Appendix

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Acoustic Impact Assessment

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BOGGABRI COAL PTY LIMITED

ACOUSTIC IMPACT ASSESSMENT

CONTINUATION OF BOGGABRI COAL MINE ENVIRONMENTAL ASSESSMENT

REPORT J0130-30-R2
12 OCTOBER 2010

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1 INTRODUCTION

Boggabri Coal Pty Limited (Boggabri Coal) operates the Boggabri Coal Mine located approximately 15 km north east of Boggabri within the Narrabri Shire Council (NSC) Local Government Area (LGA). Boggabri Coal currently operates under Development Consent Departmental File Number (DFN) 79/1443(z)2 which allows mining of up to 5 Million tonnes per annum (Mtpa) of product coal for a period of 21 years from the granting of a mining lease. Coal Lease CL 368 was granted on 15 November 1990 and DFN 79/1443(z)2 therefore expires on 14 November 2011. In 2009 Boggabri Coal produced approximately 1.5 Mtpa of coal.

1.1 The Project

Boggabri Coal is proposing to apply for approval to continue its open cut mining operations for a further 21 years. Project Approval is sought under Part 3A of the *Environmental Planning & Assessment Act (1979)* (EP&A Act) to gain a single, contemporary planning approval for the continuation of mining within the Project Boundary (the Project). The Project comprises the following:

- Continuation of mining operations via open cut methods up to 7 Mtpa product coal to the Merriown seam;
- Open cut mining fleet including excavators and fleet of haul trucks, dozers, graders, water carts and other equipment with the flexibility to introduce a dragline as required and utilising up to 495 employees;
- Modifications to existing and continuation of approved (but not yet constructed) infrastructure including:
    - Coal Handling and Preparation Plant (CPP);
    - Modifications to existing site infrastructure capacities including Run of Mine (ROM) coal hopper, second crusher, stockpile area, coal loading facilities, water management and irrigation system;
    - Rail loop and 17 km rail spur across the Namoi River and flood plain including overpasses across the Kamilaroi Highway, Therribri Road and Namoi River;
    - Minor widening of the existing coal haul road including overpasses across the Kamilaroi Highway, Therribri Road and Namoi River; and
    - Upgrading and relocating site facilities including offices, car parking and maintenance sheds as and when required.
- Closing a section of Leard Forest Road; and
- Upgrading the power supply capacity to 132 kilovolt (kV) high voltage lines suitable for dragline operations.

Further details regarding the Project, including a plan showing the current and proposed mining areas, are included in the Continuation of Boggabri Coal Mine EA.

This report has been commissioned by Hansen Bailey on behalf of Boggabri Coal to assess noise and vibration impacts as part of the EA. The report includes an assessment of noise and blasting impacts associated with the Project to current NSW Department of Environment Climate Change and Water (DECCW) guidelines and policies as described below.

1.2 Environmental Noise Policies

DECCW has developed or adopted policies and recommended procedures to assess environmental noise levels from various noise source categories. The following policy documents are relevant to this assessment:

- The NSW Industrial Noise Policy (INP) (EPA, 2000) is intended to guide noise investigations from existing or proposed industrial developments including coal mines. The INP recommends procedures to determine:
  - background noise levels at receiver properties;
  - existing noise levels from an industrial site;
  - recommended, not mandatory, noise criteria for existing and proposed operations;
  - predicted noise levels from proposed developments; and
  - negotiation options if recommended noise criteria are not or may not be met.
- The *Environmental Noise Control Manual (ENCM) (EPA, 1985)* predates the INP. While much of the ENCM is no longer applicable, some sections remain relevant including chapter 19 related to sleep disturbance from industrial sources operating at night.
- The *Environmental Criteria for Road Traffic Noise (ECRTN) (EPA, 1999)* provides recommended noise criteria and assessment procedures for road traffic noise, including Project-related traffic, from public roads but excludes noise produced by vehicle movements on the Project site.
- The Australian and New Zealand Environment Council (ANZEC) *Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990)* recommends residential ground vibration and overpressure limits and time restrictions for blasting.
- *Assessing Vibration – a Technical Guide (DEC, 2006)* provides recommended criteria and methods for assessing vibration, primarily from construction activities such as pile driving.
- *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects (Interim Rail Noise Guideline) (DECC, 2007)* provides criteria and methods to assess noise from train movements on publicly owned rail lines.
- *Interim Construction Noise Guideline (DECC, 2009)* provides criteria, recommended hours and methods for assessing noise from construction work.

1.3 Receivers

The existing Boggabri Coal Mine operates primarily within the Leard State Forest and adjoins rural and residential receivers on all sides. Closest properties to the south have previously been purchased by Boggabri Coal to provide an environmental buffer around the mine, or are owned by Whitehaven Coal Mining Pty Ltd (Whitehaven Coal). Properties and residences owned by Boggabri Coal and Whitehaven Coal Mining are not considered to be noise-sensitive receivers and are not specifically assessed in this report.

A land ownership plan showing land owned by Boggabri Coal, other mining companies and private individuals or companies is included in each noise contour figure in Appendix A and in the main body of the Continuation of Boggabri Coal Mine EA.

2 EXISTING ENVIRONMENT

2.1 EIS

The Boggabri Coal Project Environmental Impact Statement (BHP – AGIP – Idemitsu Joint Venture, 1987) described the results of background noise measurements taken at various locations around the mine in 1979. While the measurement procedures and instrumentation used do not necessarily comply with current standards, the results are considered relevant to this assessment.

Noise measurements at Nagero Homestead, at the site of the current mine facilities, indicated background noise levels in the range 30 to 35 dBA during the day and as low as 23 dBA during the night. The reported levels were LA90 levels measured over an unspecified time period.

Noise measurements at Heathcliff and Cooboobindi Homesteads indicated background levels were approximately 30 dBA during the day and in the range 20 to 25 dBA during the night, while measurements within the town of Boggabri indicated similar background levels during the night and higher levels during the day due to traffic on Wee Waa Street.

2.2 Recent Noise Monitoring Data

The Boggabri Coal Mine Annual Environmental Management Report 2009 (AEMR) includes results from noise compliance monitoring completed at eleven residential locations. Reported results include only mine contributed LAeq,15min noise levels with no reported background levels and have not been considered further.

The Tarrawonga Coal Mine lies immediately south of the existing Boggabri Coal Mine. The 2008 AEMR for the Tarrawonga Coal Mine includes detailed noise monitoring results at four receiver locations around the mine, with all receivers located south of Boggabri Coal Mine. These results are considered representative of background noise levels at all assessed receivers. Table 1 shows monitoring results reported in the AEMR.

Table 1: Measured Background Noise Levels, Tarrawonga AEMR 2008, LA90,15min.

Receiver	Measured Background Level, LA90,15min July 07, February 08		
	Day	Evening	Night
54 Tarrawonga	- , 24	- , 23	- , 21
85 Ambardo	21, 28	21, 26	21, 24
Templemore *	19, 41 #	18, 42 #	18, 41 #
Bollol Creek Station *	18, 27	16, 33	16, 30

* Properties owned by Whitehaven Coal.

\# Higher background noise levels were due to a pump or similar machine operating near the homestead during the monitoring period.

2.3 Adopted Background Noise Levels

The data above indicates background noise levels well below 30 dBA (from the EIS) or 30 LA90,15min (from the Tarrawonga AEMR) have been measured at various receiver locations around the mine. While not all measurement results have necessarily been obtained according to currently recommended standards or procedures, it is nevertheless clear that existing background noise levels are below 30 LA90,15min during all time periods, at all receiver locations.

As the INP recommends background noise levels below 30 LA90,15min should be considered 30 LA90,15min for the purposes of a noise assessment, a background level of 30 LA90,15min has been adopted for all receivers and time periods.

3 CRITERIA

3.1 Mining Noise

The INP contains two sets of noise criteria for residential receivers. Intrusive criteria are set 5 dBA above the Rating Background Level (RBL) in each time period and are designed to limit the relative audibility of mining or industrial operations. These criteria can be adjusted by one or more 'modifying factors' such as tonality or impulsiveness described in Section 4 of the INP, or alternatively the source noise levels can be adjusted to consider any modifying factors applicable to those sources. As any relevant adjustments have been applied to source noise levels, an intrusive criterion of 35 LAeq,15min is adopted for this assessment for all receivers and time periods.

Amenity limits recommended in the INP depend on existing industrial noise levels, in the absence of existing Boggabri Coal Mine noise, and the nature of the receiver area. The amenity limits are designed to control the total or cumulative level of industrial noise at a sensitive receiver such as a residence. Amenity criteria are set to the amenity limits in cases where limited industrial noise is currently received, or to lower levels to ensure the cumulative impact of existing and proposed noise sources does not exceed the amenity limit for each time period.

The only known source of potentially audible industrial noise in the area, excluding existing Boggabri Coal Mine operations, is the nearby Tarrawonga Coal Mine previously known as the East Boggabri Coal Mine. Predicted noise levels from Tarrawonga are shown in the *East Boggabri Coal Mine Noise and Vibration Assessment* (2005 Tarrawonga Assessment) (Spectrum Acoustics, May 2005). The Tarrawonga AEMR 2008 also contains data regarding the noise level contribution from Tarrawonga Coal Mine, as shown in Table 2.

Table 2: Tarrawonga Mine Noise Contribution, LAeq,15min.

Receiver	Day	Evening	Night
	Predicted Noise Level LAeq,15min, Spectrum Acoustics 2005 Initial Mining, End Year 1, Year 3, Year 4, Year 6		
54 Tarrawonga	30, 31, 31, 29, 28	30, 31, 31, 29, 28	34, 33, 33, 34, 31
85 Ambardo	31, 31, 30, 30, 29	31, 31, 30, 30, 29	33, 31, 30, 32, 31
Templemore *	34, 33, 33, 35, 33	34, 33, 33, 35, 33	34, 33, 33, 35, 33
Bollol Creek Station *	33, 32, 32, 34, 32	33, 32, 32, 34, 32	33, 32, 33, 34, 32
Matong	28, 28, 28, 28, 28	28, 28, 28, 28, 28	28, 28, 28, 28, 28
	Measured Noise Level LAeq,15min, AEMR 2008 July 07, Sept 07, Jan 08, Mar 08		
54 Tarrawonga	- , - , - , IA	- , - , - , IA	- , - , - , IA
85 Ambardo	31, 35, 36, 28	36, 36, 33, 34	IA, 28, 29, IA
Templemore *	IA, 26, IA, -	IA, 30, IA, -	IA, 32, IA, -
Bollol Creek Station *	IA, 29, IA, 20	IA, 31, IA, 20	IA, 33, IA, 20

* Properties owned by Whitehaven Coal
IA means 'inaudible'.

Results in Table 2 indicate the existing Tarrawonga Coal Mine can produce up to 36 LAeq,15min at closest residences at times depending on both mine operating conditions and prevailing weather conditions, with a maximum predicted or measured level of 35 LAeq,15min during the night. The four properties listed in Table 2 are the closest residences to Tarrawonga Coal Mine and, on that basis, are assumed to receive the highest noise levels from Tarrawonga Coal Mine (excluding noise from

Tarrawonga's haul road which potentially affects properties further south). Therefore, it is reasonable to conclude Tarrawonga Coal Mine would produce 36 LAeq,15min or less at any assessed residence during the day and evening and 35 LAeq,15min or less during the night.

Measured and predicted noise levels from Tarrawonga Coal Mine are all expressed as LAeq,15min levels which are average noise levels over a worst case 15 minute period during the day, evening or night. Noise levels during the worst case 15 minute period would occur as a result of combined worst case operating conditions, with mining equipment in relatively exposed areas of the mine, and worst case weather conditions including a north westerly wind during all time periods or a temperature inversion during the night. Worst case noise levels are unlikely to persist for an entire day, evening or night due to variations in both mine operating conditions and prevailing weather conditions and a nominal correction factor of -3dBA has been applied to adjust predicted or measured LAeq,15min noise levels to LAeq,period noise levels.

In the absence of noise from Boggabri Coal Mine, most assessed receivers would be considered 'rural' properties as defined in the INP due to the lack of industrial noise and heavy traffic. Receivers close to Tarrawonga Coal Mine and the Kamilaroi Highway could conceivably be considered 'urban' receivers due to their proximity to dominant traffic or existing industrial sources, although the results in Table 2 indicate existing noise levels from Tarrawonga Coal Mine are not sufficient to justify this classification. For the purposes of determining appropriate noise amenity criteria, all assessed receivers have conservatively been assigned the 'rural' amenity category.

Amenity criteria are determined by considering the relevant amenity limits for the area and the existing level of industrial noise excluding existing Boggabri Coal Mine noise. Table 3 shows the intrusive and amenity criteria adopted for this assessment and the method used to determine these criteria.

Table 3: Adopted Boggabri Coal Operational Noise Criteria.

Time Period	Day * 7am – 6pm	Evening 6pm – 10pm	Night 10pm – 7am
Adopted background noise level LA90,15min (Section 2.3)	30	30	30
Intrusive Criteria LAeq,15min (Background + 5 dBA)	35	35	35
Amenity limit LAeq,period (INP, rural category)	50	45	40
Existing industrial noise level LAeq,period	< 33	< 33	< 32
Amenity Criteria LAeq,period (Table 2.2 of INP)	50	45	40
Adopted Noise Criteria LAeq,15min	**35**	**35**	**35**

* Night ends, and Day begins, at 8am on Sundays and public holidays

Noise criteria in Table 3 apply to all on-site noise sources including mining and coal processing equipment, coal trucks on the private haul road, train loading equipment and train movements on a private rail loop. The criteria apply within 30m of a residence, or at the receiver property boundary where the boundary is closer than 30m from the residence.

Car and truck traffic on public roads and train movements on public rail lines are subject to alternative noise criteria as described below.

3.2 Where Criteria May be Exceeded

Noise criteria listed in Table 3 should be considered the levels above which some acoustic impact may be noticed by residents. Louder noise levels at a residence do not necessarily imply the noise is unacceptable at that residence.

The INP describes strategies to deal with potential exceedances of the criteria such as:

- best practice noise mitigation measures applied to individual plant items and mine operating procedures;
- adoption of alternative noise criteria based on achievable noise levels and considering other factors such as social worth attached to the development and historical noise levels from existing developments;
- negotiation of offset arrangements with regulators and/or the affected community; and
- acquisition of properties where the predicted or measured noise impacts are unacceptable.

Recent noise assessment practice for coal mine developments considers an exceedance of up to 5 dBA above the intrusive or amenity criteria is generally acceptable provided the proponent can show all reasonable and feasible noise control measures and best practice operational noise management measures have been incorporated into the design and operational planning for the development. These residences are typically considered to fall within a ‘management zone’ and the proponent is normally expected to implement ongoing management practices and engineering noise control measures to achieve the lowest practical levels at these properties.

Residences expected to receive more than 5 dBA above the intrusive criteria are typically considered to lie within an area of affectation and are often subject to acquisition by the mine upon request by residents or are offered other negotiated mitigation options if desired by residents.

3.3 Construction Noise

Construction work has historically been assessed under the ENCM, although the DECC has recently published the Interim Construction Noise Guideline (ICNG) (DECC, 2009) which is intended to replace the relevant chapter in the ENCM.

Section 1.2 of the ICNG states it does not apply to industrial sources, including construction associated with quarrying and mining, and suggests this activity be assessed under the INP. In that case, noise criteria applied to CHPP, rail spur and other construction work are identical to mine operational criteria as shown in Table 3.

3.4 Sleep Disturbance

Sleep disturbance can be caused by a short, sharp sound that is noticeably louder than the typical or usual noise level within a bedroom, although further research is required to accurately determine the effects of different types of noise on sleep. The ENCM recommends a conservative sleep disturbance criterion of 15 dBA above the night background noise level and, in the absence of more recent research or recommendations, this conservative criterion is adopted.

All residential properties are therefore subject to a sleep disturbance criterion of 45 LA1,1min. The criterion applies 1m outside the potentially most affected bedroom window of a residence during the hours 10pm to 7am, or to 8am on Sundays and Public holidays.

3.5 Traffic Noise

Relevant traffic noise criteria are listed in Table 1 in the ECRTN. Noise criteria for Situation 13 “Land use developments with the potential to create additional traffic on local roads” are 55 LAeq,1hr during the day and 50 LAeq,1hr during the night and apply to all traffic on the road including vehicles associated with the Project. Noise criteria in the ECRTN only apply to residential receivers.

The LAeq,1hr parameter refers to the average traffic noise level in the loudest 10% of the hours in a day or night. As it is difficult to determine the loudest 10% hour during the day and night, this assessment conservatively considers the loudest hour during a 24 hour period.

Rail noise criteria are sourced from the Interim Rail Noise Guideline which recommends trigger levels of 65 LAeq,15hr during the day, 60 LAeq,9h during the night and 85 LAmax from existing rail lines such as the Mungindi to Werris Creek Railway (MWCR). Condition L6.1 of Environment Protection License EPL 3142 issued to the Australian Rail Track Corporation (ARTC) specifies noise level objectives of 65 LAeq,15hr day, 60 LAeq,9hr night and 85 LAmax at one metre from the façade of affected residential premises.

3.6 Low Frequency Noise

Section 4 of the INP recommends low frequency noise levels be considered in the normal operational noise criteria by the addition of a 'modifying factor' to either a source sound power level or a received noise level. Any modifying factors that are relevant to the assessment have been applied to the adopted sound power levels for mining and transportation equipment.

In addition, the Queensland EPA's draft guideline for the assessment of low frequency noise suggests an internal noise criterion of 50 dBL for this frequency range to minimise the potential for impacts on noise sensitive receivers which is approximately equivalent to an external criterion of 60 dBL. Experience on other NSW mine sites indicates an external level of 80 dBL is unlikely to be noticed by receivers.

It should be noted that dBL means unweighted decibels, without the usual A-weighting correction that is normally applied to approximate the frequency response of an average human ear. The suggested dBL criteria cannot be directly translated to equivalent criteria in dBA.

3.7 Blast Overpressure and Vibration

Current noise and vibration criteria are recommended in the ANZEC publication "Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration". Recommended noise and vibration limits in the Guideline are:

- Overpressure 115 dBL; and
- Ground vibration 5mm/s Peak Particle Velocity (PPV).

The Guideline recognises blast effects cannot alway be controlled accurately and allows higher limits of 120 dBL and 10mm/s PPV for up to 5% of the total number of blasts on a site in a 12 month period. Recommended blasting criteria apply during the hours 9am to 5pm Monday to Saturday, excluding public holidays.

4 ASSESSMENT

4.1 Noise Assessment Method

Noise levels from operation of the proposed mine, including the haul road and rail loading facility or the private rail spur and associated facilities, have all been assessed using a comprehensive model of the site based on RTA Technology's Environmental noise Model (ENM) software. ENM is a general purpose noise modelling package that combines terrain and noise source information with other input parameters such as weather conditions to predict noise levels at specific receiver locations or as contours over a specified receiver area. It is recognised in NSW as the most appropriate choice for situations involving complex topography and a large number of individual noise sources and where a detailed assessment of the effects of atmospheric conditions on noise propagation is required.

The standard ENM package includes data input modules to allow terrain and noise source information to be entered and amended, plus an initial setup page containing terrain and source lists and modelled weather conditions for each scenario. All terrain and source files were prepared for this assessment using a combination of AutoCad and Excel based data then automatically converted to ENM format terrain and source files using specially prepared software. All outputs were obtained using ENM's standard sectioning and contouring algorithms and are presented on a base plan after minor tidying such as closing gaps in the contour lines. Tabulated noise levels at residences, and noise levels over 25% of properties, have been produced by specially prepared software based on ENM's intermediate calculation files used to produce the noise contours. Noise contour figures are presented in Appendix A.

4.2 Weather Conditions

Atmospheric conditions including temperature, relative humidity, wind speed, wind direction and vertical temperature gradient can all affect noise propagation and received noise levels at some distance from a source. A weather dataset was compiled by PAE Holmes using raw data obtained from weather stations operated by Boggabri Coal and Tarrawonga Mine for the period September 2008 to September 2009. The compiled dataset has been analysed to determine appropriate atmospheric parameters for this assessment.

The INP recommends noise enhancing winds or temperature inversions that occur for at least 30% of the time in any season or time period should be considered when predicting noise levels. Data analysis was completed using the following best practise procedure:

- Separate data by season and time period (day, evening, night);
- Count and discard wind speeds less than 0.5m/s (calm) and over 3m/s (windy);
- Separate remaining data by wind direction in 16 compass directions and combine 5 adjacent directions (total 112°) to determine the occurrence of a significant vector component of wind in each of the 16 directions;
- Identify wind directions where a significant vector component occurs for 30% of the time in each season and time period and include each set of wind parameters in the noise model. The modelled wind speed would be 3m/s unless the data clearly indicate a lower wind speed is appropriate;
- Assess the occurrence of F and G-class temperature inversions during the combined evening and night in winter and, if such inversions occur for at least 30% of the time, include an INP default 3°/100m temperature inversion in the noise model for the night scenarios; and
- If temperature inversions are modelled, include a 2m/s cold air drainage flow in the most appropriate direction considering the dominant topographic features that exist between the site and receivers as required by the INP.

The dataset included stability classes A to F with no occurrence of G class inversions, indicating strong temperature inversions do not occur in this area. Further discussion of this issue is included in Section 4.2.4 below.

4.2.1 Gradient Winds

Results from the wind analysis are shown in Table 4, with entries in bold font highlighting significant winds that occur over 30% of the time in any season or time period.

Table 4: Noise Enhancing Winds, 2008/09.

Wind Direction	Occurrence of Noise Enhancing Winds, % of Season and Time Period											
	Summer			Autumn			Winter			Spring		
	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night	Day	Even.	Night
N	10	20	**32**	9	13	**33**	11	**46**	**53**	12	**34**	**44**
NNE	9	17	**31**	9	12	**32**	8	**42**	**49**	9	**33**	**42**
NE	8	15	27	11	13	29	7	**36**	**44**	7	28	**34**
ENE	7	12	15	10	8	15	4	15	14	7	16	12
E	11	13	15	15	15	17	7	8	5	9	15	10
ESE	15	13	17	23	18	21	13	8	7	15	15	11
SE	19	15	17	28	24	24	21	10	8	23	17	13
SSE	22	14	15	**32**	26	22	25	12	8	27	14	13
S	23	13	14	**32**	29	19	27	9	7	28	12	12
SSW	22	12	9	28	23	12	26	10	6	28	11	10
SW	20	13	7	23	23	9	24	15	6	25	11	8
WSW	18	14	7	18	19	5	20	21	7	20	10	5
W	16	16	8	12	15	6	18	23	11	17	13	7
WNW	14	19	15	9	12	11	17	29	16	16	20	16
NW	14	23	28	11	15	28	17	**50**	**47**	17	**32**	**39**
NNW	12	22	**32**	10	15	**33**	15	**53**	**56**	14	**35**	**44**

Table 4 shows dominant winds can occur from the south during the day, although such winds occur just over 30% of the time and only in autumn. Nevertheless, a 3m/s southerly wind has been included in the assessment for the daytime period.

Wind conditions during the evening and night are very similar and indicate a dominant northerly wind during these time periods, particularly during the colder months of the year. Given the higher occurrence of this wind during the cold months and the location of the weather station near the mine's existing surface facilities, it is clear that this result represents a cold air drainage flow associated with a temperature inversion rather than a gradient wind. Evening and night time periods have been combined in this assessment given the similarities between evening and night weather conditions shown in Table 4.

4.2.2 Drainage Flows

Cold air drainage flows tend to flow downhill and, with significant variations in topography across the site, would change direction depending on the location of the observer. A detailed inspection of topographic features around the Boggabri Coal Mine has indicated the mine itself is located in a depression bounded to the north, east and west by hills, and open to the south. Cold air accumulating in the mining area during the evening and night would therefore tend to run towards the south, and it is this cold air flow that is reflected in the results in Table 4.

Further analysis of topography over the Boggabri Coal Mine indicates the existing train loading facility is located on the southern side of a hill. Drainage flows associated with temperature inversions would therefore also flow from north to south past the train loading facility.

The existing haul road from the mine to the train loading facility, and the proposed private rail spur to the mine, cross the Namoi River floodplain. The Namoi River flows from south to north in this area and cold air drainage flows would therefore also flow along the river valley from south to north in contrast to the mine and the rail loading facility.

This assessment therefore includes a northerly wind for the mine, rail loading facility and locomotives on the existing rail loop, and a southerly wind for the existing haul road and proposed rail spur. Noise contours and predicted noise levels presented in this report, for the night wind scenarios, include both sets of wind directions combined.

4.2.3 Adopted Weather Conditions

Table 5 shows adopted atmospheric parameters for this assessment.

Table 5: Modelled Weather Conditions.

Atmospheric Parameter	Day		Evening and Night		
	Neutral	Prevailing	Neutral	Inversion No wind	Inversion and Wind
Temperature, °C	20	20	15	10	10
Relative Humidity, %	70	70	80	90	90
Wind Speed, m/s	0	3	0	0	2
Wind Direction	-	South	-	-	North (mine, rail loop) South (haul road)
Temp Gradient, °C/100m	-1	-1	0	3	3

The adopted weather conditions represent prevailing conditions for receivers in all directions from the site, including those which do not receive a significant occurrence of winds towards them from the site and are therefore assessed under calm wind conditions during the day and temperature inversion conditions during the night.

4.2.4 Strong Temperature Inversions

Anecdotal evidence indicates previous noise and atmospheric investigations on other mine sites in the Gunnedah Basin have shown the need to consider stronger temperature inversions that the INP default of 3 °/100m.

Temperature inversions tend to cause increased received noise levels because they refract sound 'rays' down towards the ground. Winds also cause increased noise levels, for receivers down wind, for the same reason. Research indicates the effects of inversions and winds are approximately cumulative and the noise model software adopts this approach by combining inversions and winds into an equivalent inversion strength. For the 'rural' terrain category in Environmental Noise Model (ENM) software as used for this assessment, the equivalent inversion strength used for determining received noise levels is calculated by:

Equivalent Inversion °/100m = Inversion °/100m + 2.5 x Wind speed m/s. *Equation 1.*

Table 5 indicates the night scenarios include a combined 3 °/100m inversion plus a 2m/s wind, from the north for the mine and rail loop and from the south for the haul road and rail spur across the Namoi river floodplain. According to Equation 1, a 2m/s wind is equivalent to a 5 °/100m inversion for receivers downwind of the source and the night scenarios, with a combined wind and inversion, include an equivalent inversion of 8 °/100m for downwind receivers. This equivalent inversion is significantly stronger, and causes greater noise enhancement, than the INP default 3 °/100m inversion strength.

The combined wind and inversion approach adopted in this assessment satisfies the recommendations in the INP while simultaneously assessing strong temperature inversions for closest receivers located generally south of the mine. Noise levels at receivers generally north and east of the mine are calculated using a 3 °/100, inversion, which is appropriate given the significant ridgeline that exists between the mine and receivers which would prevent a strong inversion forming in this area.

The adopted weather conditions would also result in increased rail loop noise for receivers generally south of the existing rail loop, which is likely to be appropriate given the topography in this area, and for receivers north of the haul road which again is appropriate given the expected drainage flows that would occur in the Namoi River valley.

4.3 Noise Control Measures

The following noise control and mitigation measures have been incorporated into the Project to minimise noise impacts on receivers and to reduce the Project's area of affectation.

- All mining trucks would be fitted with best practice exhaust silencers to reduce their noise emissions;
- The overburden fleet would be directed to higher, exposed emplacement areas during favourable weather conditions (generally during the day) and to lower, more shielded emplacement areas where possible during noise enhancing weather conditions (generally during the evening and night);
- Three existing product haul trucks operate along the private coal haul road between the mine and the rail loadout facility. Additional trucks purchased for this role would produce a sound power level of 108 dBA, i.e. the same noise level as a standard on-road truck and lower than the existing truck fleet;
- The existing three product haul trucks would be operated at a speed of 90 km/hr during the day and during favourable weather conditions, and at a speed of 50 km/hr during noise enhancing weather conditions in the evening and night;
- Vehicle reverse alarms and horns, equipment start alarms and other audible warning devices would be selected, installed and adjusted to produce the lowest possible noise level consistent with safe operation;
- Mobile and coal handling equipment would be maintained in good condition to maximise productivity and, at the same time, minimise any additional or unnecessary noise; and
- The proposed rail spur, if constructed, would include noise control measures such as large radius curves to minimise wheel squeal, concrete instead of steel bridges or vibration isolation material between the rails and steel bridges, and continuously welded rails to minimise wheel noise over joints.

Preliminary noise modelling in the absence of the proposed noise control measures has indicated the proposed measures would achieve a significant noise reduction at all receiver locations.

4.4 Operational Noise Sources

Proposed mining operations would rely on a number of items of fixed and mobile equipment to uncover, extract, process and transport coal. Sound power levels for proposed equipment included in the noise model are listed in Table 6.

Sound power levels in Table 6 have been derived from on-site noise measurement data obtained by Spectrum Acoustics where such data were available, or from noise measurements taken around similar equipment on other mine sites. Sound power levels for locomotives travelling at slow speed on a loading loop were measured on a loop at another mine, while coal trains travelling at higher speeds were measured in late 2009 in the East Maitland area near Newcastle.

Table 6: Modelled Noise Sources and Sound Power Levels.

