7 September 2023
Job No: 1016884.1000

Meridian Energy Limited
Level 2,55 Lady Elizabeth Lane
Queens Wharf
Wellington 6011

Attention: Nick Bowmar

Dear Nick

Mount Munro Section 92 Response to Items 96 - 109

1 Background

The purpose of this letter is to provide responses to the Section 92 additional information request for items 96 – 109, received by Meridian Energy Limited (Meridian) in response to their Resource Consent application for a new Wind Farm at Mount Munro.

Item numbers used in this letter correspond to the section 92 request letter, with the request for information in italics, followed by our response.

2 Geotechnical/Land Stability

2.1 Item 96a

The following requests relate to more specific information on related geotechnical influences on the corridor widths (including cut slopes, roading/culvert fill area and fill disposal areas):

Have fill disposal areas (footprints) been used to inform the proposed corridor widths?

No - proposed corridor widths for the turbine envelope zones and turbine exclusion zones are nominally 120m wide. In some areas they are wider than this to accommodate turbine platforms which are offset from the road alignment, or where more flexibility is required for the road alignment. Fill disposal areas will be accommodated within these corridors, but have not dictated the widths.

2.2 Item 96b

What assumed cut slope angle, roading/culvert fill batter and excess fill batter angles have been used to inform the proposed corridor widths i.e., the maximum cut and fill slope angles, or has lower slope angle contingency been added? Noting that the Civil Engineering Report states maximum cut slope and fill batter angles have been used as a basis for preliminary civil design to assess environmental effects and to provide an indicative earthworks volume.

Maximum cut and fill angles have been used to inform the proposed corridor widths.

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2.3 Item 96c

What geotechnical aspects have influenced the wider corridor width in roading zone section R01?

Where R01 crosses the stream and heads upslope in a south westerly direction (see red circled area in Figure 2.1), the corridor width is driven by the maximum preferred road gradient and also potential slope instability on the eastern slopes above the proposed R01 road. A wider corridor in this area will allow for shallower batter slope angles where slope instability is encountered or is expected to occur and no stabilisation measures are constructed.

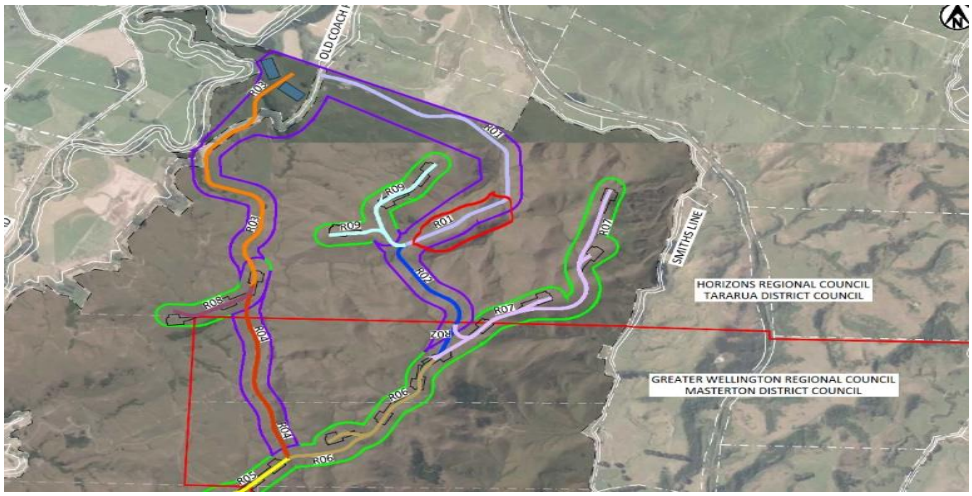

Figure 2.1: Road R01 Corridor Width

2.4 Item 96d

Can all batter cuts and fill embankments/disposal areas be contained within the turbine exclusion and turbine envelope zone corridors either with or without mitigation works to ensure long term stability?

Yes, we confirm that all batter cuts and fill embankments/disposal areas be contained within the turbine exclusion and turbine envelope zone corridors. 3d modelling of the road alignment and turbine platforms has informed the turbine exclusion and turbine envelope zone corridors.

2.5 Item 96e

Please provide a plan showing the indicative road alignment and cut slope footprint with respect to the corridor boundaries.

A plan showing the earthworks footprints is provided with this response. Refer to drawing 1016884.1000-016.

