Mount Emerald Wind Farm Traffic Impact Assessment

RATCH-AUSTRALIA CORPORATION LIMITED

Technical Note 2 - Traffic Impact Assessment Engineering Response

Traffic Impact Questions 23 to 26 | Rev 1

Response to Ministerial Call-In Information Request - TRAFFIC

29 August 2014

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Mount Emerald Wind Farm Traffic Impact Assessment

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Contents

Executive Summary

This technical note responds to queries from the State Government regarding the potential traffic impact of the proposed Mount Emerald Wind Farm (MEWF). Traffic Impact queries are addressed in Questions 23 to 26.

Question 23: Provide a clear description of all possible access routes (in their entirety) to the site for oversized vehicles. This should include at least a high level identification of constraints along the network and identification of measures that would be put in place to allow State Government and council to assess these impacts.

In response to Question 23, two possible access routes for oversized vehicles were identified: the first via the Palmerston Highway, the second via the Kennedy Highway. A high-level investigation of constraints suggests that checks should be conducted for the full length of each route to determine restrictions to oversized vehicles. Such restrictions include horizontal and vertical geometry, horizontal and vertical clearance, and the structural integrity of culvert and bridge crossings. Appropriate permits and escorts may need to be obtained, and traffic control measures may need to be implemented to allow passage of the proposed oversized vehicles.

Question 24: An assessment of the access to site (along Hansen Road and Springmount Road) for vertical geometry which utilises recent survey data.

In response to Question 24, it was noted that more recent survey data or appropriate 3D mapping does not exist to provide a more detailed vertical geometry assessment of Hansen Road and Springmount Road. GPS long section drawings are provided from a previous technical note (SKM 2012) identifying possible points of conflict.

Question 25: Provide further information on how staff travel to site can be managed in a way that will allow the maximum number of staff vehicles to remain below 30 vehicles per day as indicated in the Traffic Impact Assessment.

In response to Question 25, the estimate of 30 vehicles per day for construction staff traffic is achievable based on eight 30-seater busses, eight light vehicles, and a nominal 10 additional vehicles for various purposes. These figures were based on pre-feasibility estimates of worker numbers and construction schedules that would need to be confirmed by the nominated contractor in their construction traffic management plan. It is recommended that this plan be developed in consultation with relevant stakeholders.

Question 26: Should sufficient measures to restrict staff traffic to 30 vehicles per day not be provided, a new assessment identifying the worst case traffic impact on the road network should be provided.

In response to Question 26, a new assessment identifying the worst case traffic impact on the road network is not required as it is possible to restrict staff traffic to less than 30 vehicles per day.

These conclusions are given strictly in accordance with and subject to the following limitations and recommendations:

> The sole purpose of this report and the associated services performed by Jacobs is to respond to an information request as part of ministerial call-in by the State Government for the assessment of the MEWF Project as proposed by RATCH-Australia Corporation Limited in accordance with the scope of services set out in the contract between Jacobs and the Client (RATCH-Australia Corporation Limited). That scope of services, as described in this report, was developed with the Client.
>
> In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change.
>
> Jacobs derived the data in this report from information sourced from the Client (if any) and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations, and conclusions expressed in this report.

Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations, and findings expressed in this report, to the extent permitted by law.

This report should be read in full and in conjunction with the following reports:

- Mount Emerald Wind Farm Traffic Impact Assessment (TIA) – 8 August 2011 undertaken by SKM. This report will be referred to as SKM 2011
- Technical Note: Mount Emerald Wind Farm Traffic Impact Assessment Engineering Responses - 19 December 2012 undertaken by SKM. The report will be referred to as SKM 2012

No excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

Specific limitations include:

- Estimations of worker numbers, vehicle numbers, and types of vehicles required were provided by the Client, and parent company Transfield Services (Australia) Pty Limited, as noted in the above-mentioned reports
- Client-imposed budget and time restraints in obtaining more recent survey data, other than that gathered for the above-mentioned reports

This report has been prepared on behalf of, and for the exclusive use of, Jacobs' Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

1. Introduction

1.1 Purpose of this Document

Jacobs Group (Australia) Pty Ltd (Jacobs) has been commissioned by RATCH-Australia Corporation Ltd (RATCH-Australia) to provide a technical response to a further round of information requests. The proposed Mount Emerald Wind Farm (MEWF) project has been called-in by the State Government for assessment. The purpose of this report is to provide engineering input to the State Government's queries regarding the impact of traffic generated by the proposed MEWF (Questions 23 to 26).

1.2 Background and Current Situation

The proposed project is situated on the Atherton Tableland within the jurisdiction of Tablelands Regional Council (TRC) and is located approximately 50 kilometres south-west of Cairns in Far North Queensland. More specifically, the site is 18 kilometres south of the township of Mareeba, 15 kilometres north of Atherton, and 6 kilometres south-west of Walkamin.

The major road adjacent to the proposed site is the Kennedy Highway, which runs in a north-south direction between Mareeba and Atherton. This road 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 Kennedy Highway at Walkamin, the recommended (and most viable) route to the proposed MEWF site is via Hansen Road and Springmount Road, and direct access to the site is off Kippen Drive. All of these roads are locally controlled by TRC and are generally two lane, two-way, sealed roads with unsealed shoulders and verges. Kippen Drive, however, is an unbound gravel road/track.

Based on information received from RATCH-Australia, a maximum of 75 wind turbines are planned for construction. A tourist viewing facility is also likely to be built but its location is currently undetermined.

Jacobs (previously Sinclair Knight Merz) provided technical assistance with the Mount Emerald Wind Farm Traffic Impact Assessment (TIA), dated 8 August 2011. Following this, TRC requested further information. This was provided as Technical Note: Mount Emerald Wind Farm Traffic Impact Assessment Engineering Responses, dated 19 December 2012. The proposed MEWF project has now been called-in by the State Government for assessment. As part of this process, there has been a request for additional information. The following sections address Questions 23 to 26 regarding the potential traffic impact of the proposed MEWF project.

2. Response to Question 23

2.1 Query

Provide a clear description of all possible access routes (in their entirety) to the site for oversized vehicles. This should include at least a high level identification of constraints along the network and identification of measures that would be put in place to allow State Government and council to assess these impacts.

2.2 Response

Two possible access routes for oversized vehicles were analysed in their entirety from Cairns Port to Mount Emerald. Maps detailing these two routes have been included in Appendix A of this report. A summary of each route is detailed in Table 2-1 below:

Table 2-1 Possible access routes for oversized vehicles from Cairns Port to Mount Emerald

Route No.	Traversed Roads
1	Dutton Street, Kenny Street, Draper Street, Bruce Highway (Ray Jones Drive), Bruce Highway (Innisfail – Cairns), Palmerston Highway (Innisfail – Ravenshoe), Millaa Millaa – Malanda Road, Malanda – Atherton Road, Mars Lane, Tinaroo Falls Dam Road, Kairi Road, Lawson Street, Kennedy Highway (Mareeba – Ravenshoe), Hansen Road, Springmount Road, Kippen Drive.
2	Dutton Street, Kenny Street, Port Connection Road (Bunda Street), Martyn Street, Mulgrave Road, Sheridan Street, Captain Cook Highway (Cairns - Mossman), Kennedy Highway (Cairns - Mareeba), Kennedy Highway (Mareeba - Ravenshoe), Hansen Road, Springmount Road, Kippen Drive

Of the roads listed in each route above, Dutton Street and Kenny Street (partial) are controlled by Cairns Regional Council, and Marks Lane, Kiari Road, Lawson Street, Hansen Road, Springmount Road and Kippen Drive are controlled by TRC. All other listed roads are state controlled roads maintained by the Department of Transport and Main Roads (TMR). It is noted that all roads forming *Route 1* to Hanson Road are gazetted B-Double routes while the Kennedy Highway (Cairns – Mareeba) which forms a section of *Route 2* is a non-approved B-Double route. It is suggested that Lawson Street is utilised for both directions of travel on *Route 2* to avoid traversing through the township of Tolga when transporting large material components despite being a gazetted B-Double route for south bound traffic only.

A high level identification of constraints and measures, which may be required to be implemented, has been completed for each route to allow State Government and Councils to assess the impact of these constraints:

It is recommended that a horizontal and vertical (crests and sags) geometry check, in addition to checking the vehicle envelope, is completed for the full length of each route. Due to their generally narrower road widths, it is noted that the horizontal geometry of Council-controlled roads should be checked. Horizontal geometry limits and overhanging rainforest canopy experienced on the Kennedy Highway (Cairns – Mareeba) via *Route* 2 will not permit the turn paths and the large envelope exhibited by the B-Doubles when transporting larger components (such as the rotor blade, hub, machine house components and steel sections). Contrary to this, there may be the potential for vehicle configurations with a smaller vehicle envelope and tighter turn path to utilise *Route* 2 when transporting smaller components under a permit as it is significantly shorter in comparison to *Route 1*.

Due to the substantial turn paths and large vehicle envelope exhibited by the oversized vehicles and material components, traffic control may be required at intersections where over-dimensional vehicles

(wide loads) are required to turn. These intersections have been identified for both Routes 1 and 2 and are detailed in Table 2-2 and Table 2-3, respectively (refer below). Also listed for each intersection are minor works and additional control measures that may need to be implemented.

Table 2-2 Intersections potentially requiring traffic control and measures involving minor works – Route 1

Intersection	Potential measures/works that may be require implementation
Dutton St / Kenny St	• Traffic Control • Remove and re-erect signage • Check clearance to railway crossing signals • Check clearance to overhead power lines
Kenny St / Draper St (roundabout)	• Traffic Control • Remove and re-erect signage • Check clearance to overhead power lines
Draper St / Bruce Highway (Ray Jones Drive)	• Traffic Control • Remove and re-erect signage • Check clearance to signal mast arms
Bruce Highway (Innisfail - Cairns) / Palmerston Highway (Innisfail - Ravenshoe)	• Traffic Control • Remove and re-erect signage
Millaa Millaa - Malanda Road / Malanda - Atherton Road	• Traffic Control • Check clearance to overhead power lines
Malanda - Atherton Road / Marks Lane	• Traffic Control
Marks Lane / Tinaroo Falls Dam Road	• Traffic Control • Remove and re-erect signage
Tinaroo Falls Dam Road / Kiari Road	• Traffic Control • Check clearance to overhead power lines
Kiari Road / Lawson St	• Traffic Control • Check clearance to overhead power lines • Remove and re-erect signage
Lawson St / Kennedy Highway (Mareeba - Ravenshoe)	• Traffic Control
Kennedy Highway (Mareeba - Ravenshoe) / Hanson Road	• Traffic Control

Table 2-3 Intersections potentially requiring traffic control and measures involving minor works – Route 2

Intersection	Potential measures/works that may be require implementation
Dutton St / Kenny St	• Traffic Control • Remove and re-erect signage • Check clearance to railway crossing signals • Check clearance to overhead power lines
Kenny St / Port Connection Road (Bunda Street)	• Traffic Control • Remove and re-erect signage • Check clearance to overhead power lines
Port Connection Road (Bunda Street) / Martyn Street	• Traffic Control • Remove and re-erect signage • Check clearance to overhead power lines
Martyn Street / Mulgrave Road	• Traffic Control • Remove and re-erect signage • Check clearance to overhead power lines
Mulgrave Road / Captain Cook Highway (Sheridan Street)	• Traffic Control • Remove and re-erect signage
Captain Cook Highway (Cairns - Mossman) / Kennedy Highway (Cairns - Mareeba) (Roundabout)	• Traffic Control
Kennedy Highway (Mareeba - Ravenshoe) / Hanson Road	• Traffic Control

Any areas requiring a temporary lane closure must comply with the *Far North Queensland – Table of Allowable Lane Closures (TALC)* and will require an approved Traffic Guidance Scheme and Traffic Management Plan prior to implementation. It is also suggested that a Community Liaison Officer is utilised to communicate lane closures with the relevant Local Authorities; local business or organisations which may be affected; and the general public. It should be noted that these issues are not restricted to the locations noted above and the following issues may be experienced along the entire route:

- Vertical clearance of vehicle envelope to overhead power lines, gantry signs, signal mast arms, street lights and overhead fauna crossings (rope bridge, Palmerston Highway and Kennedy Highway (Cairns – Mareeba)) should be assessed to determine if there is a requirement to consult/engage the Department of Transport and Main Roads (TMR), Cairns Regional Council, Tablelands Regional Council or Ergon Energy as applicable for any adjustments that may be required to their assets.
- Structural integrity of culvert and bridge crossings should be determined by consulting TMR, Cairns Regional Council or Tablelands Regional Council as applicable to request recent inspections including details of type of inspection carried out. Further assessments may be required depending on the completeness of previous inspections.
- Requirement for permits and escorts to traverse the detailed routes should be identified and obtained as required.