Code, Source	Octave Band Centre Frequency, dBL *								L	A
	63	125	250	500	1k	2k	4k	8k	Total	Total
CHPP and Transportation Sources										
C1, Conveyor 100m	97	96	96	99	99	95	85	75	105.7	102.3
C2, Conveyor 200m	100	99	99	102	102	98	88	78	108.7	105.3
C5, Conveyor 500m	104	103	103	106	106	102	92	82	112.7	109.3
Cpp, Preparation plant	111	112	111	112	112	109	103	94	119.8	115.9
FB, ROM feeder breaker	109	107	107	108	105	100	93	83	115.6	109.3
Sk, Stacker tripper/chute	105	106	102	102	98	97	90	84	111.7	104.0
Tr, Transfer station	111	110	101	101	98	95	87	76	115.9	103.4
B, Truck or train loading bin	107	109	103	99	97	94	92	82	113.4	102.8
Loi, Locomotive (idling)	100	101	97	93	90	89	80	75	106.2	96.2
Haul trucks x7 (90km/hr)	131	127	124	115	112	109	105	100	134.3	120.2
Haul trucks x7 (50km/hr)	127	123	119	112	108	104	100	94	131.2	115.7
Train (50km/hr) #	126	123	119	118	119	121	118	115	132.3	126.0
Mining Sources										
S, Rope Shovel	120	115	118	115	113	110	108	99	125.6	118.2
Dr, Drill	125	115	106	112	111	111	109	96	128.6	116.9
Dz, Dozer	121	121	111	111	110	108	107	101	126.3	115.7
E, Excavator	125	121	116	115	116	113	110	103	129.6	120.2
L, Loader	121	119	114	109	113	111	104	100	126.0	117.0
G, Grader	119	121	119	114	103	104	101	93	126.0	115.2
W, Water cart	121	123	121	116	105	106	103	95	128.0	117.2
Tf, Truck (flat ground)	119	121	119	116	106	107	104	96	126.0	116.8
Tu, Truck (uphill)	111	119	118	117	113	113	106	99	124.5	119.4

* dBL means unweighted, as opposed to A-weighted, noise levels. Total dBL and dBA sound power levels are shown in the last two columns in Table 6.

\# A train includes three locomotives and 90 wagons travelling at an average speed of 50 km/hr on the rail spur.

Seven haul trucks are included in Table 6 for a maximum production rate of 7 Mtpa, which is expected to occur in years 5, 10 and 21. Lower production rates in year 1 have been considered by modelling three trucks in that year. The private rail spur option has been modelled separately.

Minor items of equipment that are unlikely to be audible at any receiver under any weather conditions, such as pumps located in the pit or conveyor drives within the coal handling area, have been shown by preliminary noise modelling to have no appreciable effect on received noise levels and have been omitted from the assessment. Figures showing noise source locations for the mine and rail loading facility are included in Appendix B.

4.5 Predicted Mining Noise Levels

Noise levels from the Project have been modelled for representative operating scenarios, time periods and weather conditions. Noise contour figures showing predicted noise levels for years 1, 5, 10 and 21 under neutral and prevailing weather conditions are included in Appendix A while detailed tables of noise levels at potentially affected receiver locations are presented in Appendix C. Predicted noise levels include normal mining activity, coal processing, road haulage of coal to the existing rail loading facility, operation of the rail loading facility and three locomotives operating at low speed on the loading loop. Tables 7A and 7B summarise the area of affectation from the Project based on the results presented in Appendix C and Figure 1 rounded to the nearest 1 dBA. Residences, separate lots and properties that are owned by a mining company or are subject to a private agreement with a mining company have been excluded from the Tables.

Table 7A: Mining Noise - Summary of Noise Affected Residences, Lots and Properties.

Residences	25% of Separate Lot Area	25% of Entire Property Area	Predicted Noise Level, LAeq,15min	
			Day	Evening/Night
Belleview Jeralong	14, 24, 26, 28, 35, 41, 46, 51, 52, 53, 61,81	Horse Shoe Northam	-	> 40

Table 7B: Mining Noise - Summary of Moderate and Mild Noise Impacts.

Residences	25% of Separate Lot Area	25% of Property Area	Predicted Noise Level, LAeq,15min	
			Day	Evening/Night
-	36	-	38	Less than 40
-	37	-	37	
-	38	-	36	
Goonbri	42, 67, 80, 107	87 Templemore	35 or below	
-		Cooboobindi	37	39
-	39, 68, 78, 82, 108	Roma BJ Crosby 48 Wilboroi East	35 or below	
-	72	-	39	38
-	13	-	38	
-	23	Bullock Paddock	37	
Cooboobindi	25, 27	-	36	
-	43, 79, 84, 89, 102, 109	47 Wilboroi	35 or below	
Roma Glenhope Pine Grove Flixton	29, 30, 31, 103, 110	10 Kelso Billabong 44 Glenhope	35 or below	37
Billabong Northam Barbers Lagoon	90, 93, 98, 106	PM MI Mainey Brighton 45 DV RJ Gillham 88 Pine Grove 116 RA CM Collyer 158 KL Grover	35 or below	36
-	126, 127, 128, 130	-	37	35 or below
-	121, 122, 124, 125	CM RRF Morse	36	
Brighton	111, 118, 120, 123, 131, 132, 136	92 94 Callandar PD LA Finlay	35 or below	

Figure 1: Mining Noise Area of Affectation.

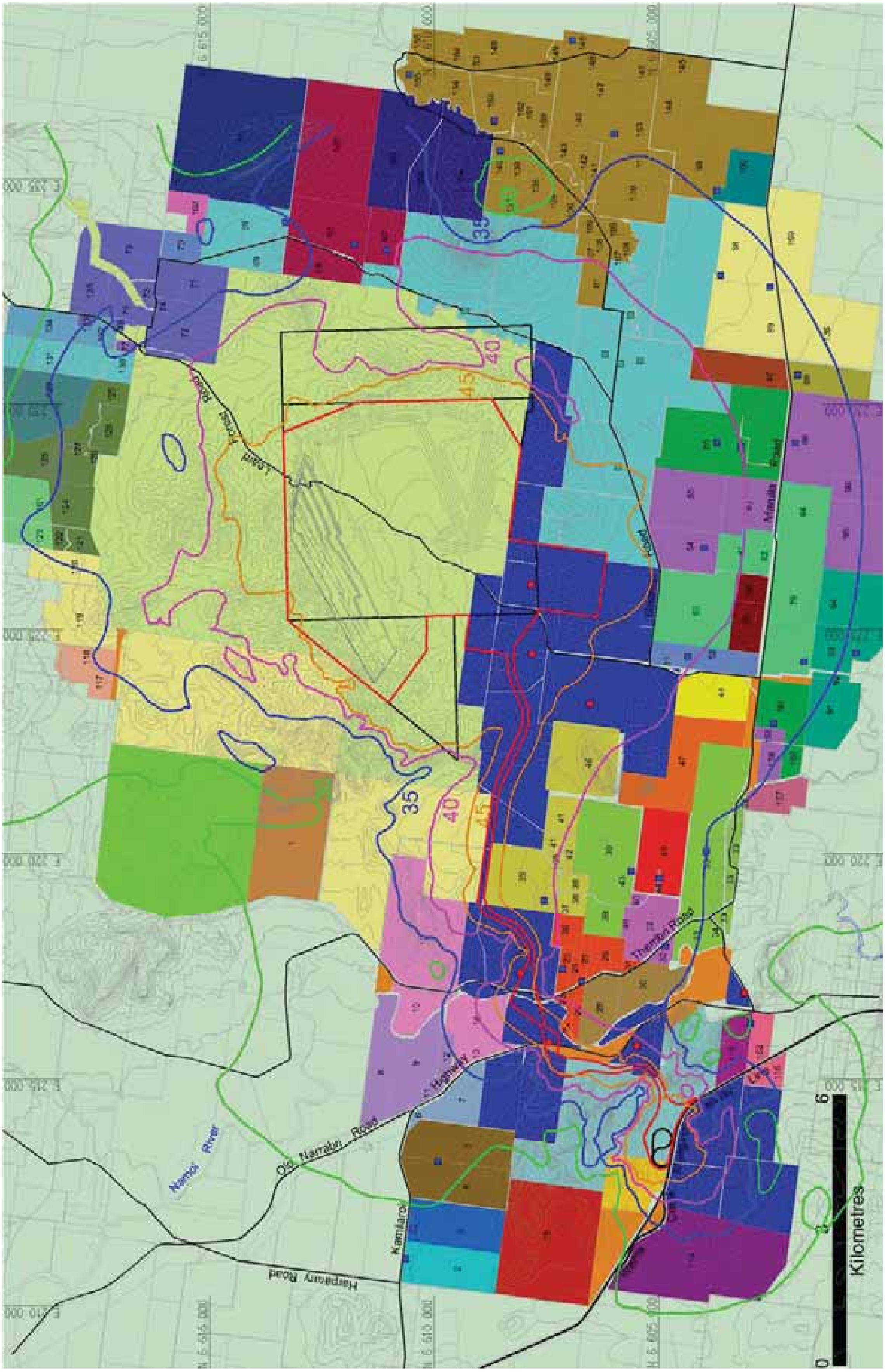


Figure 1 shows the area of affectation from the Project and represents the outer envelope, or maximum noise level, from all assessed years and weather conditions. The blue noise contour represents the 35 dBA intrusive criterion while the magenta contour represents a noise level 5 dBA above the criterion, or 40 dBA.

Table 7A indicates a total of 2 residences and 2 properties are expected to receive noise levels on or over 40 dBA, which represents 5 dBA or more over the intrusive noise criterion during one or more years and assessed weather conditions. Table 7B indicates a further 5 residences and 17 properties are expected to receive noise levels between the 35 dBA intrusive criterion and 40 dBA, which represents a moderate to mild noise impact for these receivers.

4.6 Dragline Option

The noise contours in Appendix A and results in Table 7 above assume a truck and shovel mining operation. Boggabri Coal intends to introduce a dragline, depending on geological and economic factors, to replace either a shovel or an excavator and the associated truck fleet. A dragline, if used, would therefore replace an excavator or shovel and typically 6 to 8 overburden trucks.

Assuming a fleet of 6 trucks and an excavator, the total sound power level of these 7 items is approximately 126 dBA. In contrast, a single dragline that would replace this fleet would produce a sound power level of approximately 118 dBA, based on noise measurements around large draglines on other mine sites. A dragline is therefore 8 dBA quieter than the equipment it would replace.

No detailed noise modelling has therefore been completed for the dragline option. Based on this discussion, it is clear that a dragline would result in a minor reduction in noise levels from the site and is therefore acceptable compared to the modelled situation.

4.7 Private Rail Spur Option

This assessment assumes all coal would be hauled by truck from the CPP to the existing rail loadout facility, using a fleet of up to 7 trucks for the proposed production rate of 7 Mtpa in years 5 to 21. All noise contours in Appendix A are based on this assumption.

An alternative transport option being considered by Boggabri Coal includes a rail spur from the main line to a new loading loop adjacent to the CPP. A production rate of up to 7 Mtpa would require one or two trains per day to enter the mine via the proposed spur and loop, rather than 7 trucks travelling almost constantly on the existing haul road.

A comparison between the assumed road transport option and the alternative rail spur option has been made by modelling the road alone, and the rail spur alone. Figure 2 shows noise levels produced by a fleet of 7 trucks travelling on the haul road, as assumed for years 5 to 21. The blue points show the 116 modelled noise source locations along the road, from the loading bin near the CPP to the rail loadout facility.

Figure 3 shows noise levels produced by a single train movement along the private spur line, assuming the train averages 50km/hr and therefore travels along the entire spur line in a 15 minute period. The blue points show the 135 modelled noise sources along the length of the spur from the end of the loop, where the locomotives begin to accelerate, to the main line.

A comparison between Figures 2 and 3 indicates a train movement is a little louder than the fleet of trucks, when comparing 15 minute average noise levels. However, the truck fleet must operate for most of the day and night to transport 7 Mtpa of product coal, while one or two trains per day (two or four train movements along the spur per day) would carry the same amount of coal. Noise levels in Figure 2 would therefore occur for well over 50% of each day, while noise levels shown in Figure 3 would occur for approximately 4% of the time per day.

Figure 2: Noise Levels from Road Haul Trucks, 7 Trucks, 7 Mtpa, LAeq,15min.

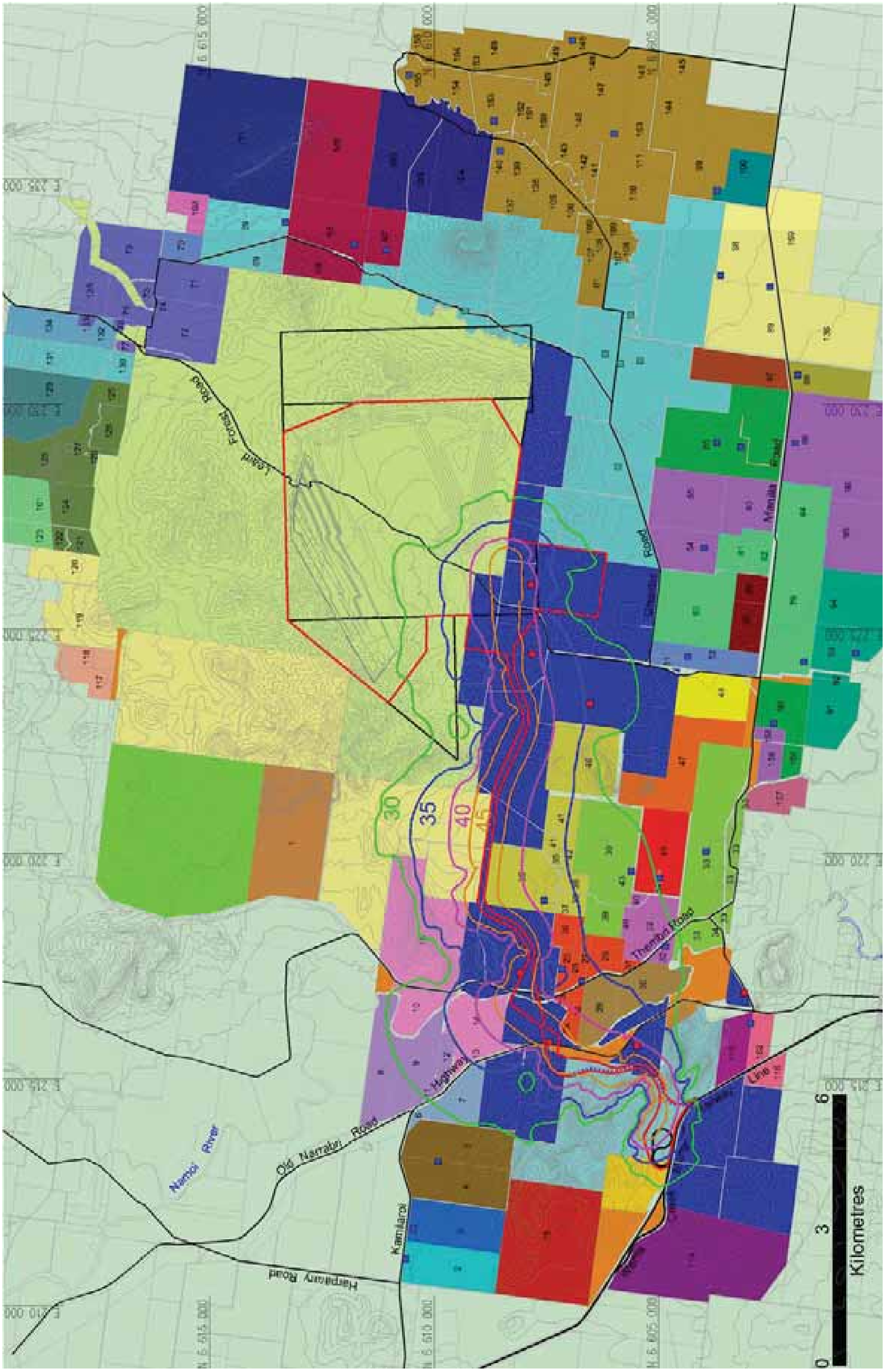
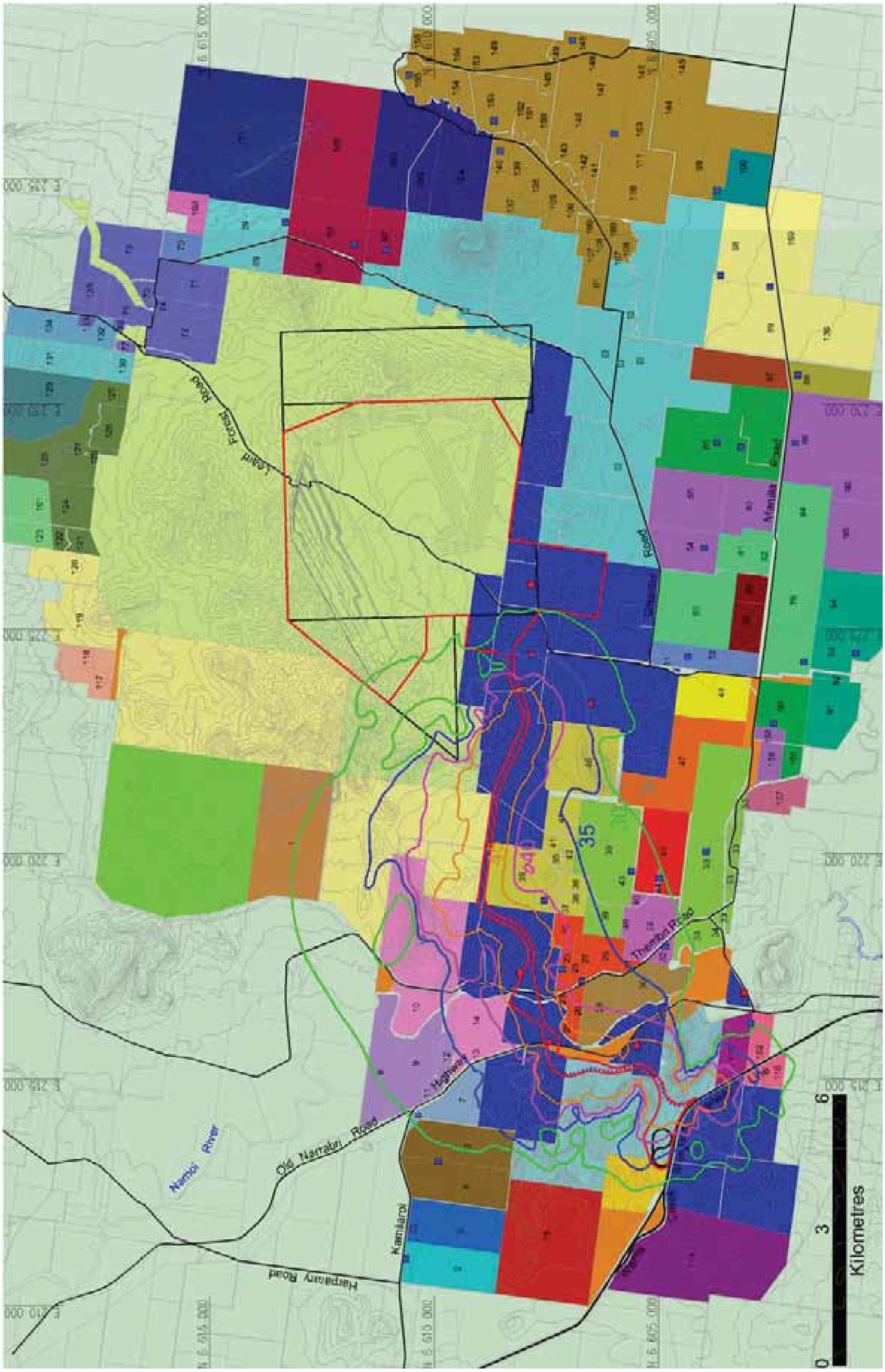


Figure 3: Noise Levels from Train Movement on Private Spur, LAeq,15min.



The intent of DECCW noise policies, including the INP, is to 'protect 90% of people for 90% of the time' from environmental noise impacts. With train movements on the private spur producing noise for only 4% of the time in a day, it is not necessarily appropriate to require strict compliance with INP noise criteria when assessing noise from the rail spur. While train movements on the spur would be louder than truck movements for short periods of time for some receivers, the average daily noise level produced by trucks is significantly greater than the average daily noise level produced by trains. Therefore, while coal haulage along the private road remains an acceptable option, the rail spur is considered a slightly better option from an environmental noise perspective.

4.8 Construction Noise

4.8.1 Construction Activities

Construction work would be required to implement the following Project works.

- Dragline assembly;
- Rail loading facility, loop and spur including Therribri Road, Namoi River and Kamilaroi Highway bridges;
- Haul road widening including Therribri Road bridge;
- CPP including ROM hopper and stockpiles; and
- Facilities including office, carpark and sheds.

Table 8 shows typical construction noise sources required to complete the proposed works, assuming all machines operate continuously at full power to present a worst case assessment.

Table 8: Typical Construction Sources and Sound Power Levels.

Project	Typical Construction Machines	Sound Power Level, dBA	
		Per Machine	Total
Assemble dragline (mechanical work)	Mobile crane	112	120
	Welder x3	104	
	Truck	108	
	Various hand tools including grinders	119	
Rail spur, loop etc (earthmoving phase)	Scraper x4	119	128
	Dozer x3	116	
	Truck x4	108	
	Excavator x3	112	
	Grader x2	112	
	Roller x2	110	
Haul road widening (earthmoving phase)	Dozer	116	121
	Truck x3	108	
	Excavator x2	112	
	Grader	112	
	Roller x2	110	
	Backhoe/bobcat	110	
CPP	Same as dragline assembly		120
Office, carpark, etc (earthmoving phase)	Truck	108	118
	Excavator	112	
	Grader	112	
	Roller	110	
	Backhoe/bobcat	110	

Table 8 shows the loudest proposed construction activity would be the rail spur earthmoving phase, primarily due to a number of diesel powered machines required on the site, followed by dragline assembly work with hand held angle grinders being the dominant source.

4.8.2 Dragline Assembly

If a dragline is required it would be assembled on site over a period of approximately 12 months. The dragline construction pad would be located close to the CPP and would therefore be at least 4.8 km from any privately owned residence. The expected construction sound power level of 120 dBA would produce less than 35 LAeq,15min at any residence, under all daytime weather conditions. Dragline assembly work would clearly produce acceptable noise levels, therefore detailed noise modelling of this source is not warranted.

4.8.3 Rail Spur

Construction work associated with the rail spur would produce a maximum sound power level of 128 LAeq,15min according to the calculations in Table 8. Machines would be located along the route, although a concentration of machines may occur at times for specific tasks. Assuming earthmoving machines would be spread evenly along the route results in the following construction noise levels during daytime neutral and southerly wind conditions.

- Residence 23 36 LAeq,15min;
- Residence 27 38 LAeq,15min; and
- Residence 35 41 LAeq,15min.

All other residences are expected to receive less than 35 LAeq,15min.

Predicted noise levels at three residences would be above the intrusive noise criterion, with one residence most exposed to the rail spur expected to receive noise levels more than 5 dBA over the criterion. Predicted rail spur construction noise levels are similar to worst case mining and transportation noise levels indicated in Table 7, so no extension to the previously identified area of affectation from the Project is required based on these calculations.

4.8.4 Rail Spur Bridge Work

Construction of a bridge over Therribri Road, the Namoi River and the Kamilaroi Highway would be required to complete the rail spur. Construction work would most likely involve pile driving, followed by more typical machines such as concrete trucks, concrete pumps and mobile cranes to place bridge beams and other components into place. Depending on bridge details, some pre-assembly work may be required before the components are lifted into place.

Concrete trucks and pumps would be covered by the estimated 128 dBA construction sound power considered above. Impact pile driving, however, would typically produce a sound power level in the range 125 to 130 LAmax and up to 125 LAeq,15min depending on the length of time required to drive a pile. Modifying factors discussed in the INP, specifically tonality and impulsiveness, can in many cases apply to impact pile driving noise.

Assuming a sound power level of 125 LAeq,15min and a 5 dBA tonal or impulsive penalty, results in an effective sound power level of 130 LAeq,15min which would cause a received noise level of up to 50 LAeq,15min at the closest Residences 27 and 35. Residence 23 is protected from closest pile driving noise by a small hill and would be expected to receive less than 45 LAeq,15min from the pile driver, while all other residences would receive significantly less than 45 LAeq,15min from this source.

Given the temporary nature of construction work, predicted noise levels are not necessarily considered unacceptable. A construction noise management plan for the rail spur works is recommended to ensure all feasible and reasonable mitigation measures are adopted during the work, although such measures are unlikely to result in the 35 LAeq,15min intrusive criterion being met at all times and at all residences.

4.8.5 Haul Road Widening

Construction work associated with the proposed haul road upgrade would be approximately 7 dBA quieter than rail spur construction, as shown in Table 8. As the haul road and rail spur follow a similar route, haul road construction noise levels would be below the levels predicted for the rail spur, excluding pile driving, therefore a detailed assessment is not required.

4.8.6 CPP Works and Facilities Upgrade

Construction of the CPP and upgrades to the office, carpark and other infrastructure would be acoustically comparable to the dragline assembly work, in that they would produce a similar sound power level and occur in an area at least 4.1 km from the nearest privately owned residence. These works would produce less than 35 LAeq,15min at any residence which is acceptable.

4.9 Sleep Disturbance

4.9.1 Mining

Coal mining primarily involves a number of diesel powered machines operating to remove overburden and extract coal. Most machines, such as trucks, have very little potential to produce noises likely to disturb sleep. Other machines, such as shovels and dozers, can produce intermittent louder noise depending on working conditions, machine condition and operator actions.

Shovels handle overburden by scooping the material into a bucket, swinging the bucket over a truck and allowing the rear section of the bucket to swing open to release the material into the truck. The rear of the bucket, known as the gate, is then swung closed and latched ready for the next load of material and can produce a moderately loud impact noise as it closes. Noise measurements on other mine sites indicate a shovel gate can produce a wide range of noise levels, with a sound power level in the range 125 to 128 dBA representing a typical maximum for this source.

Tracked dozers generally work in the forward direction, either pushing material with the blade or ripping hard ground with the rear-mounted ripping tines. Forward operation, particularly under load, tends to produce noise from the engine and exhaust but very little noise from the tracks. As a dozer reverses, however, lack of tension in the tracks tends to cause them to droop between the drive sprocket and the rear idler and this lack of tension can cause a regular impact noise. The level of noise a dozer can produce in reverse depends on a number of factors including machine type, condition, speed and ground conditions, with a sound power level in the range 125 to 130 dBA representing a typical maximum for this source.

Other sources of potential sleep disturbance include raw coal being dumped from a truck or loader into a steel ROM hopper, vehicle horns and equipment alarms. Noise measurements on other mine sites indicates these sources tend to produce a sound power level in the range 115 to 120 dBA, although the proposed vehicle horns and alarms would be significantly quieter.

This discussion indicates dozer tracks are generally the loudest sources of potential sleep disturbance within the mine, followed by shovel gates and train wheel squeal. Received noise levels from these sources depend on the location of the source and receiver. Dozer track noise can occur from within the mining area and from within the rail loading facility.

4.9.2 Trains

Train movements on the proposed private rail spur also have the potential to cause sleep disturbance. A long coal train travelling at 50km/hr tends to produce a sound power level of approximately 126 dBA as shown in Table 6, with some of this noise attributed to wheel squeal and other rail-related sources. While the proposed rail spur would include the noise control measures listed in Section 4.4 of this report, it is difficult to completely eliminate wheel squeal.

Train movements on the loading loop are unlikely to cause significant impact noise due to the slow travel speed required while loading. Train movements on the private rail spur have the potential to cause increased noise levels due to the higher anticipated speeds and possible wheel squeal that may occur on the bends, despite the proposed track design to minimise this source.

4.9.3 Calculated Noise Levels

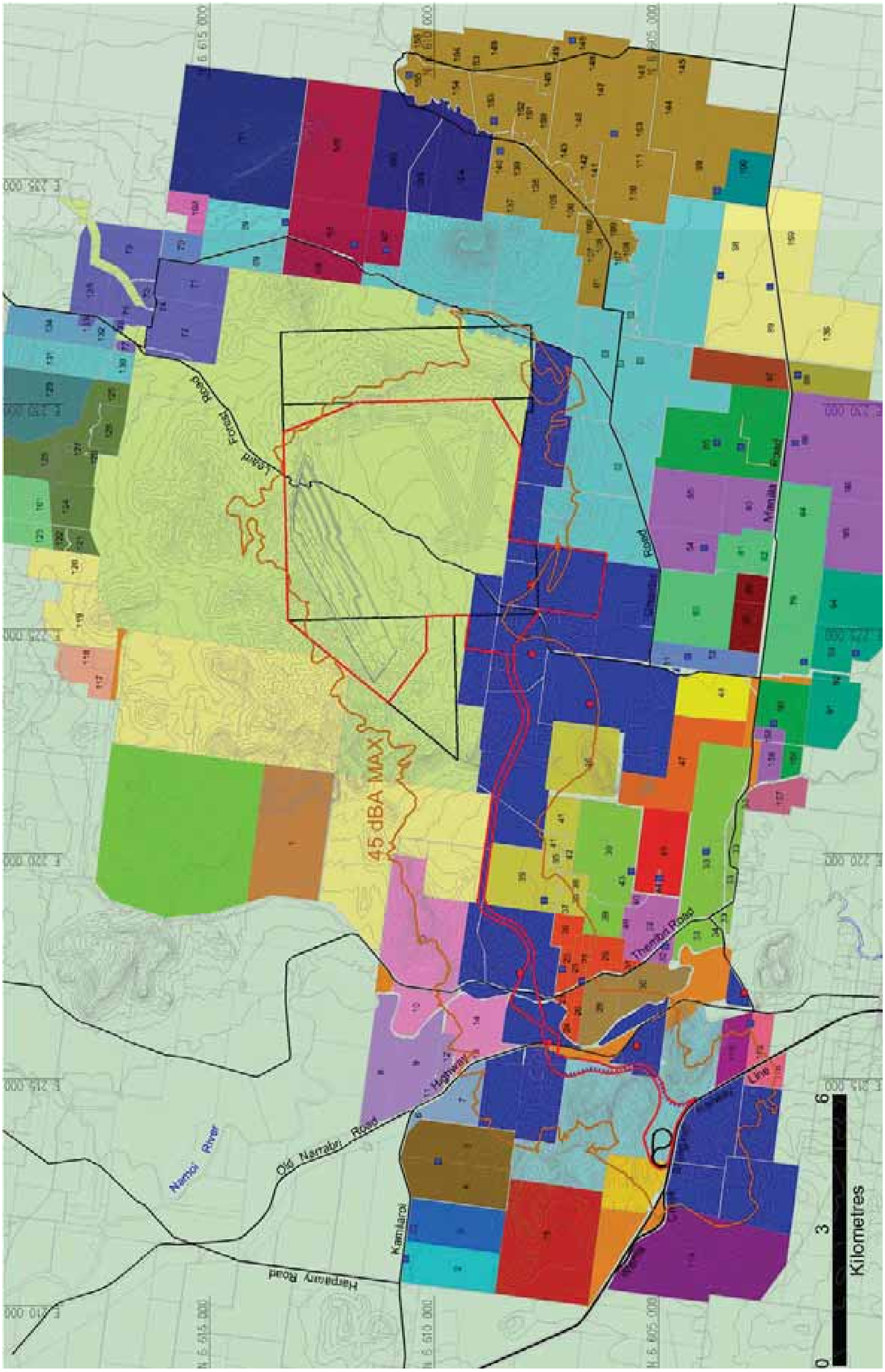
Figure 4 shows the 45 dBA maximum contour, which is approximately equivalent to the 45 LA1,1min sleep disturbance criterion, produced by the following sources:

- Dozer track noise within the mining area for all years;
- Dozer track noise within the existing rail loading facility; and
- Train wheel squeal at any point on the private rail spur.

