensure that should an issue arise, it can be dealt with in a reasonable manner.

It is also noted that noise impact levels at individual properties will vary from day to day depending on the location of earthworks activities and the type of works being undertaken (i.e. rock crushing).

Overall, the noise impacts if managed properly should not cause complaints. The key in avoiding complaints is good communication with neighbours, and managing onsite activities where possible to minimise impacts upon people.

Further, as recommended, it would be advantageous to keep surrounding residents abreast of the works progress; and give prior notice of any activities which may cause unexpected noise intrusion. In the unlikely event of a noise complaint, the complaint must be dealt with sensitively and respectfully, with the noise abated as soon as possible.

As a final note, in-situ material in a portion of Precinct 9 is classified as very hard Greywacke rock, which will require blasting. At this stage, the location of blasting and the amount of blasting is unknown. Therefore, given the uncertainty of blasting requirements, we have provided a set of blasting overpressure and vibration criteria, and recommend that a specialist consultant be involved in producing the blasting plan when the specific need for blasting has been determined.

8.0 CONCLUSIONS

This report is in response to a request by Leda Developments Pty Ltd for an environmental noise impact assessment to obtain a Section 75W approval for the winning of fill material from Precinct 9 and Precinct 11 sufficient to complete the bulk earthworks in the Central Open Space of the Cobaki Development, Cobaki.

Based upon the adopted noise limit criterion, overall, the proposed earthworks activities will generally be within acceptable levels of Council's requirements, subject to the acoustic management controls and treatments recommended in Section 6 being integrated into the earthworks operations.

Report Reviewed By:



JAY CARTER BSc
Director

Report Compiled by:



Matthew Lopez BEng
Consultant

APPENDIX A

Subject Site, Noise Sensitive Receivers and Noise Monitoring Locations

Figure 1: Subject Site and Nosie Monitoring Locations (<http://maps.six.nsw.gov.au/>).