2.6 Item 96f

Please provide the range of mitigation measures that can be adopted to maintain a stable cut slope within the project corridors should poor ground/adverse groundwater conditions be encountered including at any fault zones.

Refer Section 5.4 and 5.5 of the Geotechnical report which states a range of measures that can be implemented including material clearance, slope batter reprofiling, localised drainage controls or localised slope stabilisation measures. These stabilisation measures could include retaining walls like anchored mesh faces, timber pole or geogrid reinforced walls. The wall type at any location will be

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governed by the slope height, profile and materials that need stabilising and will be confirmed during detailed design and reviewed during construction.

3 Total Earthworks Volumes

3.1 Item 97a

There are inconsistencies in the total earthworks volumes in the various references. For example, the summary in the AEE states 1,672,100m3 of cut volume and 477,000m3 of fill volume (which infers 1,195,100m3 of excess fill volume requiring disposal). The Civil Engineering Report Table 10.1 states 1,756,900m3 of cut volume and 539,700m3 of fill volume (which infers 1,217,200m3 of excess fill volume requiring disposal). The Construction Water Management Plan and Effects Assessment Report Table 1 has a total volume of fill for disposal of 1,166,300m3. In relation to the earthworks volumes:

Volume Figures: Which table/set of earthworks volume figures is correct and a breakdown of the figures is requested?

Breakdown of earthworks volumes:

1. Volumes for the internal wind farm roads and wind turbine platforms were assessed by creating a 3d design model in OpenRoads Designer. This allowed the extraction cut and fill volumes, topsoil stripping and pavement quantities directly from the model.
2. The turbine foundation volumes were assessed on the basis that all foundations would be in cut. Volumes for the turbine foundations are based on an octagonal foundation of approximately 23m width (approximately 450m2), and a 3.5m excavation depth with a 1V:1H cut slope. The initial excavation volume for each turbine foundation is approximately 42,000m^3 with a backfill volume over the completed foundation of approximately 21,000m^3.
3. The concrete batching plant will have a footprint of approximately 6,000m^3. As the final location of the concrete batching plant is subject to the Contractors methodology, a preferred location has not been identified at this stage. For the proposes of assessing earthworks quantities we have allowed for an average depth of 250mm topsoil stripping, 1m of cut and 1m of fill over the concrete batching plant site.
4. The Construction compound and laydown area has an approximate area of 14,000m^3. For the proposes of assessing earthworks quantities we have allowed for an average depth of 250mm topsoil stripping, 0.5m of cut and 0.5m of fill over the concrete batching plant site. The reason why we have assumed a smaller average cut and fill depth than what was assumed for the concrete batching plan site is that this site is expected to be a lot flatter.
5. The sub-station site has an approximate area of 10,000m^3. For the proposes of assessing earthworks quantities we have allowed for an average depth of 250mm topsoil stripping, 0.5m of cut and 0.5m of fill over the concrete batching plant site. The reason why we have assumed a smaller average cut and fill depth than what was assumed for the concrete batching plan site is that this site is expected to be a lot flatter.
6. Cut and fill volumes for cabling have been based and a total trench length and cross section area provided to us by Meridian Energy Limited (Meridian).

Please refer to Table 3.1 below for a summary of the earthworks volumes.

3.2 Item 97b

What bulking factor has been used for the fill volumes provided?

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Bulking and compaction factors have not been used in assessing the earthworks quantities as it has been assumed that there will be negligible difference in the volume of cut material and the compacted fill.

3.3 Item 97c

The Construction Water Management Plan and Effects Assessment Report Table 1 mentions earthworks volumes include a 10% contingency whereas there is no mention of a contingency in the Civil Engineering Report – what factors have been used to inform the contingency?

Approximately 96% of the cut volume and 90% of the fill volume for the Site are generated from the internal wind farm roads and turbine platforms. To provide a level of conservatism to the volumes in the unlikely event that they increase during future stages of the design, and to avoid a potential situation where Meridian may need to apply for a variation to the consent for additional earthworks, a 10% contingency has been applied to the quantities for the internal wind farm roads and turbine platform when assessing the maximum earthworks volume.