It is recommended that a visual inspection is completed to identify areas of potential conflict along the entirety of the route prior to the commencement of any localised detailed investigations (if required).

3. Response to Question 24

3.1 Query

An assessment of the access to site (along Hansen Road and Springmount Road) for vertical geometry which utilises recent survey data.

3.2 Response

To the best of our knowledge, recent survey or adequate topographical data does not exist at this time to allow a more detailed assessment of the access to site via Hansen Road and Springmount Road. Several sources were investigated, including the Queensland Government's Physical Road Network, and Geoscience Australia's Digital Topographic Data. However, at the time of this report, the Digital Elevation Model (DEM) has insufficient detail to perform such an investigation, and the Physical Road Network currently provides horizontal geometry only. In addition, survey from remote-sensing methods, such as Light Detection and Ranging (LiDAR), does not currently exist.

The Technical Note: Mount Emerald Wind Farm Traffic Impact Assessment Engineering Responses, undertaken by SKM 2012, provides a response to a query from the TRC, "Demonstrating the capability of the vertical profiles of Hansen and Springmount Roads accommodating any proposed drop deck or low loader transport of turbine components." This assessment of vertical geometry was based on a best fit to the GPS data recorded during a vehicle drive-through of the route as no detailed survey existed. The response to TRC 51 is included for information in Appendix B and the longitudinal sections, issued as Appendix C of the SKM 2012 technical report, are included in Appendix C of this report.

4. Response to Question 25

4.1 Query

Provide further information on how staff travel to site can be managed in a way that will allow the maximum number of staff vehicles to remain below 30 vehicles per day as indicated in the Traffic Impact Assessment.

4.2 Response

To respond to the Question 25 of the ministerial call (dated 11 June 2014), the following reports were reviewed:

- Technical Note: Mount Emerald Wind Farm Traffic Impact Assessment Engineering Responses - 19 December 2012 undertaken by SKM. The report will be referred to as SKM 2012
- Mount Emerald Wind Farm Traffic Impact Assessment (TIA) – 8 August 2011 undertaken by SKM. This report will be referred to as SKM 2011

Based on the information reviewed, the SKM 2011 TIA report assumes a maximum of 30 vehicles per day for workers during the construction stage of the project. Appendix B of the SKM 2012 technical report outlines in detail the estimated number of workers per month for the two year construction phase. Figure 4-1 summarises the estimated total number of workers during the construction phase (based on the information provided within Appendix D (From SKM 2012 Appendix B)).

Figure 4-1 outlines the total estimated workers for the project during the construction phase (blue line) which includes the estimated construction-related workers (green line) and the estimated skilled/unskilled contract labourers (red line).

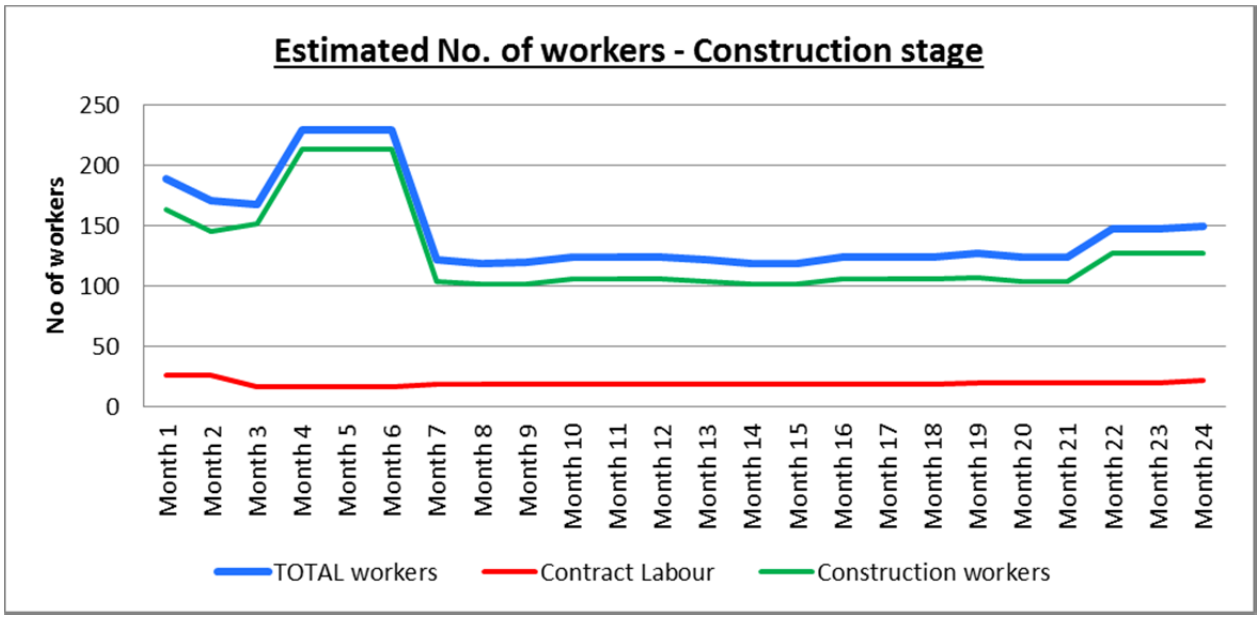


Figure 4-1 Estimated total number of workers during construction stage (24 months)

The estimated maximum numbers of workers expected to be on site during month 4 to month 6 of the construction phase is approximately 229. Of these 229 workers, 16 workers will be contract skilled and unskilled labourers and are expected to arrive and depart the site via individual or shared private vehicles.

The following assumptions (which are consistent with the previous traffic reports) have been adopted for the assessment:

- All construction workers are expected to arrive and depart the project site via dedicated 30 seater worker buses. These buses will have several pick up and drop off points at key townships
- All skilled and unskilled contract labourers are expected to arrive and depart the project site via their own vehicles. It is expected that some skilled and unskilled labourers arriving and departing the project site will carpool. Given the remote location of the project site to key townships, a conservative carpooling ratio of two people per car for the skilled and unskilled contract labours was adopted for this assessment

Based on the assumptions above, the maximum number of trips generated by the estimated number of workers during the construction is expected to be 16 vehicles per day, which comprise eight 30-seater buses and eight light vehicles. To provide a robust assessment, a nominal 10 additional vehicles per day has been added to allow for unscheduled visits, deliveries, private vehicles, miscellaneous tasks, and for construction workers who need to bring their own vehicles with trade specific tools. This makes an estimated total of 26 vehicle movements at the site per day.

Therefore, the estimated number of worker-related vehicles travelling to/from the project site is expected to be 26 vehicles per day which is expected to occur for only 3 of 24 months during the construction phase. The worker-related vehicles generated per day for the remaining 21 months will be less than the anticipated 26 vehicles per day experienced during the peak construction phase.

The estimated number of worker-related vehicles to /from the project site is less than the assumed 30 vehicles per day outlined within the SKM 2011 TIA report and SKM 2012 technical note. However, to maintain the number of worker-related vehicles arriving/departing the project site at or below the expected 30 vehicles per day, the following recommendations should be adopted by the client and the nominated construction contractor during the construction phase:

- The nominated construction contractor will provide a 30-seater shuttle bus services for construction workers arriving and departing the project site.
- The 30-seater shuttle bus will service the key townships where the construction workers live.
- Provide minimal or restricted on-site parking to discourage workers arriving to and departing from the project site via private vehicles.

These measures should be outlined in detail within the construction management plan to be developed in close consultation with the relevant Local Authorities and stakeholders.

Note that the estimated work-related vehicles per day outlined within this assessment are for a pre-feasibility design level. The construction schedule and estimated number of workers for each task may vary depending on the construction methods adopted by the nominated contractor for this project. Detailed worker numbers and construction schedules would become available once the project execution contracts have been awarded, which can only occur once this project is approved. Any changes to the construction worker numbers and schedules would be captured within a detailed construction traffic management plan which should be undertaken during the post approval stage in close consultation with the relevant Local Authorities and stakeholders.

5. Response to Question 26

5.1 Query

Should sufficient measures to restrict staff traffic to 30 vehicles per day not be provided, a new assessment identifying the worst case traffic impact on the road network should be provided.

5.2 Response

It should be noted that the estimated work-related vehicles per day outlined within this assessment is for a pre-feasibility design level. The construction schedule and estimated number of workers for each task may vary depending on the construction methods adopted by the nominated contractor for this project. Detailed worker numbers and construction schedules would become available once the project execution contracts have been awarded, which can only occur once this project is approved. Any changes to the construction worker numbers and schedules would be captured within a detailed construction traffic management plan which should be undertaken during the post approval stage in close consultation with the relevant Local Authorities and stakeholders.

6. Conclusion

This technical note has addressed the queries from the State Government, Questions 23 to 26, regarding the potential traffic impact of the proposed MEWF project.

In response to Question 23, two possible access routes for oversized vehicles were described: the first via Palmerston Highway, and the second via Kennedy Highway. A high-level investigation of constraints detected oversized vehicle restrictions; possible horizontal and vertical geometry and clearance limitations; and potential structural integrity issues for culvert and bridge crossings. Checks should be conducted for the full length of each route to determine geometry, clearance, and culvert/bridge restrictions to the vehicle and its envelope. Appropriate permits and escorts will need to be obtained for the passage of oversized vehicles, and control measures will need to be implemented to accommodate the substantial turn paths and envelope of larger vehicles.

As noted in the response to Question 24, more recent survey data does not exist to provide a more detailed vertical geometry assessment of Hansen Road and Springmount Road. Points of possible vertical geometry conflict were provided from the SKM 2012 technical note.

The response to Question 25 confirms that travel to site could be managed so that the number of staff vehicles remains below 30 vehicles per day during the busiest construction stage. This is based on a pre-feasibility estimate of eight 30-seater busses, eight light vehicles, and a nominal 10 additional vehicles for various purposes. Detailed worker numbers and construction schedules would need to be confirmed by the nominated contractor for the project prior to submission of a construction traffic management plan developed in consultation with the relevant Local Authorities and stakeholders.

As noted in the response to Question 25, it is possible to restrict staff traffic to 30 vehicles per day. Therefore, a new assessment identifying the worst case traffic impact on the road network is not required for Question 26.

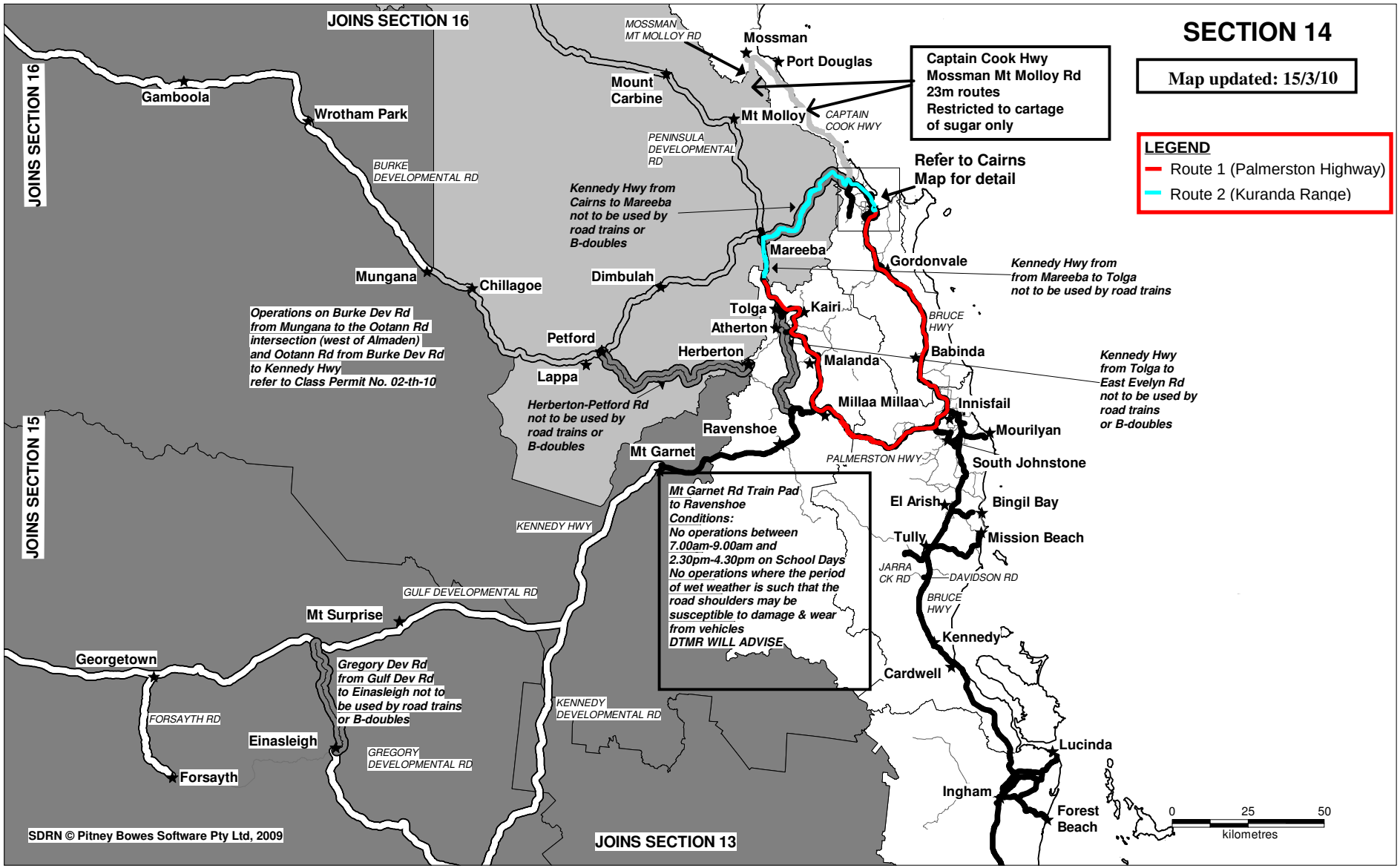
As stated previously, this report should be read in full and in conjunction with the following reports:

- Mount Emerald Wind Farm Traffic Impact Assessment (TIA) – 8 August 2011 undertaken by SKM.This report will be referred to as SKM 2011
- Technical Note: Mount Emerald Wind Farm Traffic Impact Assessment Engineering Responses - 19 December 2012 undertaken by SKM. The report will be referred to as SKM 2012

Appendix A. Multi-Combination Routes in Queensland: selection of maps with proposed routes

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



B-DOUBLES
23 metre routes
23 & 25 metre routes

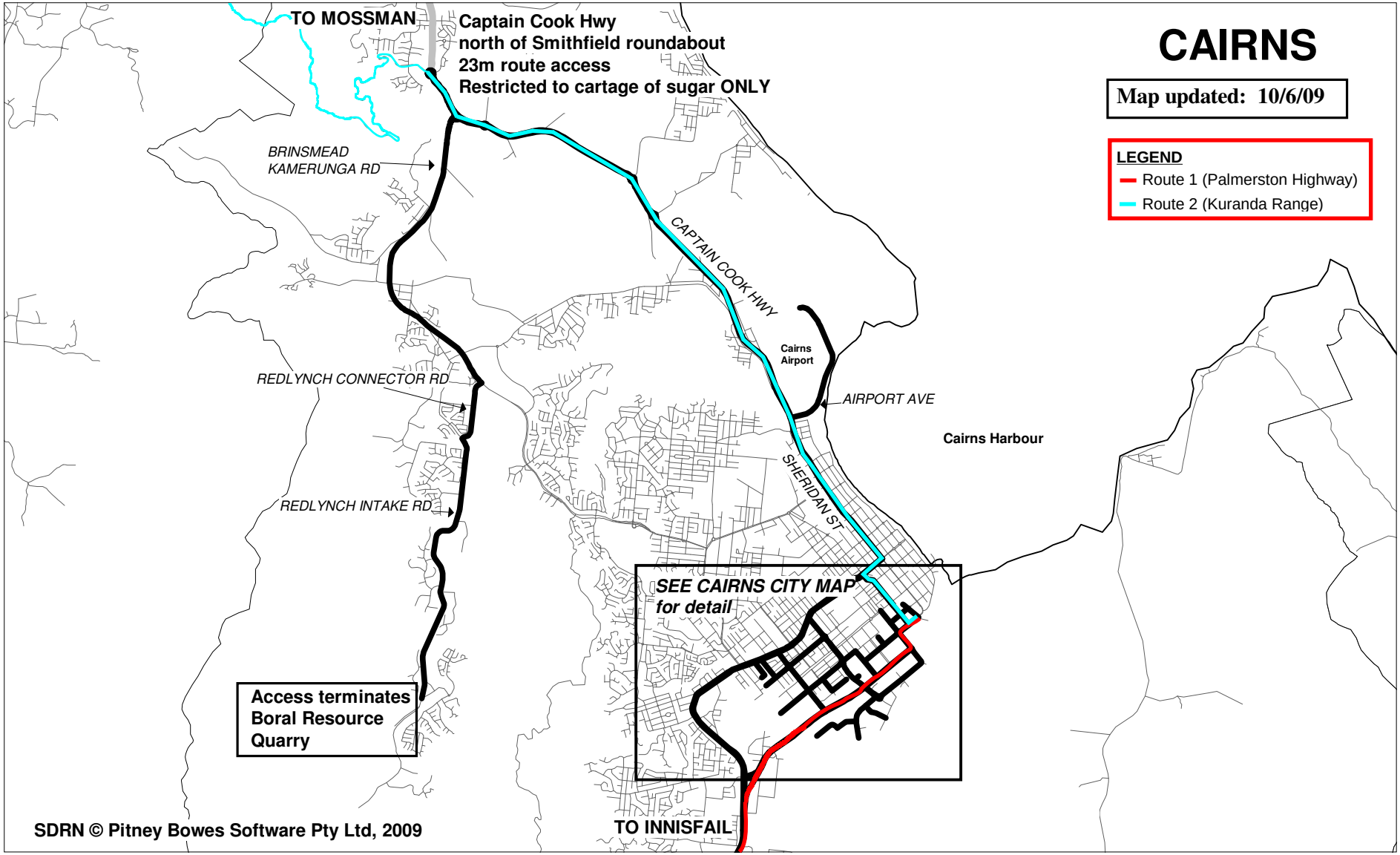
ROAD TRAINS
Type 1 routes
Type 1 & 2 routes

NO ROAD TRAINS
or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



B-DOUBLES
23 metre routes
23 & 25 metre routes

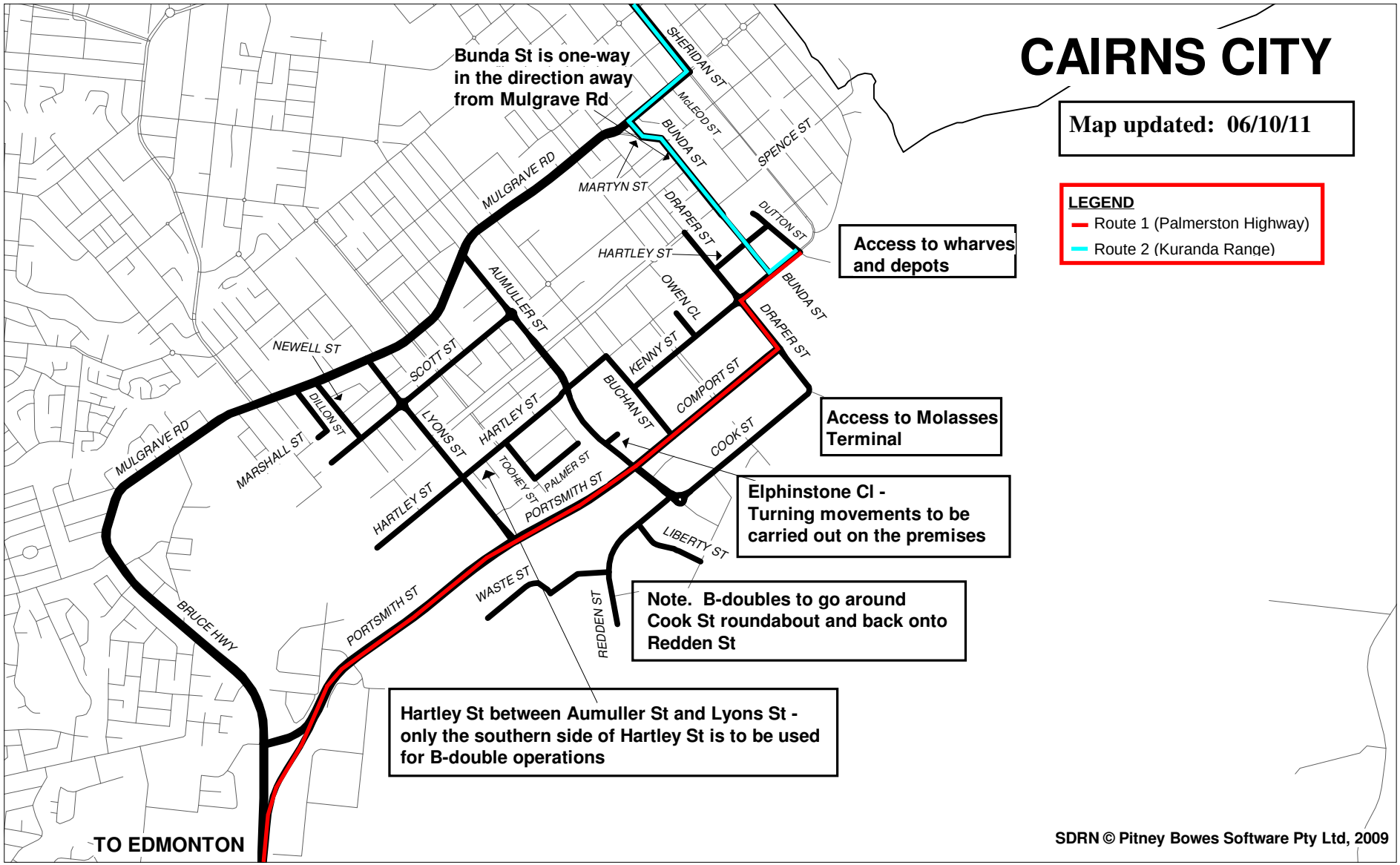
ROAD TRAINS
Type 1 routes
Type 1 & 2 routes

NO ROAD TRAINS
or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS
Note: 23 & 25 metre B-doubles can access Type 1 & 2 road train routes

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government

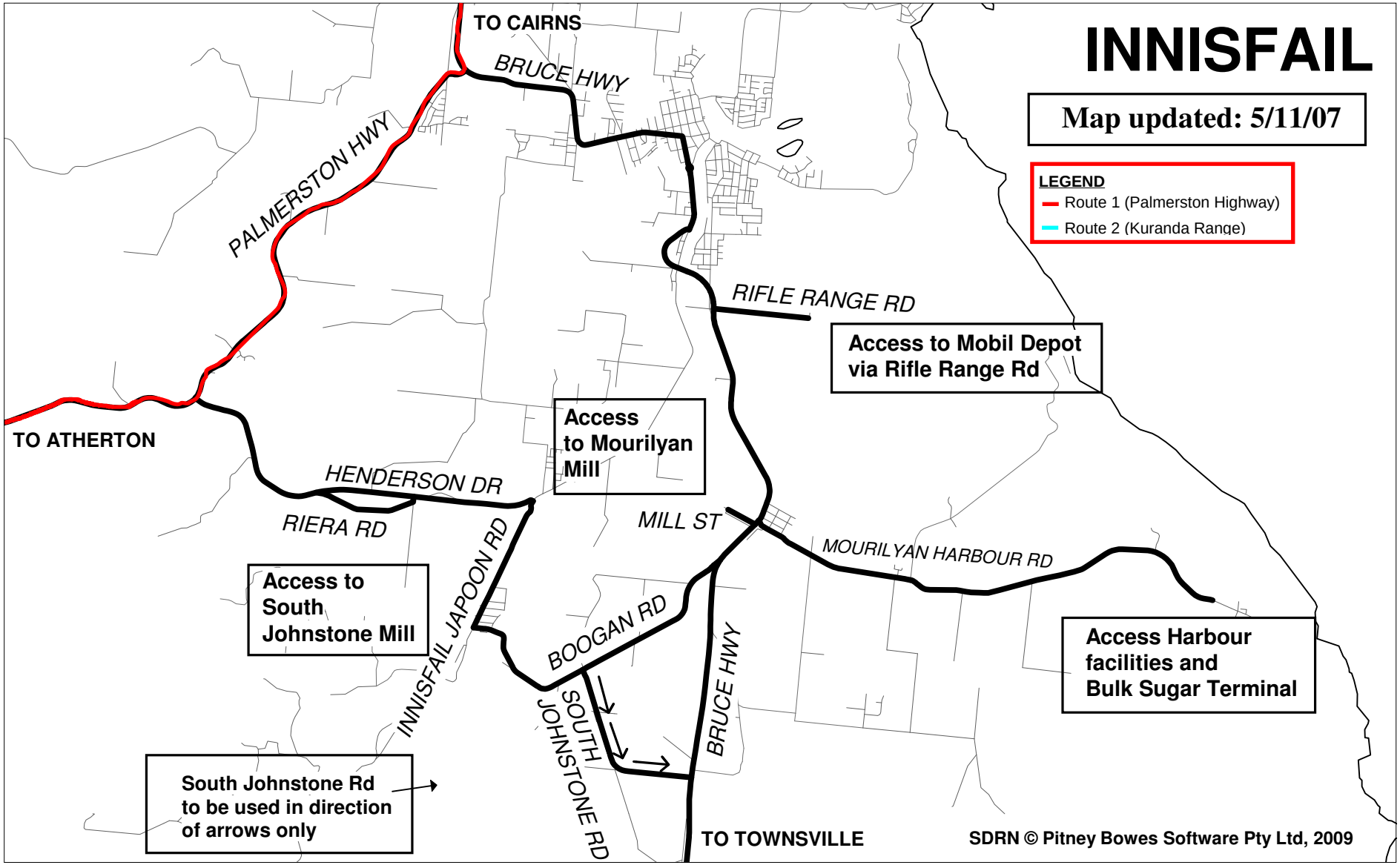


B-DOUBLES	ROAD TRAINS	NO ROAD TRAINS or B-DOUBLES
23 metre routes	Type 1 routes	
23 & 25 metre routes	Type 1 & 2 routes	