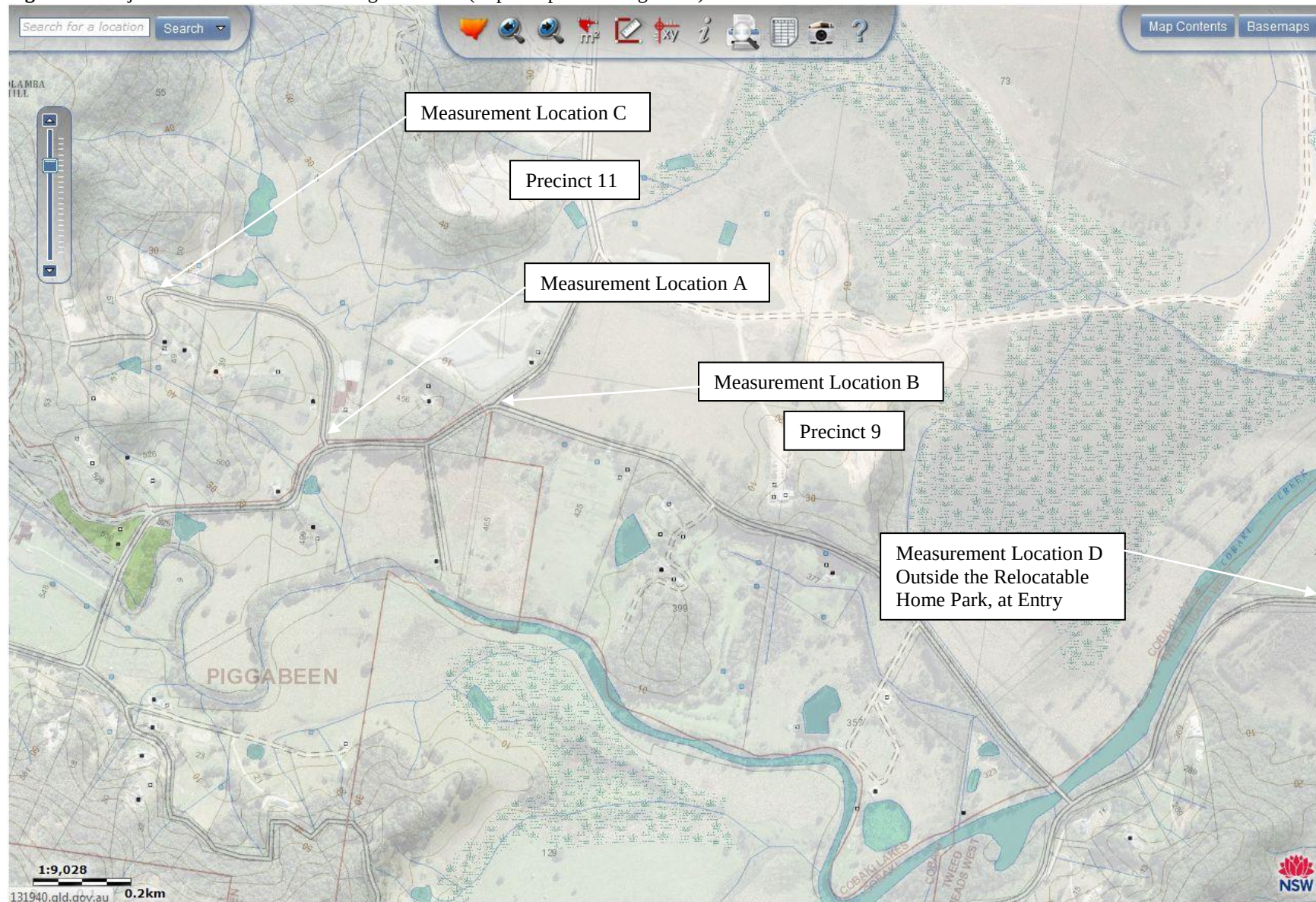


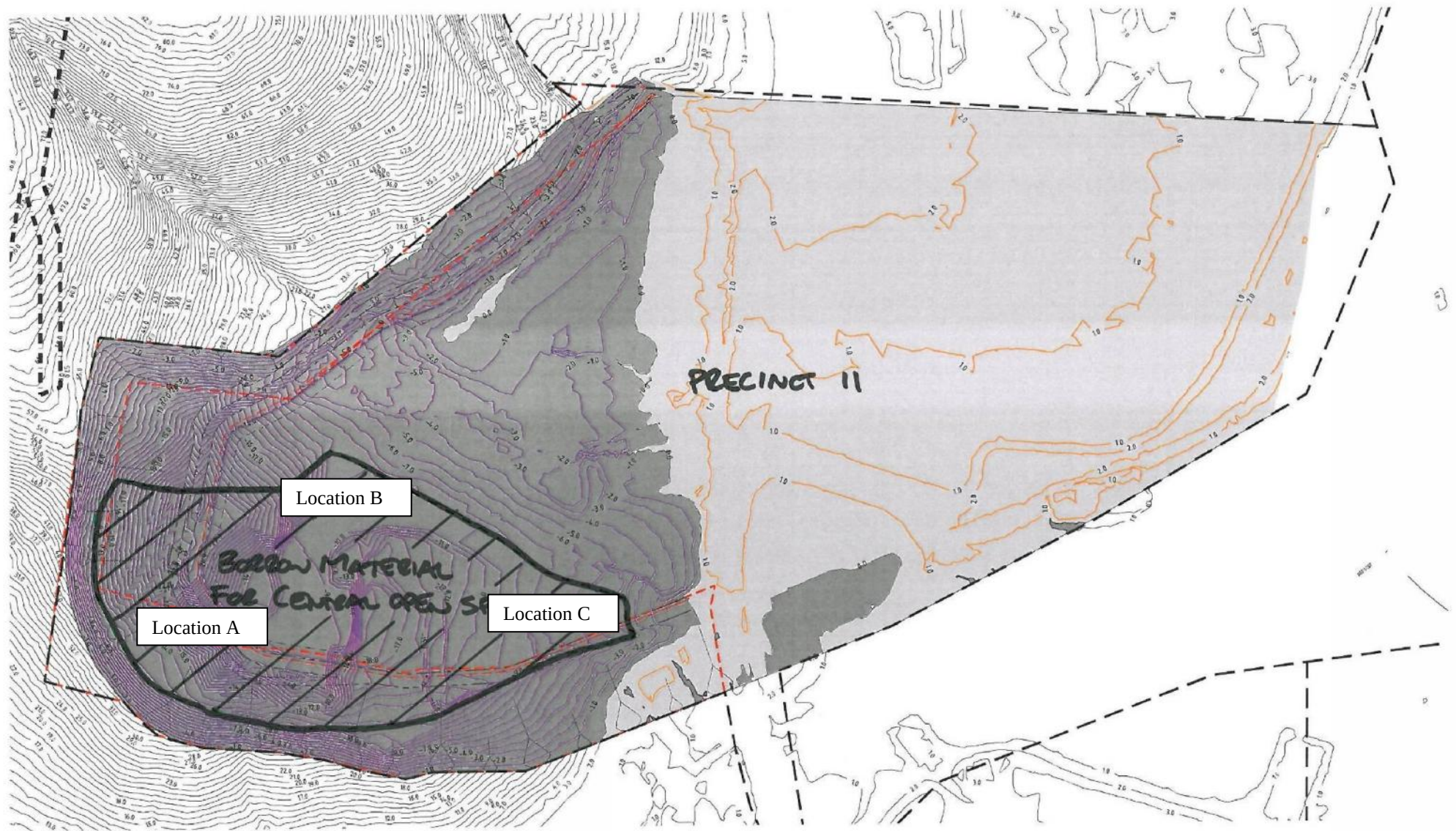
Figure 2: Subject Site and Surrounding Noise Sensitive Receivers (<http://maps.six.nsw.gov.au/>).



APPENDIX B

Earthworks Strategy Plans





APPENDIX C

Wind Rose Data, Noise Model Calculations / Predictions and Noise Complaint Register

Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

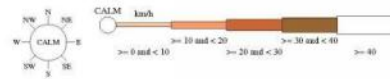
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

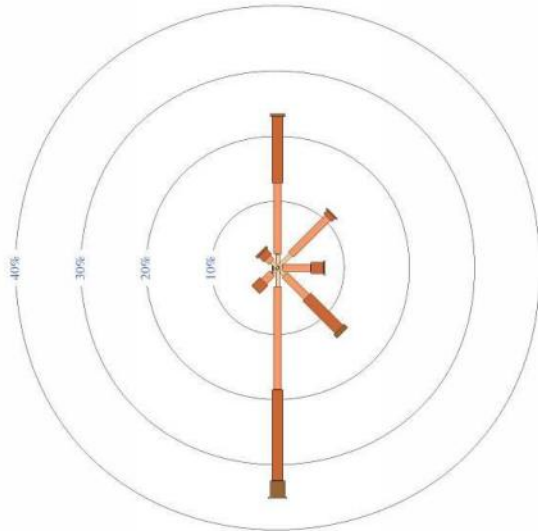
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jan
559 Total Observations

Calm 1%



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

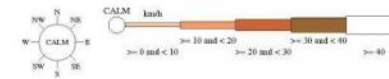
Custom times selected, refer to attached note for details

COOLANGATTA

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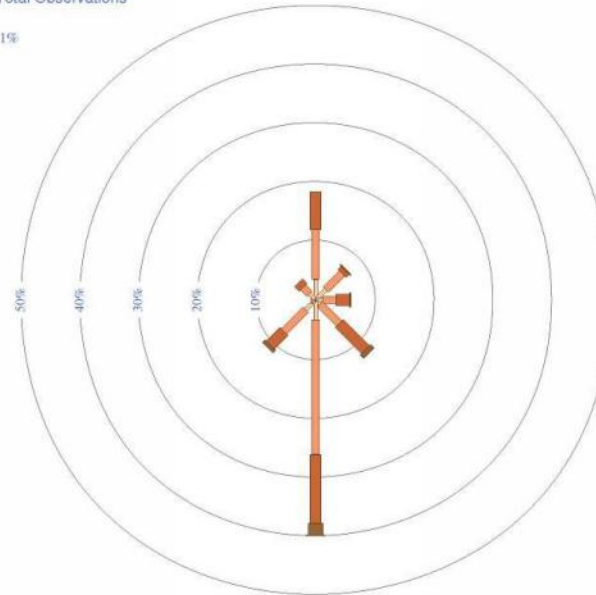
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Feb
501 Total Observations

Calm 1%



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

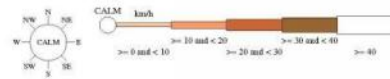
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

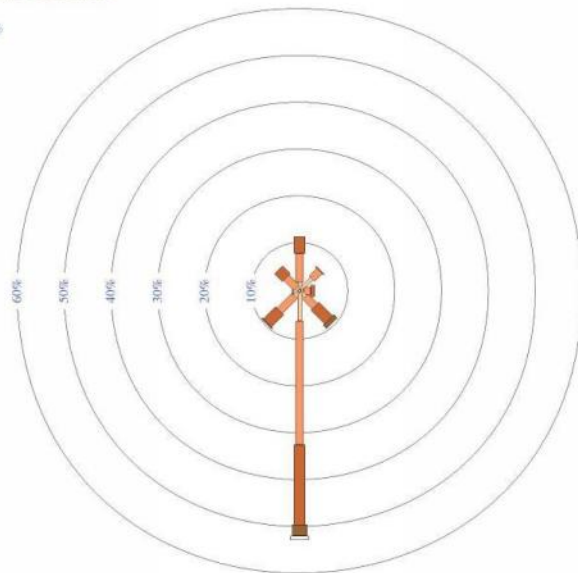
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Mar
572 Total Observations

Calm 1%



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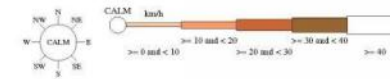
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

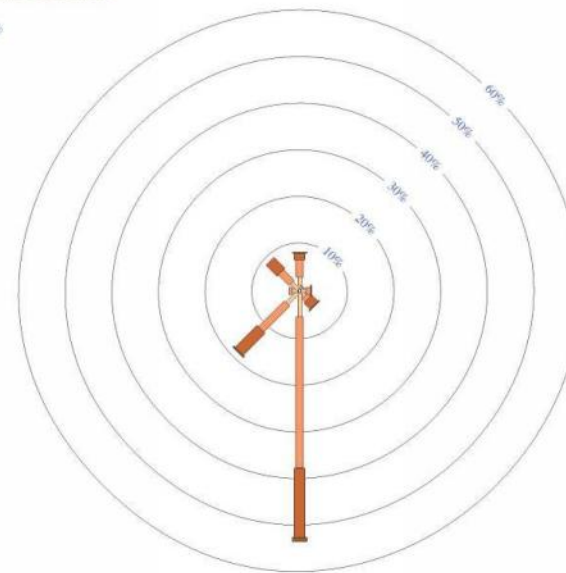
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Apr
564 Total Observations

