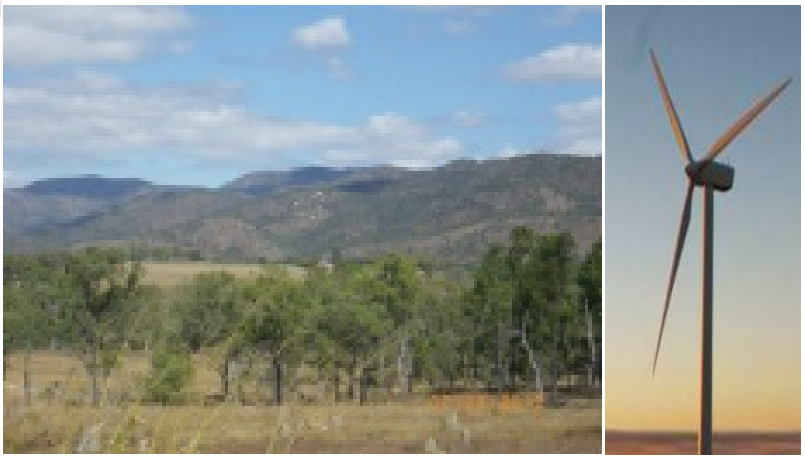
Appendix 8a

Traffic Impact Assessment – Technical Note

Prepared by Sinclair Knight Merz (SKM)

Mount Emerald Wind Farm Traffic Impact Assessment



TECHNICAL NOTE - TRAFFIC IMPACT ASSESSMENT ENGINEERING RESPONSE

- Engineering Response to Tablelands Regional Council queries
- Rev 3
- 19 December 2012

Mount Emerald Wind Farm Traffic Impact Assessment

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
1	26/10/2012	M Ali	A Paolucci	28/10/2012	Draft
2	12/11/2012	M Ali	A Paolucci	12/11/2012	Final
3	19/12/2012	V Pace	A Paolucci	19/12/2012	Final

Distribution of copies

Revision	Copy no	Quantity	Issued to
1	1	1	Terry Johannesen
2	1	1	Terry Johannesen
3	1	1	Terry Johannesen

Printed:	20 December 2012
Last saved:	20 December 2012 02:17 PM
File name:	I:\CBIF\Projects\CB24503\Deliverables\Reports\Technical Note- Mount Emerald Wind Farm Tarffic Impact Assessment_TRC 51-54_Rev 2.docx
Author:	Tanvir Asgar
Project manager:	Albert Paolucci
Name of organisation:	RATCH Australia Corporation Limited
Name of project:	Mount Emerald Wind Farm Traffic Impact Assessment
Name of document:	Technical Note - Traffic Impact Assessment Engineering Response
Document version:	Rev 3
Project number:	CB24503

1. Introduction

1.1. Purpose of this Document

Sinclair Knight Merz (SKM) has been commissioned by RATCH Australia Corporation Limited to provide engineering services to assist with providing engineering response to various Tablelands Regional Council (TRC) queries (TRC 51 – TRC 54) regarding the traffic assessment report submitted earlier for the proposed Mt Emerald Wind Farm (MEWF) project at Walkamin.

The purpose of this report is to provide engineering input to Council's queries regarding the impact that the proposed MEWF development will have on the surrounding road network, including vertical alignment checks for Hansen and Springmount Roads and various traffic generation figures during construction and operation.

1.2. Background and Current Situation

The site of the project is situated on the Atherton Tableland within the jurisdiction of the Tablelands Regional Council (TRC) and is broadly located approximately 50 km south-west of the city of Cairns in far north Queensland. More locally, the site is approximately 18 km south of the township of Mareeba, 15 km north of Atherton and 6 km south-west of Walkamin.

The major road adjacent to the proposed site is the Kennedy Highway running generally in a north-south direction and forms part of the planned route for the transport of the wind tower components from their delivery location. This State-Controlled road is a two lane, two-way, sealed road with sealed shoulders, unsealed verges and is a gazetted 23-25 m B-double route.

From the main highway at Walkamin, the recommended (and most viable) route to the proposed MEWF site is via Hansen Road and Springmount Road, while direct access to the site is off Kippen Drive. All of these roads are locally controlled by the TRC and are generally two lane, two-way, sealed roads with unsealed shoulders and verges, except for Kippen Drive which is largely an unbound gravel road/track.

Based on information received from RATCH, a maximum of 75 wind turbines are expected to be constructed on the site and a tourist viewing facility is likely to be built but its location is currently unknown. A plan showing the locality of the planned MEWF site and overall development layout is included in **Appendix A** for reference.

2. Engineering Response to TRC 51

- TRC 51 Demonstrating the capability of the vertical profiles of Hansen and Springmount Roads accommodating any proposed drop deck or low loader transport of turbine components

The assessment of the route to transport the turbine components along Hansen Road and Springmount Road to the site access at Kippen Drive has been carried out based on the following critical dimensions from "Acciona Windpower's Transportation Manual" and "REPOWER Systems Manual for Transportation, access tracks and Crane Pads".

2.1. Assumptions

- It is assumed that RATCH Australia will undertake a separate route assessment for this project
- Horizontal layout check was not undertaken as part of this report as it is included in the previous report.
- Blades are transported on a truck and rear steerable dolly/trailer, thus making the horizontal geometry not being a constraint on this route.
- The blades and tower components are mounted high above the ground so it is deemed that the transport of blades will not have vertical conflicts. (This is based on the REPOWER Systems document which details vertical crest clearances to be no greater than 1.75m over 50m lengths).
- Rotor/hub/nacelle are transported on low loaders and vertical crest curves were assessed based on the following requirements.

2.2. Vertical profile requirements

As per "Acciona Windpower's Transportation Manual – AW3000", short crest curves (less than 26m long) must not have the crest higher than 300mm or low loader transport vehicles will not be able to traverse the crest curve.

- The requirement for gradients has been checked against the requirements mentioned in section 2.4 RE Power Systems' 'Wind Power - MM82/MM92/3.2M114/3.4M104 Specification for transportation, transport roads, access tracks and crane pads'. The sections of the road which does not meet the criteria are shown in Table 1 and highlighted in the attached drawings included in **Appendix C**.
- The minimum vertical clearance height is 5 metres. Vertical clearance to overhead services and structures is not undertaken as part of this report. The report focuses on the vertical profile of the Hansen road.
- No detailed survey was available.
- Vertical geometry was developed as a best fit to the GPS data recorded during a vehicle drive through of the route.

Crests curve vertical geometry checked and shown in Table 1. Long sections and plans have been produced for two roads of approximately 10.9km in length. Refer to the drawings in **Appendix C** of this report.

Table 1: Review of vertical profiles of Hansen and Springmount Road

Review of Vertical profiles along Hansen and Springmount Road			
Location	Chainage	Possible conflict with vertical profile	Comments
1	200	Checked - no conflict	Refer Drawings in Appendix B
2	1620	Checked - no conflict	Refer Drawings in Appendix B
3	1920	Checked - no conflict	Refer Drawings in Appendix B
4	2900	Checked - no conflict	Refer Drawings in Appendix B
5	3440	Checked - no conflict	Refer Drawings in Appendix B
6	4170	Checked - no conflict	Refer Drawings in Appendix B
7	4420	Checked - no conflict	Refer Drawings in Appendix B
8	5320	Checked - no conflict	Refer Drawings in Appendix B
9	5775	Checked - possible conflict	* Eastern approach to Granite Creek causeway. As per Acciona Windpower AW3000 specification for low loaders, there is possible conflict. However, acceptable per REPower Systems Specification for blade transportation. It should be noted that this assessment was done purely from GPS survey coordinates and the road may have flatter surface profiles in reality. Recommend detail survey or refer to as constructed drawings to confirm crest details from ch 5740 to 5820.

Mitigation for Location 9

- Detail survey for the section of the road should be undertaken.
- After review of the survey and detailed reassessment of the conflict section, if the conflict remains, improvement to the vertical curve is recommended.

3. Engineering Response to TRC 52

- TRC 52 Justification of traffic figures i.e. 40 single-unit truck trips per tower considering the possible external sourcing of road base material and concrete

The traffic figure of 40 single-unit truck trips per tower has been based on ENERCON Specification E-82 – Access Roads and Crane Platforms (77m Steel Tower) and possible external sourcing of road base and concrete. Clause 2.3 of the E-82 specification states that "*Use approx. 20 trucks to transport the crane accessories to the crane"*. On top of these, it was assumed that there would be another 20 truck trips per tower for road base and material during construction of the access road and Hansen Road pavement rehabilitation if required due to the heavy vehicle loading. This 40 single-unit truck trips per tower from the original specification provided by RATCH did not include various tower components including the foundation construction and the concrete towers. Based on the new information receive from RATCH regarding the transport of concrete and other wind tower components, the calculation of truck trips has been revisited. Therefore, the new calculation for all road base materials and all tower components including foundation construction, steel tower and blades are considered for the traffic generation for the wind farm.

This earlier assumption was 40 single-unit truck trips during construction per tower through the road network for the 2 year construction period, making it 6,400 truck movements through the access during the construction phase. It was also assumed that a maximum of six semi-trailers (adapted to carry the propeller blades) per tower during construction. A maximum of 80 wind towers were planned to be constructed, equating to 960 truck movements through the access during the construction phase. However, it should be noted that RATCH advised that the number of towers be revised to 75 for the new calculation of vehicle movements.

The new calculation details various vehicle types and calculates the trips generated by those various types of vehicles during different activities and phases of the construction period. For calculation purposes it is assumed that pavement rehabilitation of entire length of Hansen Road will be required due to the heavy loading. It is assumed that 150mm gravel overlay will be required for Hansen Road. A detailed pavement impact assessment should be carried out before construction activities. Table 2 shows a summary of vehicles movements during the 2 year construction and wind towers installation period. Details of these calculations are attached in **Appendix B** of this report.

It should be noted that based on advice received from RATCH, the external sourcing of materials for the road base and the tower foundation will be done in the first 6 months, so there will be increased activities in the first six months during the construction period.

This leads to the new figure of Annual average daily traffic (AADT) of 79 (arriving loaded and leaving the site empty) during different phase of the project. It was assumed for calculation purpose that there will be 300 days of working days per year, which may vary in reality depending on other circumstances and weather condition.

It was also assumed that there was 12 working hours per day and peak hour traffic generation during construction and operation is 12% of the AADT which equates to approximately 10 vehicles per hour in the peak hour. Note that the inclusion of the new information regarding the transport of concrete and other wind tower components equates to only 2 additional vehicles per hour in the peak hour.

