

Erosion and Sediment Control Plan

for

Kaimai Wind Farm



Prepared for Kaimai Wind Farm Limited

Prepared by Ridley Dunphy Environmental Limited

Revision Number 1.0

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1. Introduction

This report provides an erosion and sediment control plan (ESCP) in support of the resource consent application by Kaimai Wind Farm Limited for the proposed 24 turbine wind farm project located along the north-western extents of the Kaimai Ranges in the Waikato Region; known as the Kaimai Wind Farm (the Project). The Project is proposed within an overall site area of 1,304 hectares located approximately 5 kms south of Paeroa, and approximately 8 km north of Te Aroha, as shown on Figure 1 below.

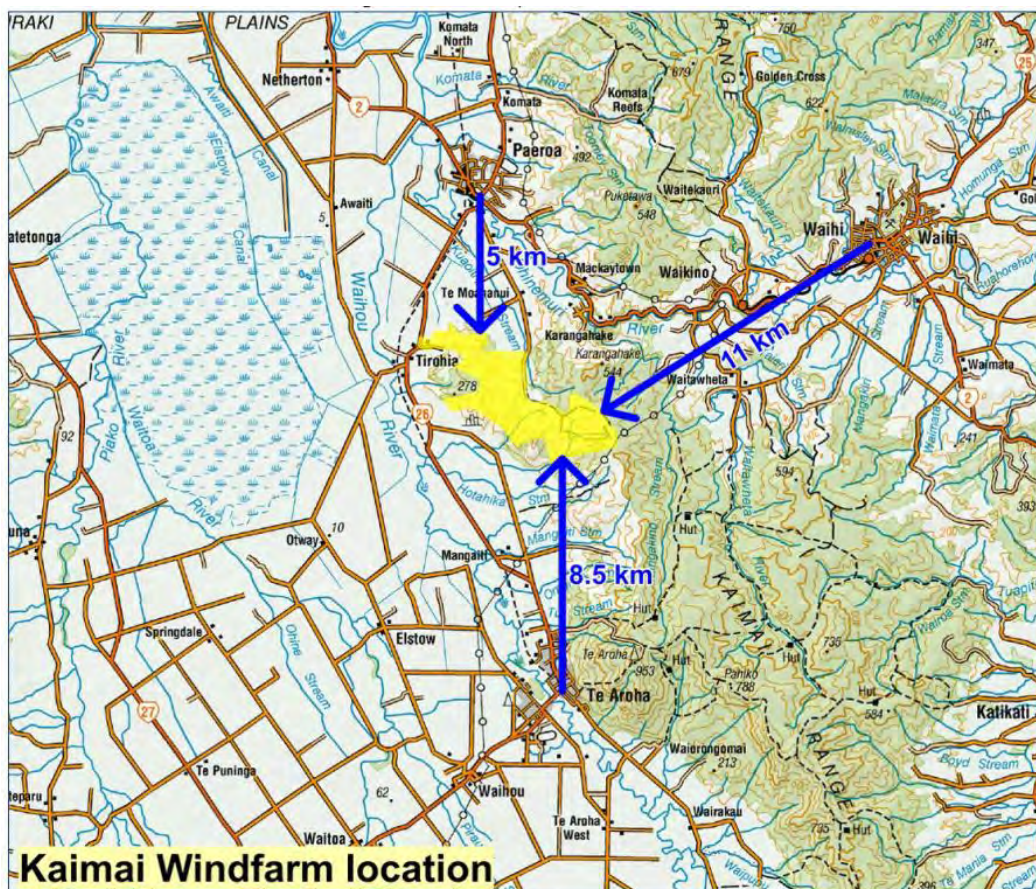


Figure 1: Site location map (McCabe, et al., 2018)

1.1 ESCP purpose and scope

This ESCP has been prepared by Ridley Dunphy Environmental Limited and has a key purpose to inform the Assessment of Environmental Effects (AEE) and to support the resource consent application process for the Project. In addition, the ESCP sets out the key principles and practices that will apply for all earthwork activities within the Project and will act as the key guidance document for the construction activities. Prior to undertaking any earthworks on the Project, specific erosion and sediment control plans for that specific location and/or activity will be established and confirmed with Waikato Regional Council (WRC). These will be referred to as Site Specific Erosion and Sediment Control Plans (SSESCP).