Calm 2%



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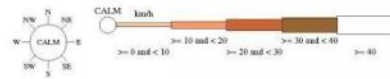
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

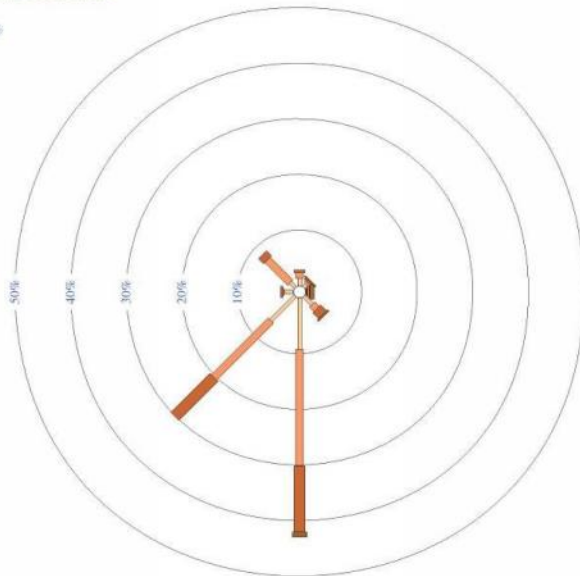
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Other important info about this analysis is available in the accompanying notes.



9 am May
581 Total Observations

Calm 5%



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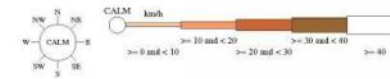
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COOLANGATTA

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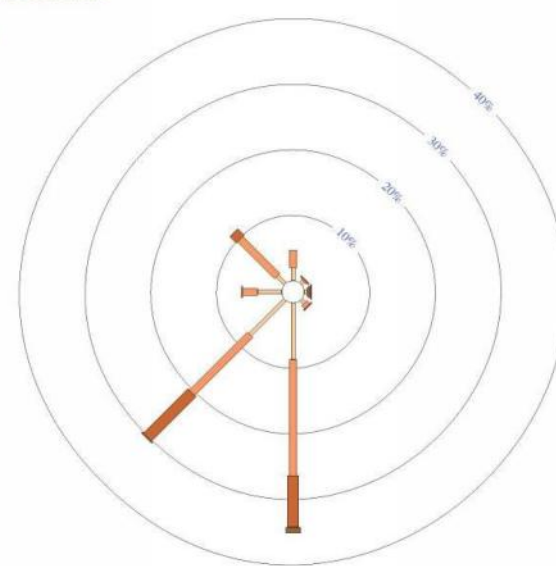
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Other important info about this analysis is available in the accompanying notes.



9 am Jun
563 Total Observations

Calm 9%



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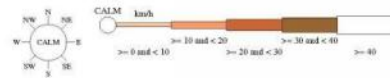
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

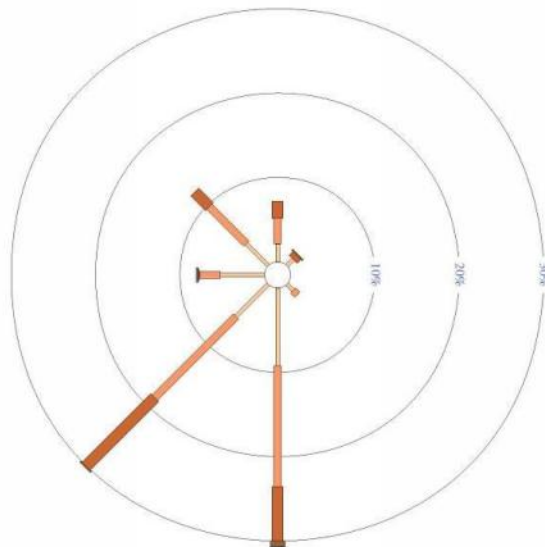
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Jul
574 Total Observations

Calm 8%



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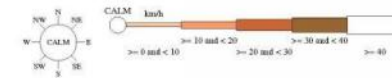
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COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

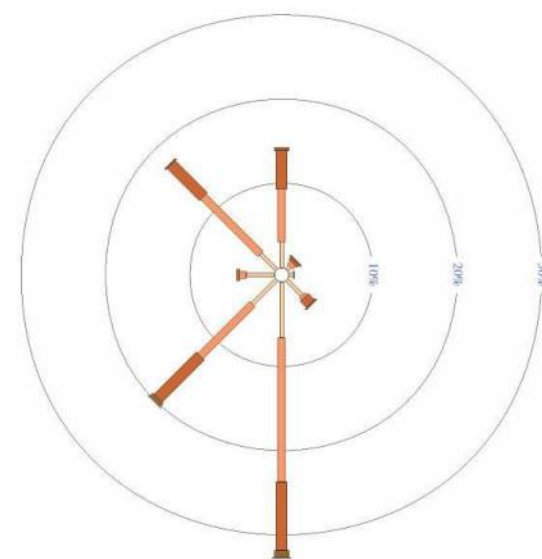
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Aug
585 Total Observations

Calm 4%



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

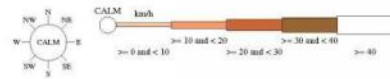
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

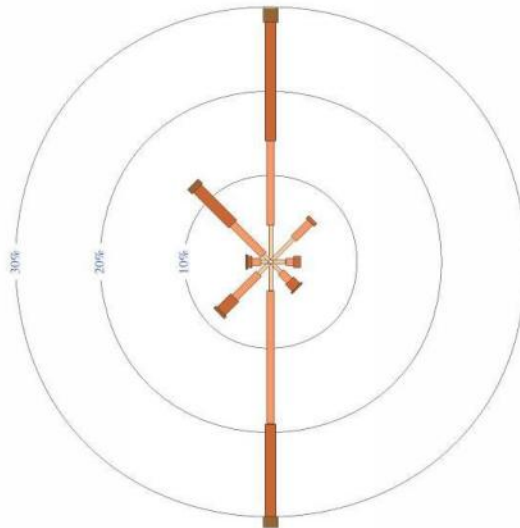
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Sep
551 Total Observations

Calm 1%



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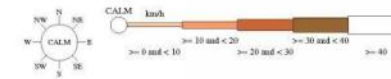
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COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

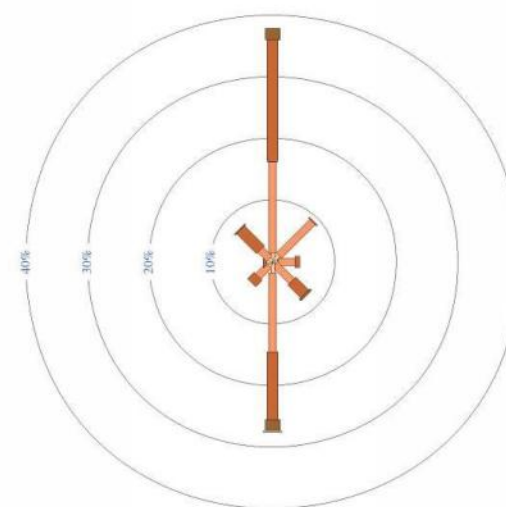
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Oct
547 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

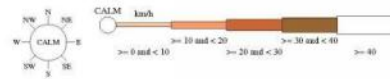
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