3.4 Item 97d

Cut Volume

The Civil Engineering Report states maximum cut slope angles have been used as a basis for preliminary civil design to assess environmental effects and to provide an indicative earthworks volume. Is it correct to assume that these cut slope angles have been used to estimate total cut volume available for road embankment filling as well as the volume of excess fill requiring disposal i.e. there is no allowance for shallower cut slope angles where actual ground conditions require this for stability reasons? Note: The potential for shallower cut slope angles being required is stated in the Civil Engineering Report as being due to rock/soil conditions encountered and whether any stabilisation measures are to be constructed.

Earthworks quantities have been based on the maximum cut and fill angles. As discussed in Item 97c, a contingency has been provided to allow for any variations in the cut and fill slope angles. In some areas where there is excess material to be disposed of, the fill slope may be increased within the turbine exclusion and turbine envelope zone corridors as required.

3.5 Item 97e

What excavation configuration is assumed for the turbine foundations for the cut volume calculation? The largest foundation type noted in the AEE is an octagonal gravity pad with a width of approximately 23 m and a depth of approximately 3.5 m.

The turbine foundation volumes were assessed on the basis that all foundations would be in cut. Volumes for the turbine foundations are based on an octagonal foundation of approximately 23m width (approximately 450m^2), and a 3.5m excavation depth with a 1V:1H cut slope. The initial excavation volume for each turbine foundation is approximately 42,000m^3 with a backfill volume over the completed foundation of approximately 21,000m^3.

3.6 Item 97f

Please provide an indicative range of earthworks cut volumes (minimum and maximum) based on the above possible scenarios in order for us to better understand the range of fill volumes that will be generated.

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It is our expectation that during future stages of the design, the overall cut and fill volumes for the wind farm roads and turbine platforms will reduce by approximately 10% as the design is refined. We also expect that some site won material will be suitable for road base construction, and have conservatively estimated that approximately 5% of cut material would be suitable. This has formed the basis of assessing the minimum earthworks volume in Table 3.1.

3.7 Item 97Gg

Fill Embankment Volume

Similar to point d. above, in the Civil Engineering Report the maximum roading/culvert embankment fill batter angle (26 degrees) has been used to provide an indicative earthworks volume (for embankment use vs fill disposal) but it is also stated that optimisation of fill slopes to 18.5 degrees or flatter could be considered and adopted. However, it is noted that the Construction Water Management Plan and Effects Assessment Report states that all batter slopes will be kept to less than 20 degrees to maintain a lower erosion risk. Which of these batter slope angles is envisaged for fill embankment slopes?

The batter slopes will be assessed in detailed design but the batter slopes throughout the project will range between 18 and 26 degrees. Slope angles will be assessed based on slope stability, earthworks, environmental and ecological considerations at every fill site.

3.8 Item 97h

Please provide an indicative range of fill (minimum and maximum) that will be used in fill embankments based on the above possible information/scenarios in order for us to better understand the fill volumes that will require disposal.

Please refer to Table 3.1

3.9 Item 97i

Fill Volume for Disposal

Leading on from Point h. above, please provide an indicative range of fill volume requiring disposal in order for us to better understand the requirements for onsite fill disposal sites.

Please refer to Table 3.1 and our response to Items 98a and 98b below.

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Table 3.1: Earthworks Summary

Earthworks source	Earthworks volumes - Current Design (m3)			Contingency (m3)		Maximum Earthworks Volume (m3)		Minumum Earthworks Volume (m3)	
	Topsoil stripping	Cut	Fill	10% Cut Contingency	10% Fill Contingency	Cut (Current design + 10% contingency ***)	Fill (Current design + 10% contingency ***)	Cut (Current design less 10%)	Fill (Current design less 10%)
Internal wind farm roads	47000	850,300	305,200	85000	30500	935,300	335,700	765300	274700
Cabling	(incl. in wind farm roads)	13,200	12,700			13,200	12,700	13,200	12,700
Turbine platforms	39600	651,500	109,400	65100	10900	716,600	120,300	586400	98500
Turbine foundaton excavation	(incl. in turbine platforms)	42,000	21,000			42,000	21,000	42,000	21,000
Concrete batching plant	1500	6,000	6,000			6,000	6,000	6,000	6,000
Construction compound/laydown area	3500	5000	5000			5,000	5,000	5,000	5,000
Sub station	2500	5000	5000			5,000	5,000	5,000	5,000
Site won road base material (assume 5% of total cut volume)									71,100
Total (m3)	**94,100.00**	**1,573,000**	**464,300**			**1,723,100**	**505,700**	**1,422,900**	**494,000**
Fill disposal volume							**1,217,400**		**928,900**