The Projects technical reports, plans and construction methodologies have been developed through a series of multi-disciplinary specialists. This Project has progressed through several iterations over more than a decade since investigation for the site first commenced in 2005. The Project has advanced through pre-feasibility and feasibility phases, and is now at the preliminary design phase. The resource consent applications, the assessment of the effects and the development of the associated management plans (including this ESCP) has been based on this preliminary design.

The scope of this ESCP is as follows:

- Identify the construction-related erosion and sediment management issues for the Project;
- Identify the construction erosion and sediment control principles for the Project;
- Describe the environmental management issues and solutions, including erosion and sediment control (ESC) measures for the construction process;
- Develop indicative erosion and sediment control management methodologies for key construction activities;
- Assess environmental risks associated with the key construction activities; and
- Identify monitoring procedures.

Assuming that resource consents are granted, the Project would then move into a detailed design phase with more specific details and plans being developed. As detailed above it is also envisaged that through the detailed design phase the contents of this ESCP will also be refined and amended to include specific Project detail and methodologies and detailed ESCPs will be developed referred to as a SSESCP. This SSESCP would require certification from consent authorities imposed under likely consent conditions.

1.2 Best practice guidelines

The nature and design criteria for all erosion and sediment controls proposed to be implemented for the Project are detailed within the *“Erosion and sediment control – Guidelines for soil disturbing activities”* (Waikato Regional Council, January 2009) (referred to hereafter as the *“Guidelines”*); and the Waikato Regional Council’s *“Earthworks series – erosion and sediment control factsheets”* where indicated for particular erosion and sediment control methods (referred to hereafter as the *“Factsheets”*).

This ESCP follows these Guidelines and Factsheets, and also seeks to implement erosion and sediment controls that are an adaption of the prescribed controls from these Guidelines or Factsheets. Any adaptations from this ESCP will be clearly identified, with the proposed implementation and design criteria detailed in the SSESCEPs.

2. Project description and existing environment

2.1 Overview

This ESCP does not repeat the details of the Project description itself or the existing environment within which it is to be located. These aspects are clearly identified within the other supporting information for the Project. The following however summarises the key Project parameters that are considered to be of relevance to the earthworks and associated erosion and sediment controls implemented.

2.2 Key project parameters

The following table confirms the key Project parameters that are considered of relevance to earthworks activities.

Key Project Parameter	2DArea / Volumes / Discussion
Area of Earthworks for Road	266,000 m ² (26.6ha)
Area of Earthworks for Fill Sites	212,500 m ² (21.2ha)
Area of Earthworks for Turbine Establishment Including turbine platforms, substation platform, transmission tower(s), and assembly area	95,000 m ² (9.5ha)
Other Earthworks Including potential road corner widening, turning areas and quarry area	23,300 m ² (23.3ha)
Total Earthworks over 25 degrees	Up to 10 ha of area as identified in the plans within Appendix A
Total Combined Earthworks Area	596,500 m ² (59.6ha)
Total Cut Volume of Earthworks	900,000 m ³
Total Fill Volume of Earthworks (excluding Fill Sites)	113,500 m ³
Total Fill Volume of Earthworks for Fill Sites	786,500 m ³
Length of New Road	8,200 m
Length of Road to be Upgraded	10,700 m
Number of Turbine Platforms	24

Table 2: Key Project Parameters

3. Risk assessment

The Project is generally linear in nature and will largely involve works occurring along ridge tops on several fronts. The earthworks areas will be subject to ongoing stabilisation as works progress to minimise the open areas of earthworks and the potential for sediment generation (erosion) and subsequent sediment yield from the Project.

