

9. Other Issues

9.1 Introduction

This chapter of the supplementary SEE provides a review of additional issues relating to the proposed construction and operation of the three proposed turbines. The issues include:

- traffic and transport
- telecommunications
- geology and soil
- water resources and water quality
- safety
- greenhouse gas emissions
- socio economic impacts
- cumulative impacts

9.2 Traffic and transport

Traffic and transport issues associated with the construction and operation of the approved Woodlawn Wind Farm project were comprehensively addressed in the 2010 SEE. This section addresses changes with traffic volumes associated with the proposed construction of three additional turbines and any changes with the approved transport routes.

9.2.1 Overview of traffic and transport issues

Typical traffic issues for wind farm projects can be broadly divided into off-site and on-site issues.

Off-site traffic issues mainly relate to:

- Choice of local roads used for access and the timing of travel
- Ability of local roads to handle the volume of construction traffic particularly in regard to over-size and over-mass vehicles
- Road safety
- Traffic management measures

On-site issues mainly relate to:

- Location of new track work and environmental considerations
- Standard of track work required, including upgrade of existing tracks
- Erosion and sediment control measures to be incorporated
- Restoration of any temporary tracks on completion of the works

The main traffic impacts of the Woodlawn Wind Farm project would occur for the local roads surrounding the site during the construction stage of the project. This is mainly due to the additional volume of traffic on the normally lightly trafficked local roads and the need to use over-size (longer than 19 m) or over-mass (gross mass in excess of 42.5 tonnes) vehicles for the delivery of a range of components. Over-size or over-mass trucks are referred to as 'Restricted Access Vehicles (RAV)'.

Over-size loads are required for the transport of the 44 m turbine blades, and over-mass loads for the transport of the nacelles, tower sections and transformers. Nacelles weigh more than 60 tonnes and the tower sections weigh between 30 and 50 tonnes.

Once the wind farm is operational, there will be a low volume of traffic accessing the site, including a small number of on-site staff and periodic visits by additional maintenance staff as required. The traffic impact of the operational stage will be minor and readily managed.

9.2.2 Deliveries to the wind farm site

Transport of the equipment to Woodlawn Wind Farm has been addressed in detail in the previous 2004 EIS and 2010 SEE. In summary it is expected that some of the components of the wind turbine equipment will be imported from overseas and will pass through Port Kembla and that sections of the towers will be manufactured and delivered by road from suppliers in other Australian states.

The large and/or heavy components will be delivered by road using over-mass and over-size vehicles or RAVs. Road transport is considered the only practical option for transporting the components due to the vertical and horizontal clearances required on the rail system.

The equipment for the three additional turbines will be delivered in the same way.

9.2.3 Transportation routes

Aspects of suitability of existing roads for the required transport include the directness of various routes, traffic safety issues and the limited extent of community disturbance as well as obtaining agreement from local Councils and the RTA.

Several route options were reviewed in the 2004 Woodlawn Wind Farm EIS and in the 2006 Environmental Assessment for Capital Wind Farm. The route used during the delivery phase of Capital Wind Farm was considered suitable for transport of equipment to Woodlawn Wind Farm and was the route that was proposed by the 2010 SEE and the basis for the project that obtained Modification Approval. The delivery of the equipment and components required for the additional three turbines routes will use the same approved routes.

Crane Delivery

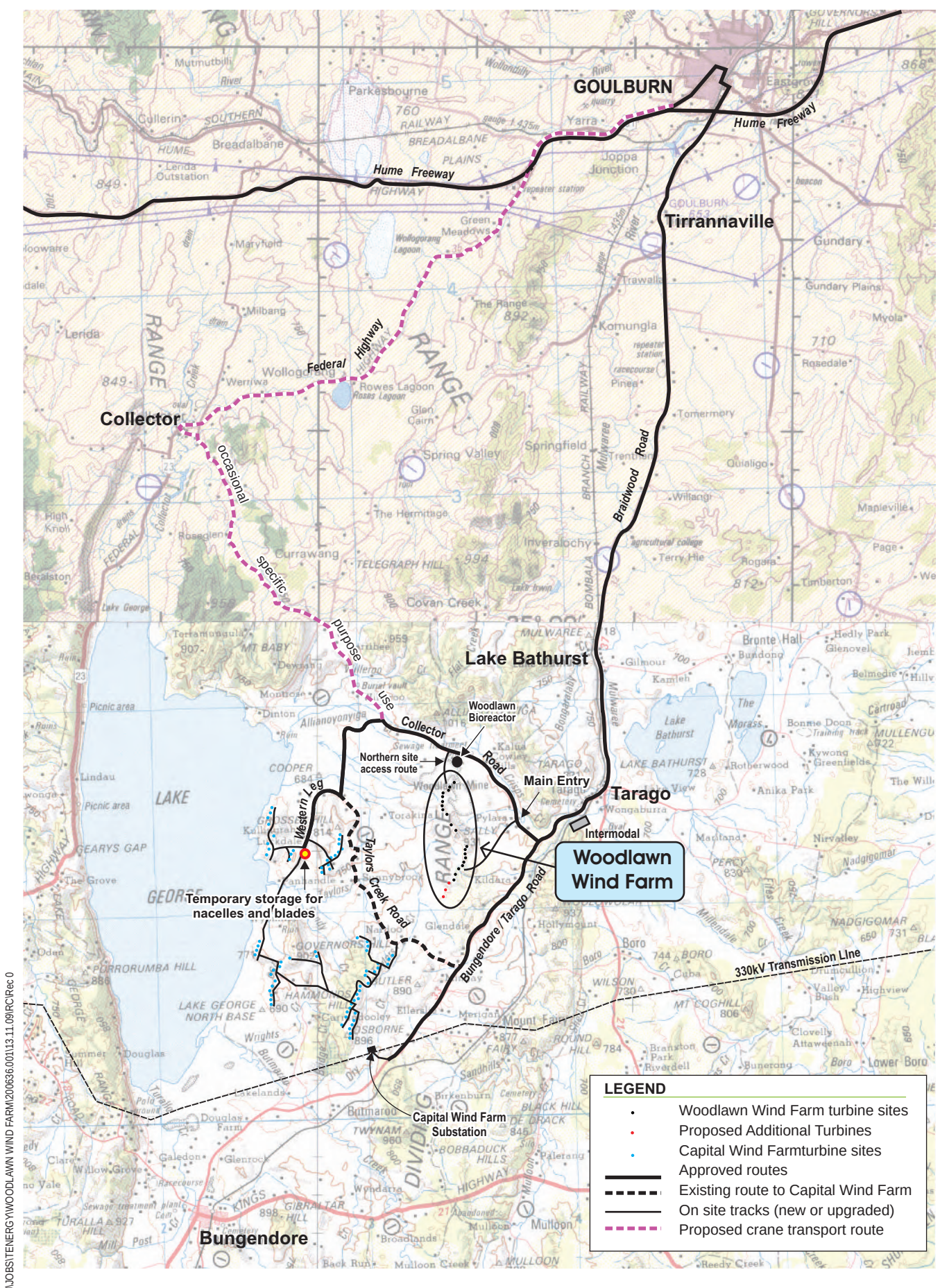
The traffic and transport management plan that was produced for Capital Wind Farm is readily applicable for the transport issues associated with Woodlawn Wind Farm. Cranes are required for construction and maintenance of the turbines and are delivered to site by oversize vehicles. Due to the dimensions and weights of the crane, the route defined in the Construction Traffic Management Plan for Capital Wind Farm and which was defined in the 2010 SEE is not considered to be suitable for the delivery of the cranes. A separate Traffic Management Plan is currently being developed for Woodlawn Wind Farm.