Figure 4 shows the 45 LA1,1min sleep disturbance criterion may be exceeded at residences 23, 27 and 35. Residence 35 is within the area of affectation from mining and is included in Table 7A. Residences 23 and 27 are included in Table 7B and are already identified as being mildly affected by noise from the Project.

Residences 23 and 27 are expected to receive approximately 51 and 48 LA1,1min, respectively, from train movements on the spur line based on the assumption that some unavoidable wheel squeal will occur. Given the occasional nature of train movements at night and the proposed rail design that would minimise wheel squeal, predicted noise levels are considered acceptable.

Figure 4: Maximum Noise Levels For All Years, 45 dBA Max.



4.10 Road Traffic Noise

Traffic noise calculations are based on the United States EPA Intermittent Traffic Noise calculation method which is the most appropriate method for occasional or intermittent vehicle movements along a route. The usual Calculation of Road Traffic Noise (CORTN) method has not been used as it is more appropriate for semi-continuous traffic flows on arterial roads.

The calculation method assumes a trapezoidal time trace, as occurs when a vehicle approaches, passes the observer then recedes. Adopted sound power levels are 95 dBA for cars, assuming predominately diesel powered four wheel drives and other larger cars, and 108 dBA for trucks.

4.10.1 Receivers and Traffic Flows

The proposed Mine access route used by the Project would be from the Kamilaroi Highway via Manilla Road and Leard Forest Road. Closest residences to the access route are Residence 33 approximately 500m north of Manilla Road, Residence 90 approximately 420m south of Manilla Road and Residence 52 approximately 390m east of Leard Forest Road. The Project includes employment for up to 500 full time staff over multiple shifts so a reasonable worst case traffic noise assessment would assume two-thirds of the staff would either enter or leave the site in a period of one hour. An operational traffic noise assessment is therefore based on 300 car movements per hour along the access route, assuming a worst case situation where most staff travel separately to the site. The assessed situation is most likely to occur at shift changeover times which would occur two or three times per day, during the day and night.

A number of truck movements along the access route are also required for delivery of fuel and lubrication products, spare parts, gravel and other civil products. Such deliveries are usually intermittent and occasional, although fuel deliveries would occur on a fairly regular basis. A reasonable worst case assessment would assume two heavy trucks would enter and leave the site in a one-hour period.

4.10.2 Assessment

Based on the assumed 300 car and 4 truck movements per hour, the following traffic noise levels have been calculated.

- Residence 33 42.2 LAeq,1hr;
- Residence 90 42.9 LAeq,1hr; and
- Residence 52 43.2 LAeq,1hr.

As Project-related traffic flows represent most of the traffic on the access route, non-project traffic flows would have an insignificant effect on traffic noise levels and do not need to be specifically considered. Calculated traffic noise levels are acceptable compared to the 55 LAeq,1hr day and 50 LAeq,1hr night criteria and no traffic noise control measures are required or recommended.

4.10.3 Construction Traffic

Construction related traffic would vary significantly depending on the work carried out at the time, with civil works such as the rail spur typically requiring a greater number of heavy truck movements compared to mechanical works such as CPP construction. A reasonable worst case construction traffic scenario would include a series of truck movements to deliver materials such as rail ballast, and is assumed to require up to 10 trucks (20 movements) per hour. Rail spur construction traffic would primarily access the site via Manilla Road and Leard Forest Road.

Up to 20 truck movements per hour would result in the following traffic noise levels.

- Residence 33 Manilla Road 42.4 LAeq,1hr;

- Residence 90 Manilla Road 43.2 LAeq,1hr;
- Residence 52 Leard Forest Road 43.5 LAeq,1hr;

Predicted construction traffic noise levels are acceptable and no traffic noise mitigation measures are required.

4.11 Rail Traffic Noise

Noise from train movements on the Mungindi to Werris Creek Railway is subject to the criteria included in Section 3.5 and is assessed separate to train noise from the private spur.

A detailed assessment of noise from train movements on the Werris Creek Railway requires data regarding the average and maximum number of train movements per day that currently occur on the railway and the location of all potentially affected residences along the route. In the absence of such data, a detailed assessment of train noise to all residences is beyond the scope of this report.

The *2009-2018 Hunter Valley Corridor Capacity Strategy – Consultation Document* (ARTC, 2009) includes the following data regarding train movements from Narrabri to Curlewis:

- 12 train movements per day from Narrabri to Boggabri;
- 14 train movements per day from Boggabri to Gunnedah; and
- 20 train movements per day from Gunnedah to Curlewis;

An average of two train movements per day to and from the existing Boggabri Coal Mine is included in the ARTC data. The Project would require one or two trains per day (average of 3 train movements per day) to transport up to 7 Mtpa of product coal, which represents less than a 10% increase in train movements from Boggabri to Curlewis and an increase in average train noise levels of 0.3 LAeq,15hr day and LAeq,9hr night. Maximum passby noise levels would not change as a result of the Project assuming all trains produce a similar maximum noise level.

A 0.3 dBA increase in average train noise levels at all potentially affected residences near the Werris Creek Railway represents a very minor noise impact and is therefore considered acceptable.

4.12 Low Frequency Noise

4.12.1 Mining Sources

A modifying factor of 5 dBA has been applied to modelled mining and transportation sources where relevant so no further analysis of low frequency noise levels is required under the INP.

Based on experience on other mining sites, the most likely sources of low frequency noise associated with the Project are screens and centrifuges in the proposed CPP and the secondary screens and crushers. It is possible for belt conveyors to produce measurable low frequency noise, however experience suggests low frequency conveyor noise is significantly less intense than CPP and crusher noise.

Measurements taken on a number of other mining sites indicate low frequency noise is typically most intense in the 14Hz to 25Hz range, corresponding to various vibrating screen speeds within the CPP. An intermediate frequency of 20Hz, which is within the frequency range covered by the noise model software, has been adopted for the purposes of this analysis.

Noise measurements taken around other preparation plant buildings indicate a sound power level in the range 130 to 135 dBL can be expected when considering frequencies below 31Hz. The small CPP proposed for the Project is likely to produce a noise level in the lower end of this range. Results from the noise model indicate a sound power level of 130 dBL would cause a received noise level of 50 dBL at closest residences, excluding those predicted to receive more than 40 LAeq,15min from mine operation as listed in Table 7A. The predicted noise level applies under temperature inversion conditions during the night and excludes any topographical shielding and is therefore conservative.

This result indicates the proposed CPP would produce acceptable low frequency noise levels compared to both the Queensland interim criterion and to a currently acceptable low frequency noise level of 80 dBL at residences near other mine sites in NSW.

4.12.2 Trains on the Spur

Coal train movements can produce low frequency noise as well as audible noise, with the locomotives and empty coal wagons being the most common sources. Noise measurements of passing coal trains taken in East Maitland in late 2009 provided the following low frequency related results, all at a distance of approximately 50 m from the line:

- Empty coal wagons produced up to 89 dBL, typically at a frequency of 25 Hz, at an estimated speed of 80 km/hr;
- Full coal wagons did not produce significant low frequency noise; and
- Locomotive noise levels reached 85 dBL at moderate power and 99 dBL at high power, typically in the 50 Hz and 63 Hz frequency bands. Engine power settings could not be determined accurately and were estimated by the locomotive noise character and by observing a visible exhaust plume.

The above measurement data suggests the following representative low frequency train sources.

- Three locomotives operating together at moderate power, 127 dBL sound power at 50 Hz;
- Three locomotives operating together at high power, 141 dBL sound power at 63 Hz; and
- 90 empty wagons at approximately 80 km/hr, 140 dBL sound power at 25 Hz.

Closest residences to the proposed rail spur, excluding those listed in Table 7A, would be Residence 23 at a distance of 680 m and Residence 27 at a distance of 1000 m. Although Residence 23 is closer to the rail spur, it is effectively shielded by a small hill and would be expected to receive noise levels approximately 1 dB lower than those received at Residence 27.

Results from the noise model indicate a worst case situation, with an empty coal train travelling at 80 km/hr at full engine power as measured at East Maitland, would produce a low frequency noise level of 75 dBL at a distance of 1000 m from the rail spur. As train speeds are likely to be lower and full engine power is unlikely to be required for trains entering the rail spur and travelling to the mine, a lower noise level in the range 60 to 65 dBL would be expected at 1000 m from the rail spur.

Full trains leaving the mine and accelerating along the spur would require at least moderate engine power, with full power unlikely to be used as the train would likely have to stop to wait for an opportunity to enter the Werris Creek to Mungindi Railway. A worst case situation with full engine power would result in a received low frequency noise level of 73 dBL at 1000 m from the rail spur, while a more moderate engine power setting is expected to produce less than 65 dBL at 1000 m from the spur.

These results indicate low frequency noise levels from train movements on the proposed rail spur would most likely remain under the 80 dBL low frequency noise level that has been found to be acceptable near other coal mine sites, but would exceed the Queensland EPA’s interim criterion of 50 dBL. It is noted that the Queensland EPA’s interim criterion is intended to apply to constant low frequency noise sources, rather than relatively brief train passby events, and assumes tonal components are present in the noise. The interim criterion is therefore a particularly conservative criterion to be applied to a transient source such as a train passby.

4.12.3 Train Noise Mitigation

Results in Section 4.11.2 indicate low frequency noise levels from trains travelling on the spur line are expected to remain within the adopted 80 dBL criterion. The following noise mitigation measures are proposed to achieve the lowest possible levels of low frequency noise from the rail spur.

- Rails would be continuously welded rather than jointed;
- The rail alignment would be designed to minimise locomotive engine power required to traverse the rail spur, in both directions;
- The rails would be installed to close horizontal and vertical tolerances to minimize transient wheel forces that may generate low frequency noise from empty coal wagons; and
- Train speeds on the spur would be controlled to acceptable levels.

4.13 Blast Overpressure and Vibration

4.13.1 Previous Blast Monitoring

Explosive blasting is currently used at Boggabri Coal Mine to fragment overburden and this practice would continue at an increased rate consistent with the proposed increase in annual coal production. Boggabri Coal currently operates a blast monitoring system using monitors installed at Bollol Creek Station (owned by Whitehaven Coal) and at Residence 63 ‘Greenhills’ which is currently subject to negotiation between Whitehaven Coal and the landowner. Overpressure and vibration monitoring results reported in the 2009 Boggabri Coal AEMR have been reviewed to determine the mine’s recent blasting history.

Section 3.6.1 of the AEMR shows peak vibration levels produced by blasts in 2008. The monitored results show a maximum vibration level of 0.75mm/s Peak Particle Velocity (PPV) compared to the 5 mm/s criterion.

Section 3.6.2 of the AEMR similarly includes Figure 37 monitored overpressure levels during 2008. The results show average maximum overpressure levels below 110 dBL, with maximum levels of 112 dBL at Bollol Creek Station and 114 dBL at Residence 63, compared to the 115 dBL criterion. Bollol Creek Station is located approximately 4.5 km from the 2008 blast sites while Residence 63 is approximately 4 km from the blast sites.

4.13.2 Ground Vibration Analysis

Analysis of the AEMR blast results indicates ground vibration levels are consistent with, or a little lower than, expected vibration levels considering typical Maximum Instantaneous Charge (MIC) weights in the range 1500 to 2500 kg as used in open cut coal mine blasts.

Calculations based on Appendix J of Australian Standard 2187.2-1993 indicate ground vibration levels would remain within the 5 mm/s criterion for blasts 1700m from a residence, based on an MIC of 3000 kg and ground coefficients of K=1140 and b=1.6. With closest residences at least 3.9 km from proposed blasts, ground vibration levels are not expected to exceed 1.3 mm/s PPV which is well within the 5 mm/s criterion. No additional vibration control measures are expected to be required although ongoing blast monitoring is recommended to ensure vibration levels remain acceptable.

4.13.3 Overpressure Analysis

Analysis of the AEMR blast results indicates overpressure levels in 2009 reached a maximum level of 114 dBL at a monitoring location approximately 4 km from the blast. Proposed blasts would be a minimum of 3.9 km from privately owned properties and, assuming the same blast practises continue, would produce a maximum overpressure level of 114.2 dBL. Most residences would remain over 4.8 km from proposed blasts and are expected to receive less than 112 dBL for all blast events.

As the predicted overpressure levels are close to the 115 dBL criterion, ongoing blast monitoring is recommended to ensure overpressure levels remain acceptable.

The proposed increase in mine production would require additional, rather than larger, blasts. Available data indicate a total of 46 blast events occurred in 2008, for a production rate of approximately 1.5 Mtpa of coal. At a proposed maximum production rate of 7 Mtpa, approximately 220 blast events per year would be required which is just over 4 events per week.

4.13.4 Buildings

Blast noise and vibration criteria are designed to provide an acceptable level of personal comfort for residents and other sensitive receivers. Noise and vibration criteria to minimise the chance of residential building damage are an order of magnitude higher than the criteria and the levels currently experienced by closest receivers. The proposed blasting program therefore offers an extremely low chance of even superficial or cosmetic damage to privately owned residences. This means structural members within each residence absorb the vibration in an elastic manner, without yielding or suffering permanent damage or change, which in turn means the vibration could theoretically continue indefinitely with no noticeable change to the building structure.

An increase in the average number of blast events per week as a result of the Project would therefore be unlikely to result in any damage to residences or other buildings.

4.13.5 Cumulative Blast Impacts

Potential cumulative impacts from blasting would normally be limited to an increase in the average number of blasts per day noticed by residents, with a very low chance of blast events at two or more mines occurring simultaneously. Nevertheless, Boggabri Coal should coordinate blasting schedules with other mines within a 10km radius to avoid any potential for simultaneous blast events. All blast events associated with the Project would be designed to meet relevant overpressure and ground vibration criteria. Potential cumulative impacts, in the form of additional blast events per day from two or more nearby mine sites, would not increase maximum overpressure or ground vibration levels so would not result in exceedances of relevant criteria.

4.14 Cumulative Noise Levels

Cumulative noise impacts would potentially be caused by simultaneous operation of the Project and other nearby industrial developments such as the existing Tarrawonga Coal Mine to the south. Existing noise levels from Tarrawonga Coal Mine have been considered in Section 3.1 when determining Project noise criteria and no further cumulative assessment of existing Tarrawonga Coal Mine noise levels is required.

The Department of Planning has requested a high level cumulative noise impact assessment including proposed and possible future coal mines, which is attached as Appendix D.

5 CONCLUSION

This assessment shows the area of affectation from the Project is expected to include a number of privately owned properties, as shown in Table 7A, while some additional properties listed in Table 7B would receive moderate or mild noise impacts under specific operating and weather conditions. All properties not listed in Tables 7A and 7B are expected to receive acceptable noise levels compared to relevant criteria.

Construction noise levels are expected to be acceptable at all residences compared to relevant criteria. Some relatively short term construction activities such as impact pile driving associated with construction of the rail bridge over Therribri Road, the Namoi River and the Kamilaroi Highway and the road bridge over Therribri Road have the potential to exceed the noise criteria at closest residences. A construction noise management plan is recommended to ensure all feasible and reasonable noise mitigation measures are implemented during rail spur and road construction work.

Sleep disturbance from impact sources within the mine such as a shovel gate and dozer tracks is unlikely to occur considering the large distance from the mine to closest receivers. Train movements on the proposed rail spur have the potential to disturb sleep for closest residents, depending on the occurrence of wheel squeal and other sources as a train travels along the rail spur. Noise monitoring of train movements is recommended after the rail spur is commissioned to identify any noise issues and required mitigation measures.

Noise from road traffic associated with construction activities and ongoing operation of the Project would be acceptable at all residences.

Low frequency noise levels from the proposed CPP are expected to be acceptable at all residences. Low frequency noise from train movements on the rail spur is also predicted to be within acceptable levels. Monitoring of low frequency noise levels during initial operation of the rail spur is recommended to confirm acceptable levels or, where required, to identify any treatment or control options.

Blasting associated with the Project is expected to produce ground vibration and overpressure levels below relevant amenity criteria at all privately owned residences. Blast monitoring at closest residences, or at other representative locations, is proposed to confirm ongoing compliance with blast criteria.

APPENDIX A – NOISE CONTOUR FIGURES

FIGURE	DESCRIPTION
A1	Year 1 Day, neutral weather conditions
A2	Year 1 Day, 3 m/s southerly wind
A3	Year 1 Evening/Night, neutral weather conditions
A4	Year 1 Evening/Night, 3 °/100m temperature inversion
A5	Year 1 Evening/Night, 3 °/100m temperature inversion and 2 m/s wind
A6	Year 5 Day, neutral weather conditions
A7	Year 5 Day, 3 m/s southerly wind
A8	Year 5 Evening/Night, neutral weather conditions
A9	Year 5 Evening/Night, 3 °/100m temperature inversion
A10	Year 5 Evening/Night, 3 °/100m temperature inversion and 2 m/s wind
A11	Year 10 Day, neutral weather conditions
A12	Year 10 Day, 3 m/s southerly wind
A13	Year 10 Evening/Night, neutral weather conditions
A14	Year 10 Evening/Night, 3 °/100m temperature inversion
A15	Year 10 Evening/Night, 3 °/100m temperature inversion and 2 m/s wind
A16	Year 21 Day, neutral weather conditions
A17	Year 21 Day, 3 m/s southerly wind
A18	Year 21 Evening/Night, neutral weather conditions
A19	Year 21 Evening/Night, 3 °/100m temperature inversion
A20	Year 21 Evening/Night, 3 °/100m temperature inversion and 2 m/s wind