Table 2: Vehicle Movements expected during 2 year construction and wind tower installation period

VEHICLE TYPE		VEHICLE MOVEMENTS expected during 2yr construction and wind tower installation period
A)	*Trucks*	
	- 10yd Dump Trucks/Trailers	14,261
	- Agitators	5
	- Flat Tray Trucks (10 tonne)	577
	- Elevated Platform Trucks	2
		14,845
B)	*Trucks*	
	- Semi/Low Loaders	513
	- Water Tankers	90
		603
C)	*Trucks*	
	- Overlength/Oversize Vehicles	78
		78
D)	*Light Vehicles*	
	- 4WD Vehicles	3,607
	- Bus/Coach 30 Seater	4,580
		8,187
E)	Earth Moving Equipment (transported on low-loader)	
	- Bulldozers	6
	- Graders	3
	- Vibrating Rollers	5
	- Excavators	7
		21
F)	*Cranes*	
	- 50 tonne plus Capacity	4
	- 400 tonne plus Capacity (Main Crane)	20
		24
	TOTAL	**23,758**
	Total Trucks per day	**40**
	Average trips per day	**79**

4. Engineering Response to TRC 53

- TRC53 Details on anticipated worker numbers and further justification of the 30 worker vehicles per day figure

It was assumed in the previous report that a total of 30 vehicles per day (vpd) will be generated for workers during construction. It was also assumed that eight hour working days with daily traffic volumes during construction not generating typical peak hours but is instead spread equally over this working period.

Following further details received from RATCH regarding Kippen Drive, internal access road construction within Wind Farm site and various construction activities relating to wind tower foundation construction, crane assembly, tower installation and energy commission; the anticipated worker numbers have been recalculated and is shown in Table 3 of this report. Total number of anticipated workers can be estimated as 150 people per day.

It should be noted it is assumed that a 30-seater bus will bring in workers to site from nearby towns, and there will be some workers coming to site by individual vehicles. A maximum of 30 worker vehicles per day was assumed in the previous report taking this into account. Details of anticipated number of workers calculation is attached in **Appendix B** of this report.

Table 3: Anticipated number of workers during the 2 year construction period

Anticipated worker numbers per day			
Work Operations	0 - 6 months	6 months - 18 months	18 months - 24 months
Kippen Drive Road Construction	49	0	0
Internal access road construction within wind farm site	85	0	0
Hansen Road maintenance and rehabilitation works	13	14	14
Concrete Foundation Construction	37	0	0
Hardstands	0	10	0
Cabling	0	8	0
Delivery of Tower Components	0	20	0
Wind Turbine Generator Construction	0	20	20
Transmission Lines	0	32	32
Control Building and Switchyard	0	0	50
Miscellaneous	19	18	20
Total no of Workers per day	202	122	137
No of towers	75		
No. of working days / year (6am - 6pm)	300		
Workers per tower	**405**	**488**	**273**
Workers per day	**202**	**122**	**137**
Average Workers per day	**154**		

Note: It should be noted that for calculating the anticipated number of worker vehicle trips, it has been assumed that there will be always new set of workers everyday, which will be not practical. It will probably be the same set of workers; however, they will produce equal number of trips if there was always a new set of workers every day.

5. Engineering Response to TRC 54

- TRC 54 An estimate of the anticipated traffic increase of Hansen Road resulting from construction and operation of the development

The calculation of traffic generation for construction and operation of the development is shown in Section 3 (TRC 52) of this report. Traffic has been recorded on a section of the Kennedy Highway that includes the intersection with Hansen Road by TMR in 2008. Similarly, another applicable traffic count has been conducted on Hansen Road near the intersection with Chewko Road by TRC in 2010.

The results of these two traffic counts are shown below in Table 4 and display as an Annual Average Daily Traffic (AADT) value expressed as vehicles per day (vpd) and a corresponding percentage of heavy vehicles where applicable. A 10 year design life for Hansen Road was assumed making the design traffic year 2022 and a traffic growth of 3% per annum.

Table 4: Existing AADT

Road	Location	Count Year	AADT (vpd)	Peak Hour (vph)	Heavy Vehicles (%)	Design Year AADT (vpd)	Design Year Peak Hour (vph)
Kennedy Highway	Hansen Road Intersection	2008	4,891	587	5.9	7,398	888
Hansen Road	Chewko Road Intersection	2010	1,318	159	-	1879	225

Kippen Drive is also planned to provide access to a viewing area after construction is complete and this will be utilised by some tourist traffic. Based on anecdotal evidence and local knowledge of the existing viewing area at the Windy Hill wind farm, an assumption has been made that 100 vpd will be utilising the proposed viewing area. The daily traffic movements estimated during construction and operation is shown in Table 5 and Table 6 detailing the anticipated traffic increase of Hansen Road for both construction and operation of the development. Note that the AADT for 2012 is calculated from Table 4 with a growth rate of 3% per annum, and the AADT increase for different phases of the construction period is taken from the calculated truck trips per day in Table 2.

Table 5: Construction Period AADT increase

Construction Period								
Road	Location	Count Year	AADT (vpd)	Peak Hour (vph)	Heavy Vehicles (%)	Avg. Wind farm trips (vpd)	Increased AADT (vpd)	Increase (%)
Kennedy Highway	Hansen Road Intersection	2012	5,670	680	5.9	79	5749	1.39
Hansen Road	Chewko Road Intersection	2012	1440	173	-	79	1519	5.49

It was also assumed that for residential purposes another 8 vehicle trips will be produced during the operation period, making it 108 vehicle trips during the operation period.

Table 6: Operation Period AADT increase

Operation Period								
Road	Location	Count Year	AADT (vpd)	Peak Hour (vph)	Heavy Vehicles (%)	Utilisation of viewing area (vpd)	AADT during operation (vph)	Increase (%)
Kennedy Highway	Hansen Road Intersection	2012	5,670	680	5.9	108	5778	2
Hansen Road	Chewko Road Intersection	2012	1440	173	-	108	1548	7

6. Conclusion

This technical note has addressed the various queries from TRC (TRC 51- TRC54) and the following was determined.

For TRC 51 query, it was found that only one location (Easter Approach to Granite Creek Causeway, Chainage 5775) in Hansen Road has some possible vertical crest issues for low loaders. This can be investigated further during the detailed design of the access road.

For, TRC 52 to TRC 54 queries, detailed amended calculations has been included in this technical note. As shown in section 5, Table 5 and Table 6, there will not be significant traffic increase in Hansen road due to the construction and operation of the wind towers.

7. Appendix A Locality Plan

SKM

MOUNT EMERALD WIND FARM
LOCALITY PLAN

PROJ. No:	CB24502
DATE:	03/08/11
SCALE:	N.T.S.
DRAWING No:	CB24502-F-001
REVISION:	A

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8. Appendix B Calculation for Vehicle Movements & Worker Numbers

Mt. Emerald Wind Farm - Quantities Estimate

PRELIMINARY INFORMATION	
Location	Mount Emerald, Walkamin
Tower Model	Siemens SWT-2.3-101 WTG
No. of Towers	**75**
No. Of working days	**300**
Total Output	225 MW

ITEM	DESCRIPTION	QUANTITY	*UNIT*	VEHICLE MOVEMENTS	TYPE OF PLANT	COMMENTS / ASSUMPTIONS
1.0	**Roads**					Kippen Drive, Internal access roads within Wind Farm Site & Hansen Road (if required)
	Length of access road	44.6	*km*			Total length of unsealed access road within wind farm site 33.2km, Kippen Drive 5.3km & Hansen Rd 6.1km.
	Carriageway width	5.0	*m*			Minimum required for transport of turbine components
	Total pavement width	7.0	*m*			1.0 m shoulder either side of carriageway
	Strip existing surface	100	*mm*	**5**	EME - Excavator	Remove top-soil along proposed access roads
	Volume of top-soil	31,220	m^3			
	Tonnage of top-soil	62,440	*tonnes*	**2,313**	Trucks - 10 yd with trailers	Assuming no cut to fill, CCM of top-soil is 2.0 tons/m^3, each truck/trailer carries 27 tonnes
	Pavement thickness	300	*mm*			Gravel compacted to minimum 300 mm thickness, axle loading of 15 tonnes
	Volume of gravel	93,660	m^3			
	Tonnage of gravel	224,784	*tonnes*	**8,325**	Trucks - 10 yd with trailers	Assuming CCM of gravel is 2.4 tons/m^3, each truck/trailer carries 27 tonnes
	Spread gravel road base evenly			**4**	EME - Bulldozer	
	Roll gravel			**4**	EME - Vibrating Roller	
	Grade road surface	312,200	m^2	**2**	EME - Grader	
2.0	**Foundations**					
	Construct WTG foundations	75	*no.*			
	Foundation plan area	289	m^2			17 x 17 m square pad footing
	Slab thickness	1.4	*m*			
	Volume of concrete per footing	405	m^3			32 MPa concrete (if a rock anchor type is used (as is highly likely for MEWF) then this reduces to 100m^3)
	Total volume of concrete	30,345	m^3			75 WTG footings in total, sand & gravel aggregates
	Tonnage of concrete	72,828	*tonnes*	**2,023**	Trucks - 10 yd with Trailers	Assuming MDD of concrete is 2.4 tons/m^3, concrete mix is 25% water
	Water trucks for concrete mix			**90**	Trucks - Water Tanker	Supply by water tanker (20,000L)
	Mix concrete			**4**	Trucks - Agitator	Assuming batching plant on site
	Deliver WTG footing rings	75	*no.*	**75**	Trucks - Flat Tray	
	Install WTG footing rings	75	*no.*	**2**	Crane - 50t plus capacity	Steel flange connection ring for lower WTG section, (2 trips to site and 2 trips from site)
	Install WTG footing steel reo.	40	*tonnes*			40 tonne steel per footing
	Total volume of steel reo.	3,000	*tonnes*	**300**	Trucks - Flat Tray	75 WTG footings in total
3.0	**Hardstands**					
	Construct WTG hardstand areas	75	*no.*			Construction area for assembling WTG by crane
	Hardstand plan area	800	m^2			40 x 20 m, max. gradient of 1%, bearing capacity > 200 kN/m^2
	Base thickness	300	*mm*			Gravel compacted to 300 mm thickness
	Volume of gravel per hardstand	240	m^3			
	Total volume of gravel	18,000	m^3			
	Tonnage of gravel	43,200	*tonnes*	**1,600**	Trucks - 10 yd with Trailers	Assuming CCM of gravel is 2.4 tons/m^3, each truck/trailer carries 27 tonnes
	Disperse gravel base			**2**	EME - Bulldozer	
	Roll gravel base			**1**	EME - Vibrating Roller	
	Grade hardstand area	800	m^2	**1**	EME - Grader	
4.0	**Cabling**					
	Trenching, laying and covering	44.6	*km*	**2**	EME - Excavator	Excavation of cable trench
	Cable and Earthing in Wind Farm	44.6	*km*	**8**	Semi/Low Loader	Approximately 40 drums of cabling, 8 tonnes each
5.0	**WTG Construction**					
	Main crane assembly	1	*no.*	**2**	Crane - 50t plus capacity	2 trips to site and 2 trips from site
	Construction of main WTG sections	75	*no.*	**20**	Crane - 400t plus capacity	75 WTG in total, assembly by using main crane (400 tonne plus capacity) (10 trucks to bring the crane and its components to site and 10 to remove it
	Nacelle section	75	*no.*	**75**	Semi/Low Loader	
	Tower upper section	75	*no.*	**75**	Semi/Low Loader	
	Tower mid section	75	*no.*	**75**	Semi/Low Loader	
	Tower lower section	75	*no.*	**75**	Semi/Low Loader	
	Tower hub section	75	*no.*	**25**	Semi/Low Loader	1 truck for every 3 hubs
	Tower blade section	225	*no.*	**225**	Semi/Low Loader	3x blades per WTG, single blade transport
6.0	**Transmission Lines**					
	Nitrogen Conductor	150	*km*	**15**	Trucks - Flat Tray	3 x 50 km transmission lines, 5 km per drum, 5-6 tonnes each
	OPGW	55	*km*	**6**	Trucks - Flat Tray	Optical ground wire cable, 5 km per drum
	Suspension Poles	102	*no.*	**17**	Semi/Low Loader	Disassembled in 40 ft containers, assumed 6 per container
	Strain Poles	24	*no.*	**6**	Semi/Low Loader	Disassembled in 40 ft containers, assumed 4 per container
	Termination Poles	23	*no.*	**6**	Semi/Low Loader	Disassembled in 40 ft containers, assumed 4 per container
	Insulators	1	*lot*	**1**	Trucks - Flat Tray	Delivered in boxes, on pallette
	Line Fittings	1	*lot*	**1**	Trucks - Flat Tray	
	OPGW Splice Enclosures	14	*no.*	**1**	Trucks - Flat Tray	
	Earthing and Labels	1	*lot*	**1**	Trucks - Flat Tray	
	Container Demurrage	1	*lot*	**1**	Trucks - Flat Tray	
	Electrical Installation	1	*lot*	**3**	Trucks - Flat Tray	Installation of electrical items such as lighting, A/C, telecomms, etc.
	Construction and assembly of transmission poles			**1**	Crane - 20t plus capacity	Pole components lifted into position by crane
	Installation of transmission lines			**1**	Trucks - EPV	
	Installation of transmission lines			**2**	Light Vehicles - 4WD	
	Installation of transmission lines			**1**	Light Vehicles - Winch Trailer	
	Concrete footings for transmission poles			**1**	Trucks - Agitator	
7.0	**Control Building and Switchyard**					
	110kV Circuit Breaker	2	*no.*	**1**	Semi/Low Loader	
	110kV Disconnector AUD	3	*no.*	**1**	Trucks - Flat Tray	1 pallette
	110kV Earth Switch	1	*no.*	**1**	Trucks - Flat Tray	1 pallette
	110kV VT	3	*no.*	**1**	Trucks - Flat Tray	1 pallette
	110kV Post Insulators	40	*no.*	**4**	Trucks - Flat Tray	4 pallettes
	110kV Surge Arrestors	6	*no.*	**1**	Trucks - Flat Tray	1 pallette
	110/22kV, 80MVA Transformer	2	*no.*	**3**	Semi/Low Loader	75 tonne for transformer, 25 tonne for oil container
	22kV Main Switchboard	1	*no.*	**1**	Trucks - Flat Tray	7-8 panels, 1 tonne each
	22kV WTG Switchgear	75	*no.*	**75**	Trucks - Flat Tray	
	22kV WTG Transformers	75	*no.*	**75**	Trucks - Flat Tray	8 tonne per transformer
	Protection	1	*lot*	**1**	Trucks - Flat Tray	< 1 tonne
	SCADA and Telecommunications	1	*lot*	**1**	Trucks - Flat Tray	
	AC/DC Aux	1	*lot*	**1**	Trucks - Flat Tray	
	Steel	1	*lot*	**1**	Trucks - Flat Tray	
	Busbars	1	*lot*	**1**	Trucks - Flat Tray	
	Cable and Earthing in Sub-station	1	*lot*	**1**	Trucks - Flat Tray	
	Ancillary Equipment incl. Installation (AC/DC Aux)	1	*lot*	**1**	Trucks - Flat Tray	
	Electrical Installation	1	*lot*	**1**	Trucks - Flat Tray	
	Installation of Switchyard Equipment			**0**	Crane - 50t plus capacity	50t crane already on site
	Installation of Switchyard Equipment			**4**	Light Vehicles - 4WD	
	Installation of Switchyard Equipment			**1**	Trucks - EPV	
	Concrete foundation for switchyard			**2**	Trucks - Agitators	
8.0	**Miscellaneous**					
	Labour Transport	229	*no.*	**4,580**	Light Vehicles - 30 seater Bus	Transport workers to site by coach/bus (max.229 on site during peak construction)
	Contractor Vehicle Access	6	*no.*	**3,600**	Light Vehicles - 4WD	
	Site Camp and Temporary Offices			**3**	Trucks - Flat Tray	
	Staff Amenities			**1**	Trucks - Flat Tray	
	Waste Transfer/Storage Facilities			**2**	Trucks - Flat Tray	