It has been proposed that crane delivery be similar to the arrangements developed for Capital Wind Farm, which allows only occasional escorted usage of Collector Road by the crane. All other crane items, counterweights and boom sections will be transported via the normal transport route. The cranes will be required initially for the construction of the turbines and then infrequently for maintenance activities once the wind farm is operational.

The approved traffic access routes and the proposed route for crane delivery are shown in Figure 9.1.

9.2.4 Volumes of traffic on local roads

A key part of the traffic assessment for the construction phase is the analysis of the likely types of vehicles to access the site and the approximate number of trips involved. This was undertaken as part of the 2004 EIS and 2010 SEE assessments. These previous assessments of components and materials required have been reviewed and updated to include the additional requirements required for the construction of the additional three turbines. The number of one way vehicle movements was estimated for a six month construction period.



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The original consent was given for approximately 200 trips per day comprising about 90 light vehicle and 98 heavy vehicle trips per day, occurring through the construction period. The 2010 SEE indicated that this would be reduced substantially to a total of 1,452 one way movements over the estimated 180 day construction period. This decrease was due to the proposed reduction in the number of turbines to be installed and due to the use of the innovative anchored footings design in place of the previously used gravity footings which require a greater volume of concrete and more reinforcing steel. Anchored footings were installed at Capital Wind Farm.

Table 9.1 shows the comparison between the approved January 2010 movements and the updated vehicle movements for the additional three turbines.

Table 9.1 – Estimated traffic movements for the approved amended project with the additional three turbines

Material	Approved movements January 2010 ⁽¹⁾		Updated total vehicle movements June 2010		Vehicle Type
	Quantity	No of vehicles	Quantity	Actual one way vehicle Movements	
Foundation Materials / anchors					
Concrete	2,000 m ³	400	2,300 m ³	460	4 axle concrete truck
Reinforcing steel	230 t	12	270 t	14	Semi-trailer
Sand / aggregate	200 m ³	20	230 m ³	23	Delivery to site vs batch plant
Cement (grout)	230 t	12	270 t	14	Semi-trailer
Stand (anchors)	63 t	4	73 t	4	Semi-trailer
Duct (anchors)	22 m ³	1	25 m ³	1	Semi-trailer
Miscellaneous (anchors)	24 t	2	28 t	2	Semi-trailer
Track construction and other items					
Aggregate for tracks	4,000 m ³	400	4,600 m ³	460	Truck
Water for dust control	1 ML	100	1 ML	100	Tanker
Misc equipment	Nominal	60	Nominal	60	Semi-trailer
Misc materials	Nominal	15	Nominal	15	Semi-trailer
Wind Turbine Components					
Tower sections	80	80	92	92	RAV
Nacelles	20	20	23	23	RAV
Hubs	20	20	23	23	RAV
Blades (two/truck)	60	30	69	35	RAV
Generator transformer	20	5	23	6	Semi-trailer
Substation					
Substation transformer	1	1	1	1	RAV
Misc substation items	Various	29	Various	29	Semi-trailer

	Approved movements January 2010 ⁽¹⁾		Updated total vehicle movements June 2010		
Cables and overhead lines					
Underground cables	7 km	18	8.5 km	21	Semi-trailer
Sand to fill trench above cable	1,500 m ³	100	1,900	125	Truck
Overhead conductors	12 km	3	12 km	3	Semi-trailer
33 kV transmission poles	120	40	120	40	RAV
Site work activities					
Site establishment	Nominal	5	Nominal	6	Semi-trailer
Cranes	2	25	2	25	Semi-trailer
Construction equipment	25	40	25	40	Various
Site disestablishment	Nominal	10	Nominal	10	Semi-trailer
Total movements		1,452		1,632	Trucks
Employee activity					
Employees cars	45 / day	8,100	45 / day	8,100	Car/4WD
Total movements		8,100		8,100	Cars

NOTE: ⁽¹⁾ – Aurecon, 2010.