Figure A1: Year 1 Day, Neutral Weather Conditions

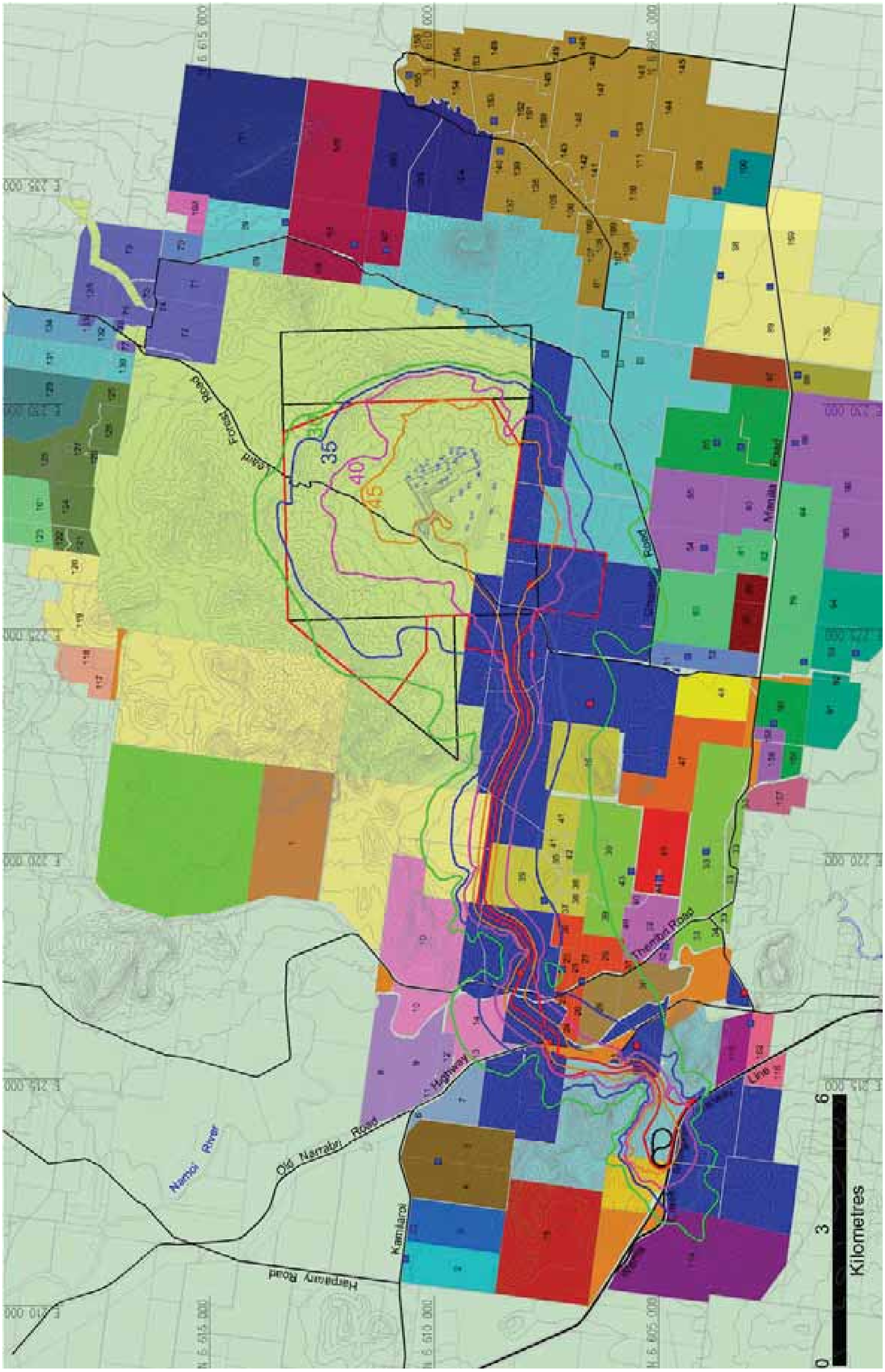


Figure A2: Year 1 Day, 3 m/s Southerly Wind

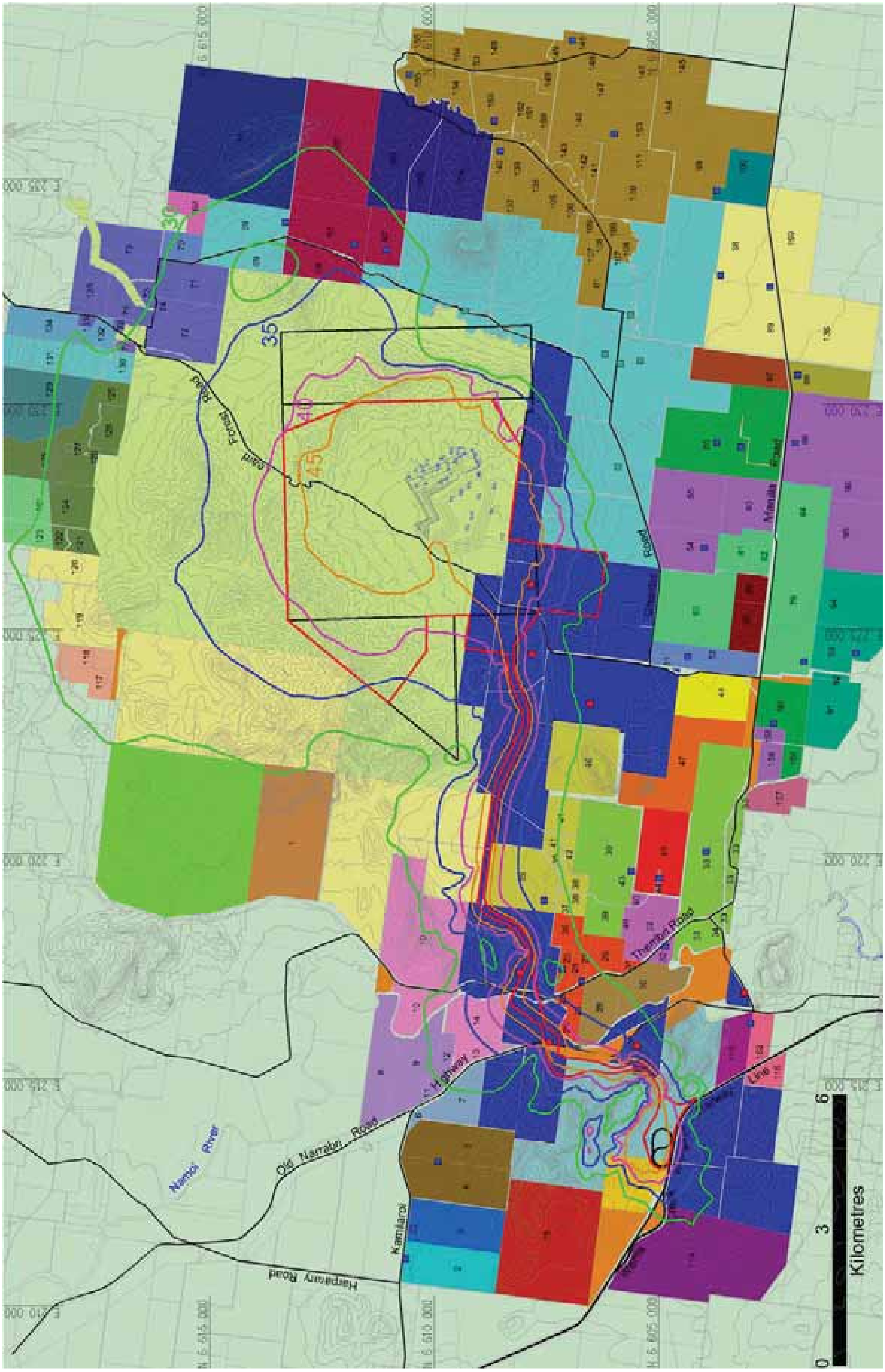


Figure A3: Year 1 Evening/Night, Neutral Weather Conditions

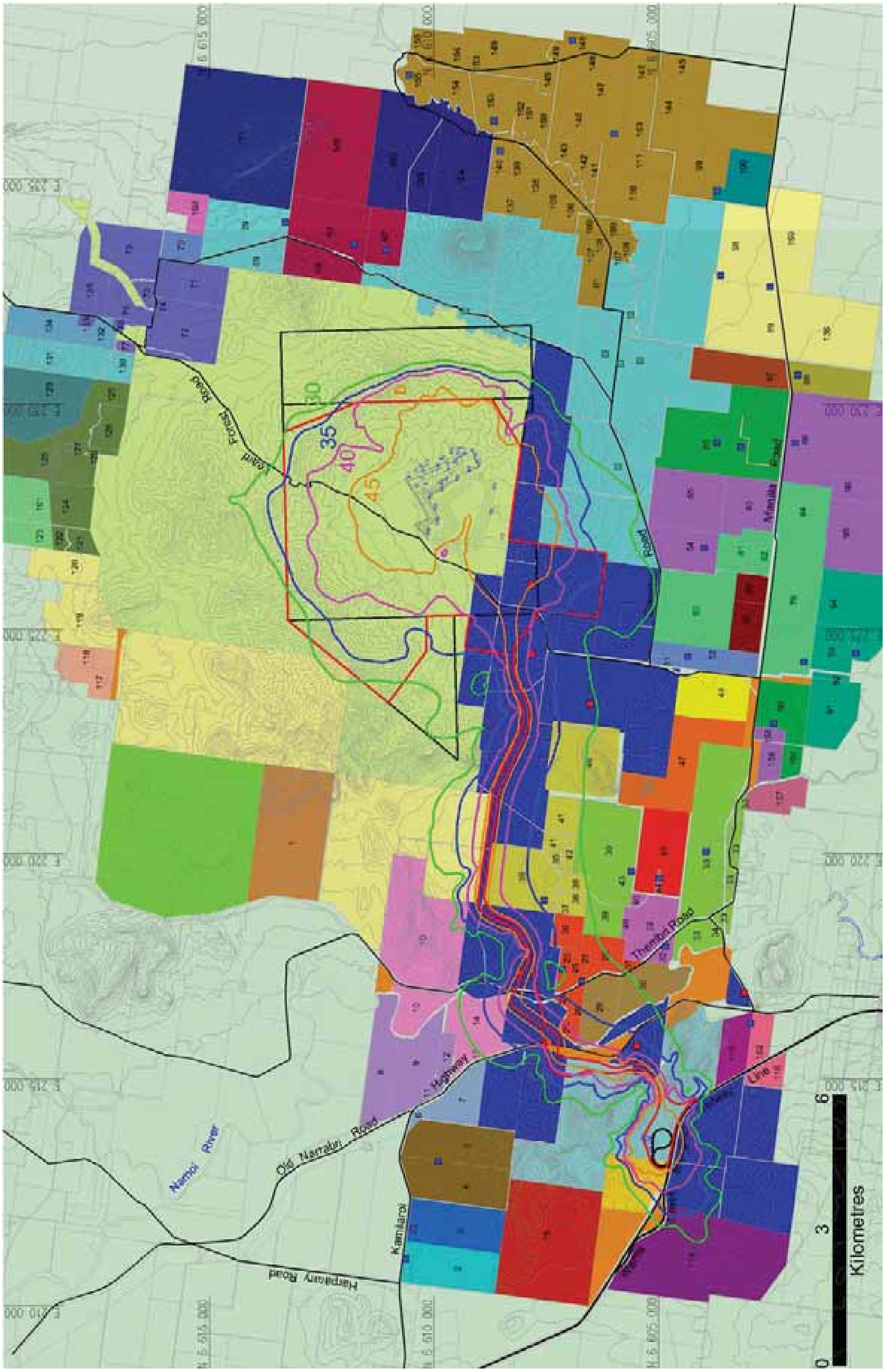


Figure A4: Year 1 Evening/Night, 3 °/100m Temperature Inversion

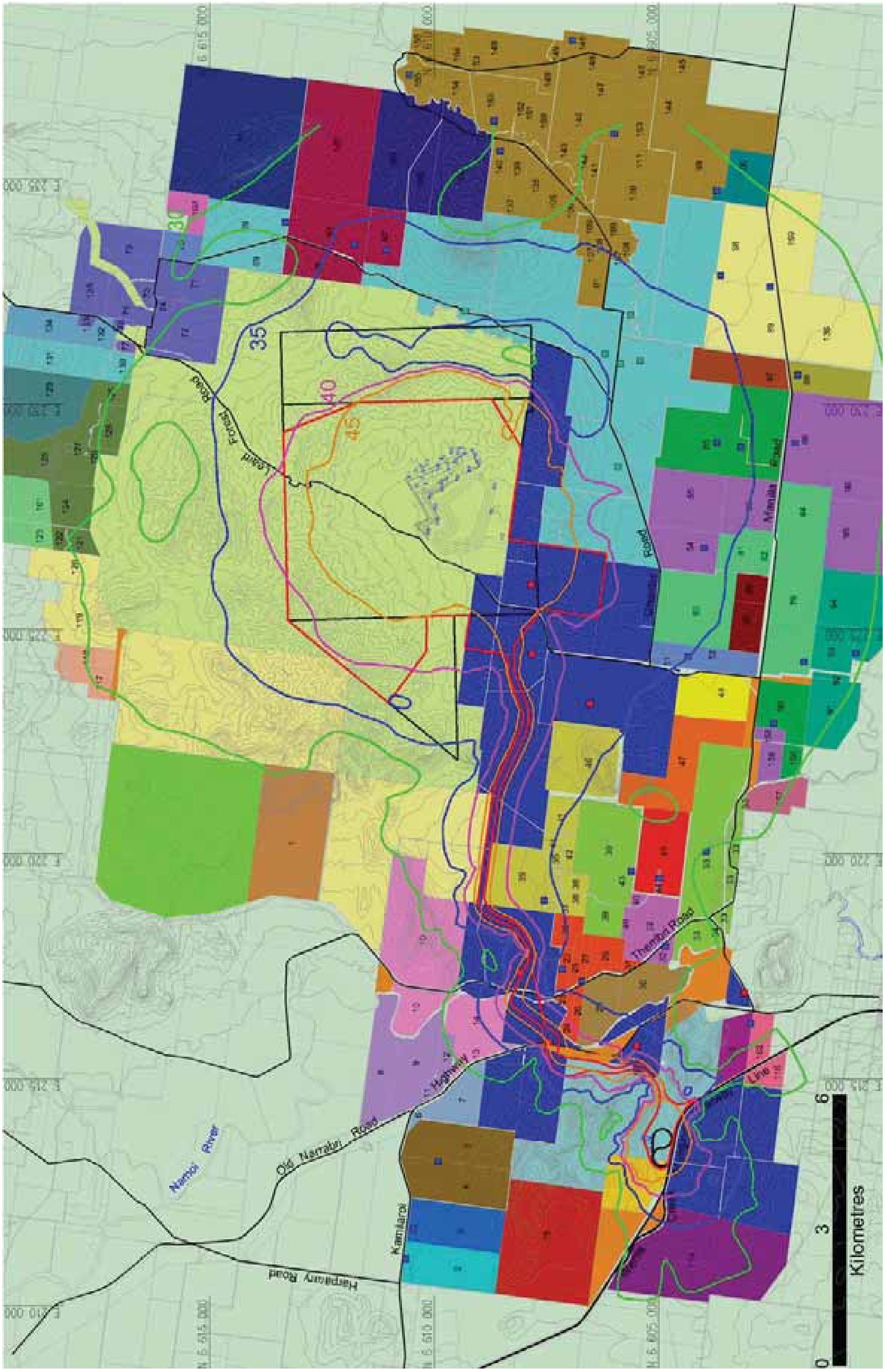


Figure A5: Year 1 Evening/Night, 3 °/100m Temperature Inversion and 2 m/s Wind

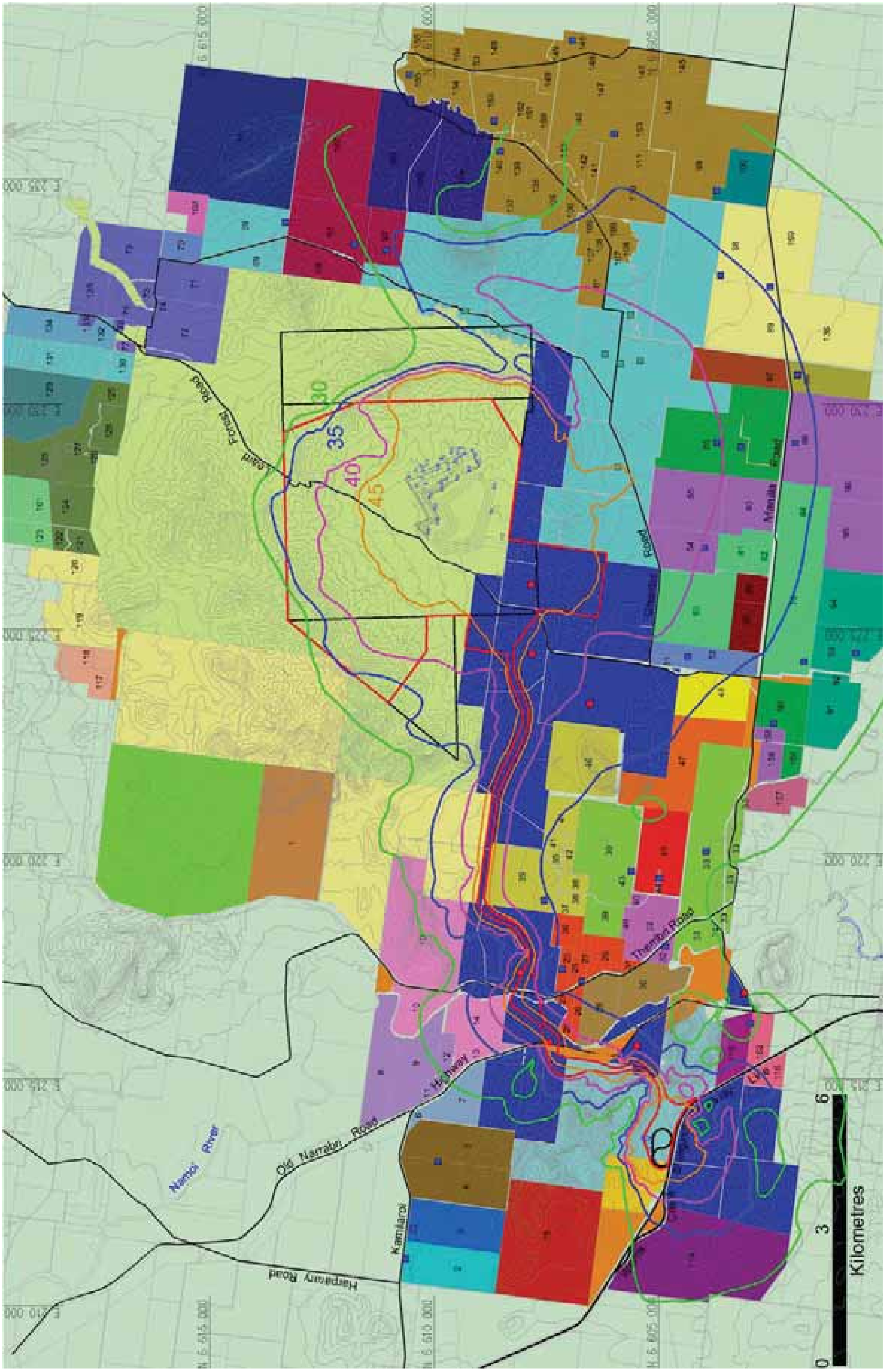


Figure A6: Year 5 Day, Neutral Weather Conditions

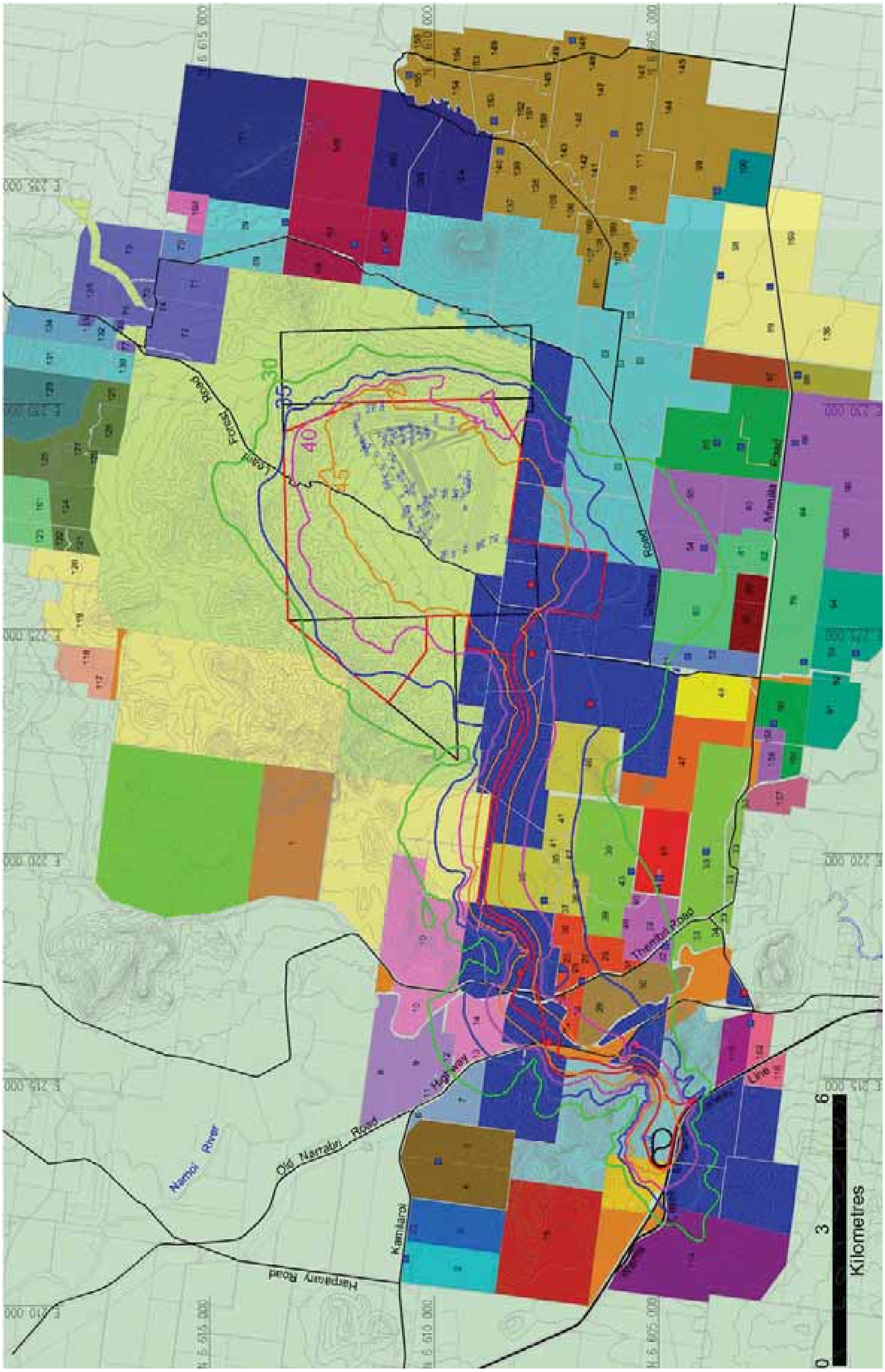


Figure A7: Year 5 Day, 3 m/s Southerly Wind

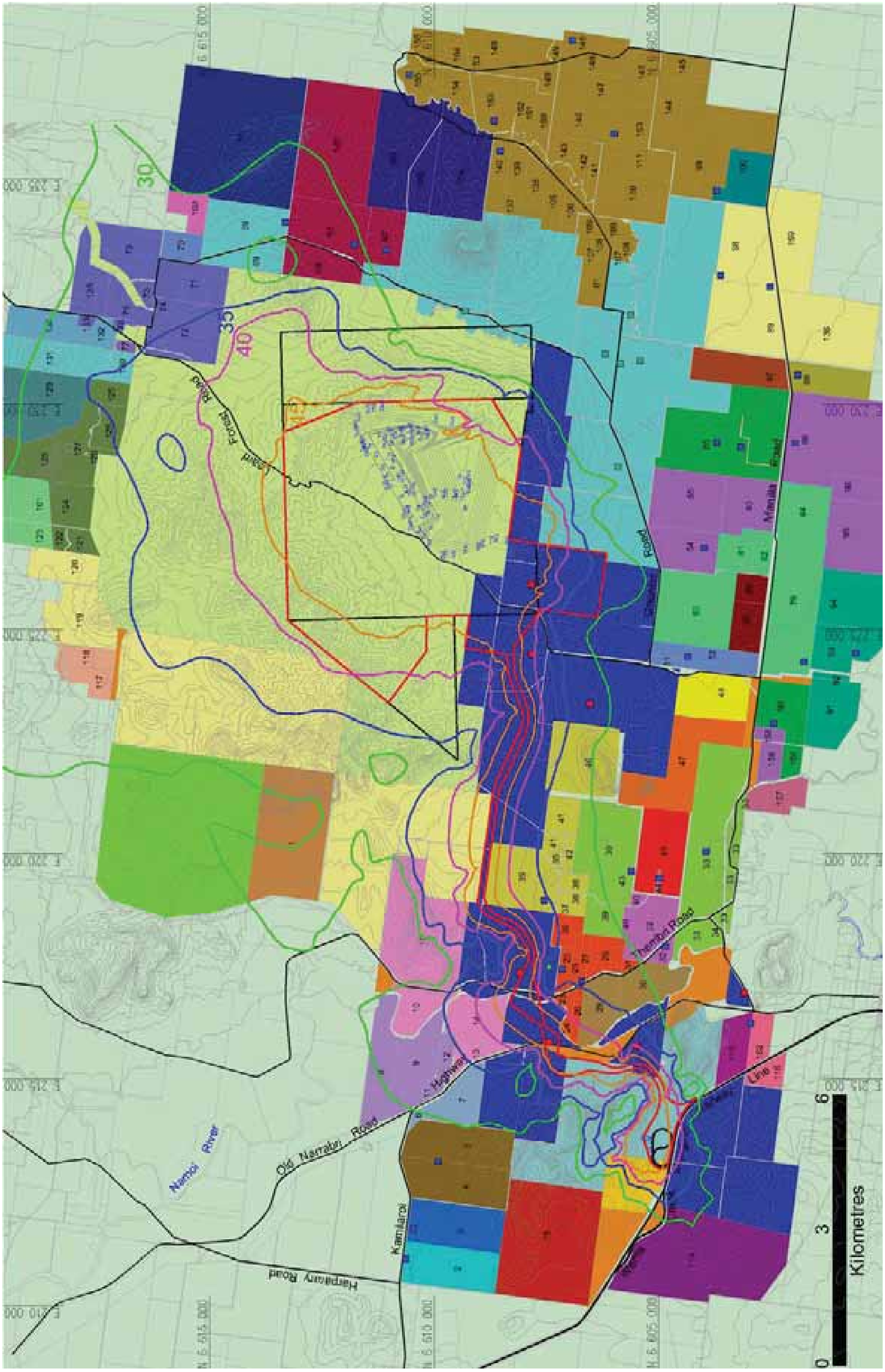


Figure A8: Year 5 Evening/Night, Neutral Weather Conditions

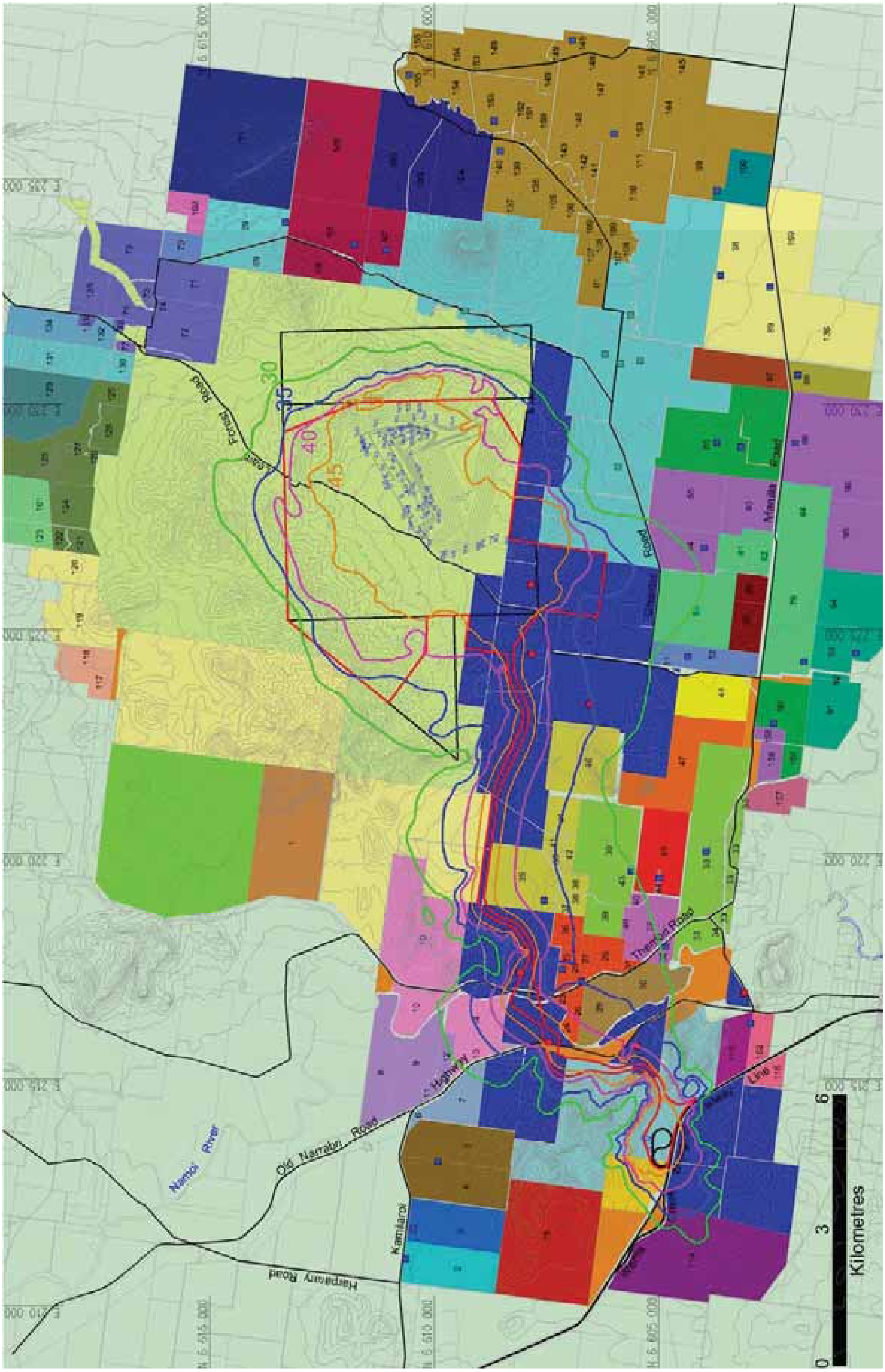


Figure A9: Year 5 Evening/Night, 3 °/100m Temperature Inversion

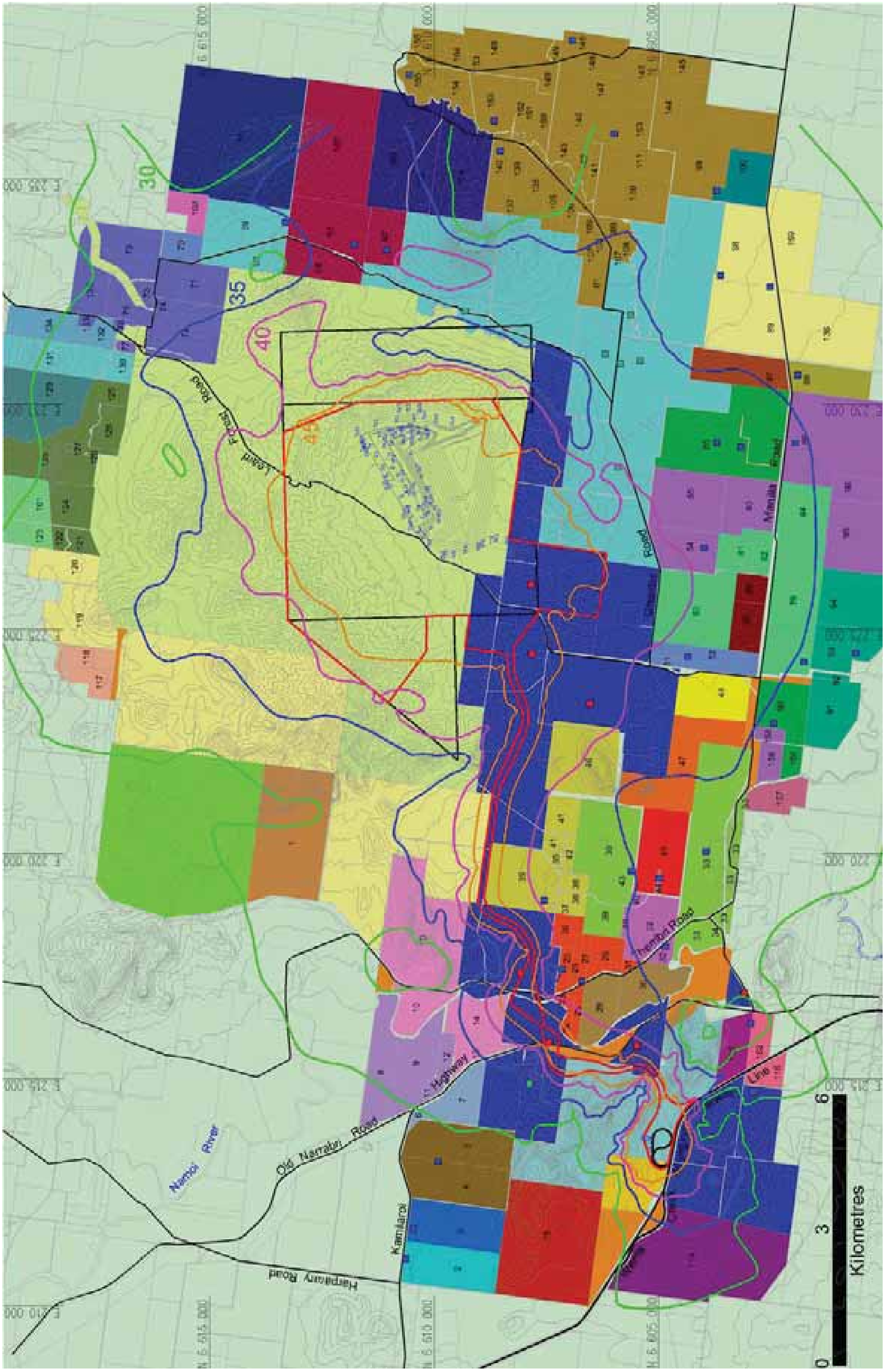


Figure A10: Year 5 Evening/Night, 3 °/100m Temperature Inversion and 2 m/s Wind