Mount Emerald Wind Farm - Construction Traffic

Proposed Quarry Locations are:
Gravel road base
- 40% from Mareeba
- 60% from Atherton
Concrete mix (aggregates & sand)
- Atherton and Mareeba

Road Usage for all construction activities consists of:
1. Kennedy Highway
2. Hansen Road

Assumptions - The following transportation estimate is based upon:
- Batching plant located on site
- Contractors required to transport workers to site by bus/coach

Predicted Construction Traffic Volumes based on worst case scenario figures

VEHICLE MOVEMENTS

Wind Farm Construction: (ME 225MW) 75 WTG Layout	Water Tanker	Agitator	10yd Truck andTrailer	Crane 50T plus	Crane 400T plus	Semitrailer/ Lowloader	Overlength Vehicle	Transported on Lowloader: Dozer	Transported on Lowloader: Excavator	Transported on Lowloader: Vibrating Roller	Transported on Lowloader: Grader	Flat Tray Truck	Elev Platform Truck	Light Vehicles	30 Seater Bus
Civil Works including WTG Construction															
Trucks															
Agitators (assuming batch plant on site)		4													
Water Tankers	90														
10 Yarders with/without trailers or equivalent (transport road material)															
- Take away stripped top-soil material			2,313												
- Deliver gravel road base to site			8,325												
- Deliver hardstand gravel base to site			1,600												
- Deliver concrete mix ingredients to site (sand and gravel)			2,023												
Cranes															
400 tonne plus capacity (assembly of main WTG sections)					20										
50 tonne plus capacity															
- Assembly of main crane				2											
- Installation of footing rings				2											
Bulldozer															
- Construction of road gravel base								4							
- Construction of hardstand gravel base								2							
Excavators (25 tonne)															
- Strip existing surface									5						
- Excavation and fill of WTG cable trench									2						
Semi/Low Loaders (transporting WTG materials)															
- Deliver WTG Nacelle sections to site							75								
- Deliver WTG upper sections to site						75									
- Deliver WTG mid sections to site						75									
- Deliver WTG lower sections to site						75									
- Deliver WTG hub sections to site						25									
- Deliver WTG blade sections to site (3 blades per tower, single blade transport)						225									
- WTG cable to site						8									
Vibrating Rollers															
- Rolling of road gravel base										4					
- Rolling of hardstand gravel base										1					
Grader															
- Grading of road profile to desired slope											2				
- Grading of hardstand area											1				
Flat Tray Trucks (Deliveries)															
- WTG footing rings to site (2 per truck)												75			
- WTG footing steel reinforcement to site (10 tonne flat tray)												300			
- Site Camp and Temporary Offices												3			
- Staff Amenities												1			
- Waste Transfer/Storage Facilities												2			
Cars/Buses															
- Workers transported to site by coach															4,580
- Contractor vehicle access														3,600	
Sub-total	90	4	14,261	4	20	483	75	6	7	5	3	381	0	3,600	4,580
Transmission Lines															
Line Trucks (EPVs)															
- Installation of transmission lines													1		
Winch Trailers															
- Installation of transmission lines														1	
Flat Tray Trucks (transporting cable and steelwork, etc.)															
- Nitrogen Conductor Cable												15			
- OPGW (Optical ground wire)												6			
- Insulators delivered on pallette												1			
- Line Fittings												1			
- OPGW Splice Enclosures												1			
- Earthing and Labels												1			
- Container Demurrage												1			
- Electrical Installation												3			
Semi/Low Loaders (transporting poles etc.)															
- Suspension Poles						17									
- Strain Poles						6									
- Termination Poles						6									
4WDs with trailers															
- Installation of transmission lines														2	
Cranes (20 tonne plus capacity)															
- Construction and assembly of transmission poles															
Trucks - Agitators															
- Concrete footings for transmission poles		1													
Sub-total	0	1	0	0	0	29	0	0	0	0	0	29	1	3	0
Control Building & Switchyard															
Line Trucks (EPVs)															
- Installation of Switchyard Equipment													1		
4WDs with trailers															
- Installation of Switchyard Equipment														4	
Cranes (50 tonne plus capacity)															
- Installation of Switchyard Equipment				0											
Semi/Low Loaders															
- 110kV Circuit Breaker						1									
- 110/22kV, 80MVA Transformer							3								
Flat Tray Trucks															
- 110kV Disconnector AUD												1			
- 110kV Earth Switch												1			
- 110kV VT												1			
- 110kV Post Insulators												4			
- 110kV Surge Arrestors												1			
- 22kV Main Switchboard												1			
- 22kV WTG Switchgear												75			
- 22kV WTG Transformers												75			
- Protection												1			
- SCADA and Telecommunications												1			
- AC/DC Aux												1			
- Steel												1			
- Busbars												1			
- Cable and Earthing in Sub-station												1			
- Ancillary Equipment incl. Installation (AC/DC Aux)												1			
- Electrical Installation												1			
Trucks - Agitators															
- Concrete foundation for switchyard		2													
Sub-total	0	0	0	0	0	1	3	0	0	0	0	167	1	4	0
TOTAL	**90**	**5**	**14,261**	**4**	**20**	**513**	**78**	**6**	**7**	**5**	**3**	**577**	**2**	**3,607**	**4,580**