The key elements of construction related environmental risk for this Project are the exposure of bare land, the steep nature of the topography in sections of the Project, and works within or adjacent to watercourses. The Waikato Regional Plan further assists with identification of risk and contains a definition of high risk erosion area as including in summary:

- *Any part of any activity where the pre-existing slope of the land exceeds 25 degrees;*
- *Any part of any activity adjacent to water bodies (including ephemeral watercourses draining catchments greater than 100 hectares).*

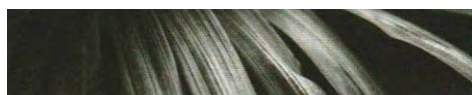
Key risk locations for this Project are therefore assessed as:

- Works within and adjacent to watercourses, primarily for the proposed culvert replacement and upgrade works;
- Cut and fill operations in steep high-risk erosion areas (defined as greater than 25-degree pre-existing slope) as defined on the plans within Appendix A; and
- Cleanfill site establishment and placement.

To assist with an understanding of the nature and magnitude of this risk we have evaluated the existing topography through site visits and plan assessments. In addition through the development of SSECPS we will confirm and identify steeper locations as higher risk and will manage this accordingly.

Those areas with slopes exceeding 25-degrees (approximately 10ha of earthworks) will be subject to a higher level of detailed design and ongoing contractor monitoring, as outlined in Section 10 of this ESCP. These monitoring and maintenance procedures will be defined further and confirmed through the SSECPS. In summary, the monitoring and maintenance will, in particular, focus on pre-forecast rainfall monitoring and post rainfall monitoring to ensure all erosion and sediment controls are in place, are working as intended and are achieving the required outcomes and will also include a water quality monitoring programme of the receiving environment.

Overall sediment yield risk is assessed for the proposed earthworks within the Project area, in the context of both event probability and associated consequence. The area of Project earthworks is not significant and will be undertaken in various stages in a lineal fashion. The risk from the earthworks themselves can be reduced by reducing exposed open areas at any one time and as part of this, progressively stabilising as works proceed. The erosion control practice of cut and cover



methodologies will therefore have a significant impact on reducing overall sediment generation and yield.

To assist in this process, it is recommended that a 14 day maximum period of leaving exposed areas with no works occurring is assessed as a critical risk reduction element, and will in itself, encourage progressive stabilisation.

Within all earthworks, including the higher risk locations, both erosion and sediment controls will be installed to minimise, capture and treat sediment laden runoff that may enter the receiving environments. Additionally, for the higher risk locations the duration and timing of works will be minimised as far as practical to minimise disturbed soils exposed to heavy rainfall. It is recommended that as part of the SSES CP process, this risk be specifically identified, the nature of the risk understood, the exposure of works to heavy rainfall are assessed and specific actions to manage this risk are identified and implemented.

Indicative methodologies for both cleanfill site establishment and placement and streamworks/culvert placement have been developed and are outlined in Section 5.8 of this ESCP. Again, these methodologies will be defined further and confirmed through the SSES CP development.

3.1 Winter works

It also recognised that wetter periods of the year (e.g. May to September), which also corresponds to colder air and soil temperatures, may pose a higher risk for sediment discharges. This is due to increased rainfall, saturated soil profiles and also cooler temperatures reducing the ability for revegetation to occur. Earthworks within this period will need to reflect this higher risk which will be achieved through the SSES CP process, whereby works during wetter periods will require additional management procedures. This is supported by winter works “restrictions” where works over that period will be aligned with the climatic conditions and also the SSES CP process which includes the identification of risk and risk management.

In some areas earthworks activities will likely to be required during the winter months and in accordance with the WRC winter works standard procedures, should winter works be required in any given year a winter works application will be prepared and submitted to WRC in writing by 1 April. This application will include:

- The nature of the proposed winter works, including the proposed locations;
- Identification of higher risk activities and locations;
- The proposed erosion and sediment control methodologies and any additional erosion and sediment controls required to manage the higher risk associated with working during the wetter winter period (e.g. chemical treatment of sediment retention ponds); and
- The proposed monitoring and maintenance schedule of the proposed erosion and sediment control methodologies.

For the winter period this risk assessment, which shall be undertaken within the SSESCP process, will specifically consider:

- The scope/nature of the proposed works;
- Structural controls proposed, or existing, that will be/are installed;
- Additional non-structural controls to be implemented (e.g. increased on site monitoring and staging); and
- Maintenance consideration of structural controls to ensure effective access can be achieved to undertake the maintenance and controls continue to work efficiency.