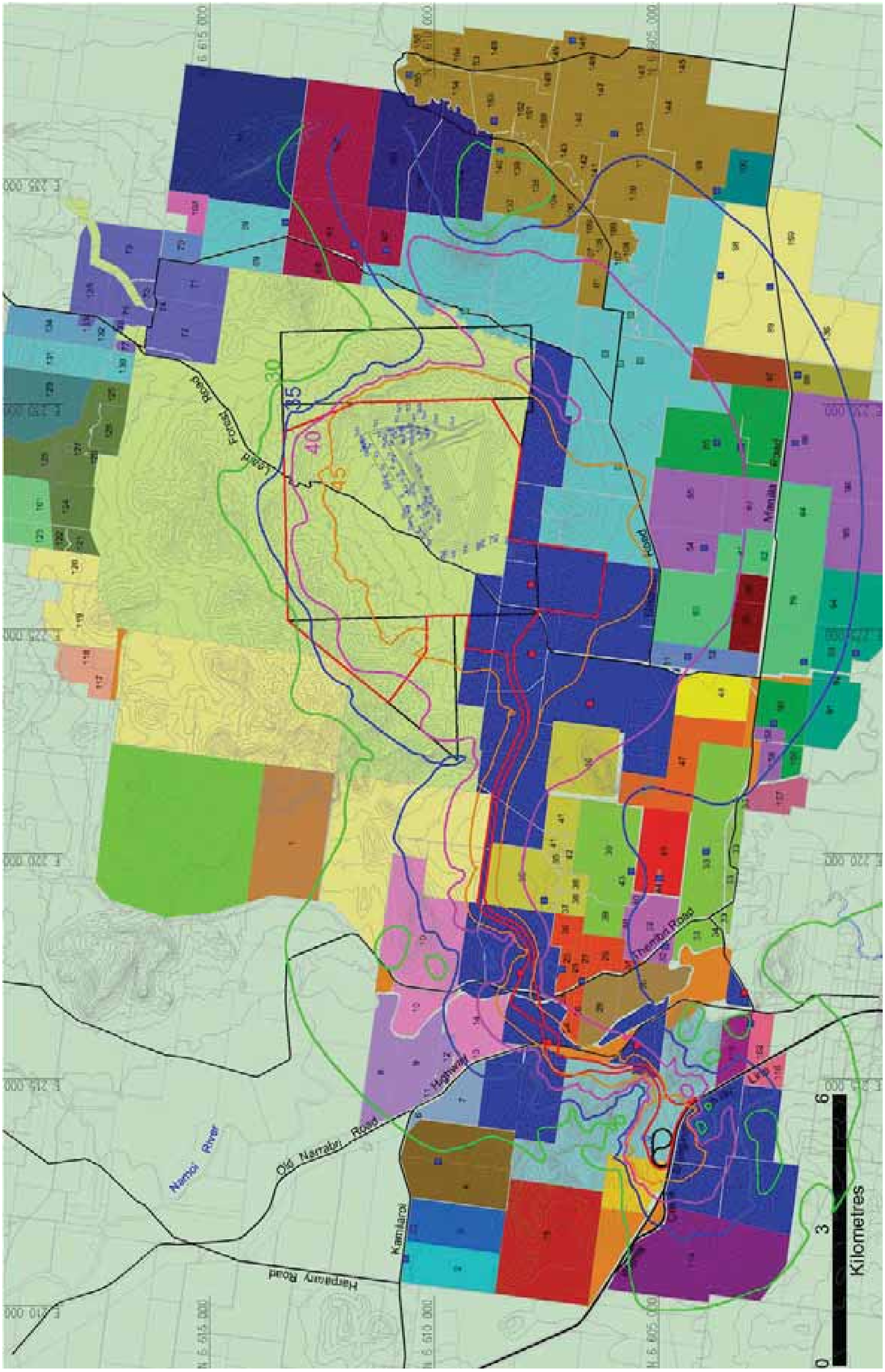


Figure A11: Year 10 Day, Neutral Weather Conditions

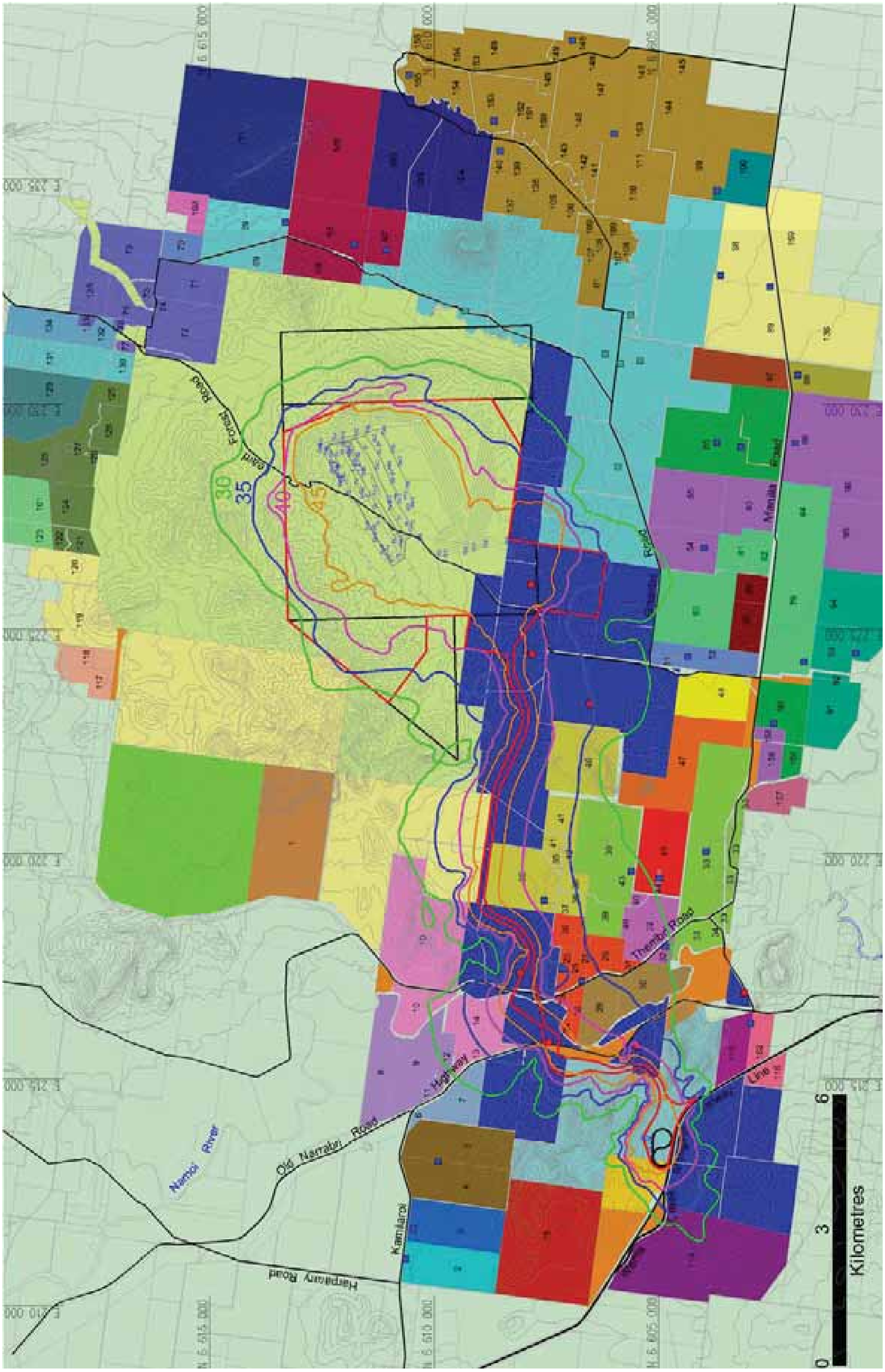


Figure A12: Year 10 Day, 3 m/s Southerly Wind

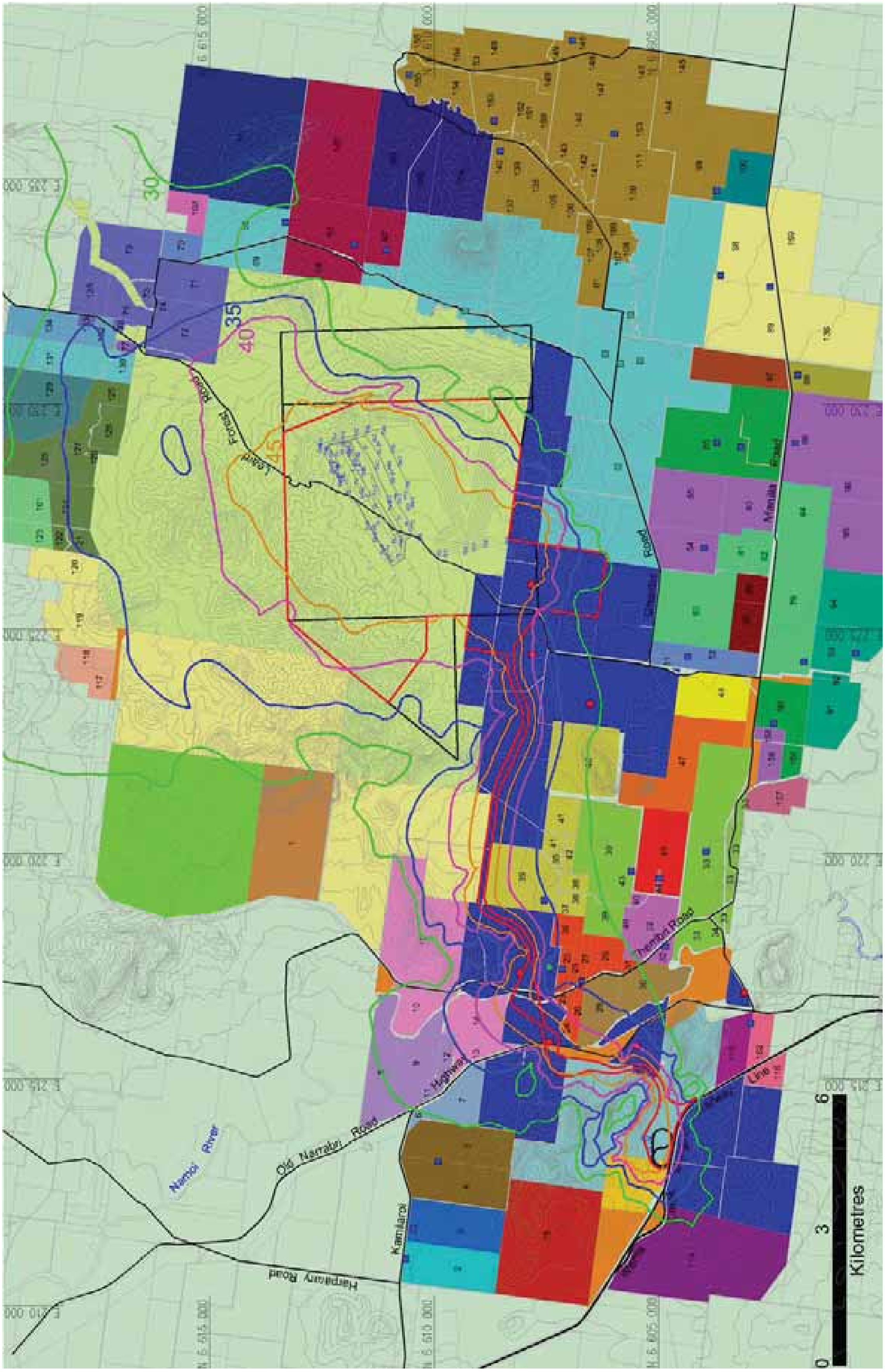


Figure A13: Year 10 Evening/Night, Neutral Weather Conditions

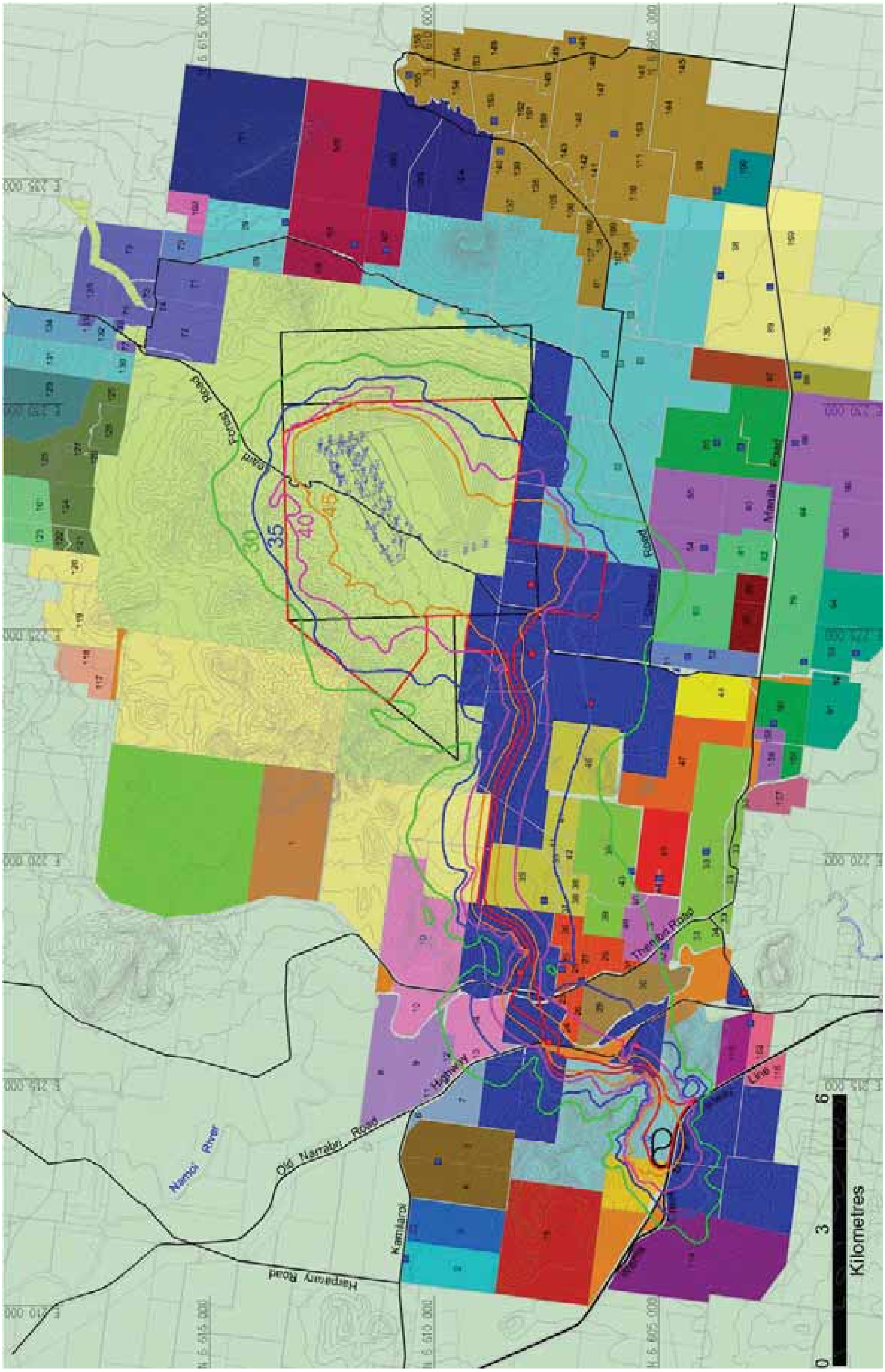


Figure A14: Year 10 Evening/Night, 3 °/100m Temperature Inversion

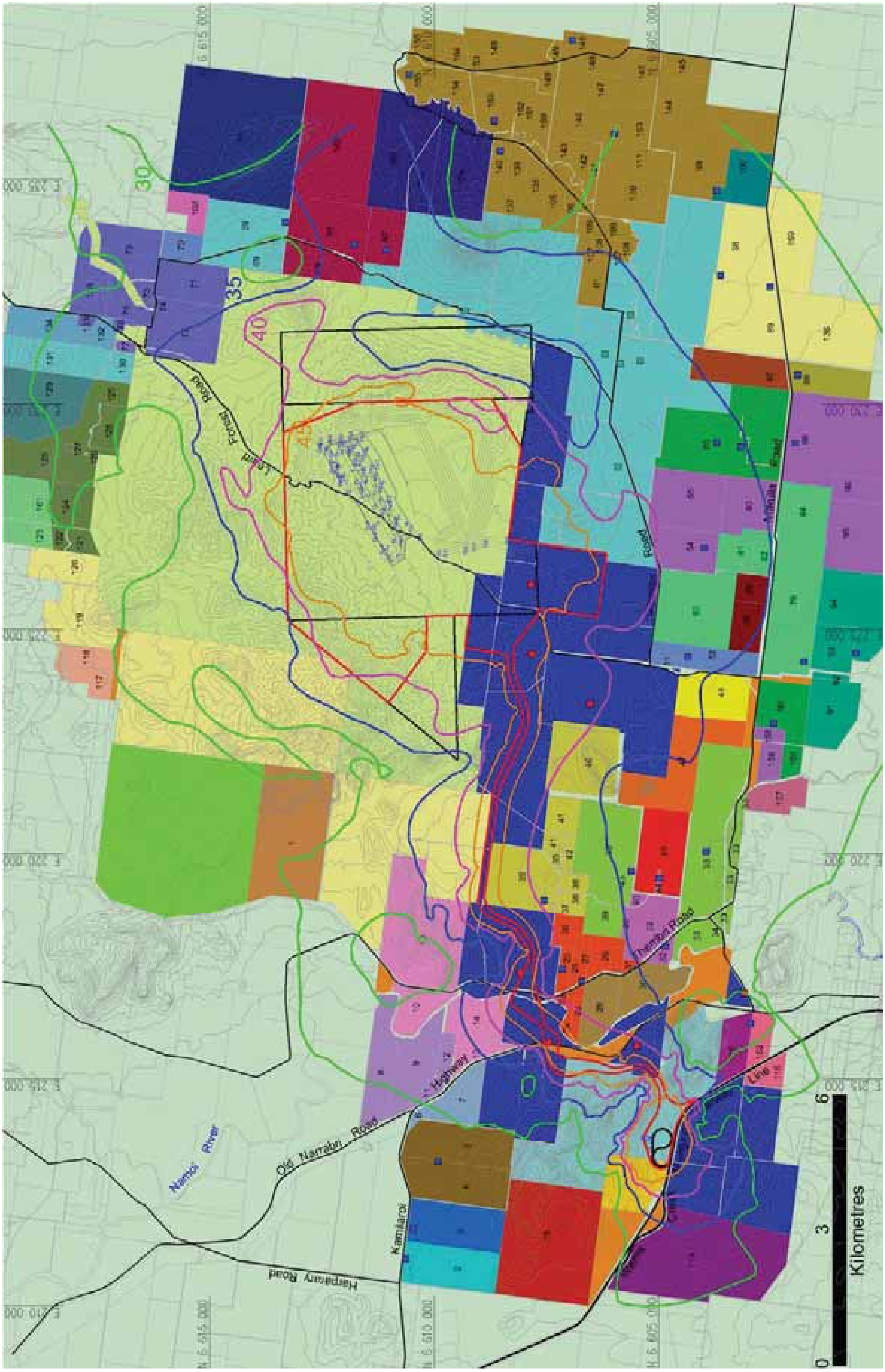


Figure A15: Year 10 Evening/Night, 3 °/100m Temperature Inversion and 2 m/s Wind

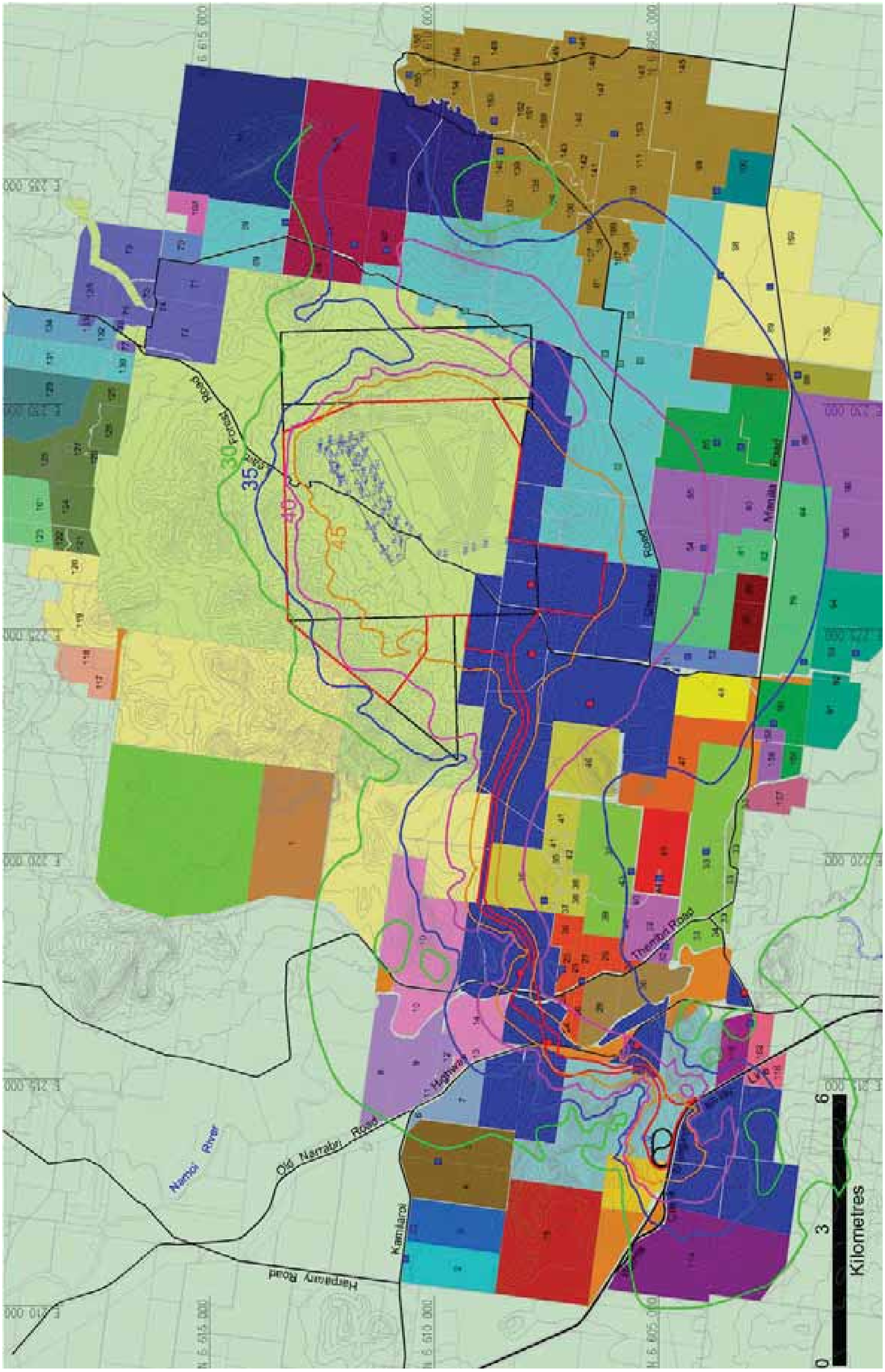


Figure A16: Year 21 Day, Neutral Weather Conditions

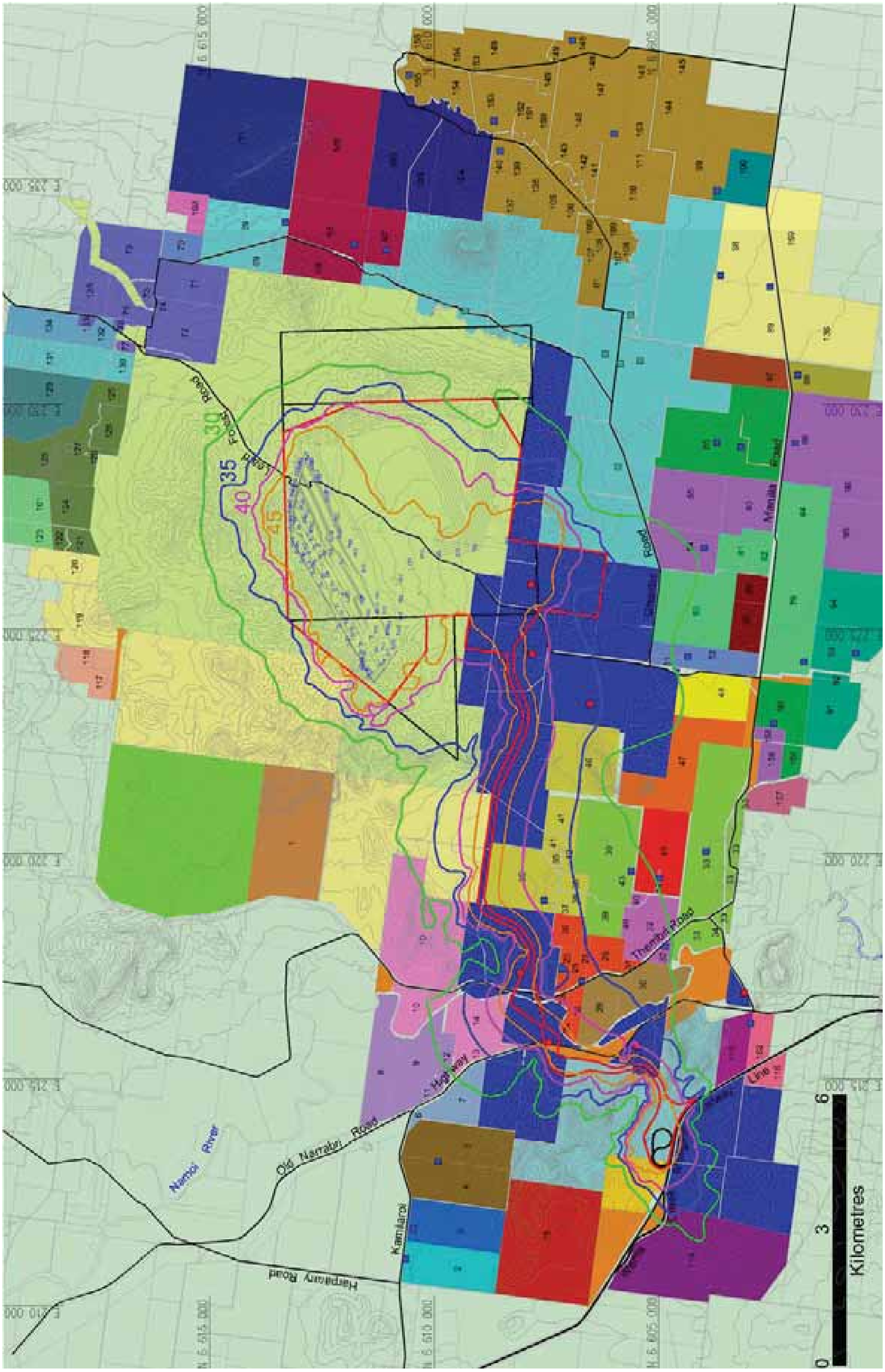


Figure A17: Year 21 Day, 3 m/s Southerly Wind

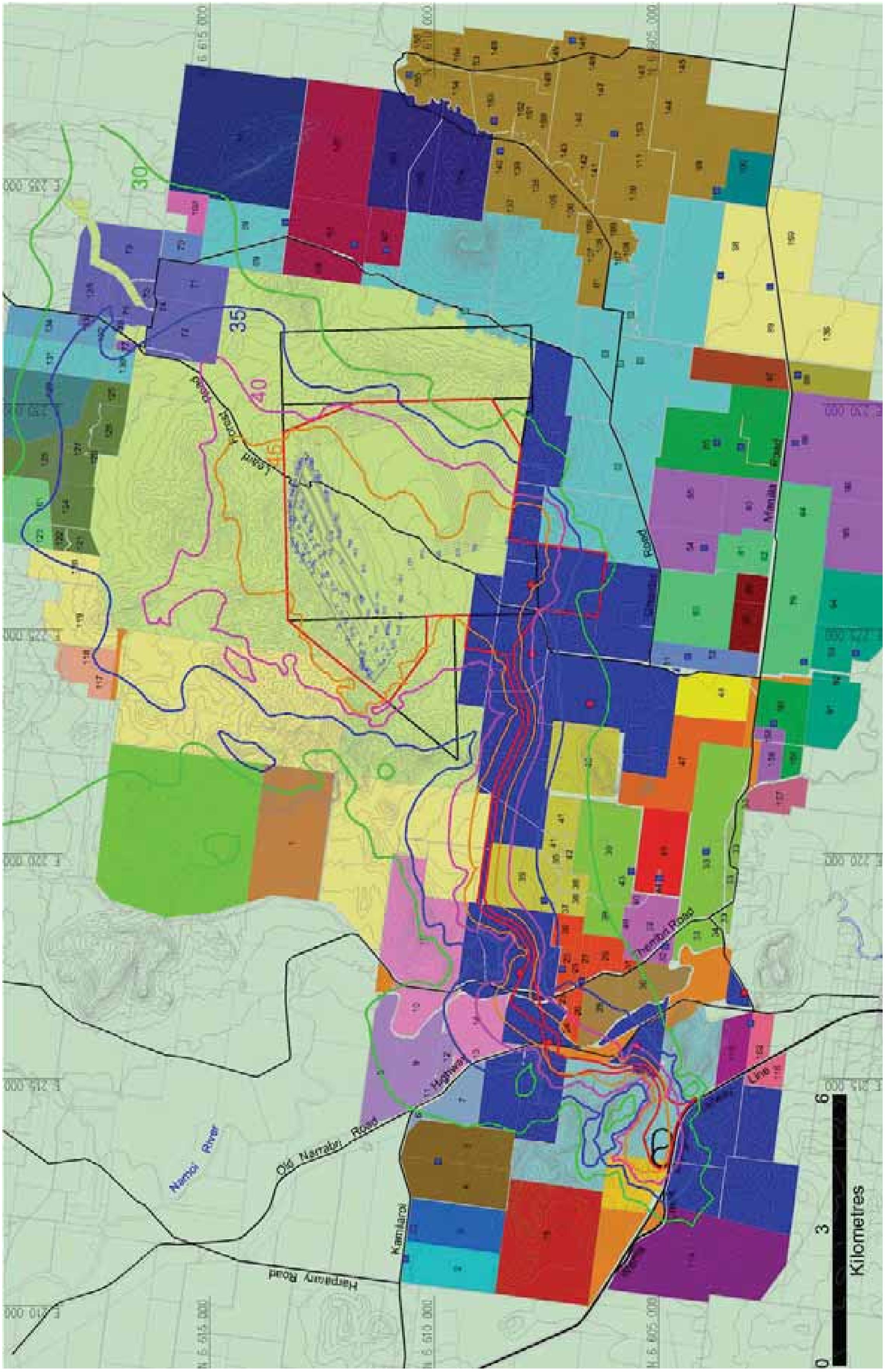


Figure A18: Year 21 Evening/Night, Neutral Weather Conditions

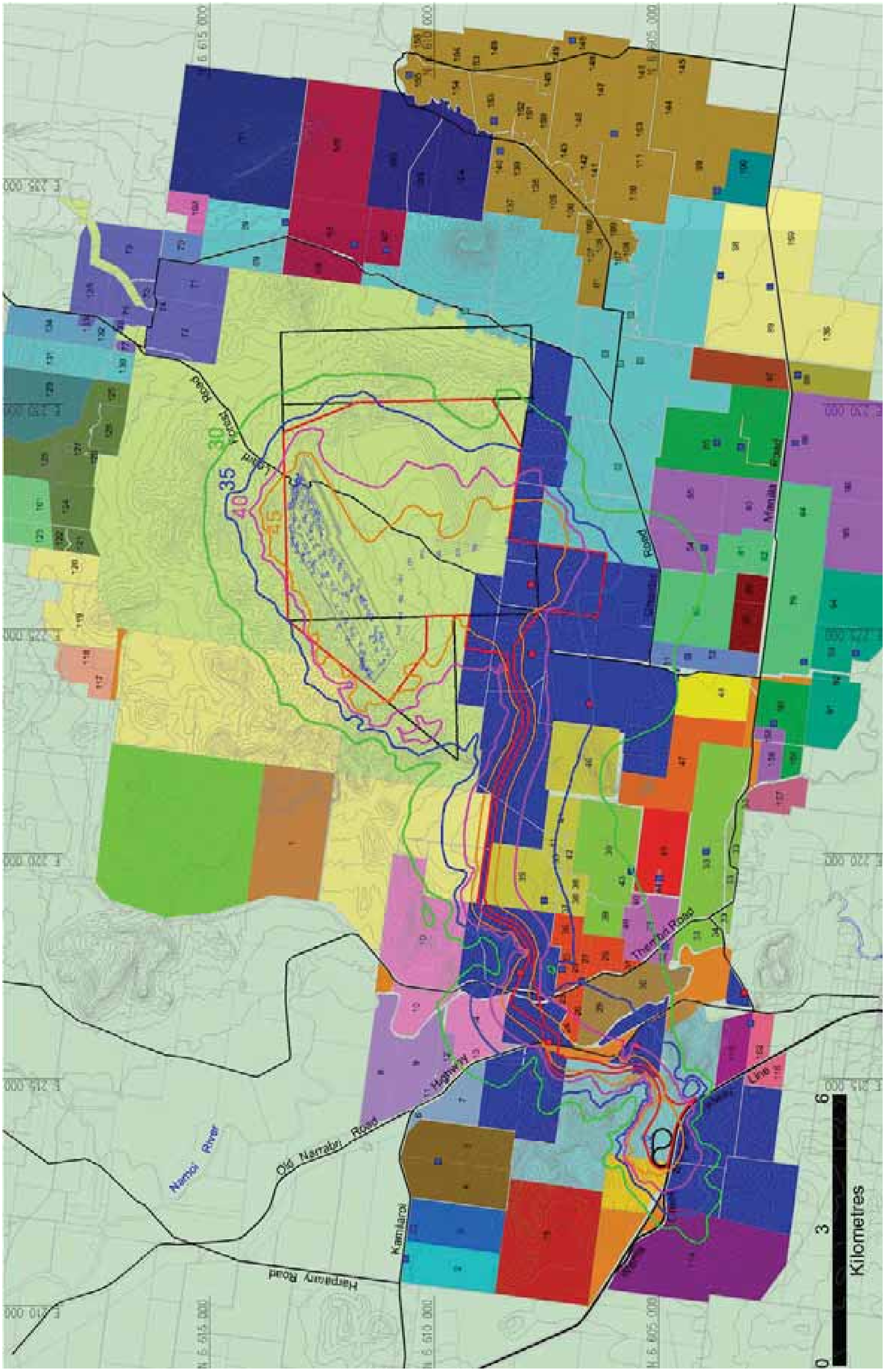


Figure A19: Year 21 Evening/Night, 3 °/100m Temperature Inversion

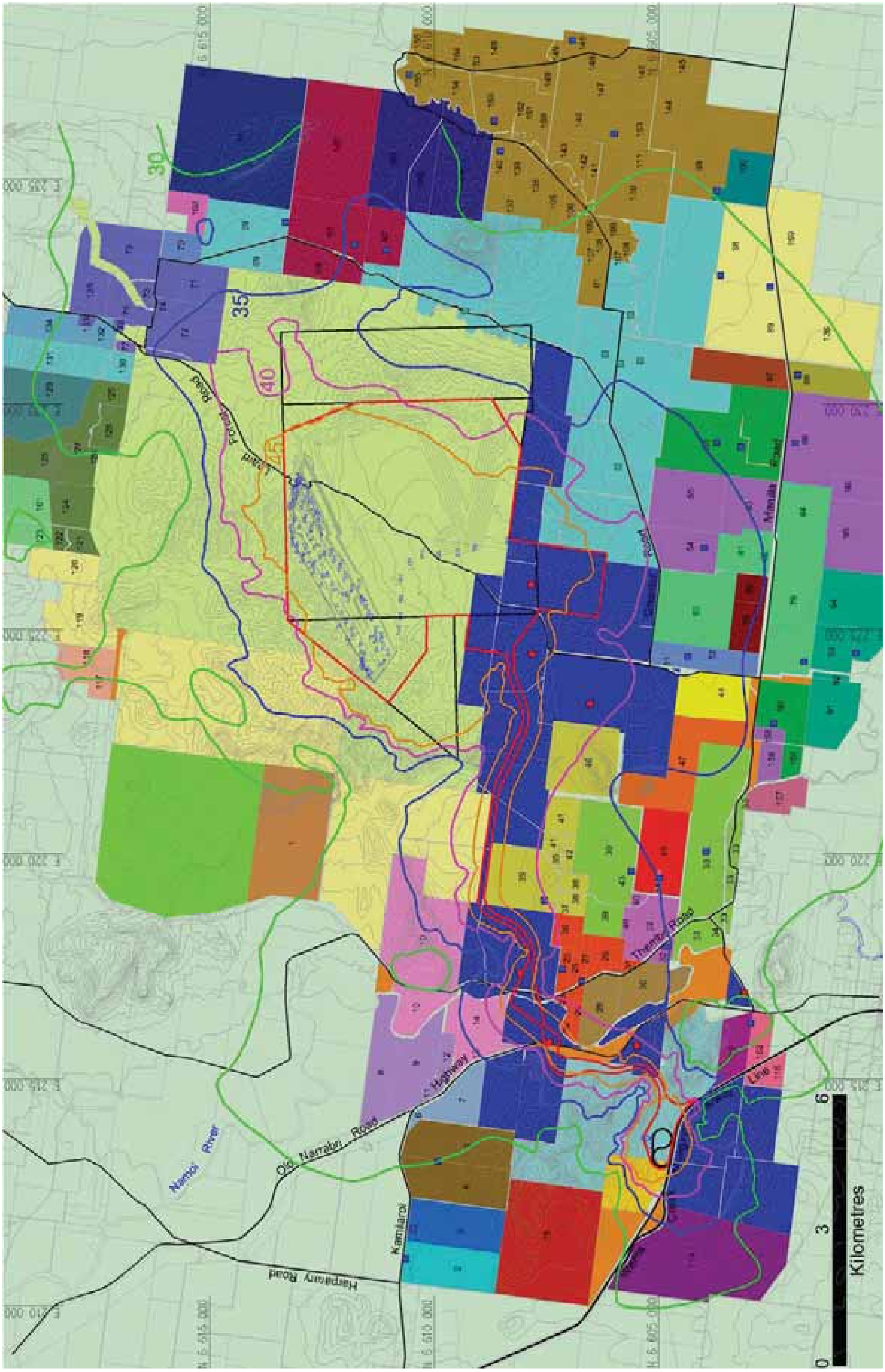
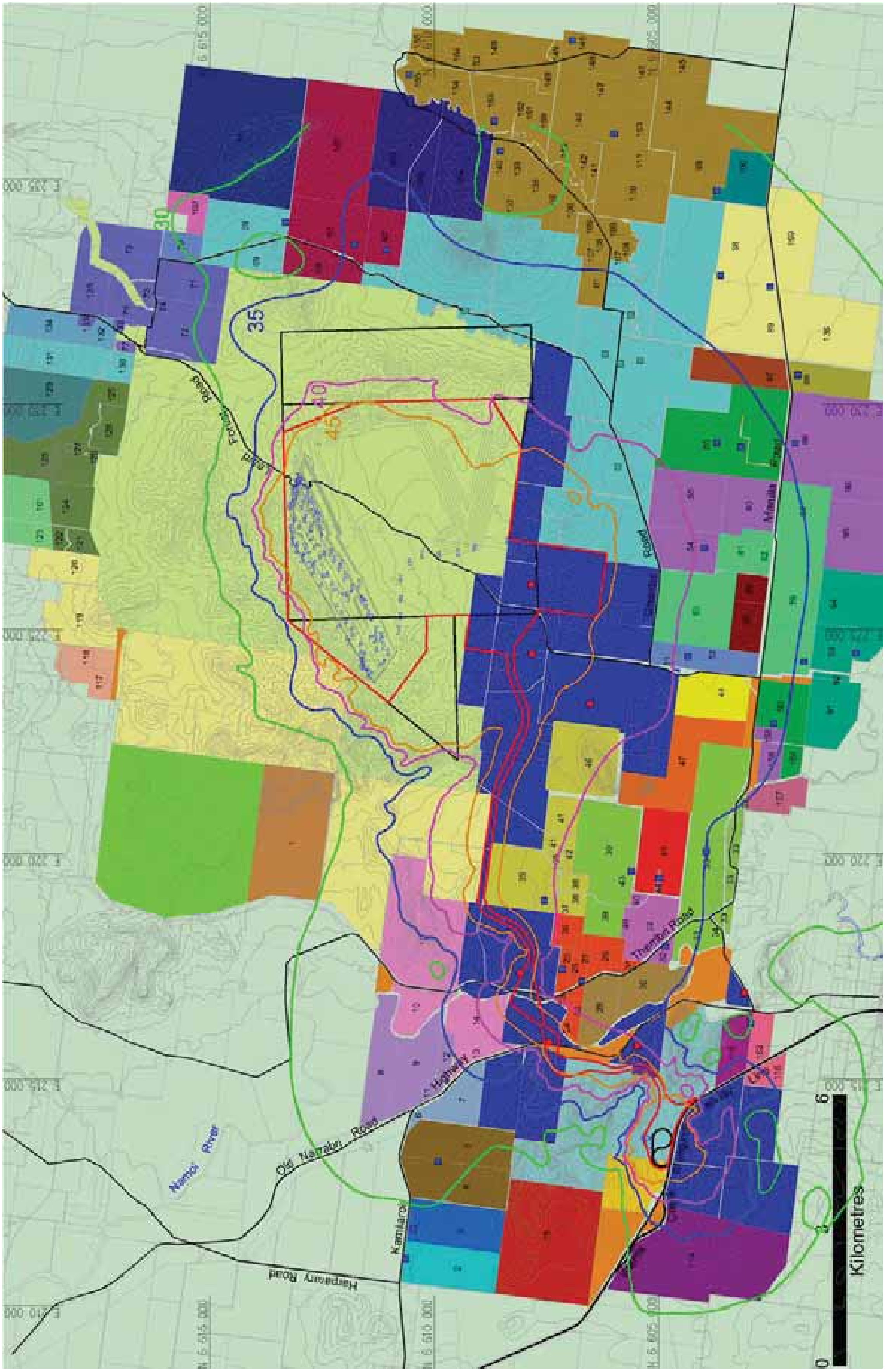