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS
Note: 23 & 25 metre B-doubles can access Type 1 & 2 road train routes

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



B-DOUBLES
23 metre routes
23 & 25 metre routes

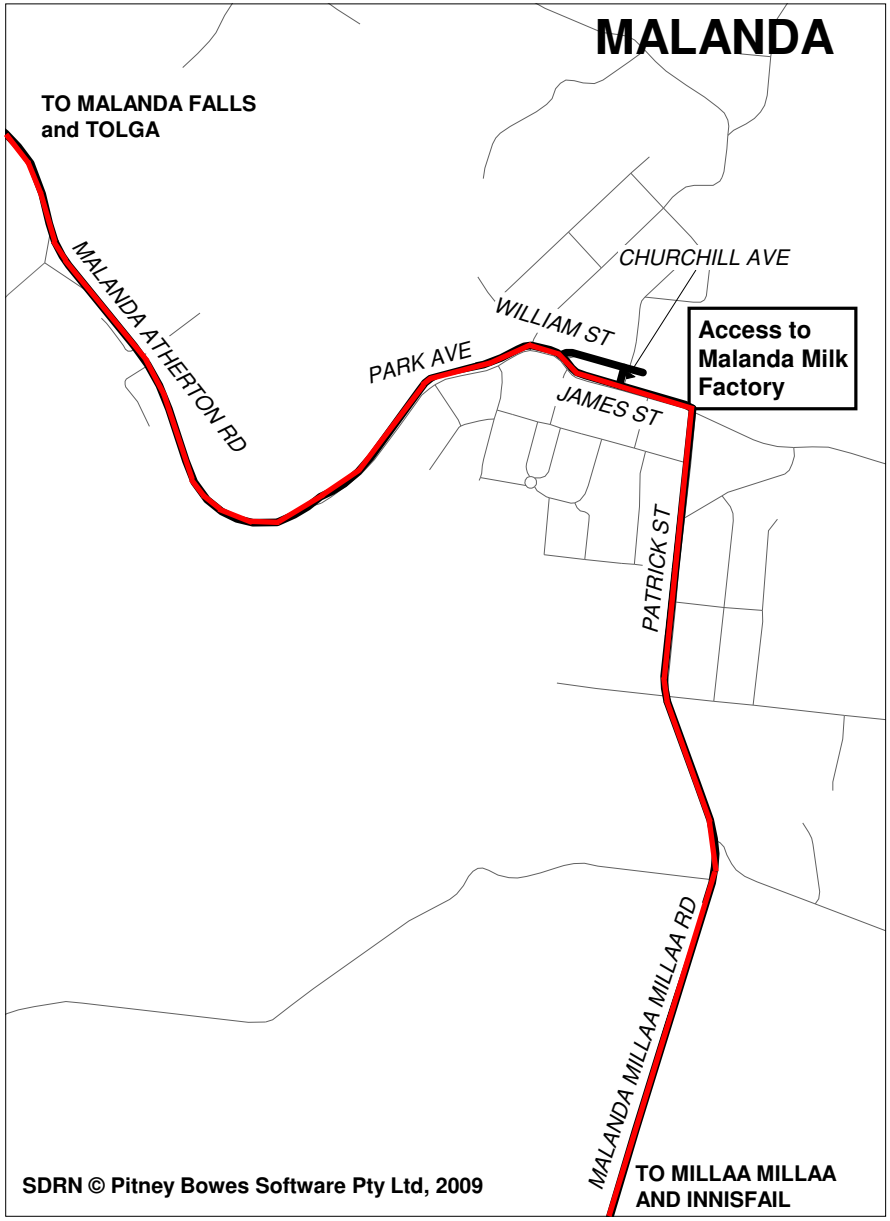
ROAD TRAINS
Type 1 routes
Type 1 & 2 routes

NO ROAD TRAINS or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



LEGEND

- Route 1 (Palmerston Highway)
- Route 2 (Kuranda Range)

B-DOUBLES
- 23 metre routes
- 23 & 25 metre routes

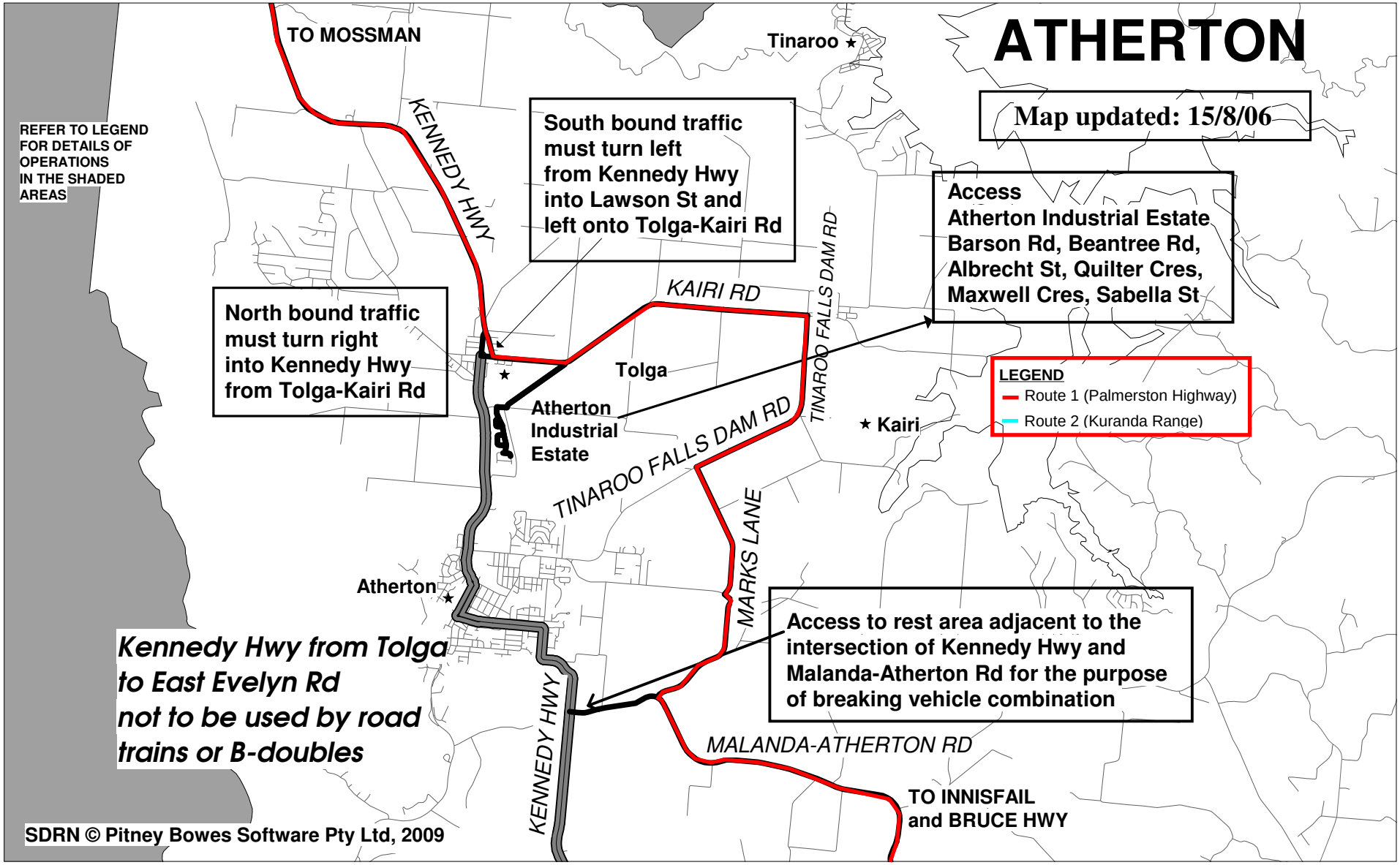
ROAD TRAINS
- Type 1 routes
- Type 1 & 2 routes

NO ROAD TRAINS or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



B-DOUBLES
23 metre routes
23 & 25 metre routes

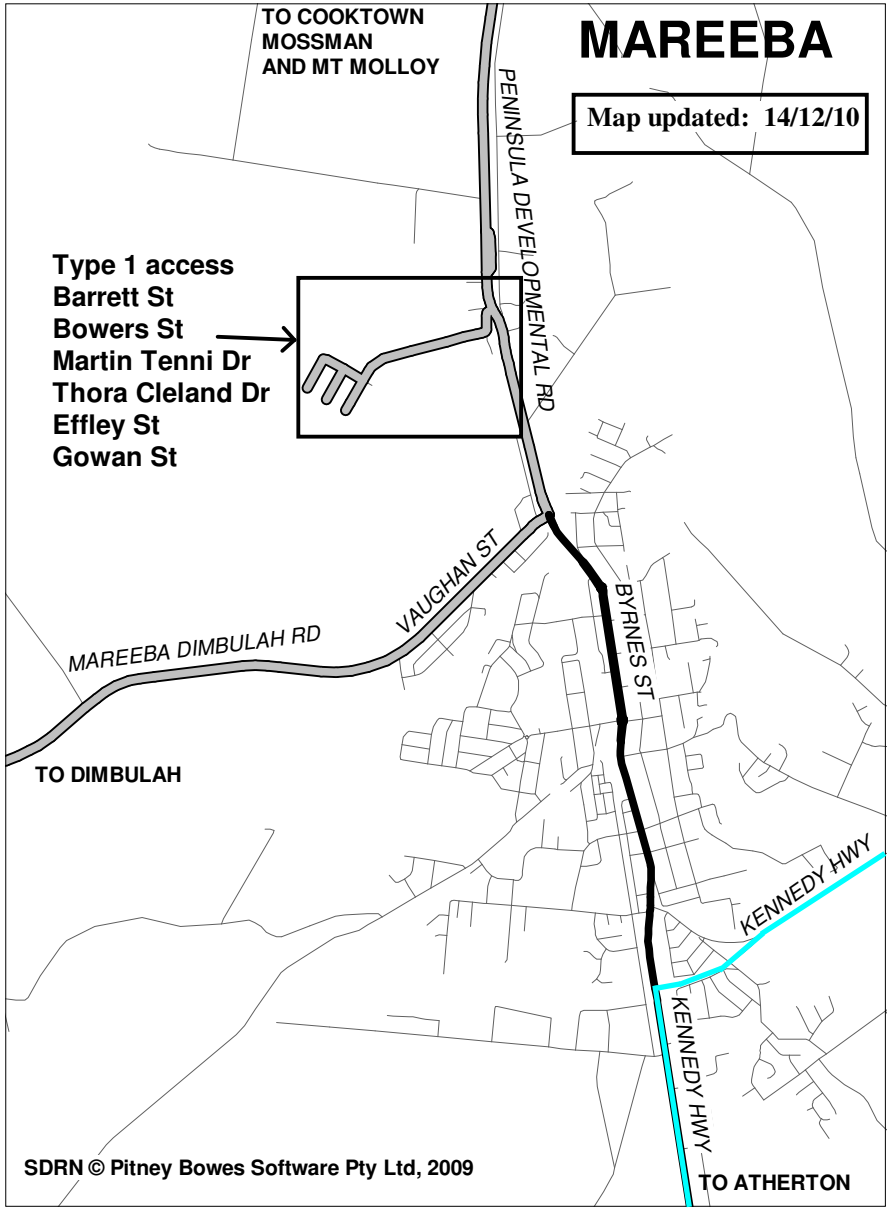
ROAD TRAINS
Type 1 routes
Type 1 & 2 routes