4. Erosion and sediment control principles

Within the WRC Guidelines there are a series of key principles that apply to all earthworks. These underpin this ESCP and the earthworks/construction methodology that applies. These are summarised as relevant for this Project as detailed below:

Minimise disturbance

A minimum earthworks strategy with a low impact design will be implemented, avoiding watercourses, wetlands, springs and where possible steep contours. All limits of disturbance (extent of earthworks) are illustrated on the plans provided with the application.

Stage construction

The extent of exposed soil and length of time that area is exposed has a direct influence on the sediment yield leaving a particular area of the site. Earthworks and construction activities will be staged and sequenced in order to limit the area of exposed soil required to complete an element of the work. Open earthworks areas will be progressively stabilised to reduce the potential for erosion to occur with a 14 day period recommended.

The specific sequencing and staging for this Project will evolve and be refined as the construction methodology is confirmed through the detailed design phase.

Protect steep slopes

Where possible, earthworks on steep slopes will be avoided. The bulk of the earthworks will occur on top of ridgelines. Runoff from the exposed working areas will be diverted where possible from steep slopes (as identified within Appendix A) to minimise the risk of erosion. If steep slopes require earthworks then progressive and rapid stabilisation will occur to protect these areas from erosion. A cut and cover methodology will apply to a large percentage of the roading activity.

Protect watercourses

Existing watercourses and proposed drainage patterns are indicated on the plans provided with the application. Existing watercourses will be protected from works and sedimentation by the proposed controls included in this ESCP.

There are culverts as identified within the application which require replacement/upgrades that are along the existing Romaru Stream. A streamworks and culvert placement methodology has been developed which includes strategies to protect where practicable, and minimise discharges to the watercourses during construction works.

Stabilise exposed areas rapidly

Progressive and rapid stabilisation methods (e.g. hay/straw mulching, hydroseeding, aggregate placement) will be implemented to minimise the length of time areas of works are exposed, thus



minimising the potential for erosion and sedimentation. Additionally, areas of completed works will be protected from stock until fully rehabilitated. As mentioned above exposed earthworks areas will be progressively stabilised to reduce the potential for erosion to occur with a 14 day period recommended.

Install perimeter controls

The bulk of the earthworks will occur on top of ridgelines and therefore, in this case it will limit upstream catchments entering the working areas. Where there is an upstream catchment to working areas, perimeter controls (e.g. clean water diversion bunds/channels, silt fences etc) will be implemented. These are designed for the key purpose of keeping clean water away from earthwork locations and also for diverting dirty water flows to sediment control devices where installed.

Employ detention devices

Sediment laden water will be treated by detention devices (e.g. sediment retention ponds, decanting earth bunds and sediment pits) prior to discharging into the receiving environment. Indicative detention devices and design are illustrated on the ESCP schematics in Appendix A and B.

Experience and training

As detailed in Section 11 of this ESCP, all earthworks will be managed by an appropriately qualified person experienced in erosion and sediment control and associated environmental issues. These people will have clearly defined roles and responsibilities including monitoring compliance with the imposed consent conditions and meeting with consent authorities as required.

Ensuring the plan evolves

As detailed in Section 12 of this ESCP, the ESCP is a live document, and as such it will be reviewed routinely and updated during the course of the Project to reflect material changes associated with construction techniques, communication, monitoring results, mitigation, compliance or the natural environment. Importantly the development of SSES CPs prior to any earthworks occurring will form the key document for implementation.

Assess and adjust

As detailed in Section 12 of this ESCP, a monitoring and maintenance programme of the erosion and sediment controls will be established, including a proposed stream monitoring programme. Based on the results of this monitoring; the erosion and sediment control measures will be maintained and adjusted accordingly to ensure these controls are operating efficiently and effectively and in accordance with the ESCP, the SSES CP and best practice.

To expand on these overarching principles further the following will apply to all earthworks associated with the Project.