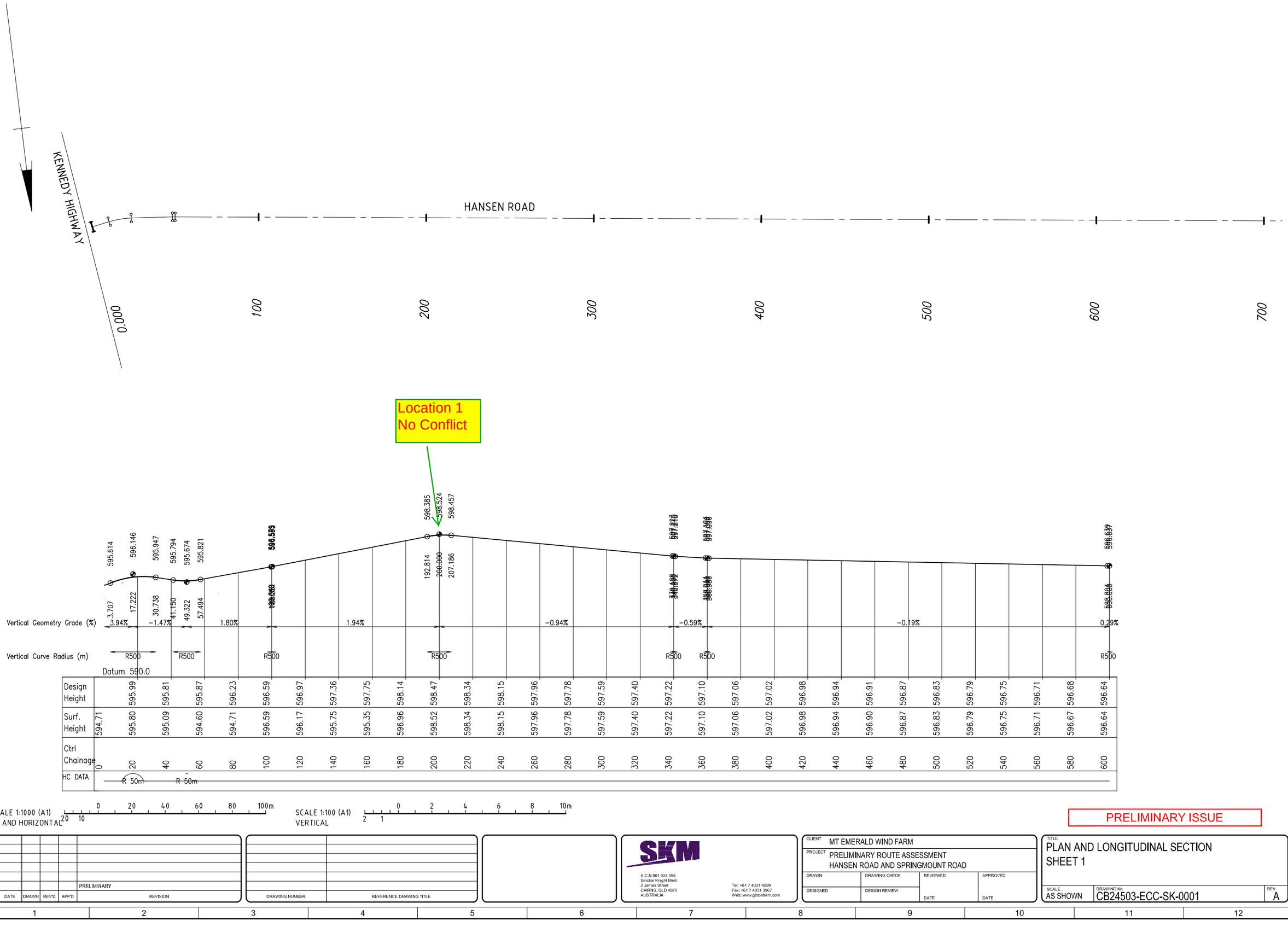
Mt. Emerald Wind Farm - Worker Numbers Estimate

PRELIMINARY INFORMATION

Location	**Mount Emerald, Walkamin**
Tower Model	**Siemens SWT-2.3-101 WTG**
No. of Towers	**75**
No. Of working days	**300**
Total Output	**225 MW**

	Year 1: Workers per day												Year 2: Workers per day											
	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12
Kippen Drive Road Construction	**42**	**36**	**38**	**59**	**59**	**59**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surveying	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearing & grubbing	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Earth moving/ Excavation	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hauling/ Dumping	4	4	4	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine grading	3	3	3	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leveliing	3	3	3	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Granular base	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electrical counduits	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Watering	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving base	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction	0	0	2	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving wearing course	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shoulder granulars	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
guardrail installation	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise barriers	2	2	2	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Signage	2	2	2	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping	0	0	0	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavement marking	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Checkout and acceptance	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal access road construction within wind farm site	**82**	**70**	**74**	**94**	**94**	**94**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surveying	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearing & grubbing	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Earth moving/ Excavation	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hauling/ Dumping	8	8	8	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine grading	6	6	6	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leveliing	6	6	6	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drainage	6	6	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Granular base	8	8	8	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electrical counduits	8	8	8	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Watering	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving base	0	0	0	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Compaction	0	0	4	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Paving wearing course	0	0	0	8	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shoulder granulars	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
guardrail installation	0	0	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Noise barriers	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Signage	4	4	4	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavement marking	0	0	0	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Checkout and acceptance	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hansen road maintenance and rehabilitation works	**2**	**2**	**2**	**23**	**23**	**23**	**14**	**11**	**12**	**16**	**16**	**16**	**14**	**11**	**11**	**16**	**16**	**16**	**5**	**2**	**2**	**26**	**26**	**26**
Surveying	0	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	0
Clearing & grubbing	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Earth moving/ Excavation	0	0	0	2	2	2	2	2	2	0	0	0	2	2	2	0	0	0	0	0	0	2	2	2
Hauling/ Dumping	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1
Fine grading	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	2	2	2
Leveliing	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1
Drainage	0	0	0	2	2	2	2	2	2	0	0	0	2	2	2	0	0	0	0	0	0	2	2	2
Granular base	0	0	0	2	2	2	2	2	2	0	0	0	2	2	2	0	0	0	0	0	0	2	2	2
Electrical counduits	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Watering	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Paving base	0	0	0	2	2	2	0	0	0	4	4	4	0	0	0	4	4	4	0	0	0	4	4	4
Compaction	0	0	0	1	1	1	0	0	1	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
Paving wearing course	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2
Shoulder granulars	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
guardrail installation	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2
Noise barriers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Signage	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2	0	0	0	2	2	2
Landscaping	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pavement marking	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
Checkout and acceptance	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1	0	0	0	1	1	1
Concrete Foundation Construction	**37**	**37**	**37**	**37**	**37**	**37**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Surveying	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clearing & grubbing	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Earth moving/ Excavation	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hauling/ Dumping	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leveliing	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Temporary formwork	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforcement bars shaping	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforcement bars installing	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Install footing rings	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pouring concrete	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Watering	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vibration	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trimming off finished surface	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Checkout and acceptance	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardstands	**0**	**0**	**0**	**0**	**0**	**0**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**0**	**0**	**0**	**0**	**0**	**0**
Construct WTG hardstand areas	0	0	0	0	0	0	4	4	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0
Disperse gravel base	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Roll gravel base	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Grade hardstand area	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Cabling	**0**	**0**	**0**	**0**	**0**	**0**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**8**	**0**	**0**	**0**	**0**	**0**	**0**
Trenching	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Laying	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Covering	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Cable and Earthing in Wind Farm	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Delivery of Tower Components	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**0**	**0**	**0**	**0**	**0**	**0**
Loading/ Unloading	0	0	0	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	0	0	0	0	0	0
Storing	0	0	0	0	0	0	10	10	10	10	10	10	10	10	10	10	10	10	0	0	0	0	0	0
Wind Turbine Generator Construction	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**20**
Main crane assembly	0	0	0	0	0	0	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Construction of main WTG sections	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Nacelle section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tower upper section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tower mid section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tower lower section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tower hub section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Tower blade section	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Transmission Lines	**0**	**0**	**0**	**0**	**0**	**0**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**	**32**
Nitrogen Conductor	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
OPGW	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Suspension Poles	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Strain Poles	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Termination Poles	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Insulators	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Line Fittings	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
OPGW Splice Enclosures	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Earthing and Labels	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Container Demurrage	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Electrical Installation	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Construction and assembly of transmission poles	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Installation of transmission lines	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Installation of transmission lines	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Installation of transmission lines	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Concrete footings for transmission poles	0	0	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Control Building and Switchyard	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**50**	**50**	**50**	**50**	**50**	**50**
110kV Circuit Breaker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110kV Disconnector AUD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110kV Earth Switch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110kV VT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110kV Post Insulators	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110kV Surge Arrestors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
110/22kV, 80MVA Transformer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
22kV Main Switchboard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
22kV WTG Switchgear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
22kV WTG Transformers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
Protection	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
SCADA and Telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
AC/DC Aux	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
Steel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Busbars	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Cable and Earthing in Sub-station	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Ancillary Equipment incl. Installation (AC/DC Aux)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Electrical Installation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Installation of Switchyard Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
Installation of Switchyard Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
Installation of Switchyard Equipment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2
Concrete foundation for switchyard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3
Miscellaneous	**26**	**26**	**16**	**16**	**16**	**16**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**18**	**20**	**20**	**20**	**20**	**20**	**22**
Experts	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Site Managers	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
E-suppliers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	4
Contractors	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Site Camp and Temporary Office installation	10	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Staff Amenities	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Waste Transfer/Storage Facilities	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Total no of workers per day	189	171	167	229	229	229	122	119	120	124	124	124	122	119	119	124	124	124	127	124	124	148	148	150
Average (daily) per 3 different phases of wind tower construction	202						122												137					
Average number of workers per day	**154**																							

9. Appendix C Drawings



SCALE 1:1000 (A1)
PLAN AND HORIZONTAL
0 20 40 60 80 100m
20 10

SCALE 1:100 (A1)
VERTICAL
0 2 4 6 8 10m
2 1

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER | REFERENCE DRAWING TITLE

SKM
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CLIENT: MT EMERALD WIND FARM
PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 1

SCALE	DRAWING No	REV
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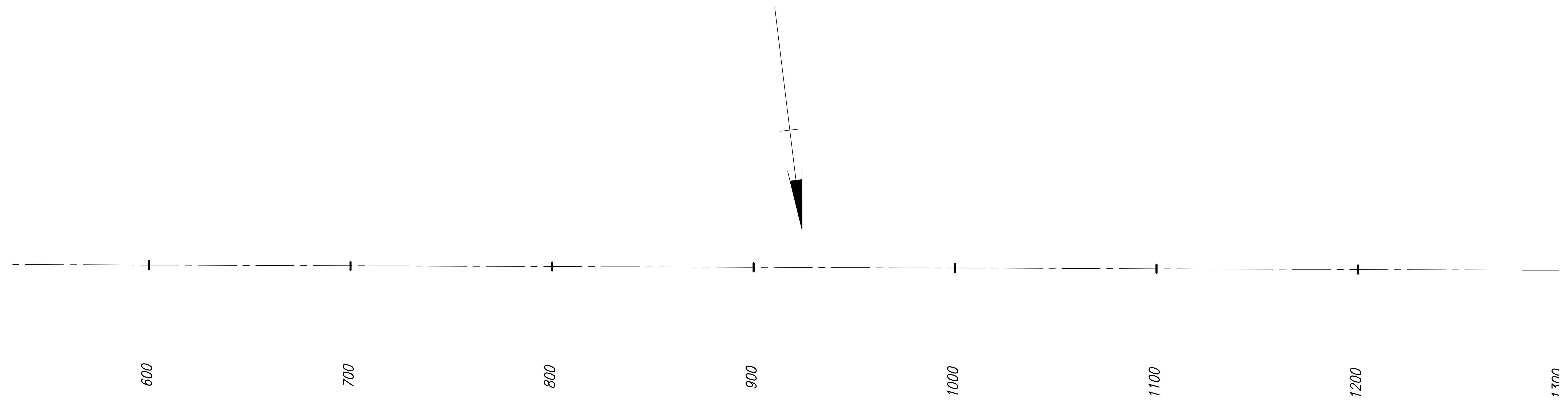