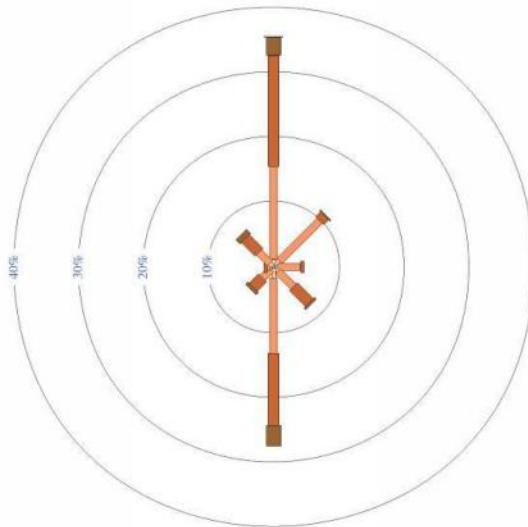
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



9 am Nov
522 Total Observations

Calm 1%



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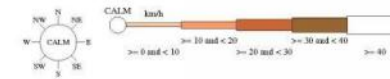
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COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

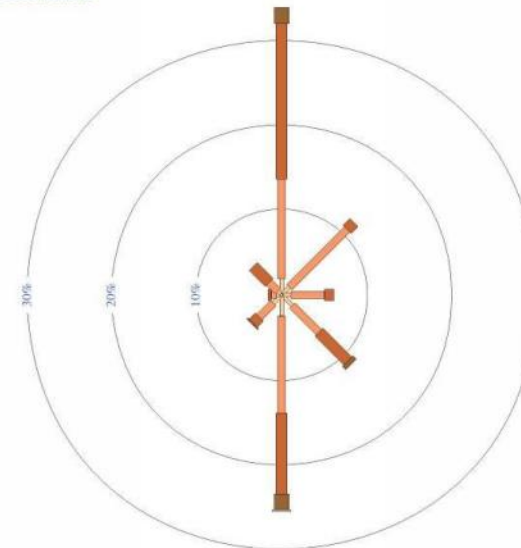
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Other important info about this analysis is available in the accompanying notes.



9 am Dec
583 Total Observations

Calm 1%



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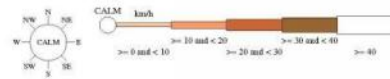
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COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

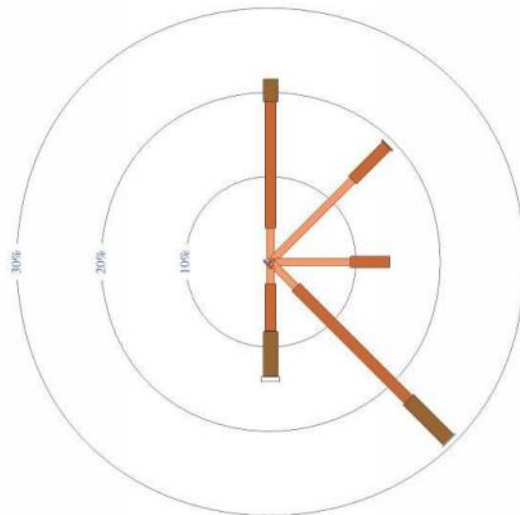
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jan
562 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

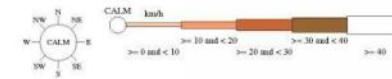
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COOLANGATTA

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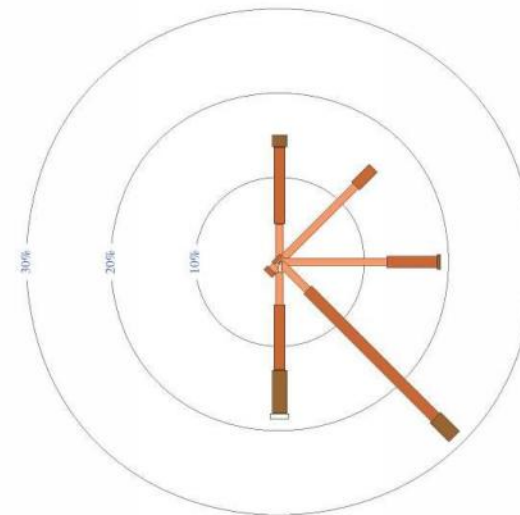
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Feb
505 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

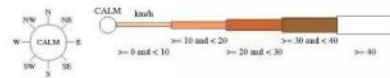
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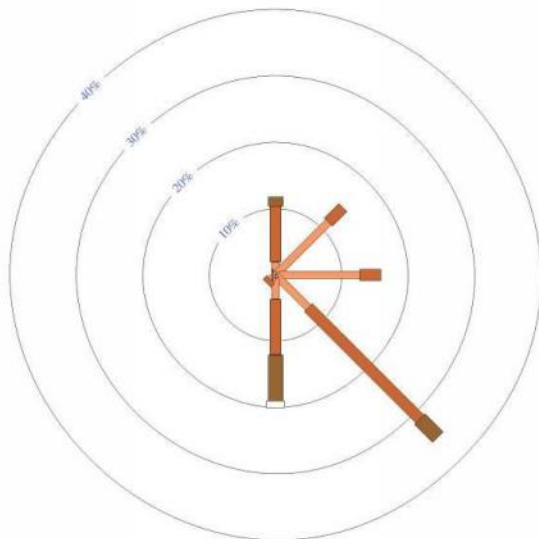
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Mar
576 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

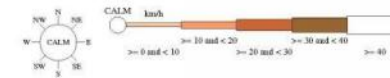
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

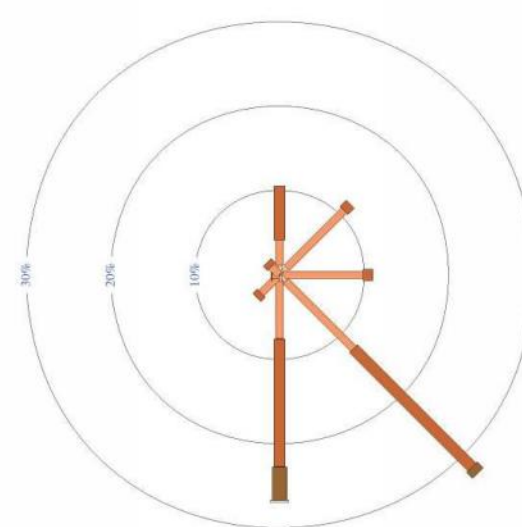
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Apr
564 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

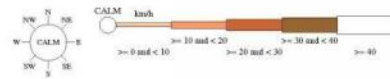
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

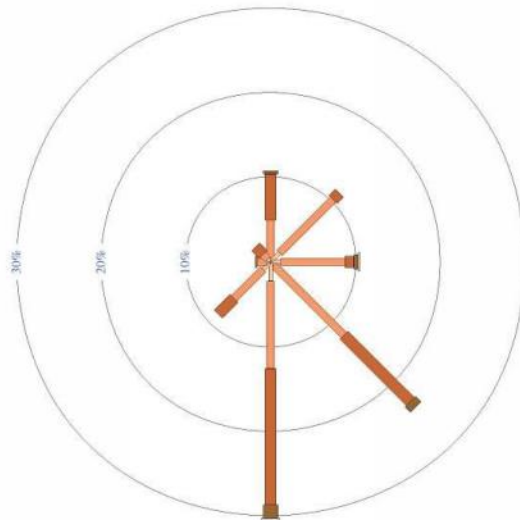
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm May
575 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