NO ROAD TRAINS or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



LEGEND
- Route 1 (Palmerston Highway)
- Route 2 (Kuranda Range)

B-DOUBLES
- 23 metre routes
- 23 & 25 metre routes

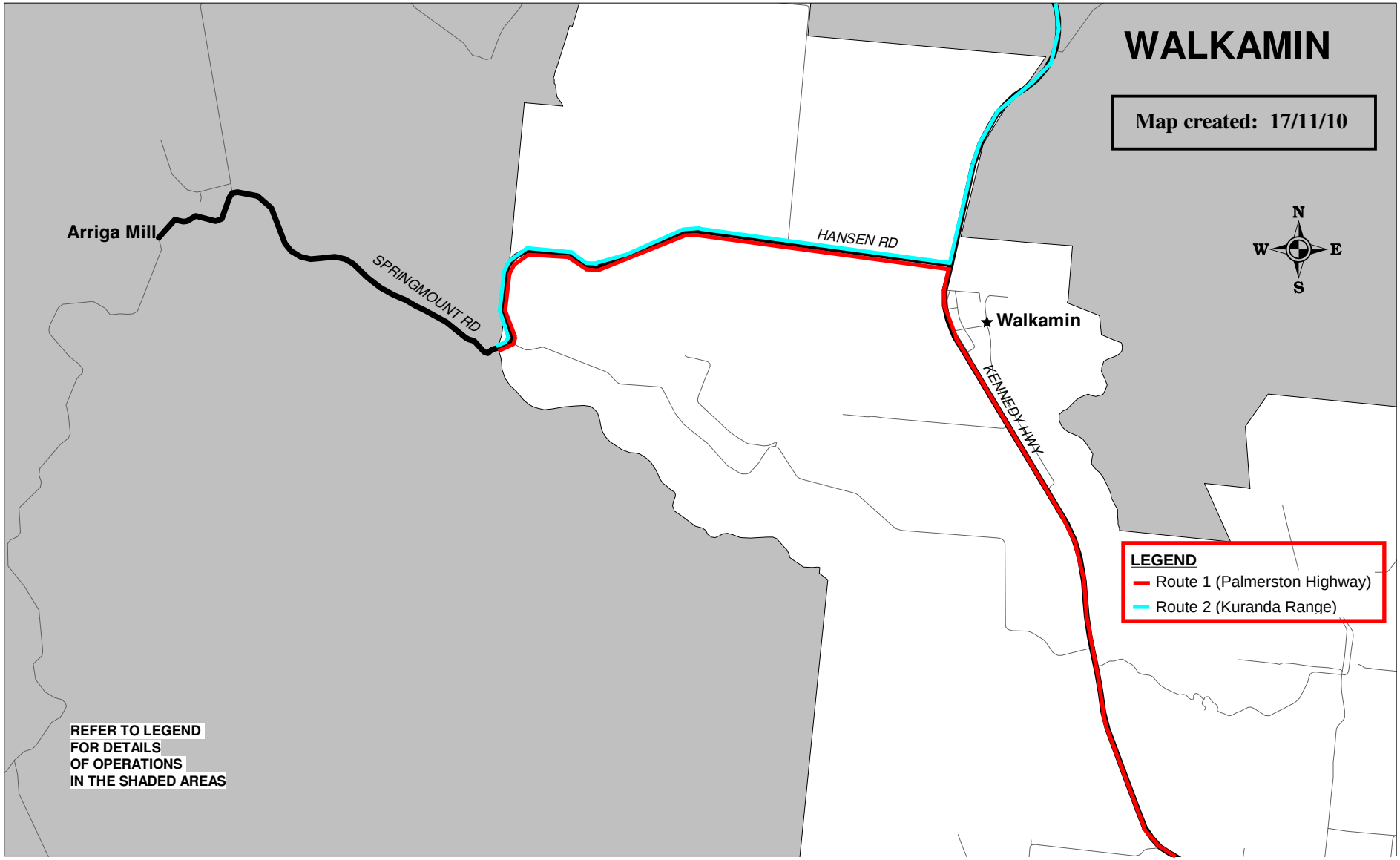
ROAD TRAINS
- Type 1 routes
- Type 1 & 2 routes

NO ROAD TRAINS or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS
Note: 23 & 25 metre B-doubles can access Type 1 & 2 road train routes

MULTI-COMBINATION ROUTES IN QUEENSLAND

Queensland Government



B-DOUBLES
23 metre routes
23 & 25 metre routes

ROAD TRAINS
Type 1 routes
Type 1 & 2 routes

NO ROAD TRAINS
or B-DOUBLES

REFER TO LEGEND FOR DETAILS OF OPERATIONS IN THE SHADED AREAS

Appendix B. Engineering Reponse to TRC 51 (From SKM 2012)

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.

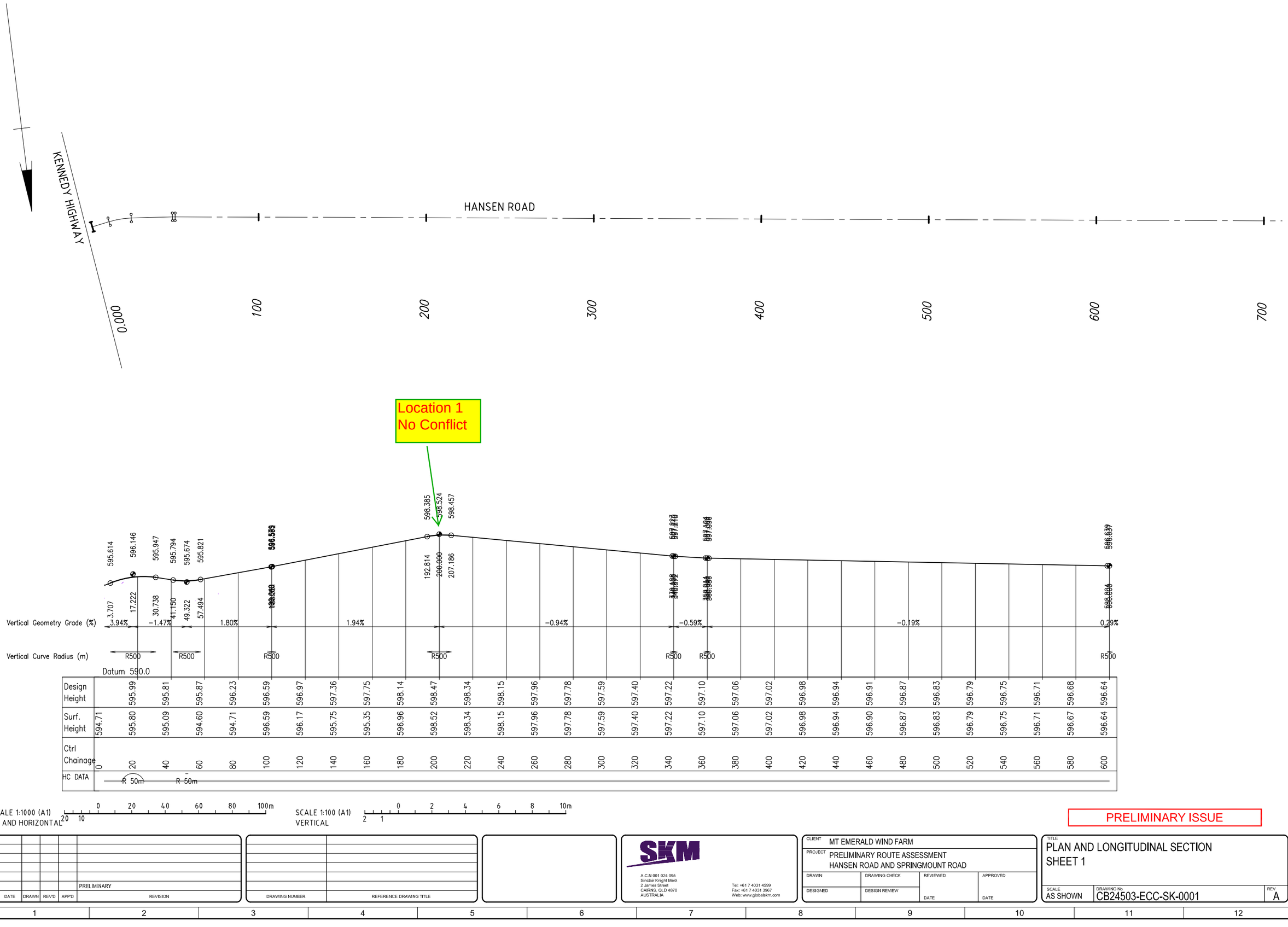
Table 1: Review of vertical profiles of Hansen and Springmount Road

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.

Appendix C. Vertical Geometry Drawings (From SKM 2012, Appendix C)



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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

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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

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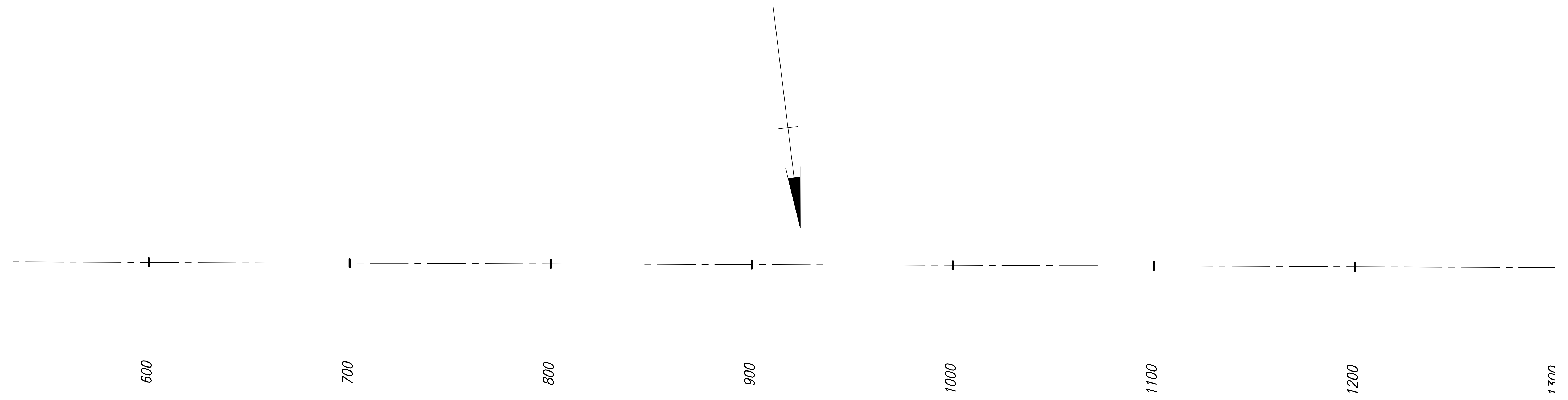

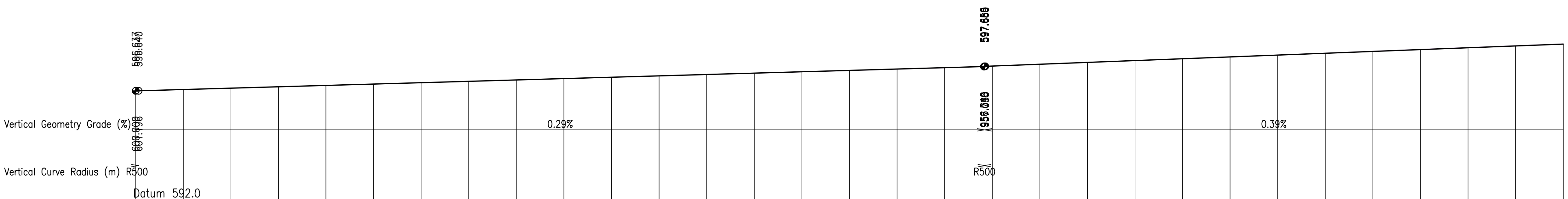

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Surf. Height	596.64	596.69	596.75	596.81	596.86	596.92	596.97	597.03	597.09	597.14	597.20	597.26	597.31	597.37	597.42	597.48
Ctrl Chainage	600	620	640	660	680	700	720	740	760	780	800	820	840	860	880	900
HC DATA																

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															

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

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HANSEN ROAD AND SPRINGMOUNT ROAD