Table 9.1 indicates that approximately 1,632 trucks movements would be required, about 180 more vehicle movements than that estimated in the 2010 SEE, but substantially lower than that estimated in the EIS supporting the original development approval.

Movement of RAV vehicles

The movement of RAV vehicles would include the initial delivery of turbine components (blades, nacelles) to temporary storage and then the transfer of the component to Woodlawn Wind Farm from the temporary storage once turbine sites have been prepared. Movement of RAVs is likely to occur for only part of the full construction period. Turbine components for 20 turbines have already been delivered to the temporary storage sites. Future RAV movements would include the delivery of the tower sections for all 23 turbines and the eight movements required to transport the turbine components for the additional three turbines.

The 92 tower sections will be delivered directly to turbine sites once the sites have been prepared. Transport to the site by RAVs may be staged over four to five months and would be arranged to minimise impact on local communities, who will be kept informed of the progress of construction works, potential impacts and safeguards incorporated. These aspects will be addressed by the Traffic Management Plan.

Table 9.1 indicates that the RAV vehicle movements would marginally increase from 191 to about 214 movements. The delivery of the tower and turbine component parts alone will generate about 179 one-way truck movements, up from the 155 estimated in January 2010.

Truck movements

The intensity of truck movements would vary during the construction stage. Events such as pouring the concrete for a turbine footing can generate up to 20 one way trips per day over a period of about eight hours. The approved project included a batching plant, to be located to the north of the ridgeline near the Woodlawn mine. Using the batching plant would minimise the need for these concrete agitator vehicles to use local roads, however the option to source concrete from a fixed batch plant elsewhere may be considered during the construction phase due to the limited number of times the batch plant would be used.



It is assumed that the contractor will stage the work so that footings are poured sequentially, with the construction crews preparing them, pouring them and then progressively establishing the tower sections that will support the turbines.

9.2.5 On-Site access management

Figures 3.1 and 3.3 show the access tracks and the on-site access routes.

On 13 July 2010, a Modification Approval was obtained for access to the northern end through the Woodlawn Bioreactor site from Collector Road. Access to turbines 1 to 11 will be via this entrance. The Pylara Farm entrance will be the main access to the wind farm. The construction site office will be located along the Pylara Farm access track. The access to the site remains unchanged for the additional delivery activities of the three additional turbines.

Once on site, the estimated 10 km of access tracks required for the approved amended wind farm will be extended by about 1 km to allow for access to the additional three turbines. The additional length of track will be located along the crests of ridges on land that has low to moderate slopes and is mostly on rocky ground with thin soil cover.

Steeper grades and a crossing of an ephemeral drainage line are required for the access track in the vicinity of turbine site 23. This steeper section of access track may be benched into the slope and will require particular attention to drainage to prevent erosion of the track and energy dissipation for stormwater flows being diverted from the track onto surrounding land. The drainage line crossing will need to be upgraded to 'all weather' access.

Grids may be installed in place of selected gates to facilitate access between turbine sites. Gates may be used at property boundaries and at other locations.

9.2.6 Mitigation measures

A number of measures will be incorporated for the construction and operation of the wind farm to ensure that transport and traffic impacts arising out of the development are minimised. These measures will be incorporated into a Traffic Management Plan for the project and will be developed in consultation with Goulburn Mulwaree and Palerang Councils and form part of the CEMP to be approved by the Department of Planning. These mitigation measures have been fully addressed in the 2004 EIS and the 2010 SEE. Mitigation measures are still being finalised on consultation with the Councils and the RTA.

Additional measures associated with the new proposed route for crane movements are as follows:

- The proposed route along Collector Road is used for the transport of the crane only and all other ancillary large vehicles will be directed via the normal route through Goulburn to Tarago and onto Collector Road.
- Permits will be obtained from the RTA for the crane movement
- Notification will be provided to neighbours to the Collector Road in advance of the Crane movement
- A speed limit of 40 km/hour is proposed as the maximum for the crane movement on Collector Road. The speed will be further reduced at any locations presenting safety concerns such as narrow winding sections of road.
- Crane transport will be subject to an escort
- Movement of the crane along Collector Road will avoid the pre-school and post-school times and School Bus travel times
- Any inadvertent damage to Collector road (as advised by Council and due to the Crane movement) will be repaired by the proponent

9.3 Telecommunications

An assessment of potential telecommunications interference impacts was undertaken by Lawrence Derrick and Associates (LDA) in 2009. The methodologies used and the outcome of the assessment were described in detail in the January 2010 SEE. LDA have undertaken a further assessment has been to take into account the proposed construction of the additional three turbines.

The assessment included a review of:

- Broadcasting services including analogue and digital television, FM and MF sound broad casting and satellite pay television
- Radiocommunication services including point to point, point to multipoint, cellular mobile base stations, two-way mobile and CB radio
- EMI effects of wind turbines

This section summarises the findings of the assessment in relation to the construction of the additional three turbines. The full report is provided in Appendix H.

9.3.1 Potential impact of proposed modification

Based on the topography of the area, the review of the overseas experience and on calculations using the University of Michigan method, the following potential impacts from the Woodlawn Wind Farm on telecommunication systems and television reception are expected. Details of these methodologies are provided in Appendix H.