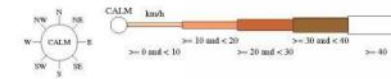
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

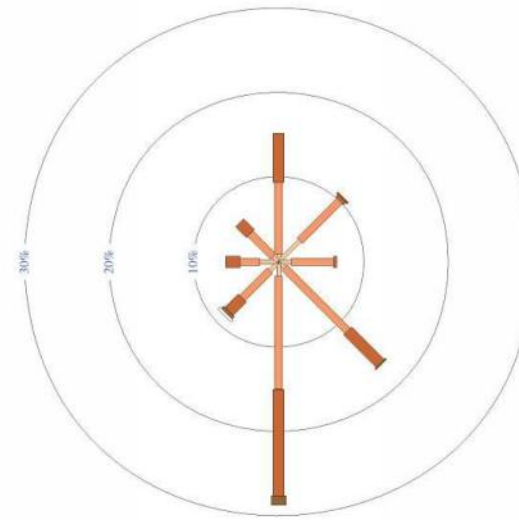
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jun
563 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

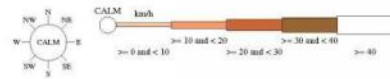
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

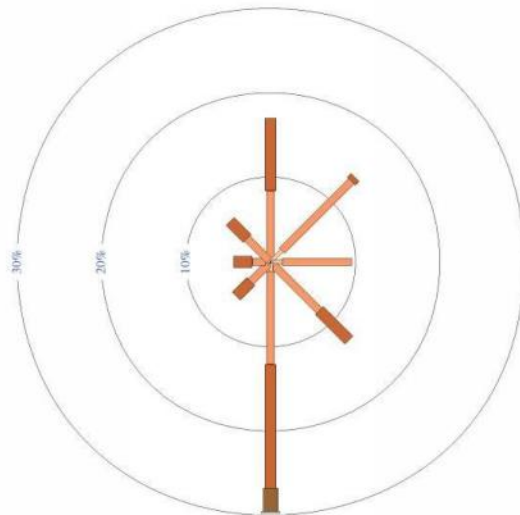
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Jul
576 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

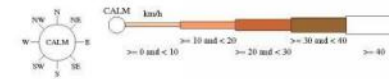
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

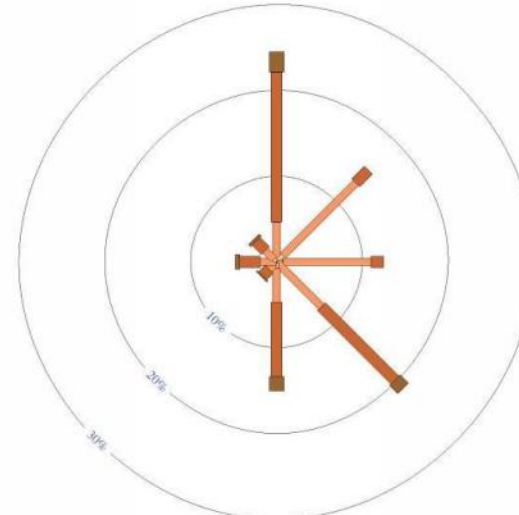
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Aug
585 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

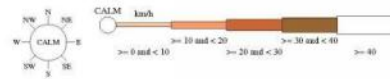
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

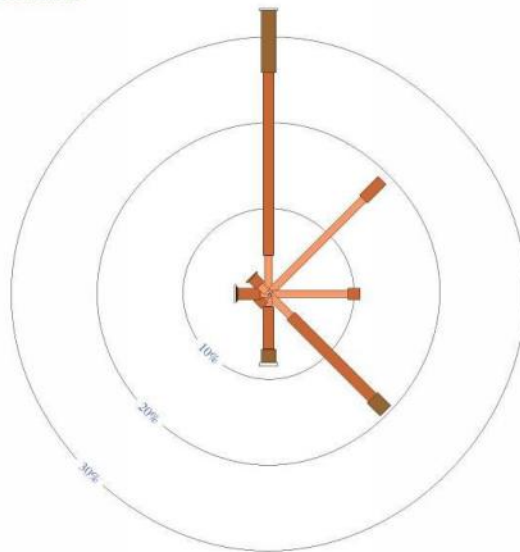
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Sep
556 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

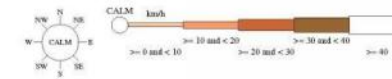
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

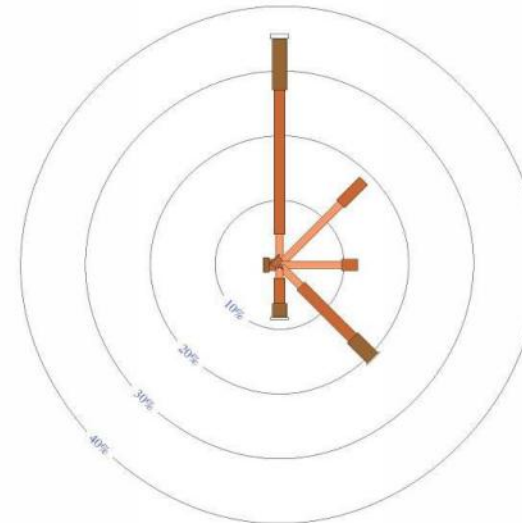
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Oct
549 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

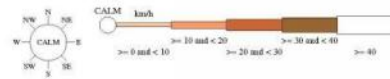
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

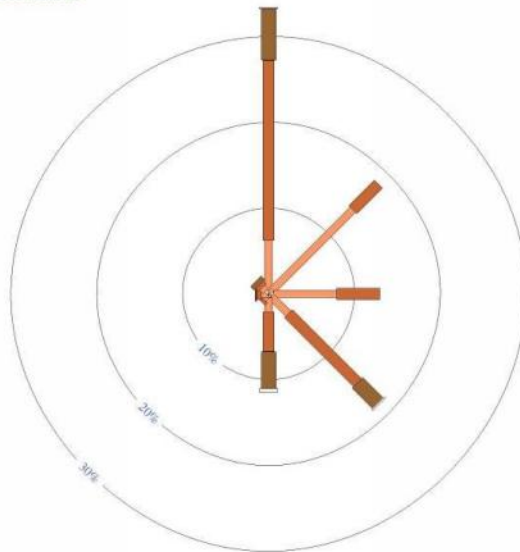
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Nov
527 Total Observations

Calm *



Rose of Wind direction versus Wind speed in km/h (01 Dec 1991 to 30 Sep 2010)

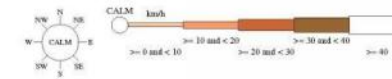
Custom times selected, refer to attached note for details

COOLANGATTA

Site No: 040717 • Opened Jan 1982 • Still Open • Latitude: -28.1681° • Longitude: 153.5053° • Elevation 4m

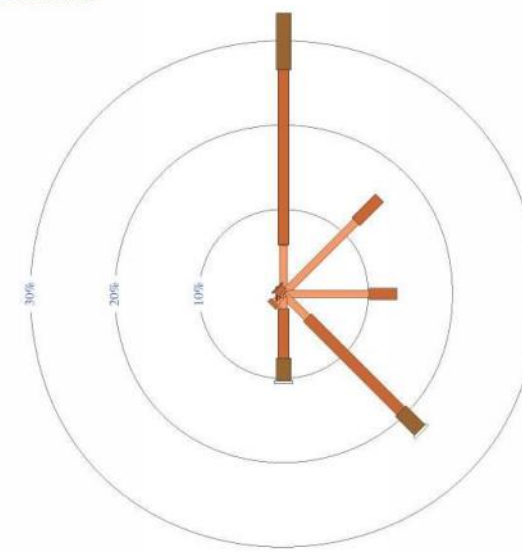
An asterisk (*) indicates that calm is less than 0.5%.