Figure A20: Year 21 Evening/Night, 3 °/100m Temperature Inversion and 2 m/s Wind



APPENDIX B – NOISE SOURCE LOCATION FIGURES

Figure B1: Year 1 Mine Day Noise Source Locations

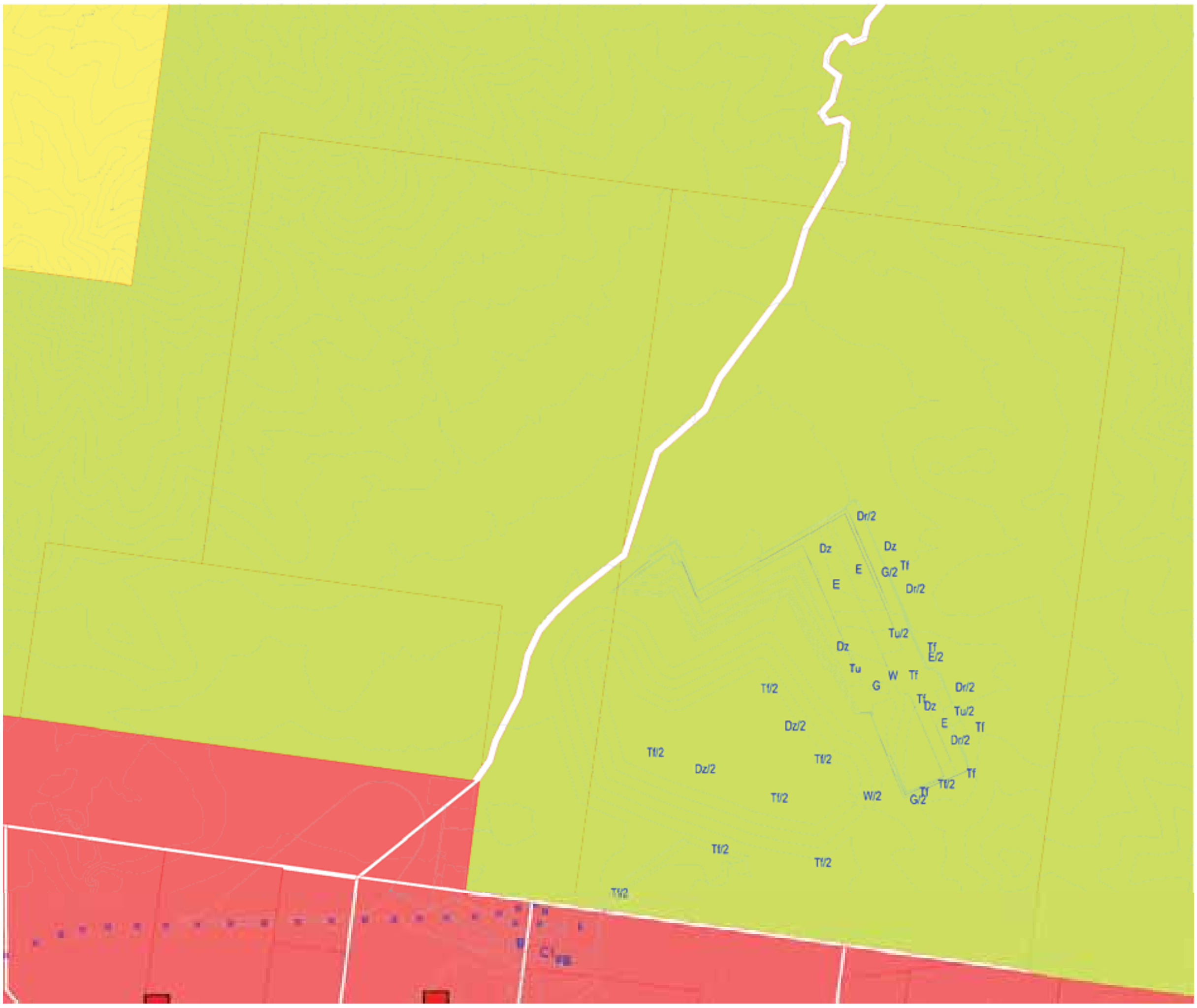


Figure B2: Year 1 Mine Evening/Night Noise Source Locations

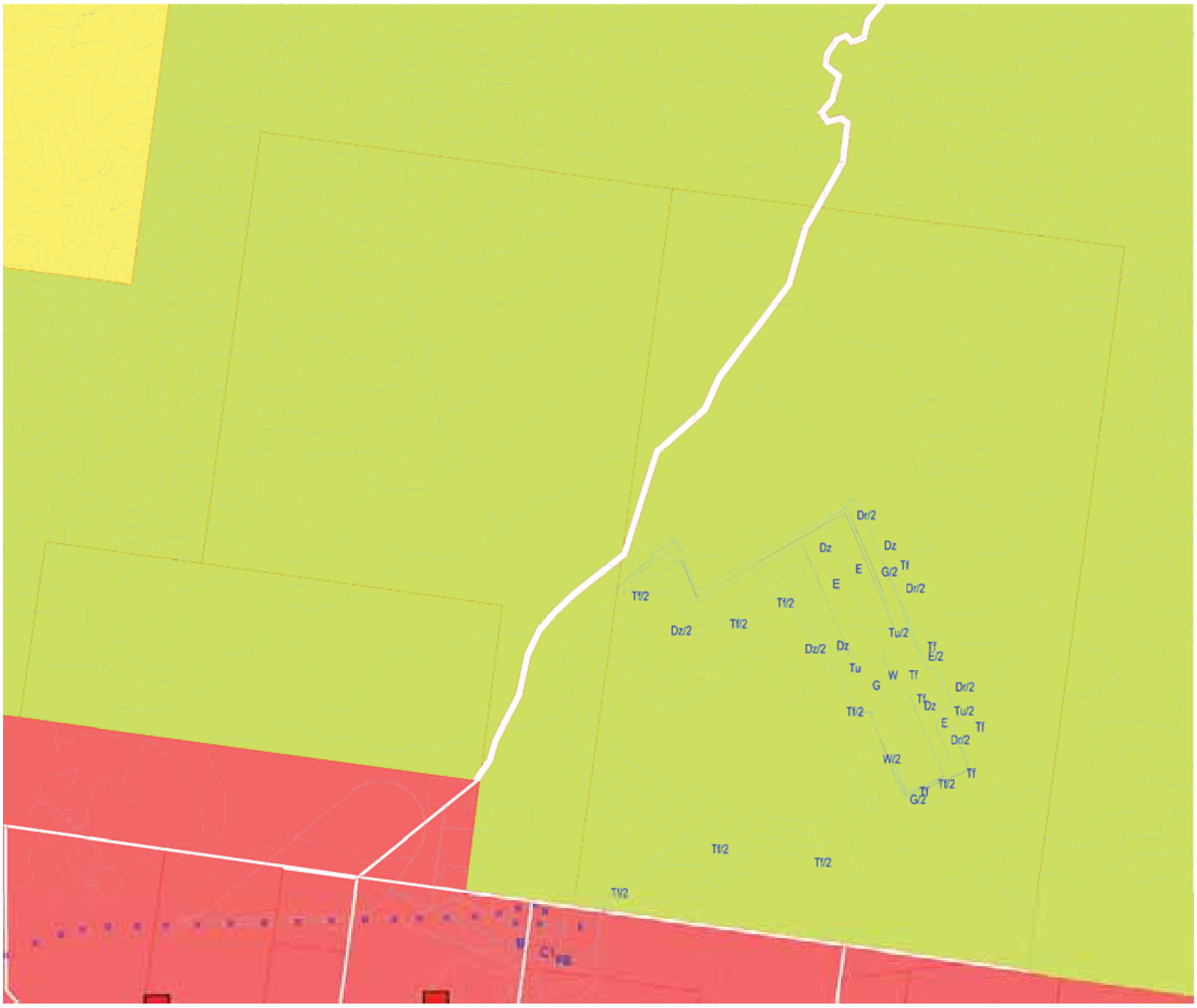


Figure B3: Year 5 Mine Day Noise Source Locations

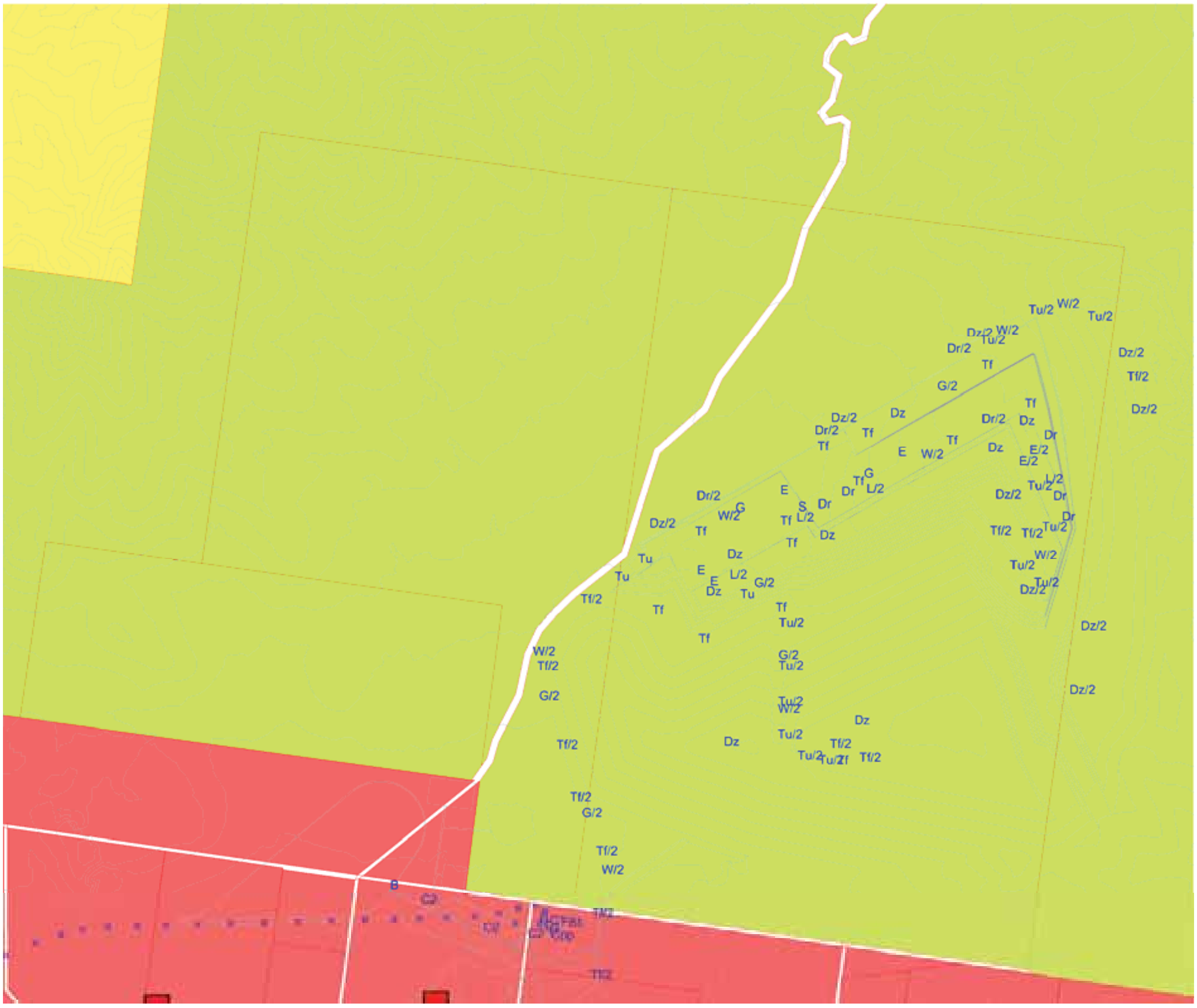


Figure B4: Year 5 Mine Evening/Night Noise Source Locations

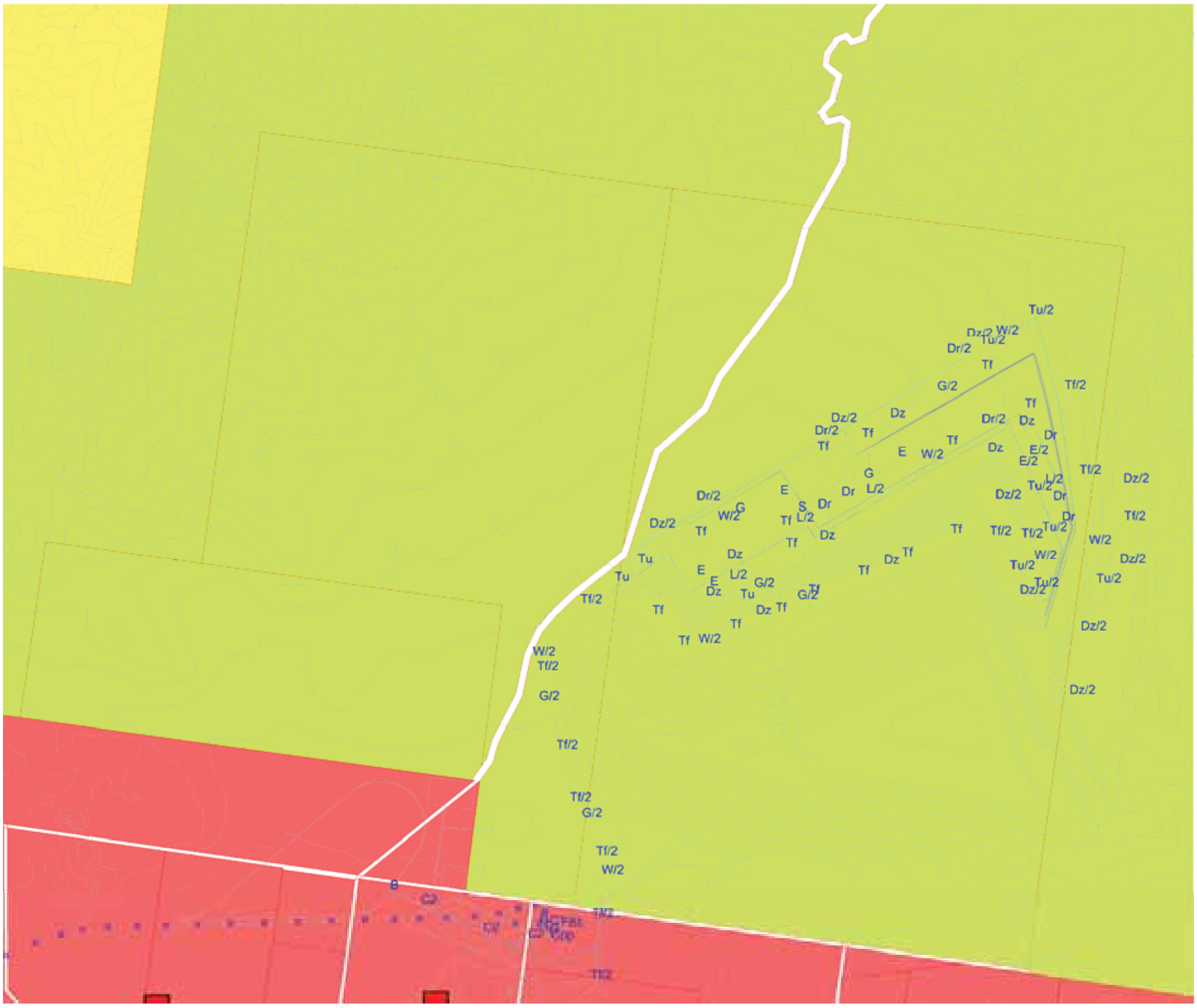


Figure B5: Year 10 Mine Day Noise Source Locations

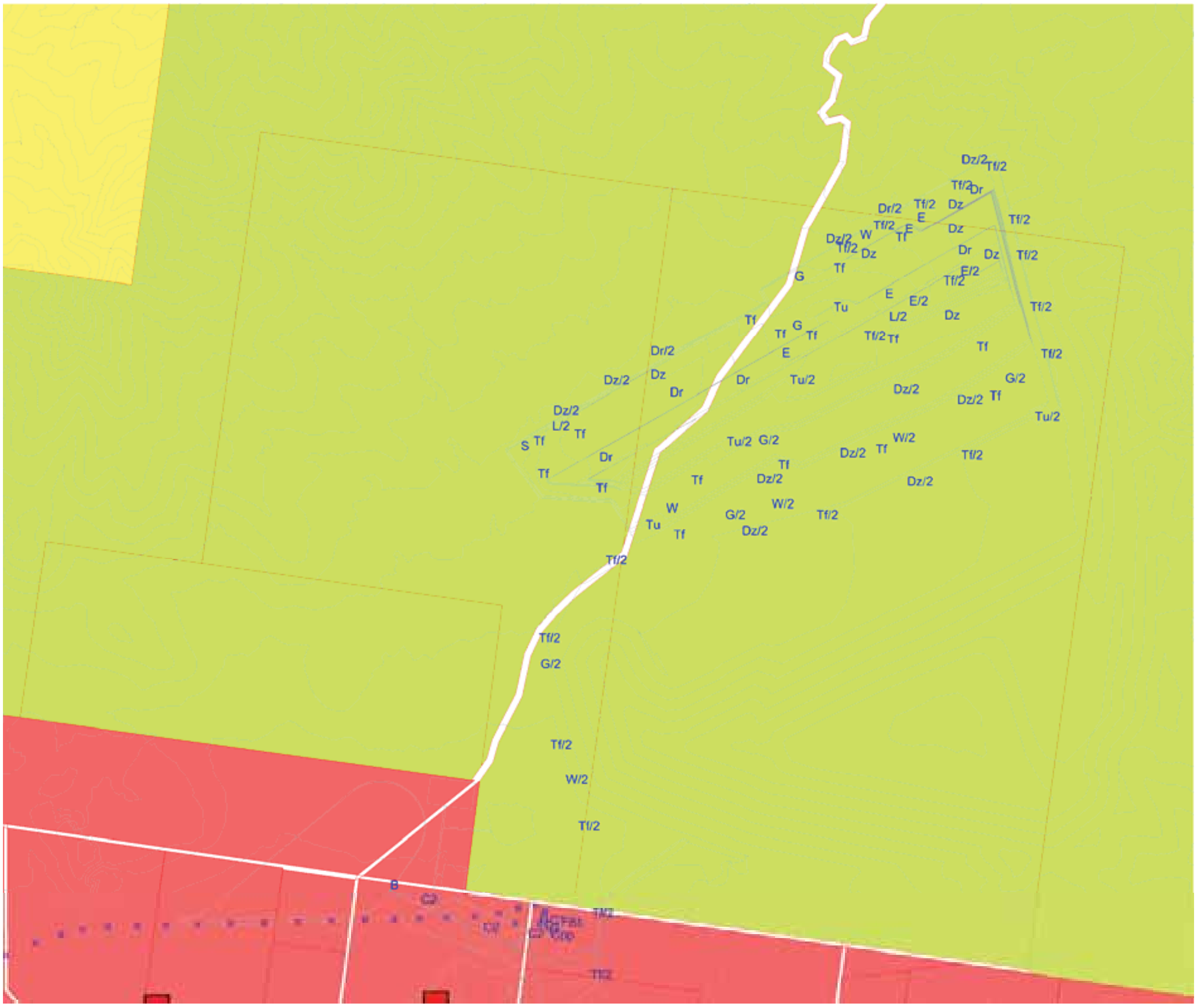


Figure B6: Year 10 Mine Evening/Night Noise Source Locations

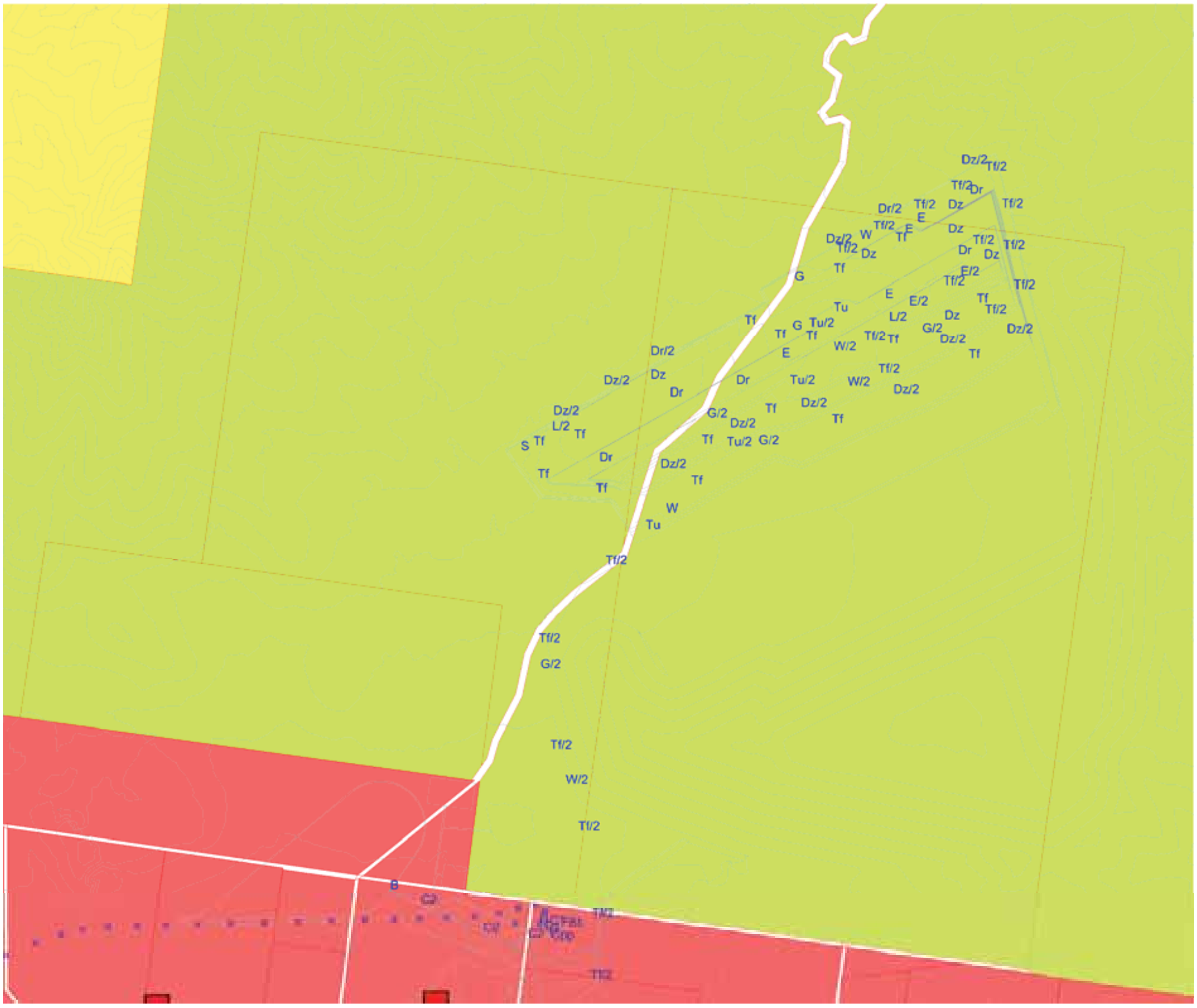


Figure B7: Year 21 Mine Day Noise Source Locations

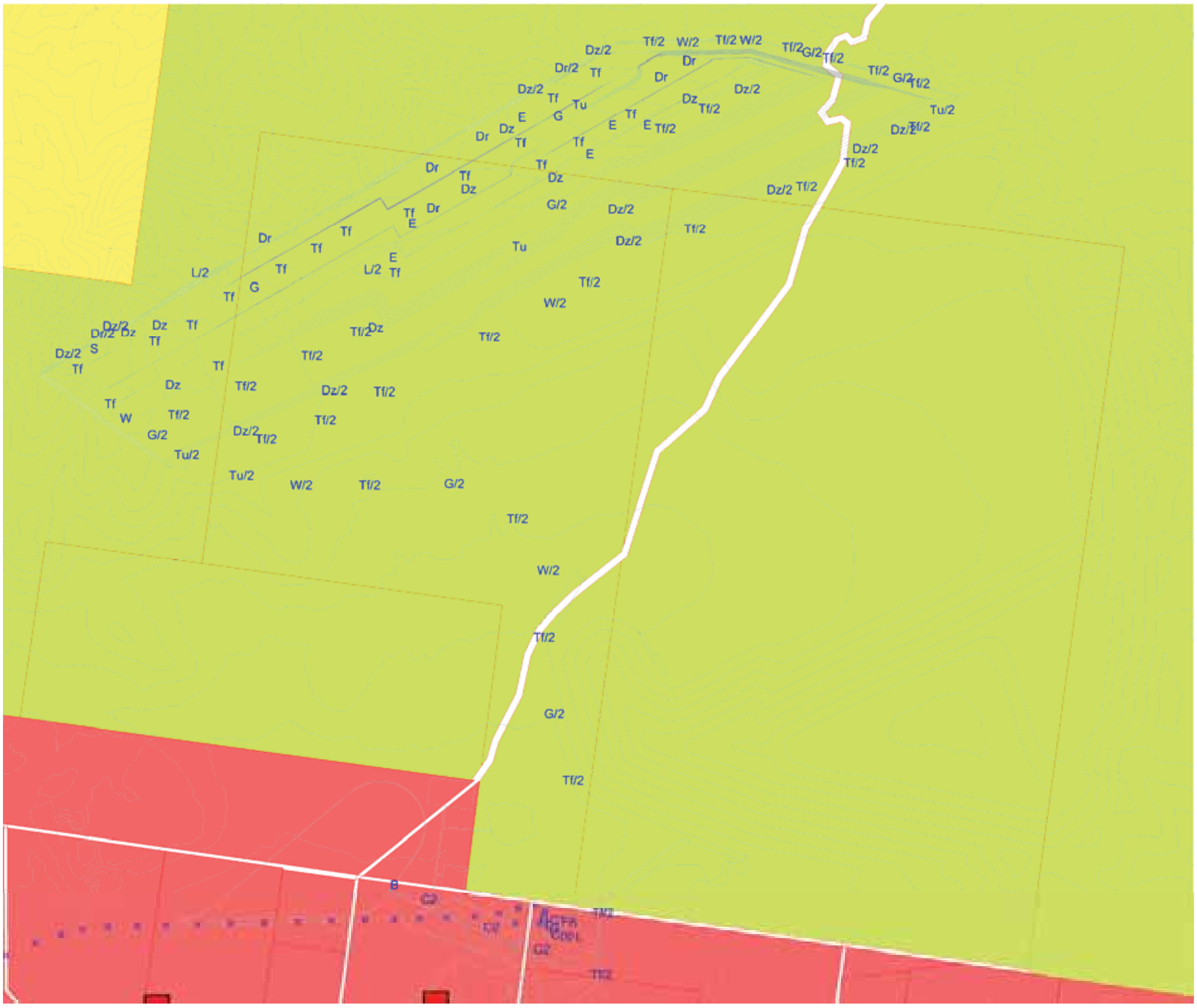


Figure B8: Year 21 Mine Evening/Night Noise Source Locations

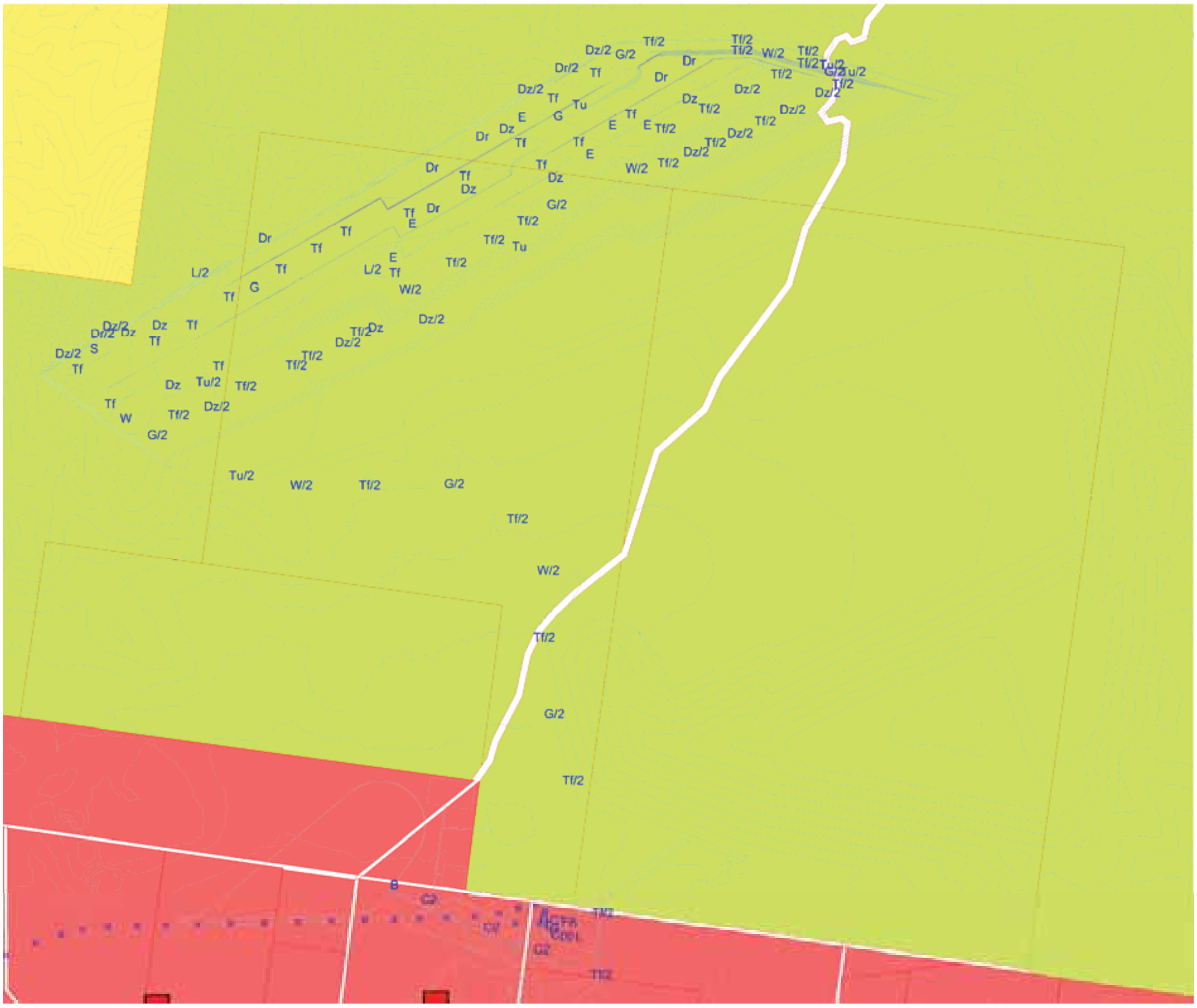
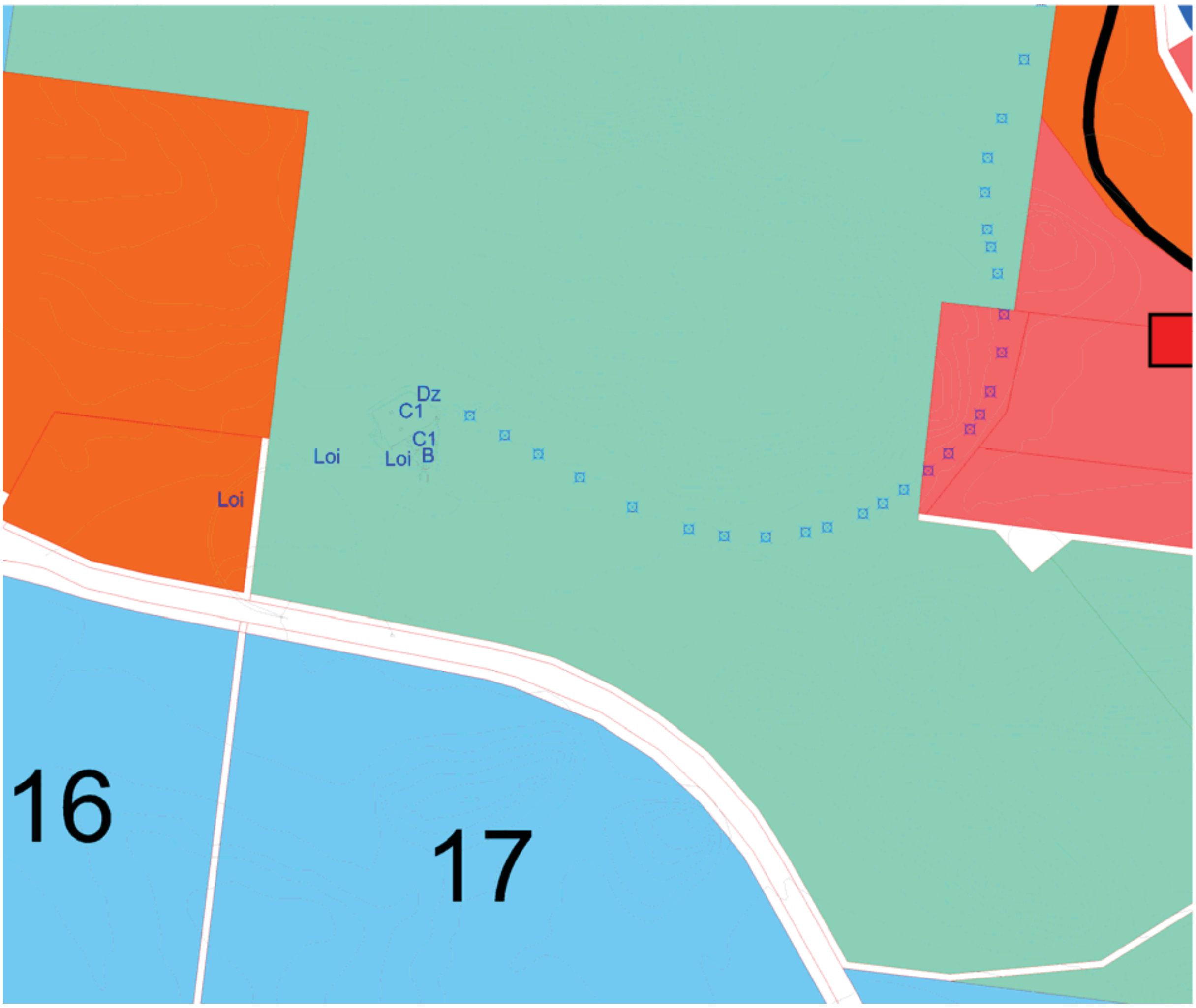


Figure B9: All Years, Rail Loading Facility Noise Source Locations



APPENDIX C – PREDICTED NOISE LEVEL TABLES

TABLE	DESCRIPTION
C1	Year 1 and 5, Noise levels at residences, LAeq,15min
C2	Year 10 and 21, Noise levels at residences, LAeq,15min
C3	Year 1 and 5, Noise levels over 25% of property areas, LAeq,15min
C4	Year 10 and 21, Noise levels over 25% of property areas, LAeq,15min

Noise levels in **bold** font highlight levels of 35.5 dBA or above, while those in **red** font highlight levels of 40 dBA or above. Residences or properties omitted from the tables are predicted to receive less than 35 LAeq,15min.

Table C1: Year 1 and 5, Noise Levels at Residences, LAeq,15min

Resid-ence	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5
2	15.6	17.7	21.8	23.2	14.7	16.8	23.1	25.6	23.5	26.1
3	16.9	19.0	23.1	24.3	16.0	18.1	23.7	26.2	24.2	26.8
4	20.8	22.9	24.2	26.1	19.7	21.8	25.2	28.0	26.4	29.0
18	17.8	19.3	13.4	15.2	18.2	19.4	29.7	30.4	**36.6**	**36.8**
23	30.8	32.8	29.9	31.9	29.8	31.9	32.7	**35.1**	32.4	35.0
27	33.0	35.0	31.6	33.6	31.9	33.9	33.9	**36.4**	33.5	**36.1**
32	27.4	29.7	24.0	26.3	26.4	28.8	30.9	33.7	30.8	33.9
33	24.1	26.1	20.3	22.1	23.3	25.2	30.0	33.1	30.3	34.1
35	**35.4**	**37.4**	32.6	34.6	34.2	**36.2**	**36.2**	**38.6**	**35.4**	**38.1**
43	27.8	30.2	24.5	26.9	26.7	29.3	31.3	34.8	31.0	**35.2**
44	26.4	28.7	22.9	25.1	25.4	27.8	30.6	33.9	30.6	34.5
52	27.4	28.6	23.2	24.1	26.6	27.9	**35.1**	**38.0**	**37.1**	**40.5**
54	27.5	30.5	22.6	25.8	27.3	29.0	**36.1**	**39.2**	**39.9**	**42.0**
59	21.6	23.9	18.1	20.4	21.8	21.9	**35.6**	**35.3**	**40.6**	**40.5**
63	23.5	25.3	23.6	24.3	24.1	26.5	**38.1**	**36.8**	**38.4**	**42.6**
67	21.5	23.4	33.1	28.8	21.8	23.8	**36.9**	**39.9**	34.1	**38.4**
68	19.5	22.1	33.4	30.7	19.8	22.1	**36.0**	**39.5**	28.7	34.6
69	16.8	20.2	32.0	32.1	17.3	20.0	32.1	34.3	20.2	25.7
79	23.4	25.4	18.6	20.6	22.3	24.1	31.7	34.6	33.3	**36.2**
85 Nth	24.5	27.7	19.8	23.4	23.2	22.2	**36.0**	**37.3**	**40.3**	**41.0**
85 Sth	24.0	26.8	19.2	22.3	22.4	21.6	**35.3**	**37.1**	**38.9**	**40.0**
86	22.3	25.0	17.4	20.3	20.8	20.7	33.6	**35.6**	**36.1**	**37.7**
88	20.1	23.4	15.4	18.9	18.8	19.2	33.1	34.1	**35.3**	**36.6**
90	23.8	25.4	19.4	21.0	23.0	24.4	31.4	34.5	32.8	**35.8**
94	22.1	24.2	17.1	19.3	20.8	22.6	30.3	33.2	31.6	34.6
98 Nth	18.6	21.2	14.7	17.2	18.6	19.4	33.6	33.9	**36.1**	**37.1**
98 Sth	18.0	20.7	13.9	16.5	17.5	18.5	32.8	33.1	34.6	**35.7**
100	16.4	19.5	13.2	16.2	16.1	17.4	31.1	32.9	32.8	34.5
115	16.7	19.0	13.0	15.4	16.7	18.6	24.9	27.0	28.9	30.0

Table C2: Year 10 and 21, Noise Levels at Residences, LAeq,15min

Resid-ence	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21
2	18.3	18.6	23.6	23.6	17.3	17.7	25.7	28.2	26.4	28.8
3	19.7	19.9	24.8	24.9	18.7	19.0	26.4	28.8	27.3	29.5
4	23.7	23.8	26.9	27.0	22.6	22.7	28.1	30.0	29.5	31.2
18	19.3	19.8	14.9	15.3	19.6	19.7	30.4	30.5	**36.7**	**36.8**
23	33.7	33.8	32.8	32.8	32.8	32.8	**35.6**	**36.6**	**35.5**	**37.0**
27	**35.9**	**35.9**	34.5	34.5	34.8	34.9	**36.9**	**37.5**	**36.5**	**37.5**
32	30.5	30.5	26.9	26.9	29.4	29.6	33.8	**35.1**	33.9	**36.0**
33	26.7	27.4	22.6	23.2	26.0	26.4	32.3	33.3	33.3	35.0
35	**38.4**	**38.4**	**35.5**	**35.5**	**37.2**	**37.2**	**39.4**	**40.2**	**38.8**	**40.6**
43	30.8	31.0	27.4	27.5	29.8	30.1	34.4	**35.8**	34.7	**37.4**
44	29.4	29.8	25.8	26.0	28.4	28.8	33.5	34.9	34.1	**36.5**
52	27.0	28.9	22.4	24.1	27.5	29.2	**36.1**	**36.7**	**38.5**	**39.1**
54	27.4	29.5	22.3	24.5	28.2	29.8	**37.7**	**37.4**	**40.2**	**39.6**
59	20.5	21.0	16.6	17.5	20.7	20.8	**35.6**	33.0	**38.3**	**35.7**
63	23.2	22.0	21.3	20.2	23.4	21.6	**36.3**	34.3	**42.6**	**36.5**
67	21.1	22.1	23.7	24.0	21.4	21.6	**38.9**	**35.9**	**39.6**	**37.1**
68	20.5	22.0	24.6	24.7	21.0	21.4	**38.8**	**35.5**	**38.3**	**35.9**
69	19.0	19.9	28.1	25.4	19.5	19.8	32.5	32.6	26.2	31.0
79	23.5	25.6	18.5	20.5	23.8	25.3	33.3	33.2	34.8	34.6
85 Nth	20.9	24.3	16.4	19.8	21.2	24.2	**36.0**	34.5	**38.9**	**37.2**
85 Sth	20.5	24.1	16.0	19.6	20.8	24.1	**35.2**	33.9	**38.0**	**36.5**
86	19.8	23.7	15.1	19.0	20.2	23.5	33.6	32.7	**35.9**	34.8
88	18.0	21.4	13.5	17.0	18.3	21.3	32.7	31.4	34.7	33.4
90	24.3	26.9	19.7	22.0	24.4	26.5	33.1	34.1	34.4	**35.4**
94	22.1	24.4	17.0	19.2	22.4	24.0	32.1	31.7	33.3	33.1
98 Nth	18.4	20.1	14.3	16.3	18.6	20.0	33.1	31.3	**35.1**	33.2
98 Sth	17.7	19.9	13.4	15.9	18.0	19.9	32.0	30.5	33.8	32.4
100	16.2	18.2	12.5	14.7	16.5	17.9	31.5	29.9	33.1	31.5
115	18.6	19.4	14.7	15.4	18.7	19.0	26.2	26.8	29.5	30.0

Table C3: Year 1 and 5, Noise Levels over 25% of Property Areas, LAeq,15min

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5
1	15.1	18.4	28.3	30.3	15.3	18.5	28.7	31.9	25.1	27.6
2	14.2	16.4	20.1	21.7	13.5	15.6	22.8	25.1	23.3	25.7
3	16.6	18.7	22.2	23.7	15.7	17.7	23.5	26.0	24.3	26.7
4	19.5	21.5	23.8	25.4	18.4	20.5	24.6	27.3	25.6	28.2