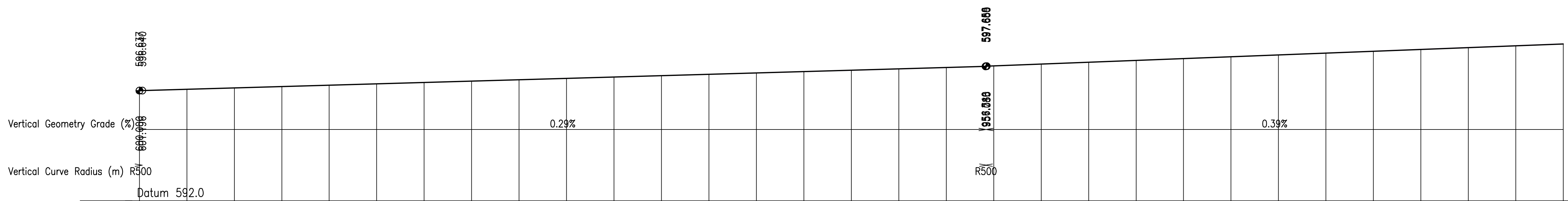

Design Height	596.64	596.69	596.75	596.81	596.87	596.92	596.98	597.04	597.10	597.15	597.21	597.27	597.32	597.38	597.44	597.50
Surf. Height	596.64	596.69	596.75	596.81	596.86	596.92	596.97	597.03	597.09	597.14	597.20	597.26	597.31	597.37	597.42	597.48
Ctrl Chainage	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900
HC DATA																

Design Height	597.55	597.61	597.67	597.75	597.83	597.90	597.98	598.06	598.13	598.21	598.29	598.36	598.44	598.52	598.60
Surf. Height	597.54	597.59	597.67	597.75	597.83	597.91	597.99	598.06	598.14	598.22	598.30	598.38	598.46	598.54	598.62
Ctrl Chainage	920	940	960	980	1000	1020	1040	1060	1080	1100	1120	1140	1160	1180	1200
HC DATA															

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL 20 10 0 20 40 60 80 100m

SCALE 1:100 (A1)
VERTICAL 2 1 0 2 4 6 8 10m

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CLIENT MT EMERALD WIND FARM
PROJECT PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE
PLAN AND LONGITUDINAL SECTION
SHEET 2

SCALE	DRAWING No	REV
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A1

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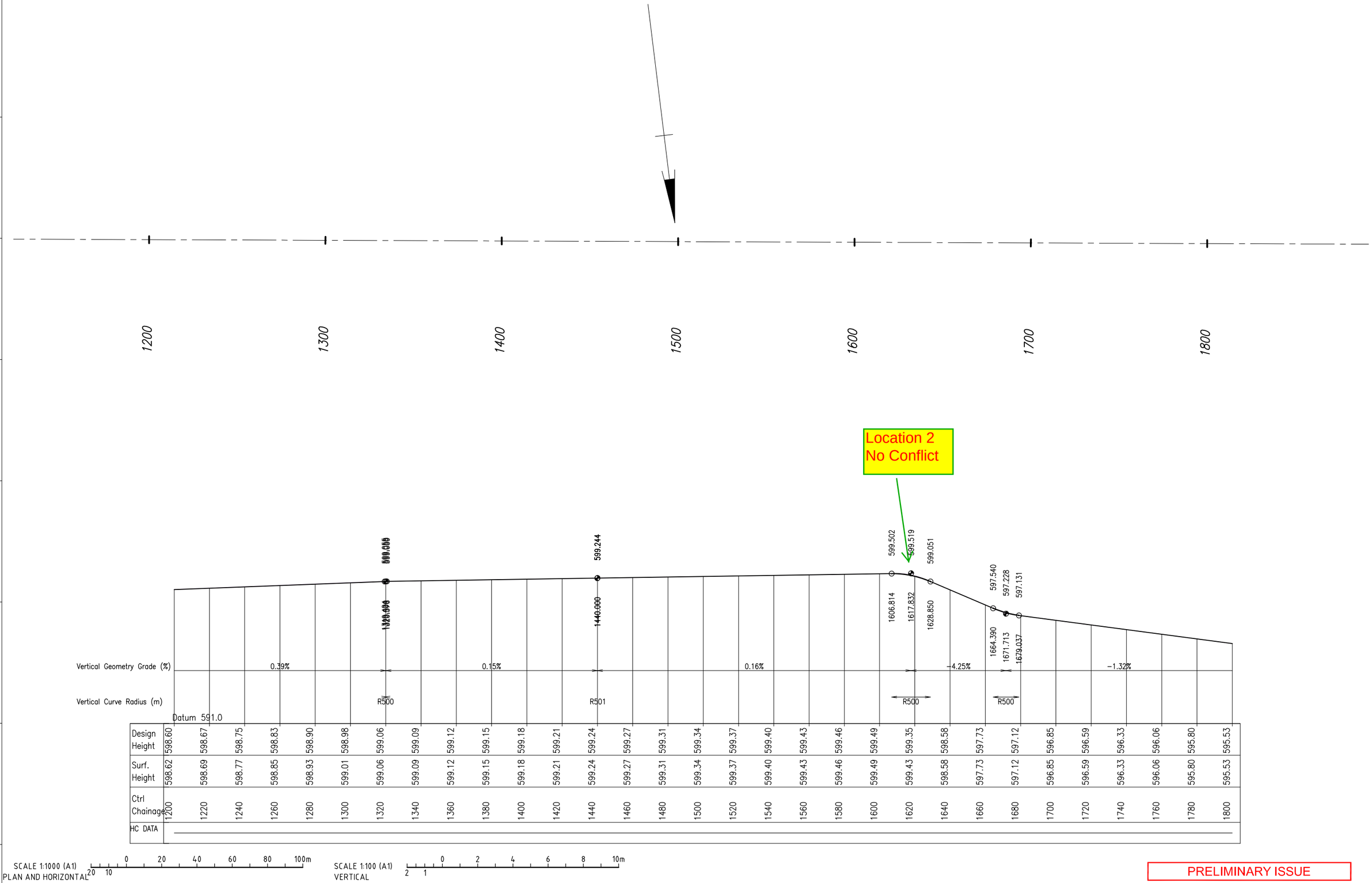

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER | REFERENCE DRAWING TITLE

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HANSEN ROAD AND SPRINGMOUNT ROAD

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DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 3

SCALE	DRAWING No	REV
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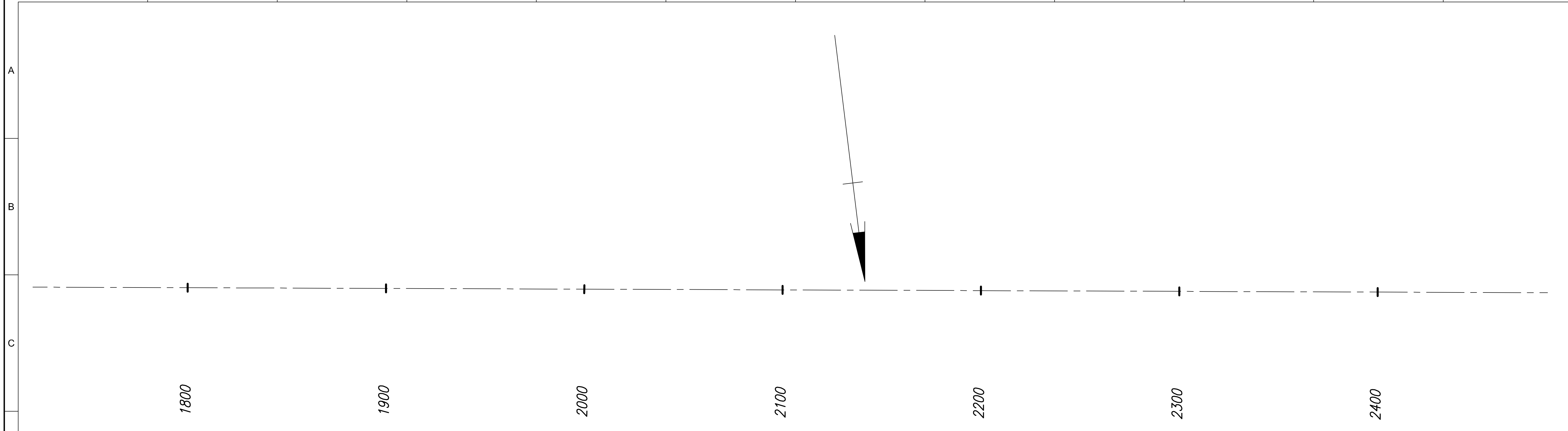

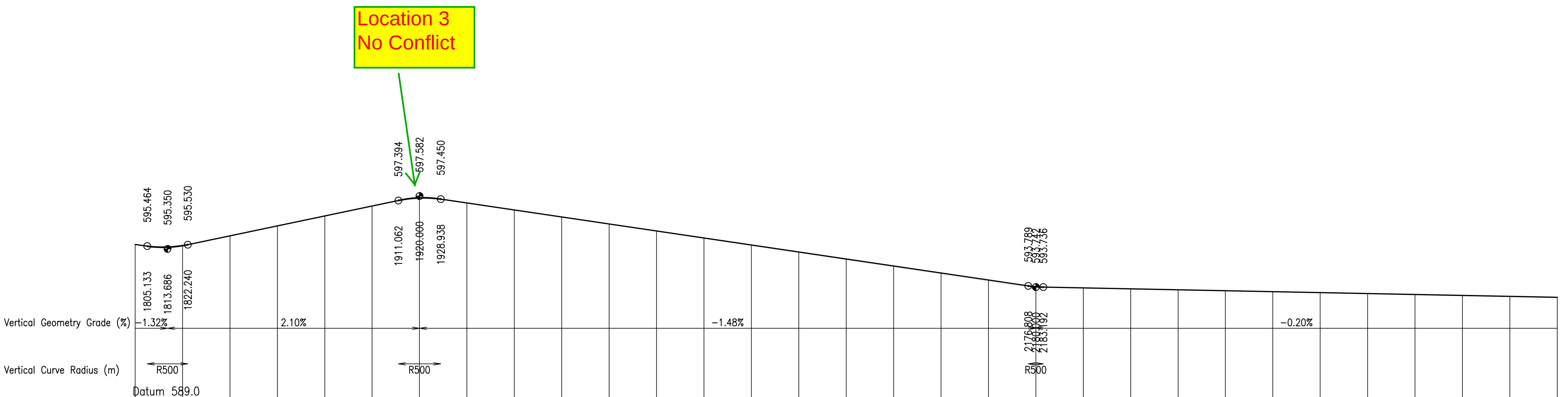

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Design Height	595.53	595.49	595.90	596.32	596.74	597.16	597.50	597.29	596.99	596.70	596.40	596.10	595.81	595.51	595.22
Surf. Height	595.53	595.48	595.90	596.32	596.74	597.16	597.58	597.31	597.00	596.70	596.40	596.10	595.79	595.49	595.19
HC DATA															

Ctrl Chainage	2100	2120	2140	2160	2180	2200	2220	2240	2260	2280	2300	2320	2340	2360	2380	2400
Design Height	594.92	594.63	594.33	594.04	593.75	593.70	593.66	593.62	593.58	593.54	593.50	593.46	593.42	593.38	593.34	593.30
Surf. Height	594.89	594.58	594.28	593.98	593.74	593.71	593.67	593.63	593.59	593.56	593.52	593.48	593.45	593.41	593.37	593.33
HC DATA																