- No interference is expected to the MF and FM sound broadcasting services in the area.
- Attachment 8 of Appendix H shows the theoretical predicted interference levels to television reception in the vicinity of the Woodlawn Wind Farm. These calculations indicate that there is a possibility some television picture degradation could be experienced where the wind turbines exist within a $\pm 20^\circ$ sector from the television antenna nominal direction of reception, and up to about 3 km from the turbines. The percentage of time the degradation would be experienced would depend on the direction and speed of the wind.
- Due to the undulating terrain around Woodlawn Wind Farm and the possible multiple television transmitting stations that individual residences will use for television reception it is difficult to predict where interference may occur.
- As indicated above, digital television is not subject to ghosting degradation in high signal strength areas, however some reduction of service area could result from reflected unwanted signals at the limits of the service area. There may be some isolated areas which are shadowed by local hills resulting in reduced signal levels, however it is difficult to predict whether digital reception will be impaired in specific locations.
- There are no television re-broadcast stations listed in the area surrounding Woodlawn Wind Farm. Therefore, no impact on re-broadcast signal quality is expected.
- For satellite pay TV services in the area of the wind farm, no interference to these services is likely to occur unless the required pointing of their dish antennas to the serving satellite is also in line with a turbine.
- Maps derived from the ACMA RADCOM database showing radio transmitters and link paths for services within the frequency range from 40 – 999 MHz and within at least 50 km of Woodlawn Wind Farm are shown in Figure 9.2. Two Radio links have been identified as crossing the boundary of the wind farm site as indicated in Figure 9.3a and 9.3b.



The proposed construction of the additional three turbines will not impact on these two radio links, however, the final turbine array design will need to ensure that the radio links passing near turbine 8 and between turbines 11 and 12 are not adversely impacted.

- The Airservices facility at Mt Majura includes aircraft radar which is about 40 km from the wind turbines. The adjacent Capital wind farm has turbines at a lesser distance. On the basis that the currently operating Capital wind farm is acceptable to Airservices it is unlikely that there would be any objection to the location of the more distant Woodlawn wind turbines.

The three additional turbines will be located well below the maximum height of turbines on the site. The conclusions remain valid from the previous assessments.

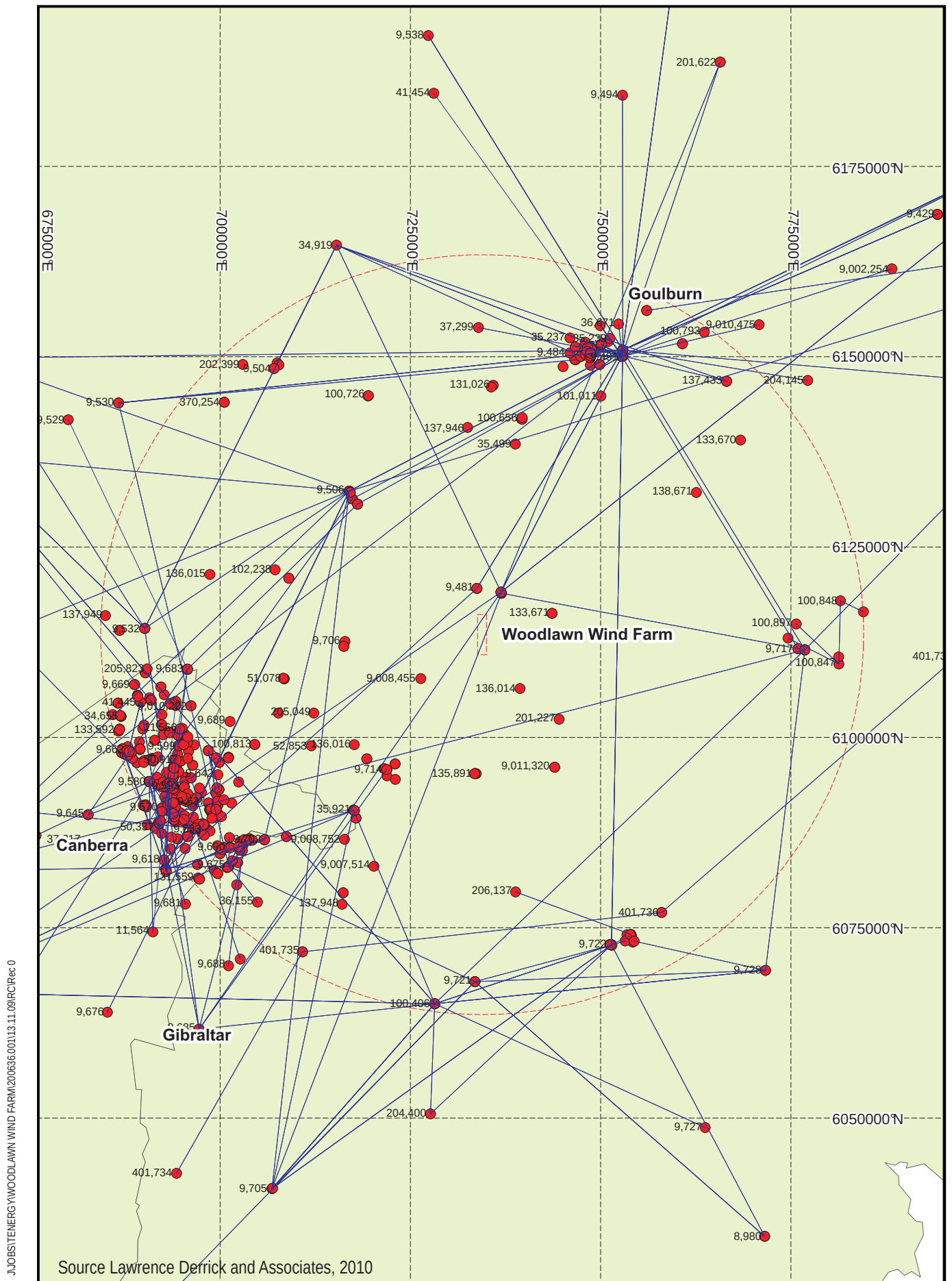
9.3.2 Mitigation Measures

For individuals experiencing degraded FM or television broadcasting service due to identified interference from the wind farm, possible techniques to reduce the interference to acceptable limits include:

- Replacement of receiving antenna system with a higher gain more directive model
- Repositioning of the antenna in height or horizontally on the dwelling
- Installation of an antenna elsewhere on the property and cable to dwelling
- Change the orientation of antennas to receive an alternative station if available. For example, point the satellite to Illawarra or Goulburn instead of Canberra
- Use available digital television channels instead of analogue. This would require a digital Set Top Box or digital television set
- Provision of an alternative satellite service eg, Free to Air or Austar pay television service.
- Where feasible, consideration could be given to the installation of a television or FM repeater station to provide service to groups of residents in a shadow zone.

Potential point to point system and mobile base coverage conflicts are not predicted with turbines being located with recommended clearance zones from radio sites or point to point ray lines. There is only one identified link passing the turbines and final micro-siting adjustments of one turbine would avoid any impacts. Final micro-siting will be determined prior to construction.

Any minor near field effects to medium frequency broadcasting would occur within tens of metres of the turbines only and with a buffer zone of at least 2,500 m to any dwelling, no corrective action will be required.



Woodlawn Wind Farm Supplementary Statement of Environmental Effects

Figure 9.2: Radio Link map 40 - 999MHz Frequencies

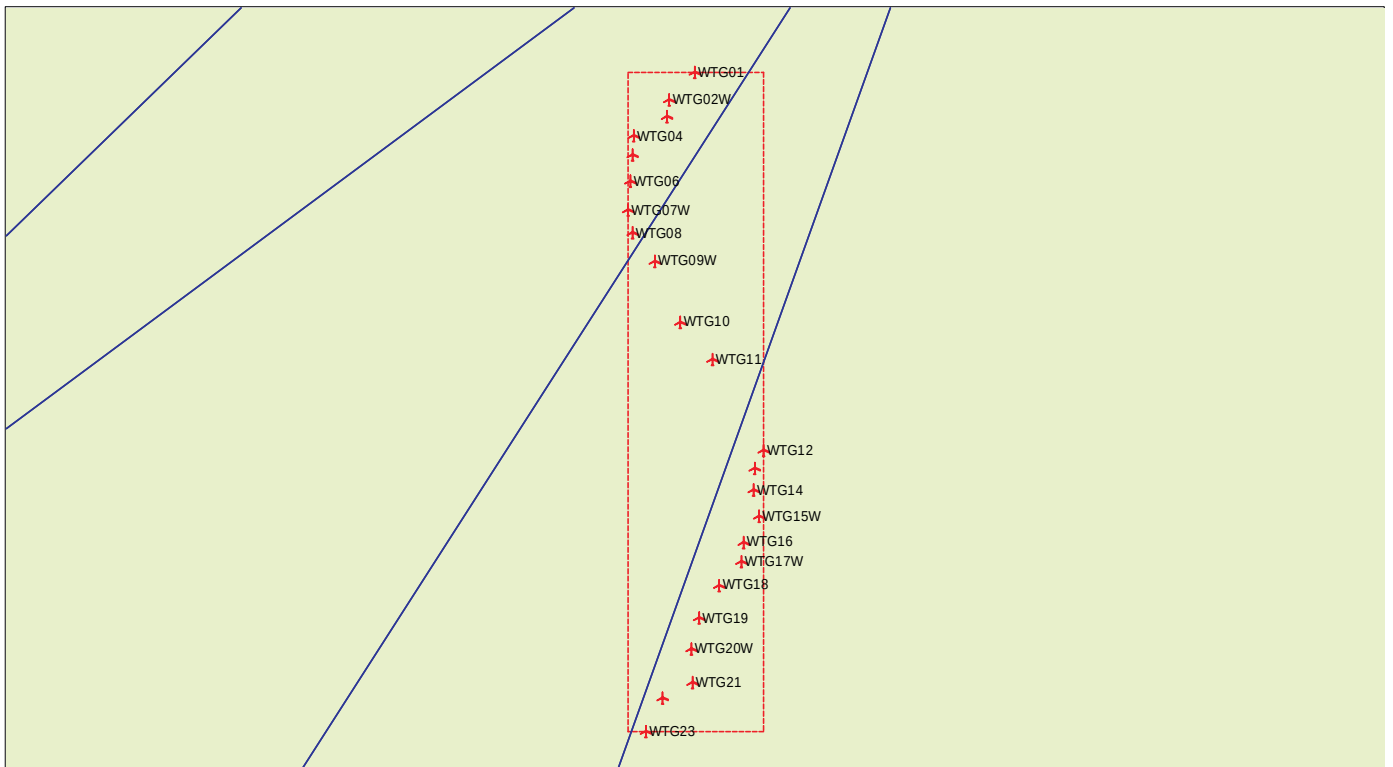


Figure 9.3a: Map of radio link paths near wind turbines

PATH PROFILE COWLEY HILLS TO GIBRALTAR HILL

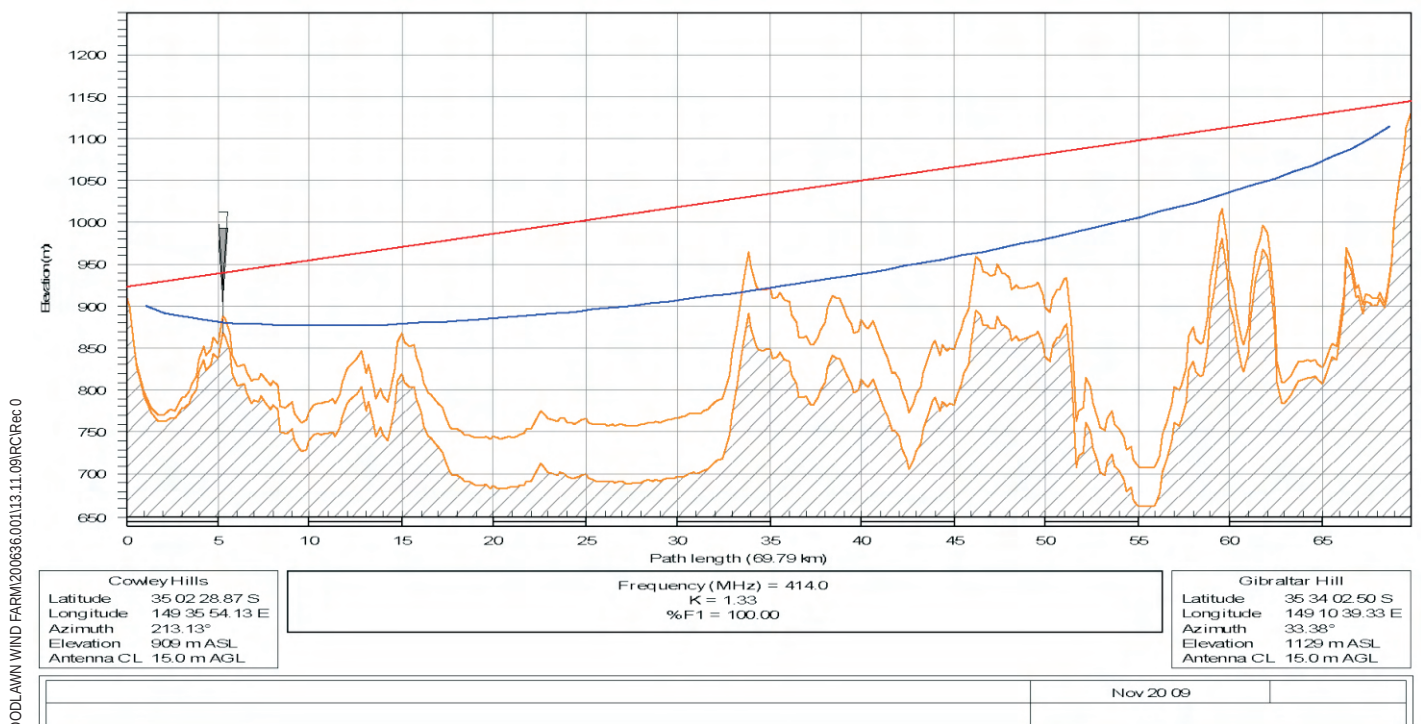


Figure 9.3b: Path profile Cowley Hills to Gibraltar Hill

9.4 Safety

The principal safety hazard issues identified in the 2004 EIS for the Woodlawn Wind Farm development related to:

- aviation
- bushfire risk
- physical safety of site infrastructure
- potential health risks including electromagnetic fields and shadow flicker
- electrical safety
- road safety
- other construction issues