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TITLE
PLAN AND LONGITUDINAL SECTION SHEET 2

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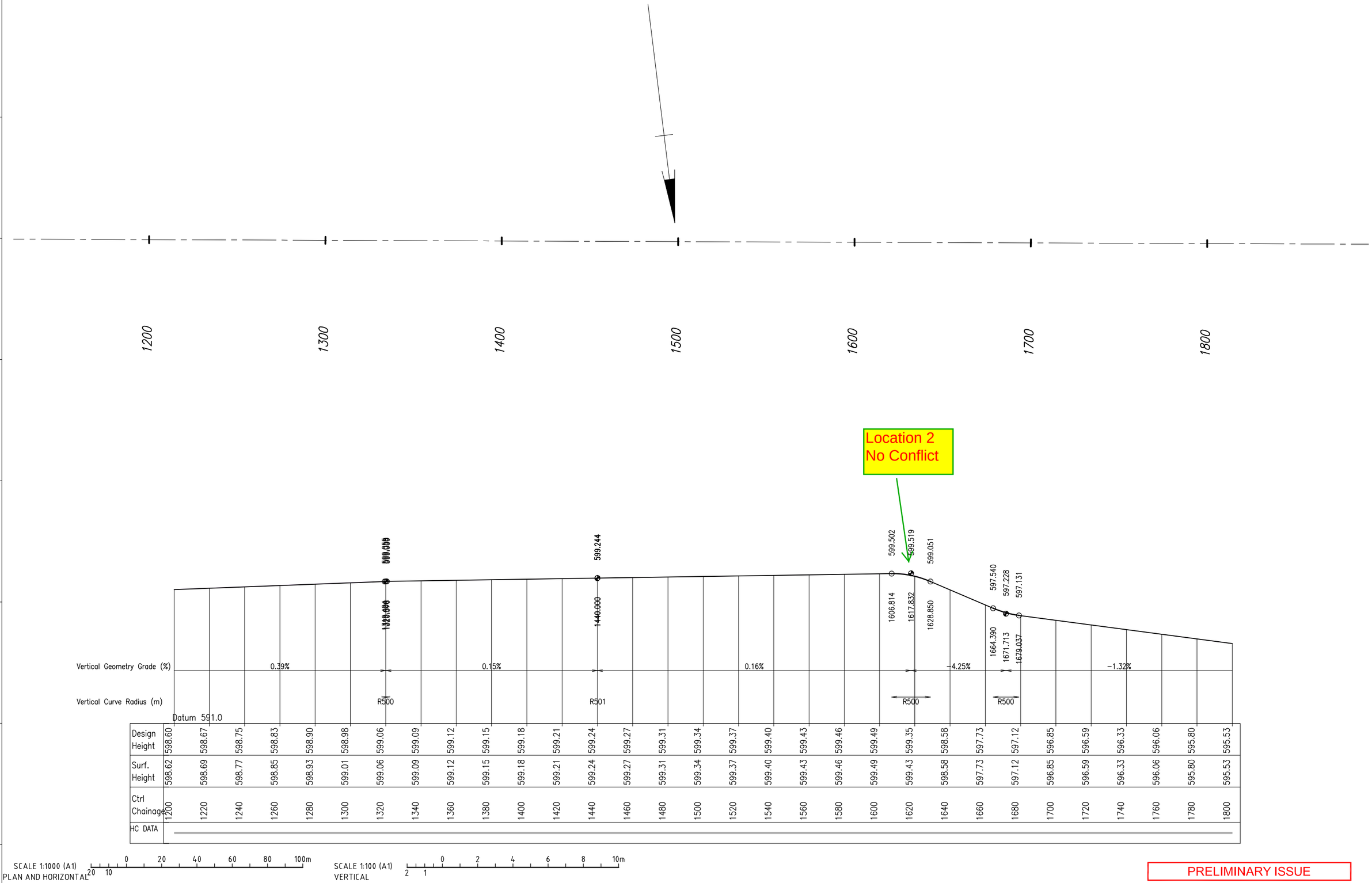

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HANSEN ROAD AND SPRINGMOUNT ROAD

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TITLE: PLAN AND LONGITUDINAL SECTION
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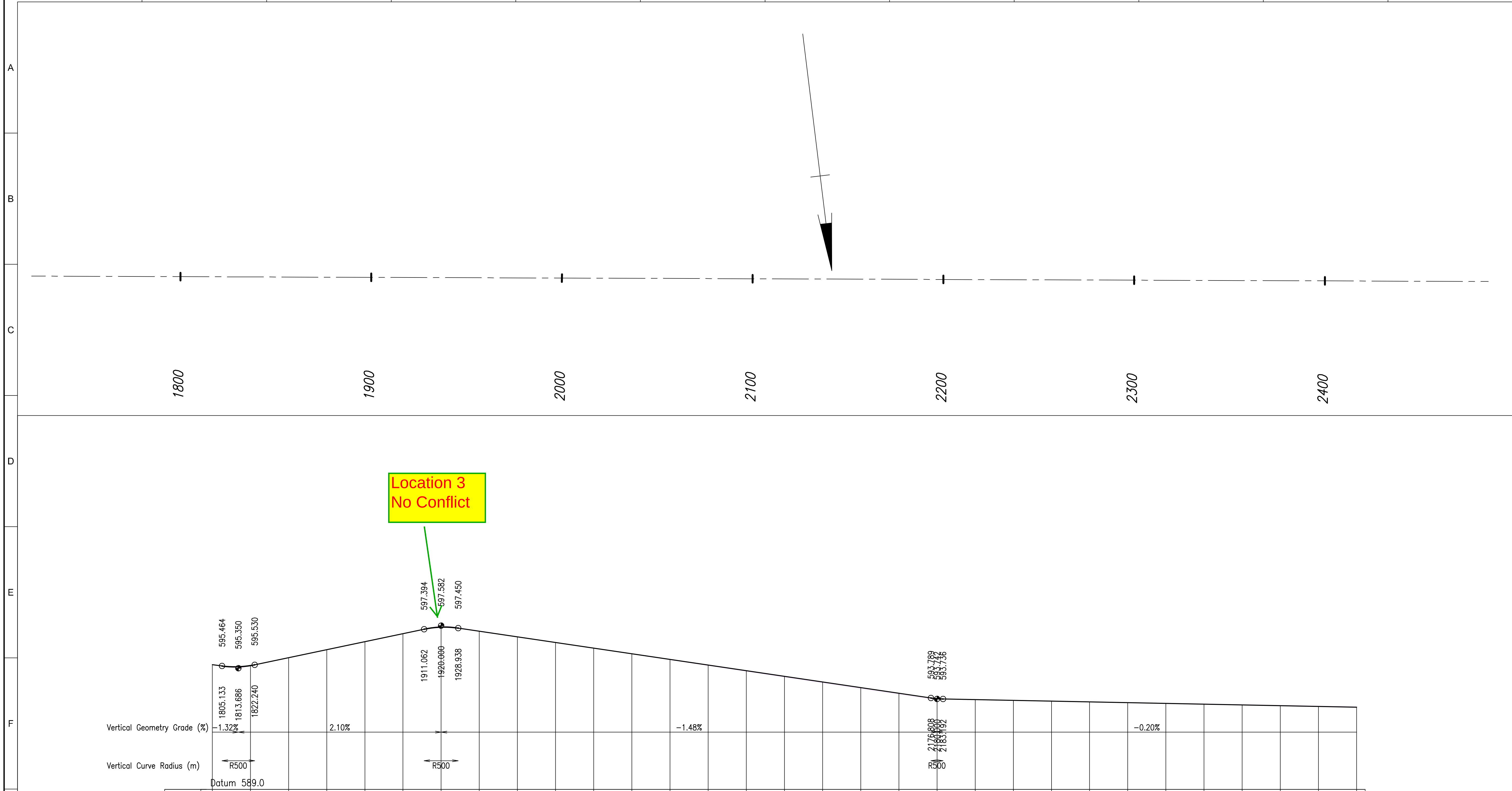

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Surf. Height	595.53	595.48	595.90	596.32	596.74	597.16	597.58	597.31	597.00	596.70	596.40	596.10	595.79	595.49	595.19	594.89
Ctrl Chainage	1800	1820	1840	1860	1880	1900	1920	1940	1960	1980	2000	2020	2040	2060	2080	2100
HC DATA																

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Design Height	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	594.58	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
Ctrl Chainage	2120	2140	2160	2180	2200	2220	2240	2260	2280	2300	2320	2340	2360	2380	2400
HC DATA															

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL

SCALE 1:100 (A1)
VERTICAL

PRELIMINARY ISSUE

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HANSEN ROAD AND SPRINGMOUNT ROAD

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DESIGNED | DESIGN REVIEW | DATE | DATE

TITLE
PLAN AND LONGITUDINAL SECTION
SHEET 4

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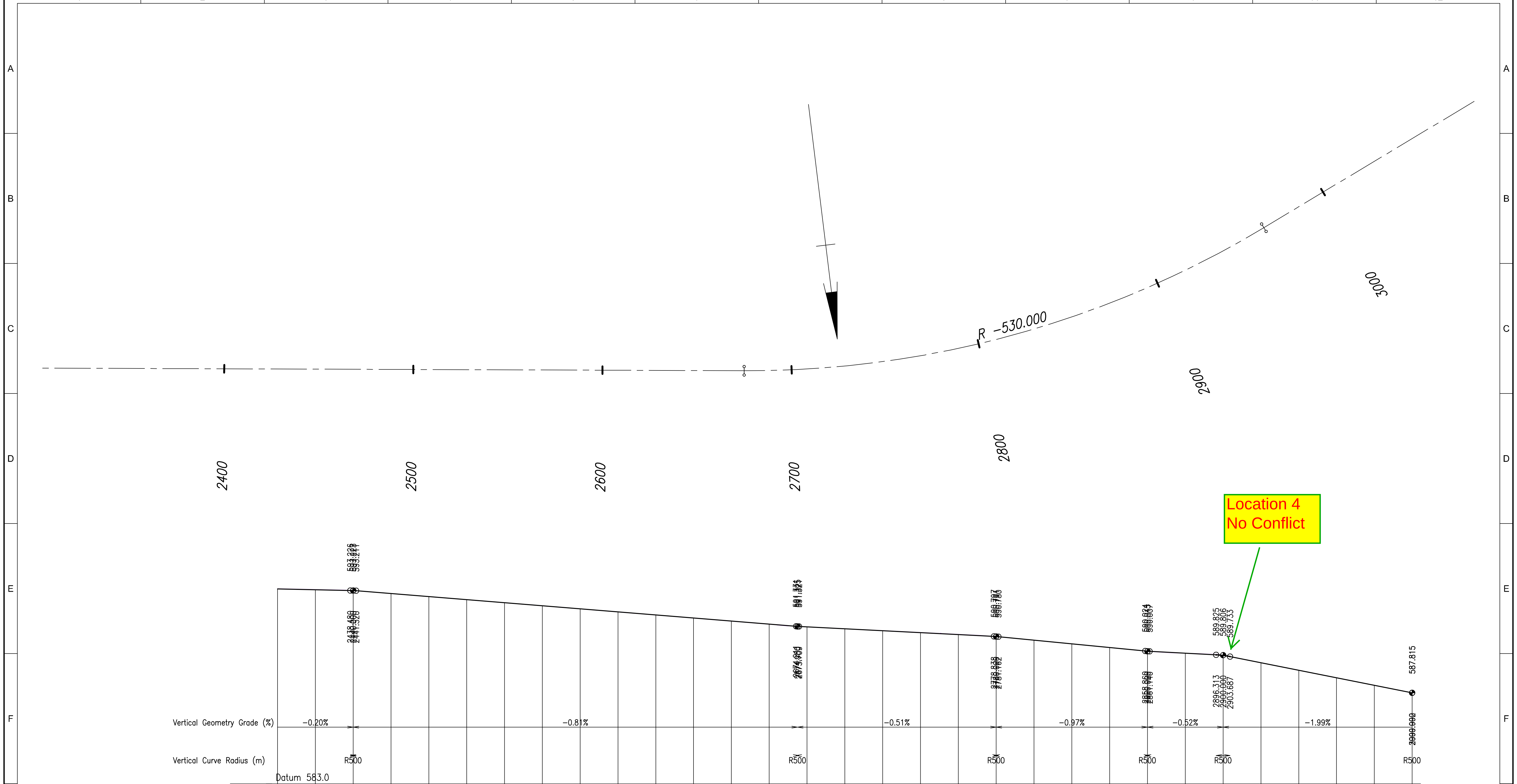

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Surf. Height	593.33	593.30	593.22	593.06	592.90	592.73	592.57	592.41	592.25	592.08	591.92	591.76	591.59	591.43	591.30	591.21
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Surf. Height	591.11	591.02	590.93	590.79	590.60	590.40	590.21	590.01	589.91	589.81	589.41	589.01	588.61	588.21	587.81
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HC DATA — R -530m

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

PRELIMINARY ISSUE

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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