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL
20 10 0 20 40 60 80 100m

SCALE 1:100 (A1)
VERTICAL
2 1 0 2 4 6 8 10m

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

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CLIENT MT EMERALD WIND FARM
PROJECT PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

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DESIGNED | DESIGN REVIEW | DATE | DATE

TITLE
PLAN AND LONGITUDINAL SECTION
SHEET 4

SCALE AS SHOWN
DRAWING No CB24503-ECC-SK-0004
REV A

A1

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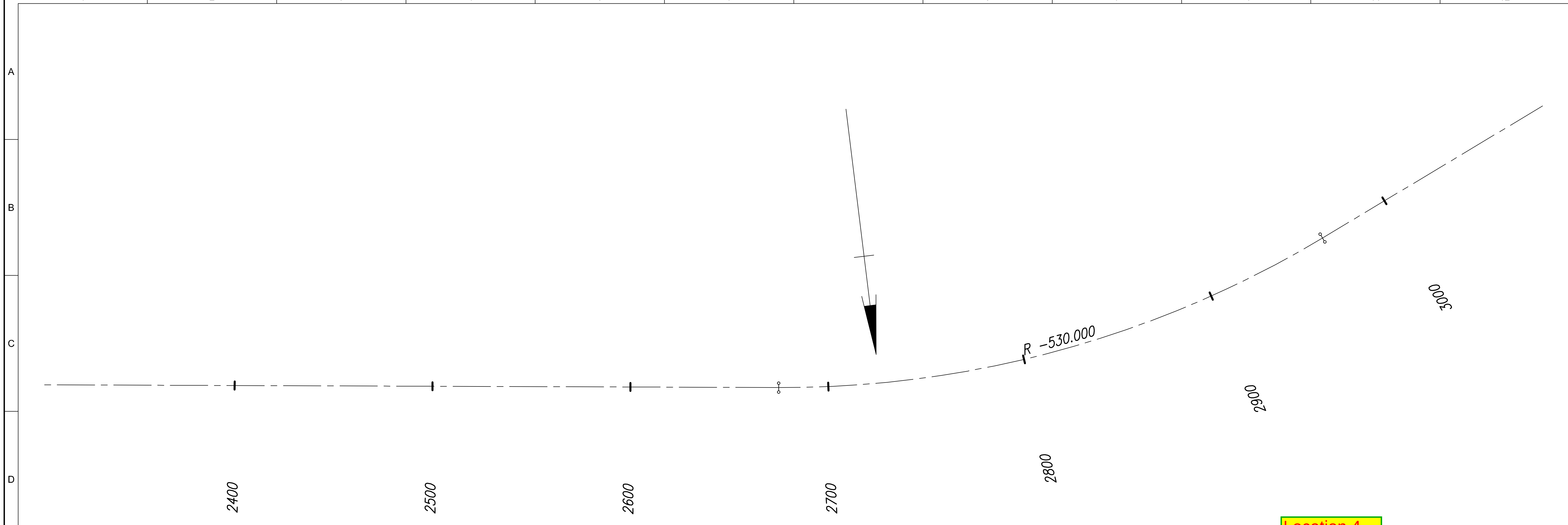

Ctrl Chainage	Design Height	Surf. Height
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2420	593.26	593.30
2440	593.22	593.22
2460	593.06	593.06
2480	592.90	592.90
2500	592.74	592.73
2520	592.58	592.57
2540	592.42	592.41
2560	592.25	592.25
2580	592.09	592.08
2600	591.93	591.92
2620	591.77	591.76
2640	591.61	591.59
2660	591.45	591.43
2680	591.30	591.30
2700	591.20	591.21
2720	591.10	591.11
2740	590.99	591.02
2760	590.89	590.93
2780	590.79	590.79
2800	590.60	590.60
2820	590.40	590.40
2840	590.21	590.21
2860	590.01	590.01
2880	589.91	589.91
2900	589.79	589.81
2920	589.41	589.41
2940	589.01	589.01
2960	588.61	588.61
2980	588.21	588.21
3000	587.81	587.81

HC DATA: R -530m

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL

SCALE 1:100 (A1)
VERTICAL

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

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HANSEN ROAD AND SPRINGMOUNT ROAD

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DESIGNED | DESIGN REVIEW | DATE | DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 5

SCALE: AS SHOWN | DRAWING No: CB24503-ECC-SK-0005 | REV: A

A1

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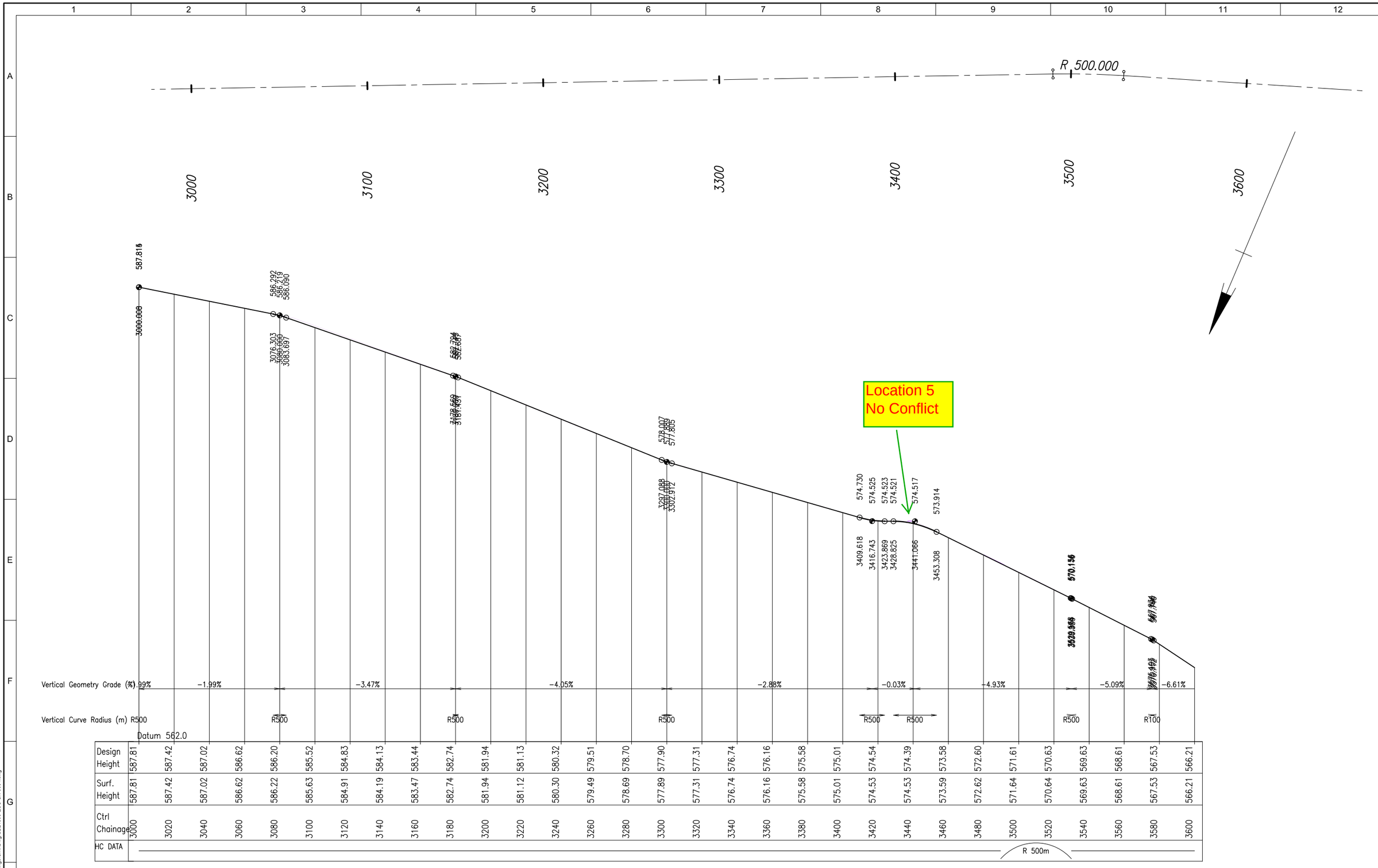

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT: MT EMERALD WIND FARM

PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 6

SCALE	DRAWING No	REV
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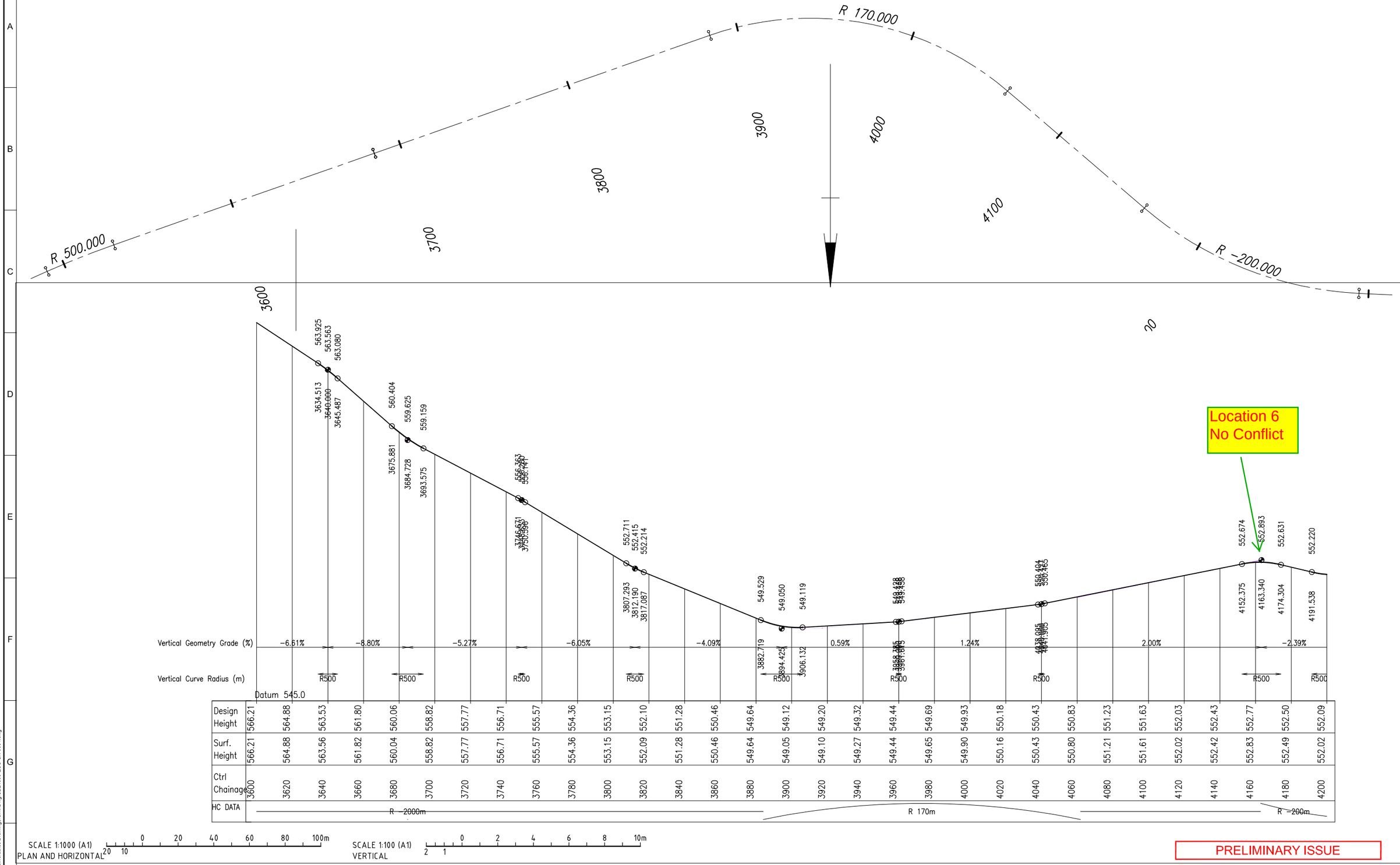