These issues were reviewed further in the 2010 SEE and in particular, the Director Generals' requirements for a revised assessment of the potential impact of the proposed modification on air safety. The overall wind farm project will be implemented in accordance with the relevant safety requirements to ensure the safety of the workforce at the site and the local community.

9.4.1 Shadow flicker

A review of the potential for shadow flicker effects at the Woodlawn Wind Farm including the additional three turbines has been provided in Chapter 5 and indicates that shadow flicker is not a significant issue for the development. Health risks posed by shadow flicker on residents or passing motorists within the project area are considered minimal.

9.4.2 Noise

The noise impacts of the development including the additional three turbines have been assessed in Appendix E and a summary of the results and the proposed mitigation measures is provided in Chapter 7 of the supplementary SEE.

The assessment of the noise impacts indicates that the wind farm is able to operate within the relevant noise criteria and that its impacts are likely to be acceptable. A post commissioning performance review will assess the wind farm noise compliance including noise arising from the substation. Construction noise will occur over the approximately eight month construction period and controls will be incorporated to limit its impact.

9.5 Greenhouse gas emissions

Detailed information on the importance of greenhouse gas emissions reduction and the role of the Woodlawn Wind Farm project in Australia's efforts to curtail emissions was provided in the 2004 EIS and the 2010 SEE. This section provides an update of the greenhouse emission savings possible as a result of the proposed modification.

9.5.1 Operational greenhouse gas emissions and savings

In the 2004 EIS, URS calculated that the estimated CO_{2-eq} emissions that would be saved by the operation of Woodlawn Wind Farm based on the 2004 NSW Electricity Pool emission coefficient. These savings were updated using the 2010 NSW Electricity Pool emission coefficient in the 2010 SEE and are updated in the SEE to include the additional three turbines. Table 9.2 shows the estimated CO_{2-eq} savings calculated for the approved projects compared to the CO_{2-eq} emission savings that could be expected from construction an additional three turbines.