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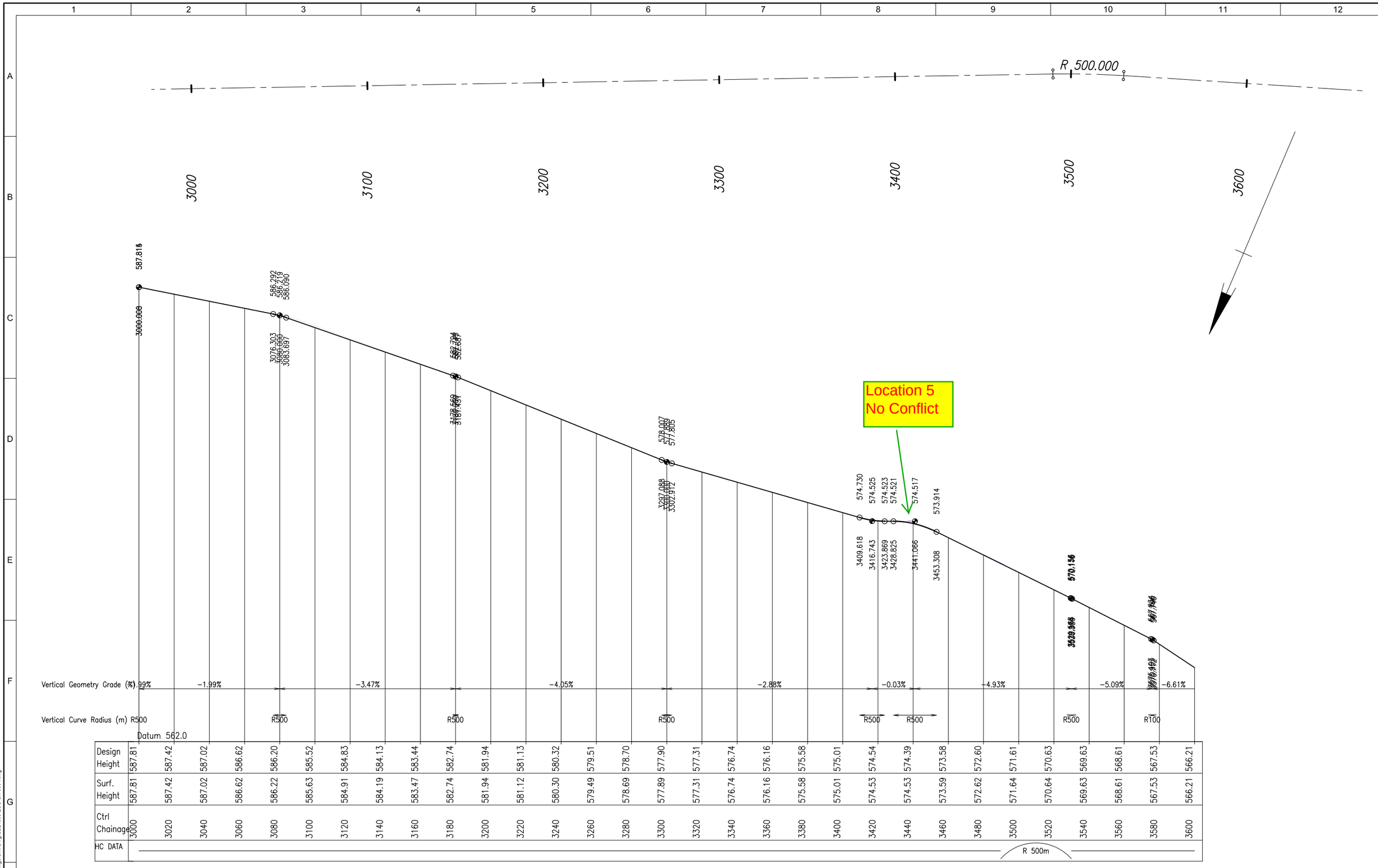

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HANSEN ROAD AND SPRINGMOUNT ROAD

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TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 6

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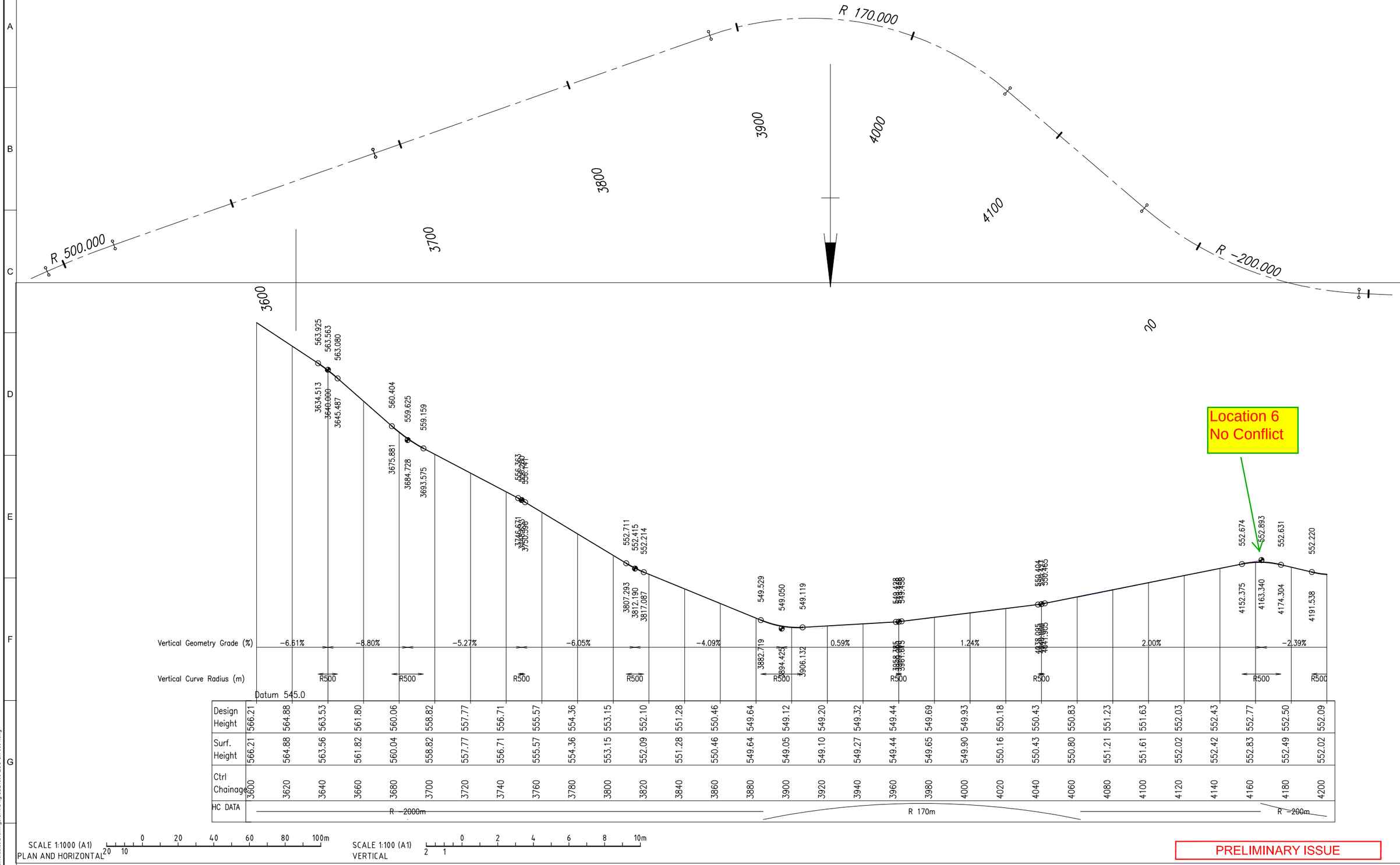

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Surf. Height	566.21	564.88	563.56	561.82	560.04	558.82	557.77	556.71	555.57	554.36	553.15	552.09	551.28	550.46	549.64	549.05	549.10	549.27	549.44	549.65	549.90	550.16	550.43	550.80	551.21	551.61	552.02	552.42	552.83	552.49	552.02
Ctrl Chainage	3600	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
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HANSEN ROAD AND SPRINGMOUNT ROAD

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DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 7

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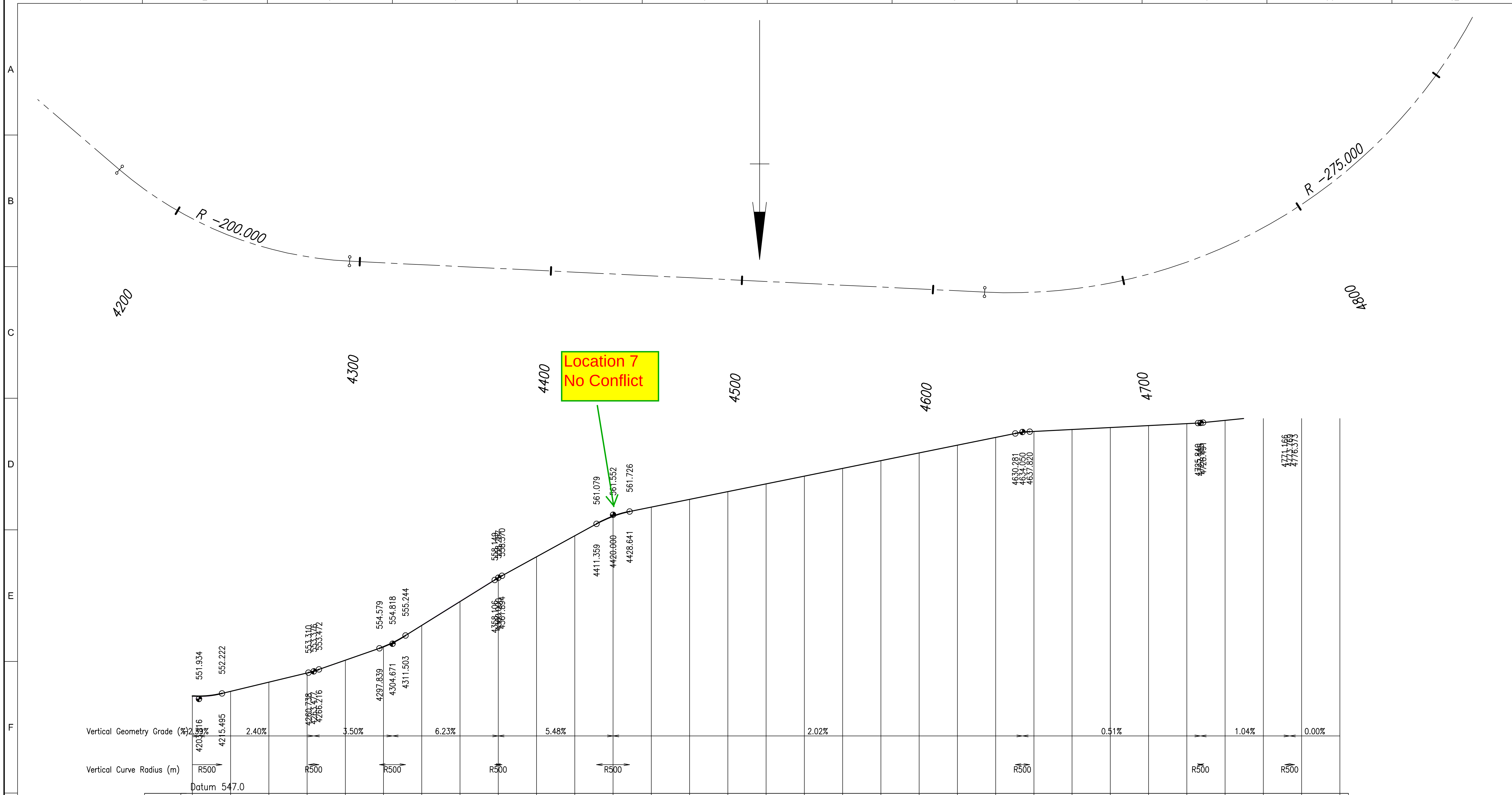

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Surf. Height	552.02	552.33	552.82	553.29	553.95	554.65	555.80	557.08	558.27	559.36	560.46	561.55	561.96	562.36	562.76	563.17	563.57	563.97	564.38	564.78	565.19	565.59	565.90	566.01	566.11	566.21	566.31	566.48	566.69	566.83	566.83
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HC DATA	R −200m																										R −275m				

SCALE 1:1000 (A1)
PLAN AND HORIZONTAL

SCALE 1:100 (A1)
VERTICAL

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PROJECT PRELIMINARY ROUTE ASSESSMENT
HANSEN ROAD AND SPRINGMOUNT ROAD