5	22.1	24.2	25.7	27.5	21.1	23.1	26.1	29.0	27.2	30.0
6	23.3	25.3	28.3	29.7	22.2	24.2	27.1	29.7	28.1	30.7
7	26.8	28.8	30.2	31.9	25.6	27.6	28.8	31.5	30.3	32.9
8	22.6	24.7	28.0	29.6	21.5	23.6	27.8	30.1	28.4	30.9
9	26.0	28.0	29.9	31.7	24.7	26.8	28.8	31.2	30.0	32.4
10	26.0	28.1	31.0	33.0	25.2	27.3	30.1	33.1	32.1	34.7
11	24.8	26.9	29.6	31.1	23.6	25.7	28.0	30.5	29.2	31.7
12	28.2	30.2	31.2	33.2	26.9	29.0	29.9	32.3	31.4	33.7
13	32.8	34.8	35.0	**37.0**	31.5	33.5	33.2	**35.6**	34.9	**37.1**
14	**36.1**	**38.1**	**38.4**	**40.4**	34.8	**36.8**	**36.3**	**38.4**	**38.1**	**40.2**
15	15.2	16.3	20.5	20.8	15.9	16.7	22.1	24.1	21.3	23.8
16	31.6	31.7	27.9	28.0	32.6	32.7	**37.0**	**37.2**	**39.9**	**40.0**
17	**35.8**	**36.2**	31.9	32.0	**36.8**	**37.0**	**40.4**	**40.5**	**44.2**	**44.2**
18	18.7	19.9	14.2	15.7	19.2	20.2	29.2	30.0	34.8	35.0
23	34.0	**36.0**	32.6	34.6	32.8	34.9	34.8	**37.0**	34.1	**36.5**
24	**41.7**	**43.7**	**40.3**	**42.3**	**40.3**	**42.3**	**41.4**	**43.5**	**40.7**	**42.8**
25	33.0	35.0	31.4	33.4	31.9	33.9	34.0	**36.3**	33.4	**36.1**
26	**39.9**	**41.9**	**38.2**	**40.2**	**38.6**	**40.6**	**39.9**	**42.0**	**39.2**	**41.3**
27	32.8	34.8	31.0	33.0	31.7	33.7	33.8	**36.2**	33.3	**36.0**
28	**36.8**	**38.8**	**35.3**	**37.3**	**35.7**	**37.8**	**37.2**	**39.4**	**36.6**	**38.9**
29	31.7	33.8	29.5	31.5	30.6	32.7	33.1	**35.5**	32.6	**35.5**
30	31.4	33.4	29.1	31.1	30.5	32.6	32.9	**35.3**	32.3	35.0
31	30.6	32.7	28.3	30.3	29.7	31.9	32.4	34.9	31.9	34.8
32	28.7	31.0	25.8	28.0	27.7	30.1	31.4	34.3	31.1	34.5
33	24.5	26.7	20.7	22.8	23.6	25.7	31.3	34.2	32.0	**35.2**
34	24.3	26.5	20.1	22.3	23.4	25.6	29.9	32.8	30.0	33.2
35	**41.1**	**43.1**	**39.3**	**41.3**	**39.8**	**41.8**	**41.1**	**43.3**	**40.3**	**42.6**
36	35.0	**37.1**	31.7	33.7	33.8	**35.9**	**35.7**	**38.1**	34.7	**37.4**
37	33.9	**35.9**	30.8	32.9	32.7	34.7	34.9	**37.4**	34.2	**37.1**
38	32.9	34.9	29.9	32.0	31.7	33.8	34.4	**36.9**	33.8	**36.9**
39	30.7	32.9	27.6	29.9	29.5	31.9	33.2	**35.9**	32.8	**36.3**
40	29.2	31.5	26.3	28.6	28.1	30.5	31.8	34.6	31.4	34.8
41	33.9	**36.0**	30.8	32.9	32.7	34.8	**35.6**	**38.3**	**35.3**	**38.4**
42	32.4	34.5	29.4	31.5	31.2	33.4	34.3	**37.0**	34.0	**37.1**
43	29.1	31.4	25.9	28.3	28.0	30.5	32.1	**35.2**	31.7	**35.5**
44	26.7	29.1	23.3	25.6	25.8	28.2	30.7	34.0	30.7	34.5
45	26.2	28.5	22.7	24.9	25.2	27.6	30.6	33.9	30.6	34.5
46	33.7	**36.3**	30.4	33.0	32.6	**35.4**	**36.9**	**40.2**	**37.2**	**40.9**
47	25.0	27.2	21.3	23.5	24.2	26.4	33.0	**36.2**	34.1	**37.5**
48	26.5	27.9	22.4	23.6	25.6	27.0	33.7	**37.0**	**35.3**	**39.0**
49	32.1	34.9	28.0	30.6	31.8	34.3	**39.3**	**43.2**	**42.7**	**46.3**
50	31.5	33.5	27.5	29.4	30.8	32.4	**39.0**	**42.3**	**42.1**	**45.1**

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5
51	29.1	30.4	25.0	26.2	28.1	29.3	**36.0**	**39.1**	**38.1**	**41.6**
52	27.4	28.7	23.2	24.1	26.6	27.9	**35.1**	**38.0**	**37.1**	**40.4**
53	29.1	31.8	24.7	27.2	28.4	30.6	**36.9**	**40.4**	**40.1**	**42.9**
54	28.7	31.7	23.9	27.0	28.5	30.8	**37.6**	**40.1**	**41.1**	**43.5**
55	28.5	30.4	23.7	26.0	27.6	27.7	**37.6**	**39.4**	**42.0**	**43.5**
56	20.9	23.3	17.1	19.5	21.0	21.4	**35.6**	34.9	**39.7**	**39.8**
57	21.6	23.9	18.2	20.4	21.9	22.0	**35.6**	**35.3**	**40.8**	**40.6**
58	21.8	24.1	18.4	20.7	22.1	22.1	**35.7**	**35.5**	**40.9**	**40.7**
59	21.7	24.1	18.3	20.7	21.9	22.0	**35.6**	**35.4**	**40.7**	**40.6**
60	21.5	24.1	18.3	21.0	21.7	21.9	**35.5**	**35.5**	**40.0**	**40.4**
61	21.8	23.9	19.0	21.0	22.1	22.8	**36.0**	**36.2**	**40.2**	**41.0**
62	23.5	25.4	22.2	23.3	24.2	26.0	**36.2**	**37.9**	**40.1**	**42.9**
63	23.7	25.6	26.4	25.5	24.4	26.6	**39.3**	**38.3**	**38.7**	**43.0**
64	25.6	27.1	30.4	27.6	26.1	27.9	**39.3**	**40.4**	**39.6**	**43.1**
65	26.9	26.4	29.1	27.5	27.0	28.1	**37.5**	**39.9**	**37.1**	**40.6**
66	21.7	24.1	34.5	30.3	22.2	24.5	**38.3**	**39.8**	32.3	**37.2**
67	21.7	23.5	33.2	29.0	21.9	23.9	**36.9**	**39.8**	34.5	**38.8**
68	19.4	22.4	33.4	32.7	19.9	22.5	**35.7**	**39.2**	28.1	34.1
69	16.6	20.5	31.2	32.8	17.2	20.6	30.9	33.3	18.3	22.5
70	16.3	21.1	30.7	33.0	16.8	20.9	30.3	32.7	16.9	21.0
71	18.1	22.8	31.3	33.1	18.6	22.8	29.9	32.4	18.4	22.7
72	19.1	23.9	33.5	**37.8**	19.4	23.7	32.2	**36.6**	19.3	23.5
73	16.1	20.9	29.4	32.5	16.3	20.6	28.7	32.2	16.3	20.5
74	17.4	21.8	30.2	32.1	17.9	21.9	28.9	31.2	17.5	21.6
75	17.3	21.3	29.6	32.1	17.7	21.2	28.0	31.3	17.3	20.8
76	17.1	20.9	29.6	32.4	17.4	20.6	28.0	31.8	17.1	20.3
77	17.2	20.9	30.5	33.8	17.6	20.7	28.9	32.6	17.3	20.4
78	26.2	28.5	21.5	23.7	25.0	27.1	34.1	**37.4**	**36.7**	**39.3**
79	24.4	26.8	19.6	21.9	23.5	25.3	32.8	**35.9**	**35.2**	**37.7**
80	26.1	29.0	21.2	24.2	25.3	27.6	34.3	**37.8**	**37.3**	**39.7**
81	26.5	29.4	21.6	24.6	26.1	27.8	**35.1**	**38.3**	**38.7**	**40.7**
82	25.3	28.0	20.3	23.1	24.7	26.4	33.9	**37.1**	**37.0**	**39.0**
83	25.3	28.1	20.3	23.4	24.7	25.9	**35.5**	**37.8**	**38.9**	**40.4**
84	23.2	26.0	18.2	21.0	22.5	24.0	33.5	**35.9**	**36.0**	**37.9**
85	24.9	27.8	20.3	23.4	23.7	23.0	**36.5**	**37.6**	**41.3**	**41.7**
86	21.4	24.3	16.5	19.5	20.1	20.5	32.9	34.8	**35.2**	**36.8**
87	21.3	24.6	17.0	20.5	20.6	21.4	**35.6**	35.0	**39.2**	**39.5**
88	20.1	23.1	15.3	18.7	18.7	18.9	32.7	33.9	34.8	**36.1**
89	19.8	22.7	15.6	18.6	19.3	20.2	34.7	34.3	**37.3**	**37.9**
90	23.9	25.6	19.5	21.1	23.1	24.7	31.7	34.8	33.2	**36.3**
91	22.6	24.4	17.9	19.8	21.6	23.2	30.5	33.5	31.7	34.8
92	22.8	24.8	18.0	20.0	21.7	23.4	31.0	33.9	32.4	**35.4**
93	23.0	25.1	18.1	20.3	21.8	23.6	31.3	34.2	32.9	**35.7**
94	22.3	24.9	17.3	19.9	21.4	23.2	31.0	33.8	32.7	**35.3**
95	21.7	24.4	16.6	19.3	21.0	22.6	31.2	33.9	33.2	**35.5**
96	20.9	23.9	15.9	18.8	20.1	21.7	31.5	33.9	33.6	**35.5**
97	18.5	21.5	15.1	18.1	18.5	19.4	33.6	34.3	**36.0**	**37.3**
98	17.9	20.7	14.1	16.7	17.8	18.7	32.8	33.4	34.8	**36.0**