Table 9.2 – Estimated CO_{2-eq} emission saving for the modified project

		2004 EIS ⁽¹⁾	Jan 2010 SEE	July 2010 SEE
No. of turbines		25	20	23
Turbine capacity	MW	2 ⁽¹⁾	2.1 MW	2.1 MW
Total wind farm generation capacity	MW	50 MW ⁽¹⁾	42	48.3
Estimated annual output	MWh/yr	140,000 ⁽¹⁾	150,000	172,500
Pool coefficient	t CO _{2-eq} /MWh	0.906	0.973	0.973
Displaced greenhouse / year	t CO _{2-eq}	126,840 ⁽¹⁾	146,000	168,000
Greenhouse over lifetime	t CO _{2-eq}	3.17 million	3.65 million	4.19 million
Greenhouse per day	t CO _{2-eq}	348	399	460

NOTE: ⁽¹⁾ From URS, 2004

9.5.2 Life cycle analysis of emissions and savings

A life cycle analysis of the emissions arising from a development takes into account the emissions due to manufacture of component parts, construction activities, operations and maintenance and eventual decommissioning and disposal or materials recovery. Wind farm developments tend to have the following life cycle emission characteristics:

- Greenhouse gas emissions for wind generated electricity on a life-cycle basis are around 10 to 15 kg/MWh which is substantially below that of fossil fuelled electricity generation. URS (2004) used a worse case life cycle emissions factor of 20 kg/MWh (see Table 13.2)
- Only about one third of the wind farm's lifetime emissions occur during the operation of the wind farm.
- About two thirds of emissions occur due to the manufacture, delivery and construction of parts that are used to build a wind farm. These emissions are from steel production, chemical processes, machining and assembly and transportation.
- Where the wind farm displaces other fossil fuel generation systems there may be net savings in greenhouse gas emissions.

Greenhouse gas saving in context over Woodlawn Wind Farm project lifecycle updated to include the additional generated output is provided in Table 9.2.

Table 9.3 – Greenhouse gas emissions savings in context

		2004 EIS	Jan 2010 SEE	July 2010 SEE
Annual generation output (MWh/yr)		140,000	150,000	172,200
Estimated greenhouse gas due to coal fired powers stations (t CO _{2-eq})	A	126,840	146,000	167,600
Life cycle greenhouse gas emissions (t CO _{2-eq}) using worse case 20 kg/MWh life cycle emissions factor ⁽¹⁾	B	2,800	3,000	3,440
Overall greenhouse gas savings (t CO _{2-eq})	A – B	124,040	143,000	164,550
Average number of households ⁽²⁾		~28,000	~30,000	~34,400
Equivalent number of trees to be planted (t CO _{2-eq} / 0.67) ⁽¹⁾		~185,000	~213,000	~245,600

NOTE: ⁽¹⁾ URS, 2004

⁽²⁾ Based on Australian Greenhouse Office (AGO, 2004) estimate that Sydney households use an average 5,000 kWh per year. URS (2004) used the AGO 1999 figure

⁽³⁾ <http://www.orer.gov.au/publications/mret-overview.html>

9.5.3 Results

With the addition of the three turbines, the proposed modification will result in an increase in overall installed capacity of the wind farm from 42 MW to 48.3 MW. The estimated total greenhouse gas emission savings resulting from the project will be in the order of 168,000 tonnes each year. This represents an increase in savings of 22,000 tonnes each year above the approved project. This would be equivalent to providing the electricity needs for around 4,500 standard households using renewable energy in place of fossil fuel sources.

9.6 Geology and Soil

The original 2004 EIS provides an assessment of the site geology, potential impacts of the project on soils and detailed geotechnical investigations. The January 2010 SEE provided an overview of the site conditions and provided recommendations relating to foundation and road design. Many aspects covered in the past two assessments continue to be applicable to the modified project, as the additional sites are located within the same project envelop as that addressed.

As shown in Figure 9.4, the topography of the Woodland Wind Farm site varies between rolling to undulating hills. A moderate degree of variability in the underlying geology (Figure 9.5a) contributes to the variation in surface features, including changes in slope and erodibility of exposed strata. The geology at the site of the three additional turbines will provide stable ground; though erodibility of disturbed areas will be quite variable, and controls will need to be adjusted to the conditions encountered.

The general subsurface soil profile is summarised below in Table 9.4. Many locations on the ridge, where the turbine sites are located, have only shallow soils and exposed rock is common. However, as mentioned above, intervening areas show evidence of erosion of weaker or more deeply eroded rock strata.

Table 9.4 – General subsurface profile (URS, 2004)

Approximate depth range (m)	Generalised soil
0 to 0.1	top soil: dry, hard brown silt with rootlets
0.1 to 0.9	extremely to highly weathered metasediments: dry extremely low to very low strength, silt(stone) to sand(stone)
0.9 to 1.6	highly weathered metasediments: dry, low to medium strength, undifferentiated metasediments

The proposed turbine sites cover a small section of the total project area, with only one soil landscape characteristic being applicable. Table 9.5 provides a summary of the soil landscape characteristics for the three additional turbine sites, while Figure 9.5b maps the soil landscapes for the area.