Other important info about this analysis is available in the accompanying notes.



3 pm Dec
584 Total Observations

Calm *



Pen3D Model Explanation:

The PEN3D General Prediction Model (GPM) is based on the method contained in the book “Engineering Noise Control - Theory and Practice” by David Bies & Colin H Hansen of the Department of Mechanical Engineering, University Of Adelaide, Publisher Unwin Hyman 1988. Chapter 5.9 Pages 117 to 127 describes the model.

The PEN3D software was originally developed in 1993 and has been in constant development and review.

The basic equation adopted by the GPM is:

$$L_p = L_w - 20 \log_{10}(r) - 10 \log_{10}(4\pi) + AE$$

Where

L_p is the sound pressure level at an observer

L_w is the sound power level of the source

$20 \log_{10} r - 10 \log_{10}(4\pi)$ is the Distance attenuation

AE is the excess attenuation factors and is determined as the sum of the contributions

The excess attenuation factors AE comprise

$$AE = A_a + A_g + A_m + A_b + A_f$$

Where

A_a = Excess attenuation due to air absorption

A_g = Excess attenuation due to ground reflection

A_m = Excess attenuation due to meteorological effects

A_b = Excess attenuation due to barriers; and

A_f = Excess attenuation due to forests

The following sections describe the excess attenuation factors and the implementation within PEN3D.

Air Absorption Excess Attenuation

A_a , the attenuation due to air absorption is dependent upon temperature and relative humidity. The values used in the PEN noise model are based on Sutherland, LC JF Piercy, H.E. Bass & L.B. Evans 1974. Method for calculating the absorption of sound by the atmosphere. Journal of the Acoustical Society of America 56, Supplement 1 (abstract).

$$A_a = m r$$

where

m is the absorption per m; and

r is the actual distance from source to receiver

Ground Reflection Excess Attenuation

Ag, The excess attenuation due to ground reflection is obtained by combining the direct wave and the reflected wave incoherently, that is the energy from the ground wave is added to the direct wave.

$$R = \frac{Z \sin(\beta) - \rho c}{Z \sin(\beta) + \rho c}$$

where

- β is the angle the reflected wave makes with the ground
- Z is the complex ground impedance (a function of the flow resistivity);
- ρ is the density of air; and
- c the speed of sound.

The reflection loss A_R is given by $-20 \log_{10}(R)$

$$A_g = -10 \log_{10}(1 + 10^{-A_R/10})$$

Meteorological Excess Attenuation

Am, the excess attenuation due to meteorology is obtained by firstly calculating the vertical sonic gradient due to wind and temperature effects. It is calculated by reference to the method outlined in “A Method to To Incorporate Meteorological Effects into A Road Traffic Model” by MA Simpson, Proceedings of Acoustics 2004.

Barrier Excess Attenuation

Ab, the excess attenuation due to barriers is obtained by firstly calculating the curved noise path due to wind and temperature effects. It is calculated by reference to the method outlined in “A Method to To Incorporate Meteorological Effects into A Road Traffic Model” by MA Simpson, Proceedings of Acoustics 2004.

If a barrier exists the effective location of the source and receiver is modified according to the method outlined in Tonin, R, “Estimating Noise Levels from Petrochemical Plants, Mines and Industrial Complexes”, Acoustics Australia, 13(2):59-67, 1985.

Forest Excess Attenuation

Af, the excess attenuation due to forest is obtained by the following:

$$A_f = 0.01 r f^{(1/3)}$$

where

- r = distance through the forest in (m), and
- f = frequency in (Hz)

LOCATION A

Pen3D2000 V 1.9.11

Project Code:13212a

Project Description:Noise assessment of Cobaki

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P9 COP.PEN

File Description:Data file covering P9 COP

Tuesday 10 Dec, 2013 at 16:09:14

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	42.3
R1 B	547553.6	6881560.8	1.5	30.6	41.5
R1 C	547408.5	6881399	1.5	40.5	40.8
R1 D	547325.4	6881415.7	1.5	18.2	41.2
R2 A	546919.3	6881675.6	1.5	1.6	38.8
R2 B	547114.6	6881588.1	4.2	2.5	41.6
R2 C	547076.1	6881441.2	1.5	1.3	39
R2 D	546896.3	6881487.1	1.5	3	37.6
R2 E	546736.4	6881613	1.5	1.9	37.2
R3	546804	6881925.5	1.5	2.5	39
R4	546474.8	6881930.5	4.2	16.5	49.5
R5	546009.7	6881952.3	1.5	4.4	48.1
R6	545988.7	6882279	1.5	15.5	49.2
R7	545755.6	6882278.4	1.5	15.3	46.3
R8	545680.6	6882329.9	1.5	33	45.5
R9	545572.1	6882328.7	4.2	34.5	44.3
R10	545501.4	6882370.2	1.5	41.8	43.5
R11	545427.6	6882542.6	1.5	22.9	43
R12	545549.8	6882623.8	1.5	20	43.9
relocatable homes	548117.4	6881954.3	1.5	3	40.2

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P11 COP final.PEN

File Description:Data file covering 11 cop

Tuesday 10 Dec, 2013 at 08:28:34

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	38.9
R1 B	547553.6	6881560.8	1.5	30.6	40.6
R1 C	547408.5	6881399	1.5	40.5	40.4
R1 D	547325.4	6881415.7	1.5	18.2	39.9
R2 A	546919.3	6881675.6	1.5	1.5	42.9
R2 B	547114.6	6881588.1	4.2	2.5	41.4
R2 C	547076.1	6881441.2	1.5	1.5	40.6
R2 D	546896.3	6881487.1	1.5	3	41.8
R2 E	546736.4	6881613	1.5	2	40.7
R3	546804	6881925.5	1.5	2.5	36.5
R4	546474.8	6881930.5	4.2	16.5	49.2
R5	546009.7	6881952.3	1.5	4.2	45.5
R6	545988.7	6882279	1.5	15.8	49.6
R7	545755.6	6882278.4	1.5	15.3	46.5
R8	545680.6	6882329.9	1.5	33	47.5
R9	545572.1	6882328.7	4.2	34.5	46.1
R10	545501.4	6882370.2	1.5	41.5	46.1
R11	545427.6	6882542.6	1.5	22.9	43.4
R12	545549.8	6882623.8	1.5	20	46.2
relocatable homes	548117.4	6881954.3	1.5	3	38.8