Design Height	566.21	564.88	563.53	561.80	560.06	558.82	557.77	556.71	555.57	554.36	553.15	552.10	551.28	550.46	549.64	549.12	549.20	549.32	549.44	549.69	549.93	550.18	550.43	550.83	551.23	551.63	552.03	552.43	552.77	552.50	552.09
Surf. Height	566.21	564.88	563.56	561.82	560.04	558.82	557.77	556.71	555.57	554.36	553.15	552.09	551.28	550.46	549.64	549.05	549.10	549.27	549.44	549.65	549.90	550.16	550.43	550.80	551.21	551.61	552.02	552.42	552.83	552.49	552.02
Ctrl Chainage	3600	3620	3640	3660	3680	3700	3720	3740	3760	3780	3800	3820	3840	3860	3880	3900	3920	3940	3960	3980	4000	4020	4040	4060	4080	4100	4120	4140	4160	4180	4200

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER | REFERENCE DRAWING TITLE

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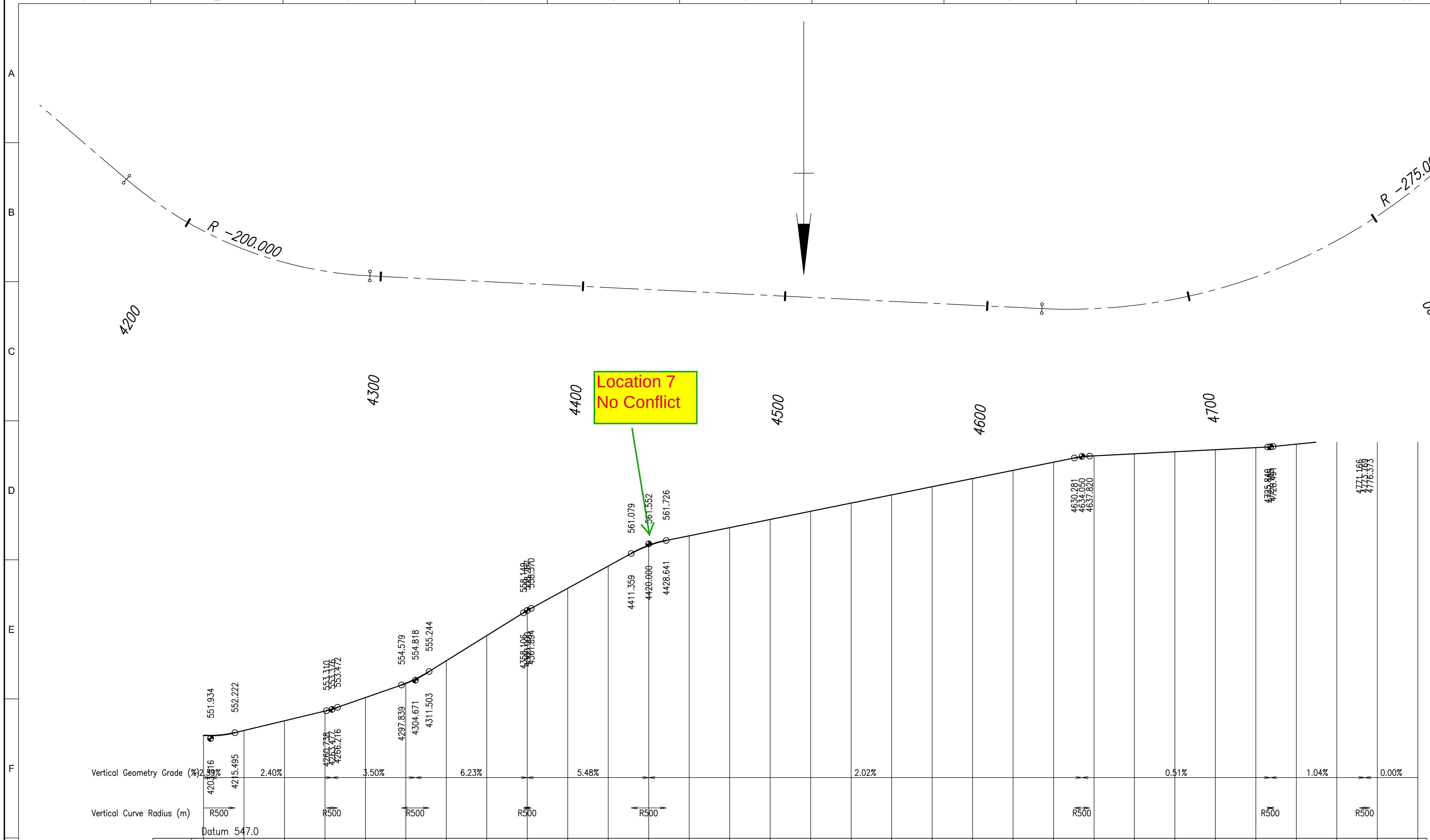
CLIENT: MT EMERALD WIND FARM
PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 7

SCALE	DRAWING No	REV
AS SHOWN	CB24503-ECC-SK-0007	A



Design Height	552.09	552.33	552.81	553.29	553.95	554.66	555.77	557.02	558.26	559.36	560.46	561.48	561.96	562.36	562.76	563.17	563.57	563.97	564.38	564.78	565.19	565.59	565.90	566.01	566.11	566.21	566.31	566.48	566.69	566.83	566.83
Surf. Height	552.02	552.33	552.82	553.29	553.95	554.65	555.80	557.08	558.27	559.36	560.46	561.55	561.96	562.36	562.76	563.17	563.57	563.97	564.38	564.78	565.19	565.59	565.90	566.01	566.11	566.21	566.31	566.48	566.69	566.83	566.83
Ctrl Chainage	4200	4220	4240	4260	4280	4300	4320	4340	4360	4380	4400	4420	4440	4460	4480	4500	4520	4540	4560	4580	4600	4620	4640	4660	4680	4700	4720	4740	4760	4780	4800
HC DATA	R −200m																									R −275m					

SCALE 1:1000 (A1) PLAN AND HORIZONTAL

SCALE 1:100 (A1) VERTICAL

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER	REFERENCE DRAWING TITLE

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CLIENT MT EMERALD WIND FARM

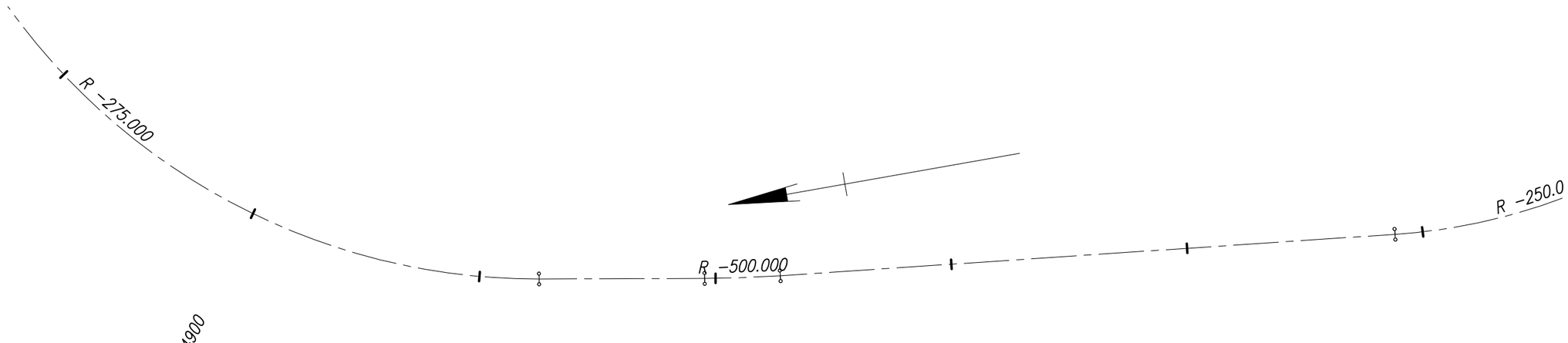
PROJECT PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

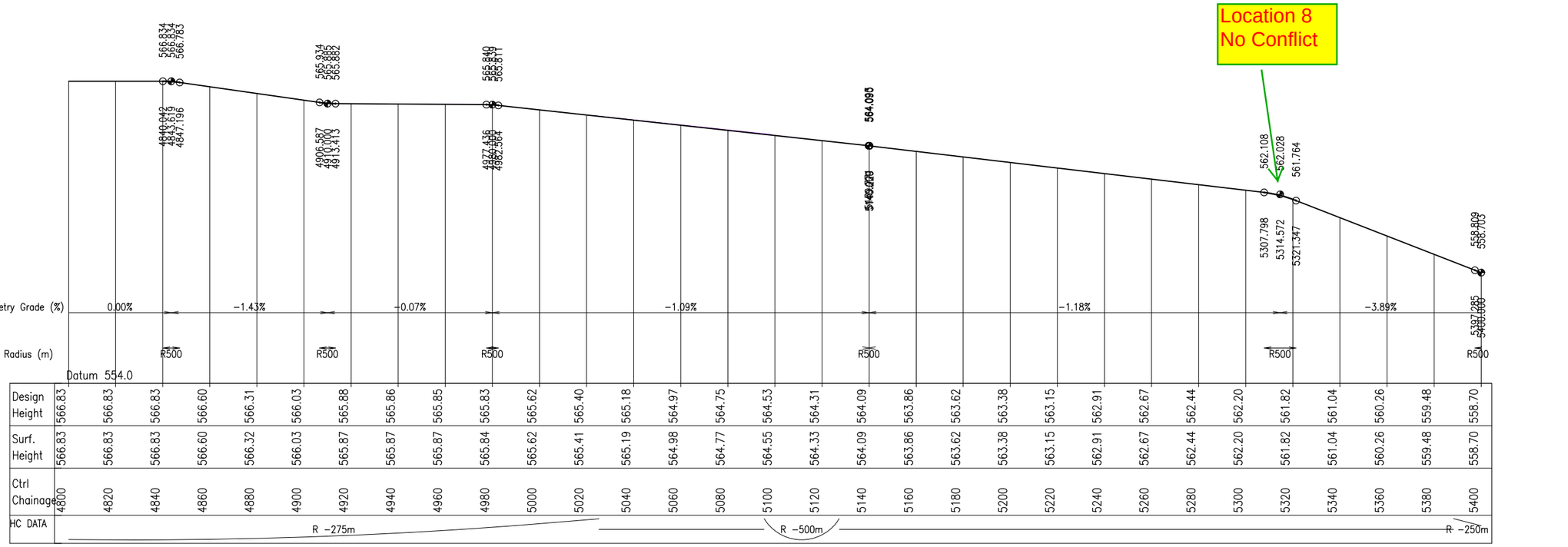
DRAWN | DRAWING CHECK | REVIEWED | APPROVED
DESIGNED | DESIGN REVIEW | DATE | DATE