Table 9.5 – Summary of soil landscape characteristics for the locality of the additional three turbines

Item	Description				
Soil Landscape	Moura Creek (Vestigial) (mk)				
Main Rock Types	Meta-sediments				
Soil Landscape – Main characteristics	Rolling low hills with short steeper slopes above drainage lines. Alluvial soils on drainage lines. Lithosols and Yellow Podzolics on crests and upper slopes, Red Podzolics, Solodics. Localised flood hazard, low wet bearing strength.				
Erodibility					
Concentrated flow	high to very high				
Non-concentrated flow	high to very high				
Wind	moderate to high				
K Factors	mk1 – 0.054	mk2 – 0.073	mk3 – 0.028	mk4 – 0.058	mk5 – 0.050
USCS Code	ML	ML	CL	ML	ML-CL

NOTE: **USCS** – Unified Soils Classification Scheme: CL/CH represent Clays; ML Silt dominant, SM Sand dominant ,
K Factor is a measure of Soil Erodibility

Representative photos of the additional site locations are provided in Plates 9.1 to 9.3. These demonstrate the mostly cleared pastoral land on which the additional turbines will be located.



Plate 9.1 – Turbine site 21



Plate 9.2 – Turbine site 22 looking south



Plate 9.3 – Turbine site 23 looking south

9.6.1 Potential impacts and mitigation measures

Construction activities will involve the excavation of footings and earthworks for access tracks and cable trenches, including the transportation of large amounts of equipment and materials to the site; these activities may have the potential to increase levels of erosion on site.

Control measures for the construction stage mirrors the two previously approved assessments. These measures will be integrated in the projects Soil and Water Management Plan (SWMP), which will form part of the CEMP, and will set out the measures to mitigate potential impacts on the soils at the wind farm site.

9.7 Water resources and water quality

The locality has relatively low annual rainfall, typical of the Southern Tablelands areas. Extended dry periods are not uncommon and for much of the time there is little or no surface flow in the upper reaches of the drainage. Winter is generally associated with slightly lower rainfall but due to lower evaporation, soil moisture can be higher during that time. Storms are possible at any time during the year but are more common in summer periods.

The ridgeline on which the Woodlawn Wind Farm is located forms a catchment divide between the Wollondilly River catchment to the east and Lake George catchment to the west. The additional three wind turbines are to be located entirely within the Lake George catchment, on the western side of the ridgeline, which drains relatively freely into Lake George (Figure 9.4).

The 2004 EIS indicated that no groundwater was encountered during excavation of test pits and it was not expected that groundwater would be an issue during construction of turbine footings due to the elevated locations of the wind turbine sites along the ridgeline and the relatively shallow depths required for the footings.

The construction of the additional three turbines and their associated track and cable routes will be undertaken in accordance with the approved SWMP. Although a tributary of Taylors Creek passes between turbines 22 and 23, the construction of the additional turbines represent a low risk for impact on water quality and the risks are able to be managed with well known procedures and techniques.

9.7.1 Potential impacts and mitigation measures

The potential for the project to impact local water courses varies with the stage of the project. The construction works will involve earthworks, storage and handling of equipment, pouring of concrete for footings and use of facilities for the construction workforce over a period of about eight months. With the effective implementation of the identified controls provided in both the 2004 EIS and the 2010 SEE, it is unlikely that there will be any significant impact on local water quality.

Potential impacts and control measures for the construction stage mirrors the two previously approved assessments. These measures will be integrated in the projects SWMP, which forms a part of the CEMP, and will set out the measures to mitigate potential impacts on the soils at the wind farm site.

9.8 Socio economic impacts

The Woodlawn Wind Farm represents a moderate size wind farm development that will have the capacity to produce 48.3 MW of electricity from a renewable energy resource. It will contribute to Australia's efforts to increase the proportion of electricity generated from renewable energy sources with the objective of reducing the overall greenhouse gas emissions intensity of electricity generation. The socio-economic aspects have been addressed in detail in the 2010 Aurecon SEE.

It is expected that the construction and operation of the additional three turbines at Woodlawn Wind Farm is unlikely to impact on the number of people required on the wind farm site.

9.9 Cumulative impacts

The potential cumulative impacts of wind farm developments and other mining, energy and waste projects at the Woodlawn Wind Farm project locality were identified in detail in the 2010 approved SEE.

The Planning NSW Guideline states that: *"Cumulative impacts may result from a number of activities with similar impacts interacting with the environment in a region. They may also be caused by the synergistic and antagonistic effects of different individual impacts interacting with each other and may be due to temporal or spatial characteristics of the activities' impacts."*



The review of the cumulative impact of the wind farm has several dimensions:

- The impact of the wind farm, when added to the combined impacts of all other existing developments and environmental characteristics of the area. Such impacts have generally been addressed in other parts of the SEE by reference to the existing environment and assessment of potential impacts relative to the baseline.
- The impact of this development in the context of the existing and potential development of wind farms in the Southern Tablelands Region and the likely growth of wind energy developments throughout Australia generally and in particular, in relation to the existing Capital Wind Farm.
- The impact of developments which are ancillary to, or otherwise associated with the proposed wind farm, such as transmission infrastructure and, other developments such as mining and energy projects at the locality.

The development of the wind farm, with the additional three turbines, will result in some minor change to the character of the landscape at the locality, but will otherwise have little further impact on the environment at this location. While some neighbours would argue that the wind farm represents a change to the landscape, it may also limit the proliferation of small acre farms and rural residences, which would also change the character of the rural environment.

The operation of the Woodlawn Wind Farm will deliver net greenhouse gas emission savings of 4.19 million tonnes of CO_{2-eq} over its project life that, together with other renewable energy projects support a national objective of mitigating Australia's greenhouse gas emissions. In the longer term, energy resources are likely to become more constrained and greenhouse issues will be of increased concern. Accordingly, developments such as the Woodlawn Wind Farm are likely to receive stronger support as the value of renewable energy developments is further recognised.

In summary, the modification to the project consists mainly of the proposed construction of three additional turbines and their associated tracks and cable routes. These are unlikely to cause additional cumulative impacts to those recorded in the previously approved projects.