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TITLE
PLAN AND LONGITUDINAL SECTION
SHEET 8

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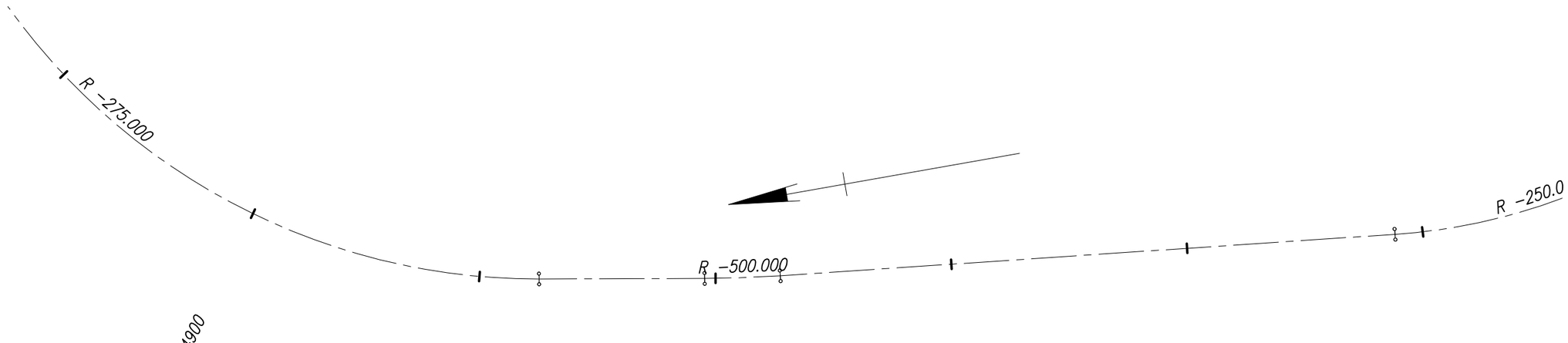

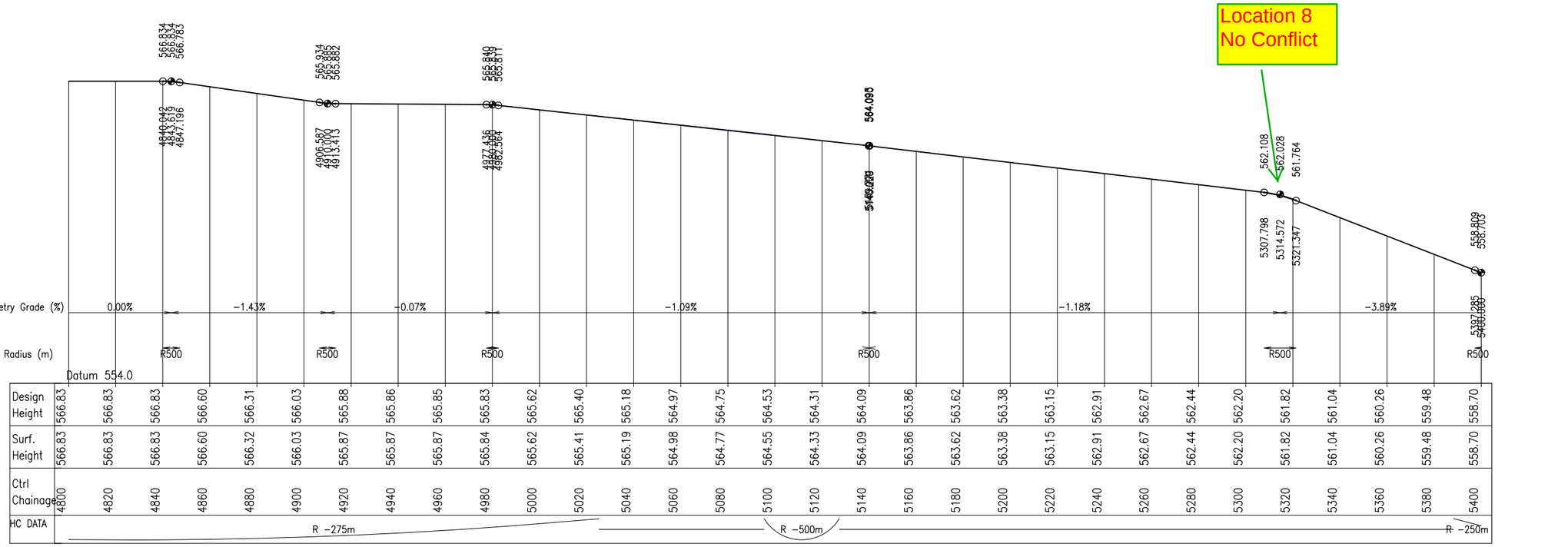

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4900	566.03	566.03
4920	565.88	565.87
4940	565.86	565.87
4960	565.85	565.87
4980	565.83	565.84
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5040	565.18	565.19
5060	564.97	564.98
5080	564.75	564.77
5100	564.53	564.55
5120	564.31	564.33
5140	564.09	564.09
5160	563.86	563.86
5180	563.62	563.62
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5260	562.67	562.67
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5340	561.04	561.04
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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

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HANSEN ROAD AND SPRINGMOUNT ROAD

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TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 9

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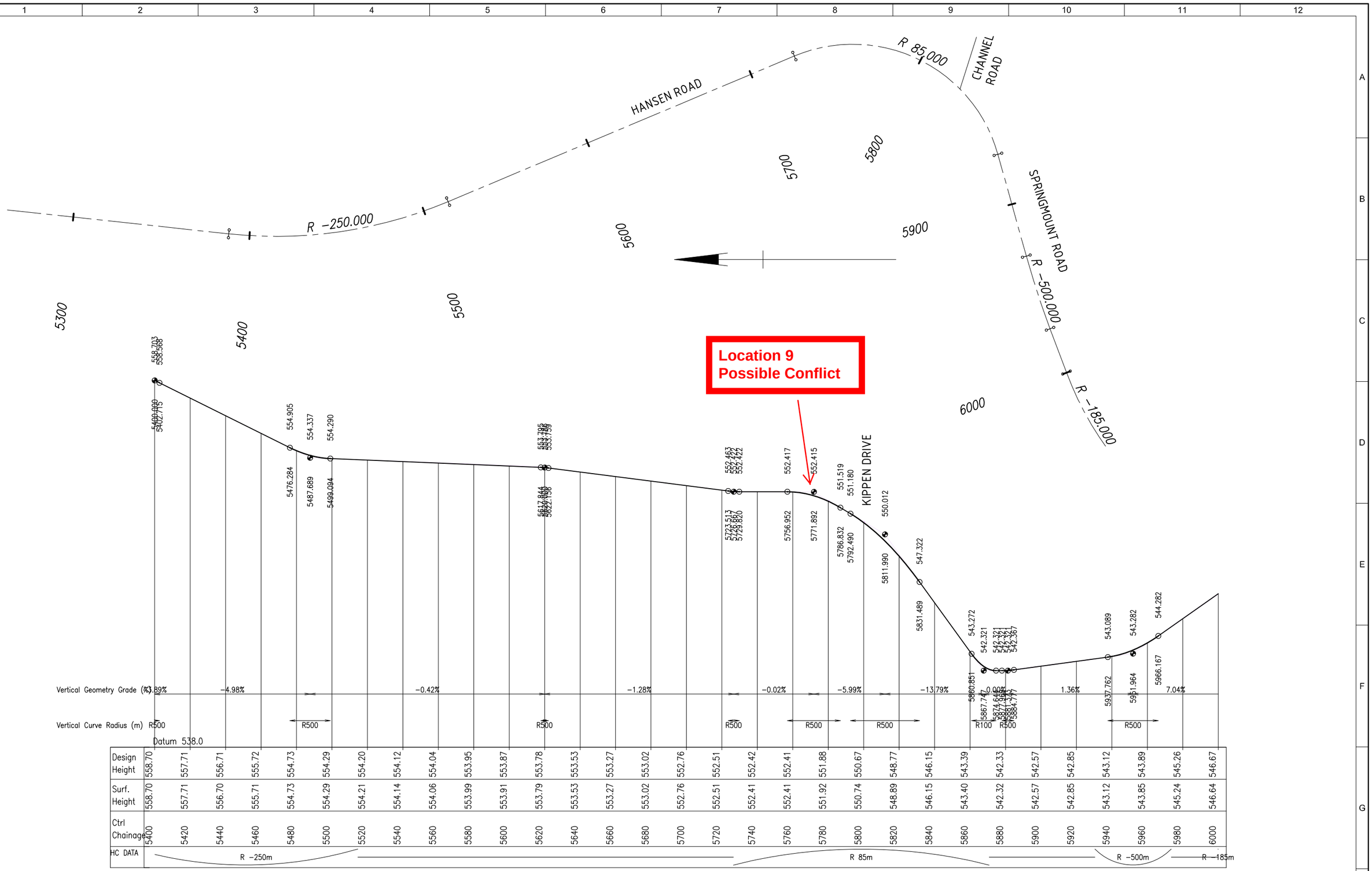

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SCALE 1:100 (A1) VERTICAL 0 1 2 4 6 8 10m

PRELIMINARY ISSUE

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

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DESIGNED	DESIGN REVIEW	DATE	DATE

TITLE: PLAN AND LONGITUDINAL SECTION
SHEET 10

SCALE	DRAWING No	REV
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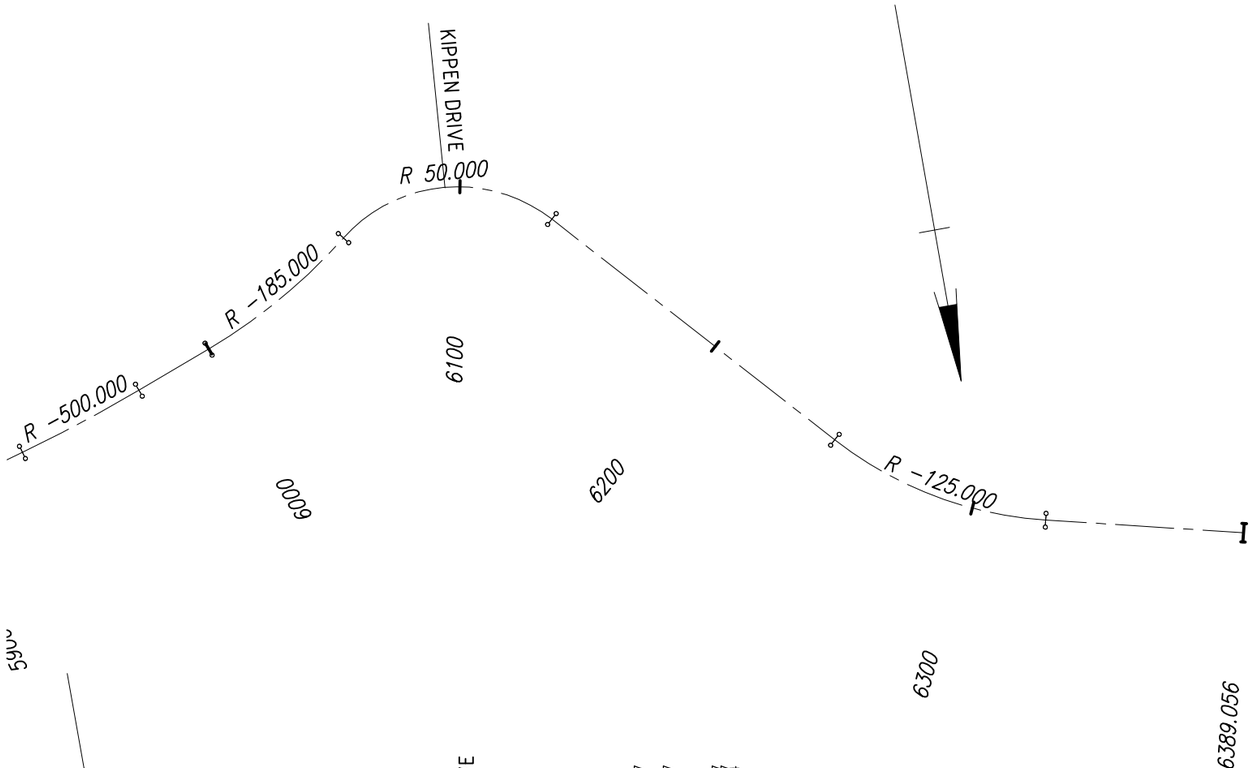
LOCATION: I:\CB\Projects\CB24503\Deliverables\Drawings\Civil\Dwg\CB24503-ECC-SK-0001.dwg



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

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 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

Appendix D. Calculation for Vechicle Movements & Worker Numbers (From SKM 2012, Appendix B)

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**																							

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	