TITLE
PLAN AND LONGITUDINAL SECTION
SHEET 8

SCALE AS SHOWN | DRAWING No CB24503-ECC-SK-0008 | REV A

A1





Ctrl Chainage	Design Height	Surf. Height
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4820	566.83	566.83
4840	566.83	566.83
4860	566.60	566.60
4880	566.31	566.32
4900	566.03	566.03
4920	565.88	565.87
4940	565.86	565.87
4960	565.85	565.87
4980	565.83	565.84
5000	565.62	565.62
5020	565.40	565.41
5040	565.18	565.19
5060	564.97	564.98
5080	564.75	564.77
5100	564.53	564.55
5120	564.31	564.33
5140	564.09	564.09
5160	563.86	563.86
5180	563.62	563.62
5200	563.38	563.38
5220	563.15	563.15
5240	562.91	562.91
5260	562.67	562.67
5280	562.44	562.44
5300	562.20	562.20
5320	561.82	561.82
5340	561.04	561.04
5360	560.26	560.26
5380	559.48	559.48
5400	558.70	558.70

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL
0 20 40 60 80 100m
20 10

SCALE 1:100 (A1)
VERTICAL
0 2 4 6 8 10m
2 1

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER	REFERENCE DRAWING TITLE

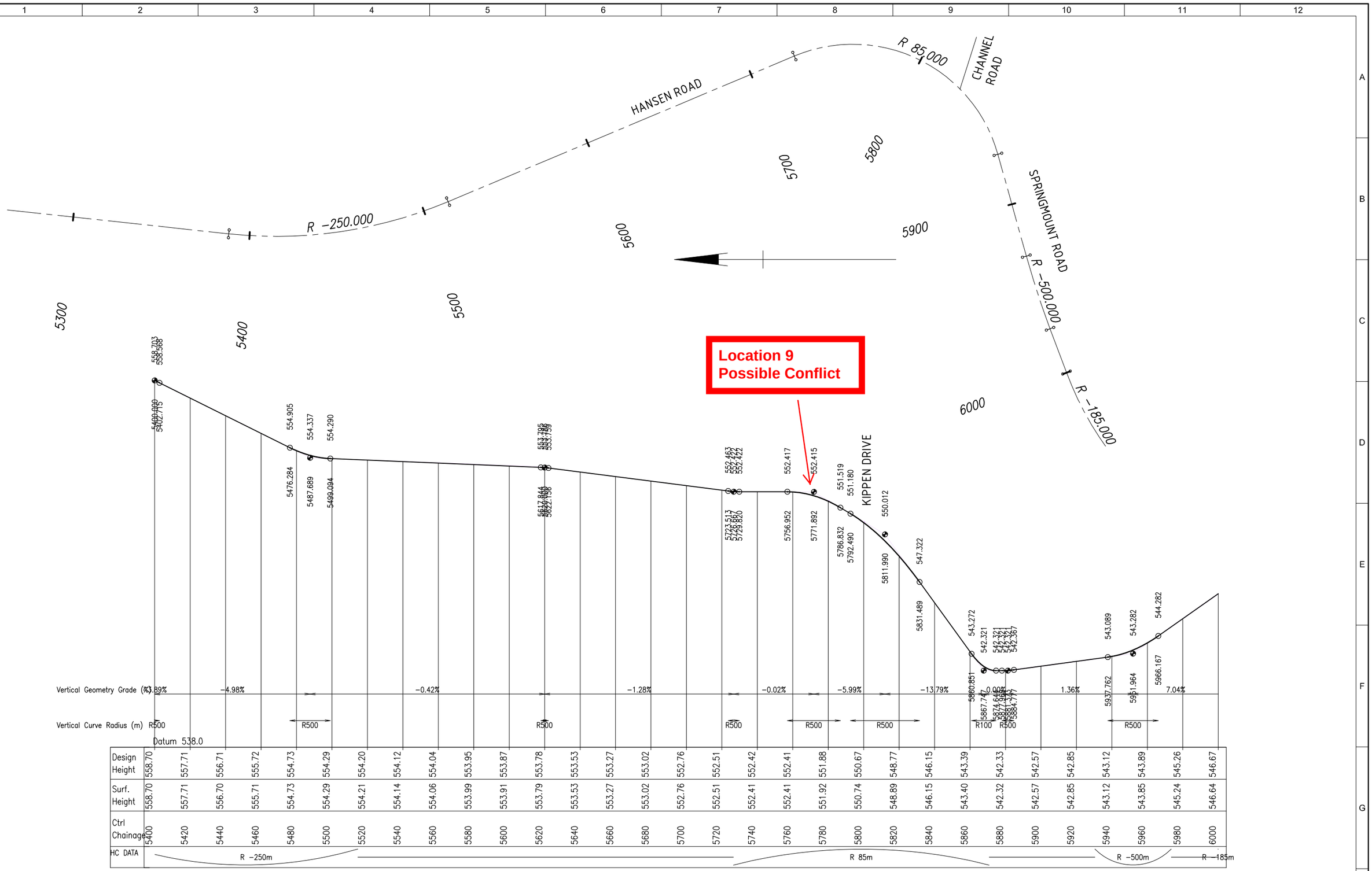
SKM
A.C.N 001 024 095
Sinclair Knight Merz
2 James Street
CAIRNS, QLD 4870
AUSTRALIA
Tel: +61 7 4031 4599
Fax: +61 7 4031 3967
Web: www.globalskm.com

CLIENT: MT EMERALD WIND FARM
PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 9

SCALE	DRAWING No.	REV
AS SHOWN	CB24503-ECC-SK-0009	A



SCALE 1:1000 (A1) PLAN AND HORIZONTAL 0 10 20 40 60 80 100m

SCALE 1:100 (A1) VERTICAL 0 1 2 4 6 8 10m

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER | REFERENCE DRAWING TITLE

SKM
A.C.N 001 024 095
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CLIENT: MT EMERALD WIND FARM

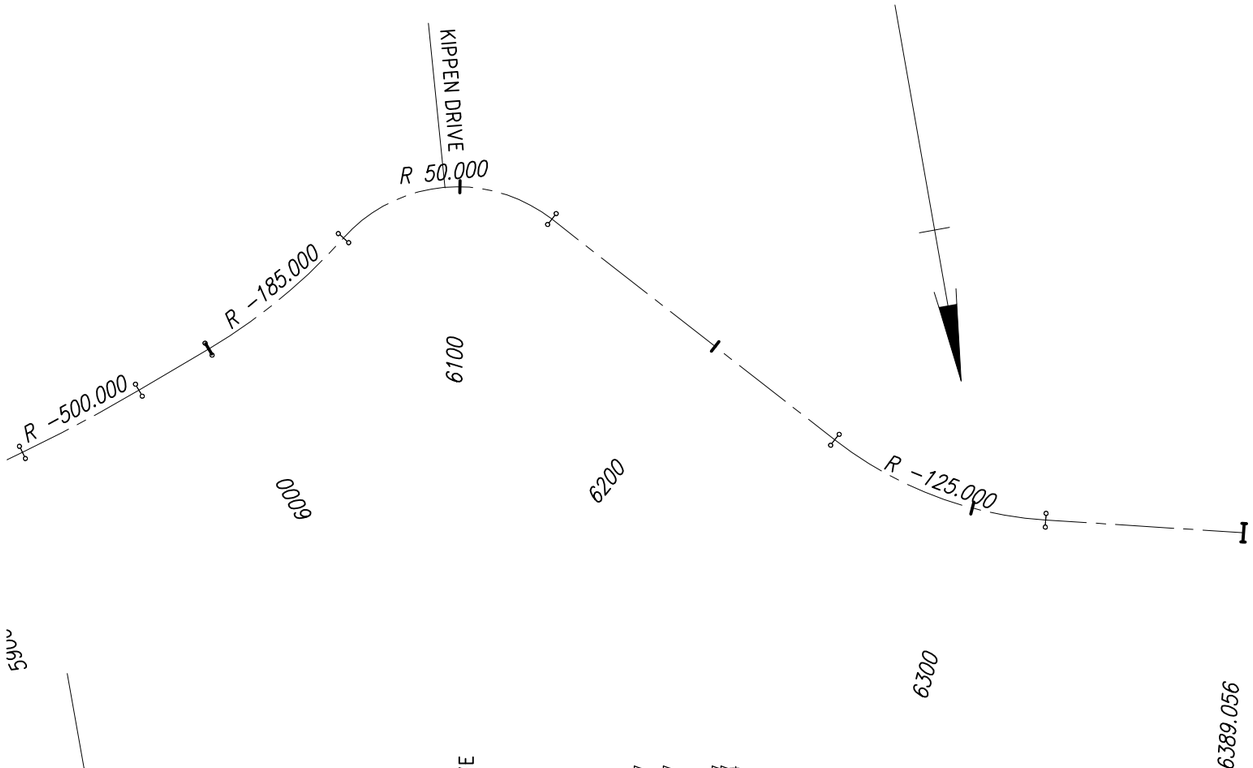
PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 10

SCALE	DRAWING No	REV
AS SHOWN	CB24503-ECC-SK-0010	A

DATE: 25/10/2012 2:27:49 PM LOGIN NAME: TRUNDLE, JEREMY (SKM)
LOCATION: I:\CB\Projects\CB24503\Deliverables\Drawings\Civil\Dwg\CB24503-ECC-SK-0001.dwg



Design Height	546.67	548.10	549.85	551.04	551.87	552.68	553.45	554.17	554.34	554.24	554.01	553.78	553.55	553.23	552.71	552.19
Surf. Height	546.64	548.07	549.88	551.02	551.88	552.68	553.42	554.21	554.34	554.24	554.01	553.77	553.54	553.23	552.74	552.21
Ctrl Chainage	6000	6020	6040	6060	6080	6100	6120	6140	6160	6180	6200	6220	6240	6260	6280	6300
HC DATA	R -185m			R 50m										R -125m		

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL
0 20 40 60 80 100m
20 10

SCALE 1:100 (A1)
VERTICAL
0 2 4 6 8 10m
2 1

PRELIMINARY ISSUE

REV	DATE	DRAWN	REV'D	APP'D	REVISION
A					PRELIMINARY

DRAWING NUMBER | REFERENCE DRAWING TITLE

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CLIENT: MT EMERALD WIND FARM
PROJECT: PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

DRAWN	DRAWING CHECK	REVIEWED	APPROVED
DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 11

SCALE: AS SHOWN
DRAWING No: CB24503-ECC-SK-0011
REV: A

DATE: 25/10/2012 2:27:01 PM LOGIN NAME: TRUNDLE, JEREMY (SKM)
LOCATION: I:\CB\Projects\CB24503\Deliverables\Drawings\Civil\Dwg\CB24503-ECC-SK-0001.dwg