*** Contingency only applied to internal wind farm roads and turbine platforms

4 Fill Disposal Sites

4.1 Item 98a

There is a paucity of information on the indicative locations of roading/culvert related embankment fills and separately excess fill disposal areas. This information is required to check the feasibility of disposing of the indicated fill volume range within the corridors (and would also better inform potential effects associated with the sites). Current information appears to be is limited to a plan (including a table) in the Construction Water Management Plan and Effects Assessment Report showing an aerial image with the general roading network plus blue areas assumed to be a combination of roading/culvert fill areas and excess fill disposal areas and red areas assumed to be cuts slopes. The plan does not show the project corridor boundaries. The accompanying table sets out topsoil stripping, cut volumes and fill volumes per roading section. The only other plans with mention of soil disposal areas appears to be the Site Investigation Location Site Plans in the Geotechnical Factual Report. These plans have a limited number of soil disposal areas marked with some extending outside the corridor boundaries. In relation to the above:

Are the soil disposal areas on the Site Investigation Location Site Plans in the Geotechnical Factual Report valid?

The final location of the soil disposal areas will be confirmed during detailed design once the road alignments and associated cuts and fills within the envelope have been confirmed. Fill disposal areas will be positioned to minimise haulage distances and to reduce environmental effects from transporting excavated soils within the site area during construction.

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From the table 3.1 above, the maximum on-site fill disposal volume is approximately 1,217,400m^3. Fill disposal locations identified within the turbine envelope and turbine exclusion zones indicate that the maximum earthworks balance can be accommodated within these locations.

Refer to Drawing 1016884.1000-16 for indicative fill disposal locations and volumes of fill disposal within the Site.

4.2 Item 98b

Please provide plans showing indicative footprint areas of roading/culvert related embankment fills and excess fill disposal areas with respect to the roads and the corridor boundaries. This should include indicative fill volumes by roading sector and colour coded on the plan accompanied by a table outlining the *location, footprint and volume for each fill site. The plans should differentiate the fill areas required to accommodate the minimum fill volume range and the maximum fill volume range (refer above for request for a range) at the assumed minimum fill batter angle. The indicative fill disposal sites should be based on the range of fill location criteria provided in Section 11 of the Civil Engineering Report.*

Refer to Drawing 1016884.1000-16 for indicative fill disposal locations and volumes of fill disposal within the Site.

A breakdown of earthworks volumes for each road alignment, based on maximum cut and fill angles, inclusive of a 10% contingency has been provided in Table 10.3 of the Civil Engineering Report

5 Transmission Corridor

5.1 Item 99

Will any excess fill requiring disposal be generated from the terminal substation, internal transmission line access tracks, the transmission line route (access and pole installation)? If yes, where will the fill be disposed of?

It is noted that a cut/fill balance is proposed for the site substation earthworks in Table 10.1 of the Civil Engineering Report.

As noted in section 3.1 above, earthworks volumes for the substation have been estimated based on assumed plan areas. A platform design has not yet been undertaken for the substation. The estimated earthworks volumes for the substation are based on a proposed footprint area of approximately 10,000m^2. Subject to confirmation during further design phases, any excess cut material will be disposed of in the adjacent land surrounding the substation or within the wind farm site, in accordance with any requirements of the CWMP and EAS Report.

6 Turbine Foundations

6.1 Item 100

What range of rock improvement/mitigation/drainage methods would be used to ensure suitable foundations are achieved for the turbines if unsuitable ground/ground water conditions are encountered?

As per Mill Creek windfarm construction in Greywacke Rock, where groundwater is encountered at the foundation subgrade level, perimeter drains around the foundation, and if required, within the foundation footprint, will be installed and will drain groundwater away from the turbine foundation and away from the crane hardstand area.

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Rock strength and stiffness will be investigated and assessed at detailed design stage and a foundation design will be prepared to accommodate the range of rock parameters expected. If during construction the rock stiffness / strength etc is lower than allowed for, then as per Mill Creek windfarm construction in Greywacke Rock, there will be localised undercutting and replacement of insitu rock with cement stabilised hardfill. This was undertaken at approximately 3 turbines of 26 at Mill Creek at short notice and immediately after the subgrade inspection was completed.

7 Public Roads

7.1 Item 101

Section 2.4.5 of the AEE notes various earthworks will be carried out to upgrade Old Coach Road to facilitate construction traffic. Will there be excess fill from these works requiring disposal and if so, where will it be disposed?