LOCATION B

Pen3D2000 V 1.9.11

Project Code:13212a

Project Description:Noise assessment of Cobaki

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P9 COP.PEN

File Description:Data file covering P9 COP

Tuesday 10 Dec, 2013 at 15:59:22

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	39.3
R1 B	547553.6	6881560.8	1.5	30.6	38.6
R1 C	547408.5	6881399	1.5	40.5	38
R1 D	547325.4	6881415.7	1.5	18.2	38.2
R2 A	546919.3	6881675.6	1.5	1.6	34.6
R2 B	547114.6	6881588.1	4.2	2.5	36.1
R2 C	547076.1	6881441.2	1.5	1.3	34.7
R2 D	546896.3	6881487.1	1.5	3	33.5
R2 E	546736.4	6881613	1.5	1.9	34.5
R3	546804	6881925.5	1.5	2.5	34.6
R4	546474.8	6881930.5	4.2	16.5	48.9
R5	546009.7	6881952.3	1.5	4.4	49.1
R6	545988.7	6882279	1.5	15.5	50.2
R7	545755.6	6882278.4	1.5	15.3	47.1
R8	545680.6	6882329.9	1.5	33	46.1
R9	545572.1	6882328.7	4.2	34.5	44.8
R10	545501.4	6882370.2	1.5	41.8	44.1
R11	545427.6	6882542.6	1.5	22.9	43.6
R12	545549.8	6882623.8	1.5	20	44.6
relocatable homes	548117.4	6881954.3	1.5	3	38.5

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P11 COP final.PEN

File Description:Data file covering 11 cop

Tuesday 10 Dec, 2013 at 08:56:08

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	38.1
R1 B	547553.6	6881560.8	1.5	30.6	38.2
R1 C	547408.5	6881399	1.5	40.5	40.4
R1 D	547325.4	6881415.7	1.5	18.2	40.4
R2 A	546919.3	6881675.6	1.5	1.5	38.4
R2 B	547114.6	6881588.1	4.2	2.5	36.6
R2 C	547076.1	6881441.2	1.5	1.5	36.8
R2 D	546896.3	6881487.1	1.5	3	36.7
R2 E	546736.4	6881613	1.5	2	38.5
R3	546804	6881925.5	1.5	2.5	34.5
R4	546474.8	6881930.5	4.2	16.5	44.4
R5	546009.7	6881952.3	1.5	4.2	42
R6	545988.7	6882279	1.5	15.8	45.8
R7	545755.6	6882278.4	1.5	15.3	39.9
R8	545680.6	6882329.9	1.5	33	40.4
R9	545572.1	6882328.7	4.2	34.5	38.8
R10	545501.4	6882370.2	1.5	41.5	38.6
R11	545427.6	6882542.6	1.5	22.9	36.1
R12	545549.8	6882623.8	1.5	20	36.7
relocatable homes	548117.4	6881954.3	1.5	3	39.2

LOCATION C

Pen3D2000 V 1.9.11

Project Code:13212a

Project Description:Noise assessment of Cobaki

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P9 COP.PEN

File Description:Data file covering P9 COP

Tuesday 10 Dec, 2013 at 15:41:07

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	40.8
R1 B	547553.6	6881560.8	1.5	30.6	40.1
R1 C	547408.5	6881399	1.5	40.5	39.1
R1 D	547325.4	6881415.7	1.5	18.2	39.2
R2 A	546919.3	6881675.6	1.5	1.6	38.2
R2 B	547114.6	6881588.1	4.2	2.5	38.6
R2 C	547076.1	6881441.2	1.5	1.3	36.8
R2 D	546896.3	6881487.1	1.5	3	36.4
R2 E	546736.4	6881613	1.5	1.9	33.7
R3	546804	6881925.5	1.5	2.5	35.3
R4	546474.8	6881930.5	4.2	16.5	40.7
R5	546009.7	6881952.3	1.5	4.4	37.7
R6	545988.7	6882279	1.5	15.5	39.6
R7	545755.6	6882278.4	1.5	15.3	36.3
R8	545680.6	6882329.9	1.5	33	37.6
R9	545572.1	6882328.7	4.2	34.5	36.6
R10	545501.4	6882370.2	1.5	41.8	36.4
R11	545427.6	6882542.6	1.5	22.9	34.2
R12	545549.8	6882623.8	1.5	20	35.8
relocatable homes	548117.4	6881954.3	1.5	3	40

File:C:\Users\User\Desktop\2013 pen files\13212a cobaki\13212a_earthworks LINE SOURCE P11 COP final.PEN

File Description:Data file covering 11 cop

Tuesday 10 Dec, 2013 at 09:17:41

Environmental Calculations

All point and line sources included. Line source segmentation angle: 10 degrees. Calculations for specified meteorology.

Noise level results are the logarithmic addition of all the noise sources

Noise level results incorporate the incoherent ground reflection algorithm

Meteorology :

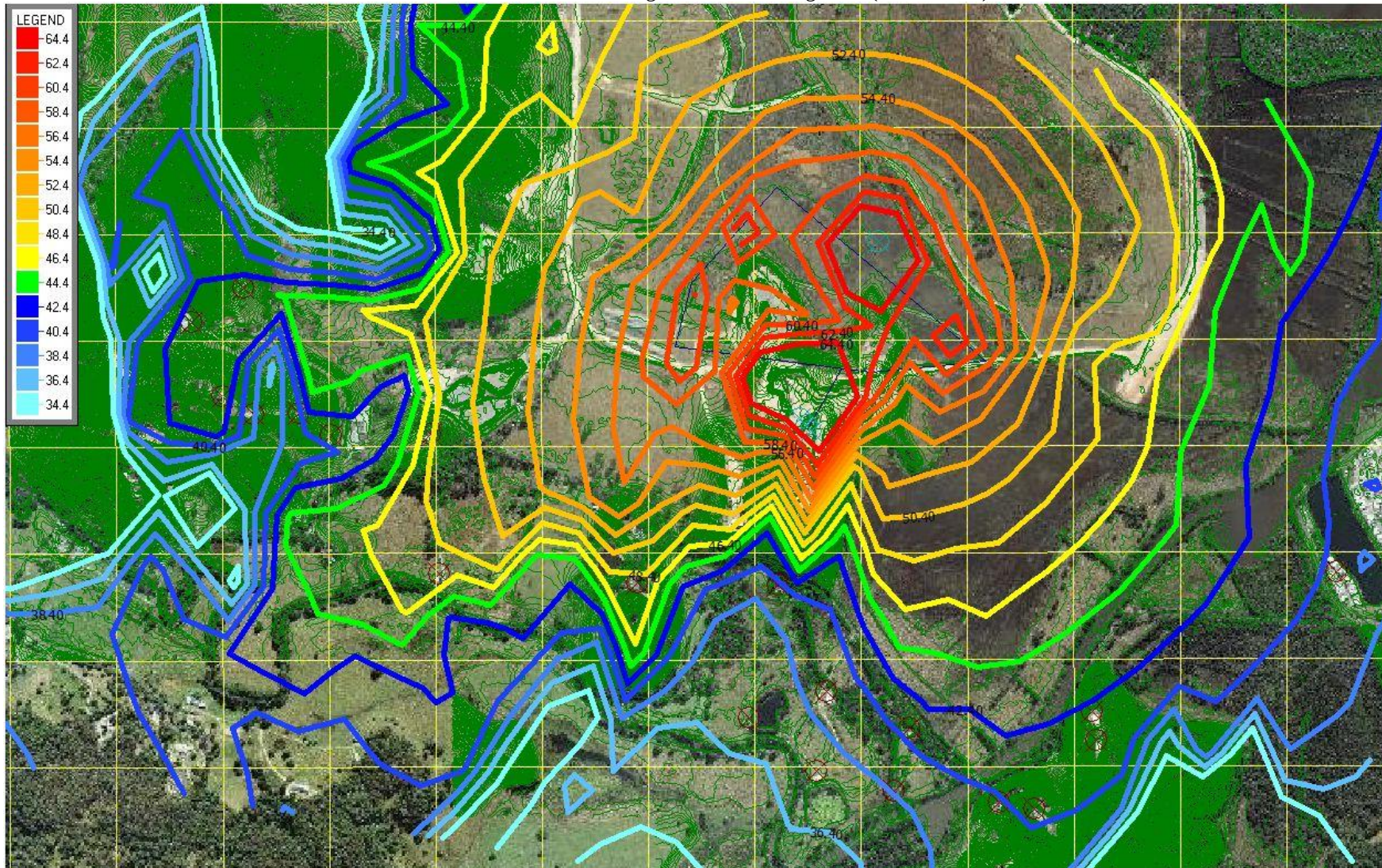
Wind speed 0.0 (m/s) Wind direction 0 Mast height 10.0 (m)