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5	Year 1	Year 5
99	15.8	19.0	12.9	16.0	15.6	17.2	30.8	32.7	32.3	34.2
100	15.9	19.1	12.5	15.6	15.7	17.0	30.5	32.3	32.2	34.0
101	16.2	18.9	27.0	29.3	16.8	19.0	27.4	30.9	20.7	25.8
102	18.3	20.3	30.8	29.3	18.3	19.8	33.0	**37.5**	30.5	**35.6**
103	20.0	21.2	26.4	24.5	20.1	21.5	32.8	**37.0**	31.5	**36.7**
104	16.9	19.1	17.5	18.5	17.7	20.2	31.2	30.5	31.1	31.4
105	21.0	22.3	19.2	20.2	20.9	21.9	29.7	30.0	31.3	32.7
106	20.8	22.7	18.6	20.5	20.6	21.7	32.6	32.2	34.6	**35.5**
107	20.5	23.3	18.0	20.6	20.8	22.2	**35.1**	**35.4**	**38.3**	**39.5**
108	20.2	23.0	17.7	20.4	20.4	21.8	34.9	**35.2**	**37.7**	**39.0**
109	19.9	22.6	17.5	20.1	20.1	21.4	34.4	34.9	**37.1**	**38.4**
110	18.3	21.4	15.7	18.7	18.4	19.9	33.3	34.2	**35.5**	**37.0**
111	16.7	19.9	14.4	17.3	16.9	18.5	31.9	33.2	33.6	**35.3**
112	19.8	22.9	16.7	19.8	19.8	20.6	34.6	35.0	**37.6**	**38.8**
113	19.0	22.1	16.0	19.1	19.0	20.1	34.1	34.8	**36.6**	**38.0**
114	24.0	24.2	22.4	22.7	25.0	25.2	32.1	32.4	33.2	33.4
115	22.9	23.4	18.8	19.4	23.9	24.3	32.1	32.5	34.6	34.9
116	17.6	19.1	13.4	15.1	18.1	19.3	31.5	32.0	**35.3**	**35.5**
117	13.8	18.1	30.9	32.3	14.3	18.1	30.1	31.5	16.3	19.4
118	14.5	18.3	31.3	32.4	15.1	18.4	30.5	31.4	16.7	19.6
119	15.2	18.7	31.4	32.5	15.5	19.0	30.3	30.9	16.6	19.5
120	13.8	17.3	31.4	33.4	14.1	17.9	30.0	32.2	15.4	18.3
121	13.0	16.9	31.7	33.9	13.5	17.5	30.4	32.9	15.0	18.1
122	12.1	16.2	31.4	33.7	12.6	16.6	29.9	32.5	14.4	17.5
123	11.7	15.9	30.6	33.2	12.2	16.2	29.1	31.8	13.9	17.0
124	12.6	16.8	31.6	34.1	13.4	17.3	29.8	33.0	14.6	17.9
125	14.2	18.2	31.1	34.3	14.8	18.3	29.6	33.1	15.0	18.3
126	13.4	17.8	31.4	34.4	14.1	18.3	29.9	33.5	14.9	18.4
127	13.9	18.2	31.3	34.7	14.5	18.7	30.1	33.5	15.1	18.7
128	15.5	19.9	31.3	**35.1**	16.1	20.4	30.3	33.6	16.1	20.0
129	14.3	18.5	30.0	33.4	14.7	18.3	28.1	32.1	14.8	18.1
130	16.9	20.5	31.2	**35.4**	17.3	20.4	29.8	33.9	17.1	20.1
131	14.9	18.7	30.4	34.5	15.1	18.4	28.9	33.2	15.1	18.1
132	16.4	19.8	29.7	33.7	16.7	19.5	28.6	32.6	16.5	19.2
133	15.5	19.1	29.4	33.5	15.7	18.5	28.2	32.2	15.5	18.3
134	14.6	18.6	28.6	32.2	14.9	18.0	27.2	30.8	14.7	17.7
135	15.6	19.7	28.5	32.0	16.0	19.0	27.4	30.8	15.8	18.9
136	18.6	21.6	14.0	17.3	17.5	18.4	32.3	33.1	34.2	**35.4**
141	18.6	21.1	16.5	18.9	18.9	19.9	31.4	31.7	33.2	34.9
156	23.1	24.9	18.9	20.6	22.2	23.7	30.4	33.6	31.6	34.7
157	23.3	25.4	19.3	21.3	22.3	24.2	30.5	33.6	31.3	34.4
158	23.7	25.5	19.6	21.2	22.9	24.3	31.3	34.4	32.5	**35.6**
159	17.0	19.7	13.0	15.6	16.6	17.6	31.5	32.5	33.1	34.5
160	15.5	19.9	30.2	32.3	16.0	19.6	30.0	32.6	16.4	20.5
161	12.7	16.3	28.2	32.1	13.3	16.7	25.8	29.7	14.0	17.0
162	21.9	22.6	17.7	18.4	22.8	23.3	31.6	32.0	33.3	33.6

Table C4: Year 10 and 21, Noise Levels over 25% of Property Areas, LAeq,15min

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21
1	18.6	22.1	29.0	29.1	18.6	22.4	29.9	29.7	27.4	28.1
2	16.9	17.2	22.2	22.3	16.0	16.5	25.1	27.9	26.0	28.6
3	19.3	19.6	24.2	24.3	18.3	18.6	26.4	28.7	27.4	29.5
4	22.3	22.5	26.1	26.2	21.2	21.4	27.5	29.6	28.7	30.6
5	25.0	25.1	28.4	28.4	23.9	24.0	29.1	30.8	30.4	31.9
6	26.2	26.3	30.5	30.5	25.1	25.2	29.9	31.3	31.2	32.6
7	29.8	29.8	32.7	32.8	28.5	28.6	31.7	32.4	33.4	34.0
8	25.6	25.8	30.4	30.4	24.4	24.7	30.4	32.1	31.4	33.2
9	29.0	29.0	32.5	32.5	27.7	27.8	31.4	32.1	32.8	33.7
10	29.0	29.3	33.8	33.9	28.1	28.6	33.1	**35.1**	**35.2**	**37.1**
11	27.8	27.9	31.9	31.9	26.5	26.6	30.7	31.7	32.2	33.2
12	31.2	31.2	34.1	34.2	29.9	30.0	32.7	33.1	34.3	34.9
13	**35.8**	**35.8**	**37.9**	**37.9**	34.5	34.5	**36.2**	**36.4**	**37.9**	**38.1**
14	**39.1**	**39.1**	**41.4**	**41.4**	**37.8**	**37.8**	**39.2**	**39.3**	**41.1**	**41.3**
15	16.4	16.5	20.9	20.9	16.8	16.8	24.0	24.5	24.0	25.0
16	31.7	31.7	28.0	28.1	32.7	32.8	**37.2**	**37.3**	**40.0**	**40.0**
17	**36.2**	**36.2**	32.2	32.2	**37.1**	**37.1**	**40.6**	**40.6**	**44.2**	**44.2**
18	20.0	20.3	15.5	15.8	20.5	20.5	29.8	30.0	34.9	**35.1**
23	**36.9**	**36.9**	**35.5**	**35.5**	**35.8**	**35.8**	**37.7**	**38.4**	**37.2**	**38.4**
24	**44.7**	**44.7**	**43.3**	**43.3**	**43.3**	**43.3**	**44.4**	**44.5**	**43.7**	**43.8**
25	**35.9**	**35.9**	34.3	34.3	34.8	34.8	**36.8**	**37.7**	**36.4**	**38.0**
26	**42.8**	**42.8**	**41.2**	**41.2**	**41.6**	**41.6**	**42.9**	**43.0**	**42.2**	**42.4**
27	**35.7**	**35.8**	33.9	33.9	34.6	34.7	**36.6**	**37.4**	**36.3**	**37.7**
28	**39.8**	**39.8**	**38.3**	**38.3**	**38.7**	**38.7**	**40.2**	**40.4**	**39.7**	**40.0**
29	34.6	34.7	32.4	32.4	33.6	33.6	**36.0**	**36.8**	**35.6**	**37.3**
30	34.3	34.3	32.0	32.0	33.5	33.5	**35.8**	**36.5**	**35.4**	**36.7**
31	33.6	33.6	31.1	31.1	32.7	32.7	**35.4**	**36.2**	**35.1**	**36.7**
32	31.7	31.8	28.7	28.7	30.7	30.8	34.6	**35.8**	34.6	**36.7**
33	27.1	27.9	23.0	23.6	26.4	27.1	33.5	34.4	34.4	**35.7**
34	27.2	27.6	22.9	23.3	26.3	26.7	32.5	33.8	32.8	34.6
35	**44.1**	**44.1**	**42.3**	**42.3**	**42.8**	**42.8**	**44.2**	**44.5**	**43.5**	**44.4**
36	**38.0**	**38.0**	34.6	34.6	**36.8**	**36.8**	**38.8**	**39.6**	**37.9**	**39.6**
37	**36.8**	**36.8**	33.7	33.7	**35.6**	**35.6**	**38.1**	**39.0**	**37.6**	**39.6**
38	**35.8**	**35.8**	32.8	32.8	34.6	34.7	**37.5**	**38.5**	**37.4**	**39.5**
39	33.6	33.7	30.4	30.4	32.5	32.6	**36.1**	**37.2**	**36.1**	**38.7**
40	32.2	32.2	29.2	29.2	31.2	31.2	35.0	**36.1**	35.0	**37.2**
41	**36.8**	**36.8**	33.6	33.6	**35.6**	**35.7**	**38.7**	**39.4**	**38.8**	**40.8**
42	**35.3**	**35.3**	32.2	32.2	34.2	34.2	**37.5**	**38.4**	**37.7**	**39.8**
43	32.1	32.2	28.8	28.8	31.0	31.1	**35.2**	**36.4**	**35.4**	**38.0**
44	29.8	30.1	26.2	26.4	28.8	29.1	33.7	**35.1**	34.1	**36.5**
45	29.2	29.6	25.6	25.9	28.2	28.6	33.4	34.8	33.9	**36.4**
46	**36.7**	**36.8**	33.1	33.1	**35.8**	**35.9**	**39.6**	**40.2**	**40.0**	**42.1**
47	26.5	28.6	22.6	24.1	26.7	28.1	34.9	**36.1**	**36.2**	**37.7**
48	27.1	29.3	22.5	24.4	27.1	29.0	**35.2**	**36.7**	**37.3**	**38.6**
49	32.2	33.0	27.5	28.2	33.3	33.6	**41.9**	**41.2**	**44.4**	**44.2**
50	30.6	31.5	26.1	26.9	31.7	32.2	**40.9**	**40.4**	**43.4**	**43.2**

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21
51	29.2	30.9	24.7	26.2	29.3	30.8	**37.7**	**38.5**	**39.9**	**41.0**
52	27.0	29.0	22.4	24.2	27.6	29.2	**36.1**	**36.8**	**38.5**	**39.1**
53	29.2	30.4	24.3	25.5	29.9	30.8	**38.5**	**37.8**	**41.0**	**40.3**
54	29.0	30.7	23.9	25.7	29.9	31.2	**39.4**	**38.8**	**41.9**	**41.2**
55	26.3	28.7	21.3	23.9	27.1	29.0	**38.7**	**37.8**	**41.7**	**40.6**
56	20.2	21.3	16.1	17.6	20.4	21.2	34.9	32.7	**37.5**	**35.2**
57	20.5	21.1	16.7	17.6	20.7	20.9	**35.6**	33.1	**38.4**	**35.8**
58	20.6	21.1	16.8	17.6	20.8	20.8	**35.7**	33.2	**38.5**	**35.8**
59	20.5	21.0	16.7	17.5	20.7	20.8	**35.7**	33.1	**38.4**	**35.8**
60	20.5	20.9	16.7	17.5	20.6	20.6	**35.6**	33.0	**38.3**	**35.5**
61	21.0	21.1	17.4	17.9	21.1	20.7	**36.2**	33.3	**38.9**	**35.7**
62	23.1	22.1	20.2	19.4	23.2	21.5	**37.6**	34.1	**41.8**	**36.5**
63	23.4	22.2	22.0	21.0	23.5	21.8	**37.5**	34.7	**42.5**	**36.7**
64	24.2	24.1	23.3	23.5	24.0	23.7	**39.2**	**35.5**	**41.8**	**37.1**
65	24.9	24.9	23.6	23.8	24.4	24.3	**38.4**	**35.1**	**40.0**	**36.5**
66	22.2	22.6	24.1	24.2	22.6	21.9	**38.1**	**35.7**	**39.1**	**36.8**
67	21.1	22.1	23.8	24.0	21.4	21.6	**38.9**	**35.9**	**39.6**	**37.0**
68	21.3	22.3	28.1	25.2	21.8	21.6	**38.2**	**35.2**	**37.5**	**35.4**
69	19.9	22.2	32.0	31.1	20.6	22.0	33.0	33.9	24.1	31.4
70	20.1	21.9	34.2	33.8	20.5	21.9	33.1	34.5	22.0	30.8
71	22.2	23.8	33.8	33.4	22.6	23.3	31.7	34.4	23.3	30.3
72	22.9	24.5	**39.0**	**38.5**	23.2	24.1	**36.5**	**38.3**	23.4	30.6
73	19.1	20.8	34.0	33.3	19.3	20.5	32.3	33.4	19.9	27.0
74	21.0	22.1	33.2	33.0	21.3	21.5	30.4	32.8	21.4	24.8
75	20.3	21.4	33.8	34.5	20.5	20.7	31.1	33.8	20.5	22.7
76	20.2	21.2	34.3	34.7	20.4	20.3	31.5	33.6	20.4	21.5
77	20.8	21.6	34.6	34.8	21.0	20.8	31.7	33.6	20.9	21.6
78	25.9	27.7	20.9	22.5	26.5	27.8	**35.6**	**35.4**	**37.6**	**37.4**
79	24.3	26.6	19.3	21.4	24.8	26.4	34.4	34.2	**36.2**	**35.8**
80	26.2	28.1	21.1	22.9	26.9	28.2	**35.9**	**35.7**	**38.1**	**37.6**
81	26.4	28.7	21.3	23.5	27.1	28.7	**36.6**	**36.3**	**39.0**	**38.3**
82	25.1	27.6	20.0	22.4	25.7	27.4	**35.3**	35.0	**37.5**	**36.9**
83	24.6	27.3	19.6	22.3	25.4	27.4	**36.0**	**35.3**	**38.7**	**37.6**
84	22.9	25.9	17.8	20.8	23.6	25.7	34.2	33.6	**36.4**	**35.4**
85	21.6	24.8	17.1	20.3	22.1	24.9	**36.5**	35.0	**39.5**	**37.8**
86	19.6	23.4	14.8	18.5	20.0	23.1	33.0	32.1	35.0	34.0
87	20.2	22.5	15.8	18.3	20.6	22.6	34.6	32.9	**37.3**	**35.4**
88	17.8	21.4	13.3	16.9	18.1	21.3	32.4	31.1	34.3	33.1
89	19.2	21.3	14.9	17.2	19.5	21.3	33.6	31.8	**35.9**	34.1
90	24.4	26.8	19.7	21.9	24.5	26.6	33.4	34.2	34.9	**35.6**
91	23.1	25.6	18.3	20.6	23.2	25.0	32.3	32.6	33.5	33.9
92	23.0	25.3	18.1	20.2	23.3	24.9	32.7	32.7	34.1	34.0
93	23.0	25.2	18.0	20.0	23.3	24.9	33.0	32.7	34.4	34.1
94	22.3	24.8	17.2	19.5	22.8	24.5	32.7	32.2	34.1	33.6
95	21.7	24.7	16.5	19.5	22.2	24.4	32.6	32.0	34.3	33.5
96	20.8	24.0	15.7	18.9	21.3	23.7	32.5	31.7	34.2	33.3
97	18.3	19.7	14.4	16.1	18.6	19.4	33.4	31.3	**35.4**	33.3
98	17.8	19.7	13.6	15.9	18.0	19.6	32.4	30.6	34.2	32.5

Property	Predicted Noise Level, LAeq,15min, by Time Period, Weather Conditions and Year									
	Day Neutral		Day Wind		Evening/Night Neutral		Evening/Night Inversion		Evening/Night Inversion+Wind	
	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21	Year 10	Year 21
99	15.9	17.9	12.4	14.6	16.1	17.6	31.2	29.7	32.7	31.2
100	15.9	18.1	12.1	14.5	16.2	17.8	31.0	29.6	32.5	31.1
101	18.3	20.5	28.3	26.9	18.5	20.3	29.9	30.8	26.0	29.3
102	18.5	21.0	24.2	24.5	18.9	20.5	**36.6**	34.1	**35.9**	34.0
103	19.0	20.9	20.4	21.2	19.2	20.5	**36.8**	34.0	**37.3**	34.8
104	19.0	19.9	17.7	18.4	19.0	19.6	30.6	30.6	32.5	31.5
105	20.2	19.6	17.5	17.2	19.9	19.1	28.0	28.7	31.1	30.5
106	20.0	19.9	17.1	17.2	19.8	19.3	31.0	29.9	33.7	31.9
107	20.4	20.9	17.0	17.8	20.4	20.3	35.0	32.3	**37.3**	34.5
108	20.1	20.6	16.7	17.6	20.1	20.1	34.6	31.9	**36.8**	34.2
109	19.7	20.3	16.5	17.3	19.6	19.8	34.1	31.5	**36.3**	33.7
110	18.4	19.4	15.1	16.3	18.4	19.0	33.0	30.8	**35.1**	32.9
111	17.1	18.4	14.1	15.3	17.1	18.1	31.5	29.9	33.6	31.7
112	19.4	20.1	15.6	16.8	19.5	19.8	34.5	32.0	**36.7**	34.3
113	18.8	19.8	15.2	16.5	18.9	19.4	33.9	31.6	**36.1**	33.8
114	24.3	24.4	22.8	22.9	25.3	25.3	32.4	32.5	33.3	33.6
115	23.4	23.5	19.2	19.4	24.3	24.3	32.4	32.4	34.7	34.8
116	19.0	19.6	14.7	15.3	19.4	19.6	31.9	32.0	**35.3**	**35.5**
117	17.6	20.3	32.5	34.6	17.9	19.9	28.4	30.2	19.8	20.9
118	18.0	20.6	32.9	**35.4**	18.2	20.3	28.8	30.9	19.9	21.0
119	18.7	21.3	32.6	33.2	18.9	21.0	26.2	28.1	19.8	21.1
120	17.9	21.0	34.3	**35.3**	18.1	20.9	28.5	28.9	19.0	20.9
121	17.6	20.9	**35.2**	**36.2**	17.8	20.8	29.5	29.0	18.9	21.0
122	16.6	19.8	34.8	**36.1**	16.8	19.6	29.7	29.7	18.1	20.0
123	16.0	19.0	34.2	**35.4**	16.2	18.7	29.6	30.3	17.5	19.2
124	17.4	19.9	**35.2**	**36.0**	17.7	19.8	30.2	28.9	18.6	20.2
125	18.2	19.7	**35.4**	**36.0**	18.2	19.3	30.6	30.4	18.6	19.6
126	18.0	19.6	**35.7**	**36.5**	18.2	19.4	30.6	29.9	18.7	19.9
127	18.5	19.8	**36.0**	**36.6**	18.7	19.7	30.7	30.4	19.0	20.2
128	20.0	20.3	**36.2**	**36.7**	20.4	19.9	30.6	32.1	20.2	20.3
129	17.9	19.4	34.6	35.0	18.0	18.4	30.7	31.3	18.1	18.8
130	20.2	21.3	**36.5**	**35.8**	20.5	20.4	32.6	33.1	20.5	21.0
131	17.8	19.7	**35.3**	**35.4**	17.9	18.9	32.1	32.8	18.1	19.3
132	19.1	20.4	**35.2**	**35.2**	19.1	19.5	32.6	33.4	19.3	20.2
133	17.7	19.6	34.9	35.0	17.7	18.8	32.8	33.4	18.0	19.3
134	17.1	19.0	33.1	33.5	17.2	18.1	31.2	31.0	17.4	18.6
135	18.3	19.6	32.7	33.9	18.2	18.9	30.8	33.0	18.6	21.1
136	17.4	20.5	12.9	16.1	17.6	20.4	31.7	30.4	33.6	32.3
141	18.5	18.6	15.6	16.0	18.3	18.2	30.4	29.3	33.3	31.4
156	24.0	26.5	19.5	21.7	23.9	25.8	32.4	33.4	33.5	34.6
157	25.0	26.6	20.6	22.0	24.9	25.7	32.7	33.4	33.5	34.6
158	24.6	27.0	20.2	22.3	24.6	26.5	33.0	34.2	34.3	**35.5**
159	16.8	19.2	12.6	15.2	17.1	19.1	31.1	29.8	32.7	31.5
160	18.9	21.5	33.5	33.0	19.4	21.6	33.3	34.6	23.7	31.7
161	16.4	18.9	33.0	33.1	16.5	18.6	28.1	28.5	17.3	18.9
162	22.4	22.8	18.2	18.5	23.3	23.4	31.9	32.0	33.4	33.6

APPENDIX D – HIGH LEVEL CUMULATIVE NOISE ASSESSMENT

Introduction

Since preparing the Environmental Assessment further information, however limited, has become available on other large scale coal mining projects proposed in the immediate vicinity of Boggabri Coal Mine. The Department of Planning (DoP) has requested that this additional information be considered for the potential cumulative impacts in the vicinity of the Leard State Forest. The following is a high level assessment of cumulative noise impacts associated with the Continuation of Boggabri Coal Mine Project and these other projects.

This assessment is consistent with *Cumulative Impacts – A Good Practice Guide for the Australian Coal Mining Industry* (Franks et al, 2010).

Background

In August 2009 Boggabri Coal Pty Limited commenced consultation with the DoP regarding a new project approval for continuation of the existing Boggabri Project. To progress that proposal, the following steps were taken:

1. 26 August 2009 — Preliminary Environmental Assessment (PEA) submitted
2. 9 September 2009 — Planning focus meeting
3. 25 September 2009 — Revised PEA and Project Application submitted
4. 15 December 2009 — EPBC Referral submitted
5. 17 December 2009 — Director-Generals Requirements (DGRs) issued
6. 2 July 2010 — EA submitted for adequacy
7. 20 August 2010 — NSW DoP letter requesting further information.

During the course of the above approval process further information has come to the attention of Boggabri Coal relating to other large scale coal mining projects in the immediate vicinity of the Boggabri Project which have since sought or may seek approval at some time in the future (Other Projects).

Accordingly, a Simultaneous Worst Cast Cumulative Impact Scenario (SWCCIS) review has been undertaken in order to attempt to gain an appreciation of the potential worst case cumulative impacts if all of those Other Projects were to proceed in conjunction with the Boggabri Coal project. The appreciation is necessarily high level and based upon some highly speculative assumptions which are detailed in this review.

The SWCCIS review is separate to the EA for the Boggabri Coal Project. Whilst it draws upon the findings made from the assessments in the Boggabri EA, this review is prepared on a different basis to the quantitative environmental assessments in the Boggabri EA as it is making qualitative assessments for the purposes of a high level review. This acoustics cumulative impact assessment forms part of the SWCCIS review.

Assessment

Tarrawonga Coal Mine Modification

Publically available data regarding noise levels produced by the proposed Modification to the Tarrawonga Coal Mine are included in the *Tarrawonga Mine Modification Environmental Assessment* (Tarrawonga EA) (Resource Strategies, 2010) including the *Tarrawonga Coal Mine Modification Noise and Blasting Assessment* (Tarrawonga Noise Assessment) (Wilkinson Murray, 2010). Predicted noise levels reported in Table 6-3 in the Tarrawonga Noise Assessment are shown in Table D1 below.

Maules Creek Project

Information regarding the proposed Maules Creek Coal Mine is available in the *Maules Creek Coal Project Preliminary Environmental Assessment* (Maules Creek PEA) (Hansen Bailey, 2010). The Maules Creek PEA describes a proposed open cut mine producing up to 13 Mtpa of ROM coal and includes plans showing the proposed mining and coal processing areas and transportation corridors.

Noise levels likely to be produced by the Maules Creek Project can be inferred via a comparison with predicted noise levels from the Boggabri Project, assuming similar mining and coal processing equipment and considering the different annual production targets for the two operations. A comparison between the two Projects results in the following assumptions for the Maules Creek Project:

- The Maules Creek Project is expected to require approximately twice as many mobile machines as the Boggabri Project;
- The Maules Creek Project CHPP is expected to provide approximately double the capacity of the Boggabri Project CHPP; and
- The Maules Creek Project CHPP is expected to require approximately twice as many train movements in an average day compared to the Boggabri Project.

In acoustic terms, a doubling of the equipment fleet or number of mobile plant movements in a time period would result in an increase of 3 dBA. Assuming all other characteristics of the two Projects are identical then it is reasonable to assume the Maules Creek Project would produce a noise level 3 dBA higher than predicted from the Boggabri Project at a similar distance from mining and coal processing areas and transportation corridors.

Figure 1 shows the total predicted noise level from the Boggabri Project for all years and weather conditions and indicates a typical distance of 2.6 to 5.3 km to the 35 dBA contour and from 1.3 to 2.6 km to the 40 dBA contour over hilly terrain east and west of the Project.

The terrain around the Maules Creek Project site is generally hilly to the east and west. Considering the assumed 3 dBA correction factor to account for the higher proposed annual production, typical distances of 3.7 to 7.5 km to the 35 dBA contour and 1.6 to 4.8 km to the 40 dBA contour could be expected east and west of the Maules Creek Project.

Future Maules Creek Project noise levels at receiver locations subject to potential cumulative noise impacts have been estimated based on the indicative distances to the 35 dBA and 40 dBA noise contours listed above plus a -3dB correction factor to convert estimated $L_{Aeq,15min}$ noise levels to $L_{Aeq,night}$ levels.

Tarrawonga Extension Exploration Lease

Exploration License EL5967 known as the Tarrawonga Extension covers a large area south of the Boggabri Project and the existing Tarrawonga Project. No known applications have been lodged or approvals granted for this Project to date.

While it is possible that cumulative noise impacts may occur during simultaneous operation of the Boggabri Project, Tarrawonga Coal Mine and a future Tarrawonga Extension, uncertainties regarding the Tarrawonga Extension preclude a detailed analysis. It is noted that the proposed Boggabri Project mine plan includes an easterly progression for the first five years followed by a northerly and north westerly progression from years 5 to 21. Assuming any mining associated with the Tarrawonga Extension does not commence in the next 5 years then noise levels from the Boggabri Project would reduce at potentially affected residences to the south and east of the Boggabri Project and the potential for cumulative noise impacts at these residences would reduce.

In the absence of information regarding the Tarrawonga Extension and assuming a medium sized open cut mine at least 1000m inside the Exploration Lease boundary, future noise levels have been assigned on the following basis:

- Over 40 LAeq,period for all properties within the Exploration Lease area;
- 35 LAeq,period for all properties 1500m from the Exploration Lease boundary; and
- 30 LAeq,period for all properties 4000m from the Exploration Lease boundary.

Goonbri Project Exploration Lease

Exploration License EL7435 covers an area of 984 ha adjacent to the south east corner of the Boggabri Project. Little is known regarding the Goonbri Project including if this would be a proposed open cut or underground mining operation. No known applications have been lodged or approvals granted for this Project to date.

While it is possible that cumulative noise impacts may occur during simultaneous operation of the Boggabri Project, Tarrawonga Coal Mine and the Goonbri Project, uncertainties regarding the Goonbri Project preclude a detailed analysis. It is noted that the proposed Boggabri Project mine plan includes an easterly progression for the first five years followed by a northerly and north westerly progression from years 5 to 21. Assuming any mining associated with the Goonbri Project does not commence in the next 5 years then noise levels from the Boggabri Project would reduce at residences to the east and the potential for cumulative noise impacts at these residences would reduce.

In the absence of information regarding the Goonbri Project and assuming a small open cut mine at least 500m inside the Exploration Lease boundary, future noise levels have been assigned on the following basis:

- Over 40 LAeq,period for all properties within the Exploration Lease area;
- 35 LAeq,period for all properties 1500m from the Exploration Lease boundary; and
- 30 LAeq,period for all properties 4000m from the Exploration Lease boundary.

Cumulative Mining Noise Assessment

Potential cumulative noise levels from coal mines for which suitable information is available are shown in Table 9 to representative properties within or close to the Boggabri Project 40 dBA contour as shown in Figure 1. Predicted Boggabri Project noise levels have been determined by subtracting 3 dBA from the worst case LAeq,15min noise levels for all years and time periods as shown in Figure 1 and Tables 7A and 7B, while noise levels from other projects have been estimated as discussed above. All predicted noise levels have been rounded to the nearest 1 dBA. Predicted cumulative noise levels should be compared to the 40 LAeq,9hr night amenity criterion.

Table D1: Indicative Cumulative Mining Noise Levels, LAeq,night.

Receiver	Boggabri Project	Tarrawonga Modification	Maules Creek Project	Tarrawonga Extension	Goonbri Project	Combined Noise Level
Belleview	38 *	<25	33	27	<25	40
Jeralong	38 *	33	31	40 *	<25	43
Goonbri	37	<25	35	31	38 *	42
Cooboobindi	35	<25	31	26	<25	37
Roma	34	<25	31	28	<25	37
Glenhope	33	<25	30	28	<25	36
Sylvania	27	29	28	30	40 *	41

* Indicates the property would lie within the ZOA of the relevant mining operation based on the indicated or assumed noise levels.

Table D1 shows four properties (Belleview, Jeralong, Goonbri and Sylvania) may be subjected to cumulative noise impacts assuming simultaneous operation of all five coal mines in the area at some time in the future. The Table also shows that any property subjected to cumulative noise impacts is also within the Zone of Affectation (ZOA) from one or more of the assessed coal mining operations.

Cumulative Rail Noise Assessment

Noise from trains accessing a mining operation on a private rail spur occurs intermittently during a typical 24 hour period, or may not occur if no trains are scheduled to visit the mine in some periods. Where two or more coal mines share part of a rail spur, multiple train movements cannot reasonably occur in a 15 minute period due to minimum distances and time delays between consecutive trains. Where two or more separate rail spurs are constructed near a privately owned property, the chance of two or more train movements occurring simultaneously on different rail spurs is considered very low.

Predicted train noise, expressed as LAeq,15min levels, would therefore not increase at any property as a result of train movements associated with two or more coal mines in the area. Similarly, maximum noise levels are determined by the loudest train travelling on the private spur and would not increase with more train movements in any time period.

Limitations

This assessment of Other Projects has been constructed from a combination of published information and from the author's speculation as described above. The results of this assessment are therefore speculative, qualitative in nature and should not be relied upon to predict accurate environmental impacts.

This is not a fully quantitative report created using the normal scientific methodology for preparing formal environmental assessments in the context of a known, detailed project (because project descriptions of the Other Projects are speculative). Acoustic modelling incorporating the Other Projects has not been undertaken as part of this assessment.

Quantitative information has been used where possible and the adopted methodology is considered reaosnable. However, base data relies on assumptions (described above) and not on legal commitments inherent in approved conditions or obligations.

The assessment has considered future mining by open cut methods. Potential acoustic impacts associated with possible future underground mining have not been considered.

Conclusion

This cumulative noise assessment considering Other Projects therefore indicates that all properties remaining outside the ZOA for each separate mining operation are unlikely to be subjected to cumulative noise impacts from two or more coal mine projects. Cumulative noise from two or more coal mines is therefore unlikely to cause significant noise impacts at any privately owned property that is not subject to a private agreement with one or more mining companies.