The detailed design of these works is yet to be completed but the intention is that any excess material from these works will be disposed of within the wind farm site at approved fill disposal locations.

8 Temporary Concrete Batching Plants(s)

8.1 Item 102

Is there to be 1 or 2 batching plants? This is not clear in the Civil Engineering Report, Section 8.

The intention is that there will only be one concrete batching plant.

8.2 Item 103

The location of the concrete batching plant(s) has not been finalised but it is noted it/they could be located in the Main Storage Laydown Area, Turbine Envelope or the Turbine Exclusion Zones. Given the required area (100m x 60 m), is there a suitable location in either of the latter two options for the plant(s) and if so, has this been considered when setting the corridor widths at these locations?

The final decision of this location will be based on the preference and construction methodology of the Contractor, once appointed.

The concrete batching plant area is approximately 6,000m^2. Turbine exclusion zones are typically 120m wide which provides a number of suitable locations for a concrete batching plant on top of the ridgeline as per the examples in Figure 8.1 below.

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Figure 8.1: Potential Concrete Batching Plant Sites

8.3 Item 104

What is the conceptual design (e.g., lined/unlined/embedded/elevated), footprint and volume of the decanting pond and settlement pond for the concrete batching plant(s)?

It is noted a cut/fill balance is proposed for the overall batching plant(s) earthworks in Table 10.1 of the Civil Engineering Report.

This will ultimately depend on site - typically would be unlined and excavate/embedded in the existing ground with a decant structure outfalling to a natural drainage path.
Any cut resulting from formation of the pond and batching plant would be stockpiled adjacent to the batching plant site for reinstatement once the batching plant is decommissioned.

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9 Main Storage Laydown Area

9.1 Item 105

How many ponds will be constructed for in the laydown area? Note: The Civil Engineering Report does not mention ponds, but a pond is mentioned in the AEE Section 2.4.6 and two pond locations are shown on various site plans.

Two potential pond locations have been identified for the laydown area; however it is intended that only one pond is constructed, with the location to be confirmed as part of the detailed design process.

9.2 Item 106

What is the conceptual design (e.g., lined/unlined/embedded/elevated), footprint and volume of any such pond?

The detailed design of the pond is yet to be completed; however the pond size allows for buffer storage to balance out the peak demands versus the overall daily supply rate via carting to allow for high water demand periods over summer when water supply may be restricted.
The approximate footprint of the pond is 100m long x 50m wide x 4m deep with 2H:1V side slopes, providing a total volume of 17,200m3 and a working volume of 13,200m^3.

9.3 Item 107

Will the pond(s) be classifiable in terms of the Dam Safety regulations?

No, as the storage volume is less than 20,000m^3.

10 Seismic Considerations

10.1 Item 108

It is noted in Section 6.2 of the Geological and Geotechnical Information to Support Civil Engineering Report, founding conditions for the turbines, main storage laydown area and earthworks and infrastructure areas across the site are to be determined prior to construction to confirm assumed sub soil classes. Will further investigations be carried out as part of windfarm design to determine liquefaction potential at the main storage laydown area and terminal substation?

Yes further investigations will be undertaken to determine liquefaction potential at the main storage laydown area and terminal substation. Based on the geotechnical work completed to date, the risk of liquefaction affecting these two structures is considered to be low.

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11 Indicative further Geotechnical Investigations for detailed Windfarm design

11.1 Item 109

Please provide a list of infrastructure (e.g., turbines, substations, culverts, ponds etc.) and earthworks (e.g., roads, cut slopes, fill areas etc) sites where further geotechnical investigations are anticipated. This includes the proposed scope and type of investigation.

Key infrastructure will be investigated at detailed design stage once locations have been confirmed. The scope and type of investigation will be confirmed at detailed design stage, however investigations are likely to comprise combinations of geological mapping, test pitting, boreholes, downhole geophysics, laboratory testing and other methods like cone penetration testing if required.

12 Applicability.

We understand and agree that our client Meridian Energy Limited will submit this memorandum as part of an application for resource consent and that Masterton District Council, Tararua District Council, Greater Wellington Regional Council and Horizons Regional Council as the consenting authorities, will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Report prepared by:

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Maurice Mills
Senior Civil Engineer

Authorised for Tonkin & Taylor Ltd by:

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Nick Peters
Project Director

7-Sep-23
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