Temperature 20.0 (C) Temperature Gradient 0.0 (C/100m) Humidity 50.0 (%)

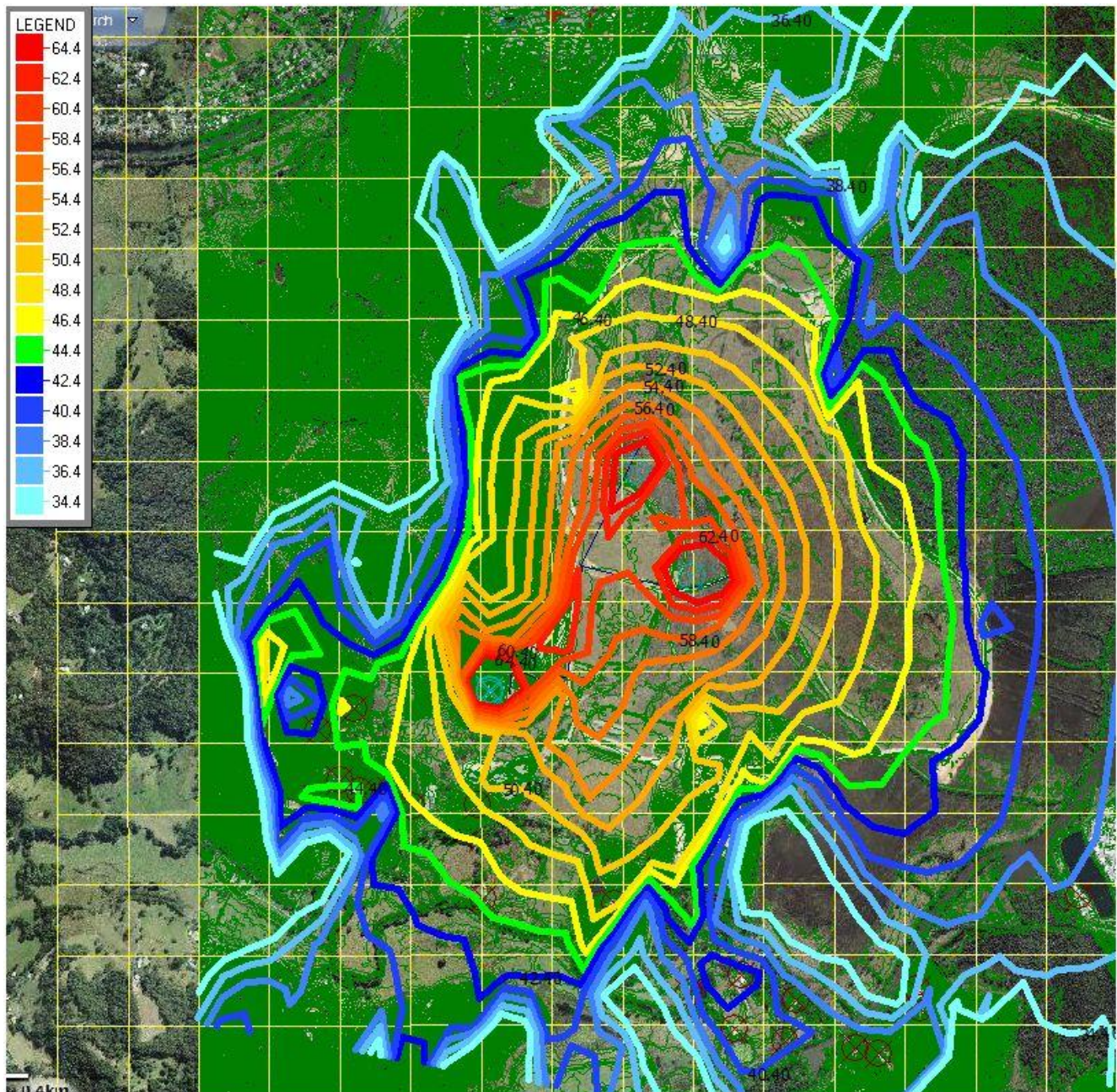
Surface Roughness of terrain 0.023000000 (m) Zero plane offset 0.080000000 (m)

Receptor	X Posn (m)	Y Posn (m)	Height (m)	Ground (m)	Noise Level (dB(A))
R1 A	547541.8	6881628.4	1.5	25.5	37.7
R1 B	547553.6	6881560.8	1.5	30.6	37.7
R1 C	547408.5	6881399	1.5	40.5	40.7
R1 D	547325.4	6881415.7	1.5	18.2	40.8
R2 A	546919.3	6881675.6	1.5	1.5	38.5
R2 B	547114.6	6881588.1	4.2	2.5	35.9
R2 C	547076.1	6881441.2	1.5	1.5	38
R2 D	546896.3	6881487.1	1.5	3	43.1
R2 E	546736.4	6881613	1.5	2	38.6
R3	546804	6881925.5	1.5	2.5	34.7
R4	546474.8	6881930.5	4.2	16.5	50.3
R5	546009.7	6881952.3	1.5	4.2	44.6
R6	545988.7	6882279	1.5	15.8	46.4
R7	545755.6	6882278.4	1.5	15.3	40.6
R8	545680.6	6882329.9	1.5	33	41.5
R9	545572.1	6882328.7	4.2	34.5	39.4
R10	545501.4	6882370.2	1.5	41.5	38.9
R11	545427.6	6882542.6	1.5	22.9	34.7
R12	545549.8	6882623.8	1.5	20	35.9
relocatable homes	548117.4	6881954.3	1.5	3	37.4

Precinct 9, Location A Scenario: Predicted Noise Contours, Receiver Height of 1.5m above ground (Not to Scale).



Precinct 11, Location A Scenario: Predicted Noise Contours, Receiver Height of 1.5m above ground (Not to Scale).



NOISE COMPLAINT RECORD

Initial Complaint Recording

Date & Time of record: _____

Name of Complainant (if given): _____

Complainant Telephone Number: _____

Address of complainant (if given): _____

Identification and description of noise source (e.g. excavator noise):

Time of day noise is occurring: _____

Number of days the noise has occurred: _____

Complaint Investigation & Remediation

Liaison with noise source equipment operator: _____

Recommended control (e.g. earth berm): _____

Verification that noise controls have been implemented: _____

Follow-up Complainant

Contact date: _____

Complainant comment (e.g. is noise still annoying ? – if yes, refer to Note below): _____

NOTE

If complainant is still affected after all reasonable steps have been taken to ameliorate the noise, specialist advice should be sought from a qualified acoustical consultant