1. Erosion and sediment control will, where practicable, be undertaken and implemented with a hierarchy and priority order as follows:

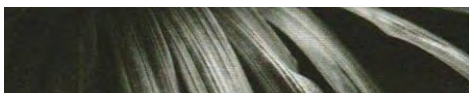


- Erosion control will be provided for in all circumstances by minimising sediment generation through a range of structural (physical measures) and non-structural (methodologies and construction sequencing) erosion control measures.
 - Sediment control will be implemented for all sediment laden discharges.
2. All erosion and sediment controls will, where practicable, meet the minimum criteria of the WRC Guidelines and will incorporate innovative ideas and procedures to match the local challenges and opportunities.
 3. The development of SSESCPs, in accordance with the direction and principles of this ESCP, will allow for future innovation, flexibility and practicality of approach to erosion and sediment control and shall allow the ability to adapt appropriately to changing conditions.
 4. Progressive and rapid stabilisation, both temporary and permanent, of disturbed areas using mulch, aggregate and geotextiles will be on-going during the earthworks phase.

Stabilisation will need to be appropriate to the soil surface geology with the intent of achieving an 80% vegetative cover or non-erodible surface over the entire exposed area of earthworked areas. Stabilisation is designed for both erosion control and dust minimisation and will be progressively implemented, including temporary stabilisation of those areas of earthworks not actively worked for more than a 14-day period.

5. All sediment retention ponds (SRPs) and decanting earth bunds (DEBs), if utilised, will be fitted with floating decants with a mechanism to control (or cease) outflow during dewatering pumping activities to these structures if required. This mechanism could take the form of a manual decant pulley system or plug. Pumping will be such that pump volumes will only be to the same level as that able to be fully captured within the retention structure and discharged out the designed decant structure.
6. Stream works will be undertaken in a manner that recognises the higher risk of this activity, from a sediment generation and discharge perspective, and the sensitivity of the receiving environments. Where practical, works with active stream channels, and any associated works with streams will be undertaken in a “dry” environment. This will typically be based upon diversion of flows around the area of works via pumping.
7. A monitoring and management approach which allows continuous improvement in response to monitoring outcomes will be utilised for the construction activity through:
 - a A risk assessment within the SSESCPs which will act as a tool to help identify construction risk, identify any specific risk management approaches and advise the construction planning and approach to erosion and sediment control; and
 - b Proactive water quality monitoring for high risk activities such as streamworks, both qualitative and quantitative, will occur as part of the Project implementation as a way of assessing the effectiveness of the treatment and allowing for

improvements/modifications as the Project works continue. Qualitative monitoring will include visual surveys of the downstream environment.



5. Construction activities

This section includes the details of ESC measures and methodologies required to manage erosion and sediment runoff from the various construction activities associated with the Project. The activities include:

- Roothing and access track establishment;
- Wind turbine platforms;
- Assembly and laydown areas;
- Ancillary structures;
- Underground cable network construction;
- Fill placement and management;
- Quarry aggregate extraction;
- Streamworks and culverts; and
- Concrete and hazardous material management.

The works methodologies discussed below are conceptual and general in nature based on current knowledge of the activities; however, these have been subject to ground truthing to ensure that they are practicable and feasible. The ESC approach has also built on the knowledge of a number of similar wind farm projects completed within New Zealand providing further confidence of implementation. The ESC measures and methodologies have been established based on the above principles and have a clear objective of ensuring that effects are managed to an acceptable level.

Appendix A of this ESCP provides some indicative plans of the proposed measures to be implemented.

Detailed and site or activity specific descriptions of the methods required to manage erosion and sediment during the construction phase for the various construction activities will be further developed and detailed within the SDESCPs.

5.1 Roothing and access track establishment

The Project will include a total of 18.9km of roosting and access tracks which typically follow existing farm access tracks and ridgelines. Approximately 10.7km of this road network is on existing farm tracks. The roads are typically 6 metres wide on straight sections, and slightly wider on the corners with some cut and fill to allow for the necessary turning radius. The surface water drainage will be managed by cross-fall gradients, roadside collection channels and culverts. A typical cross section of the proposed road alignment is illustrated in Figure 3 below.



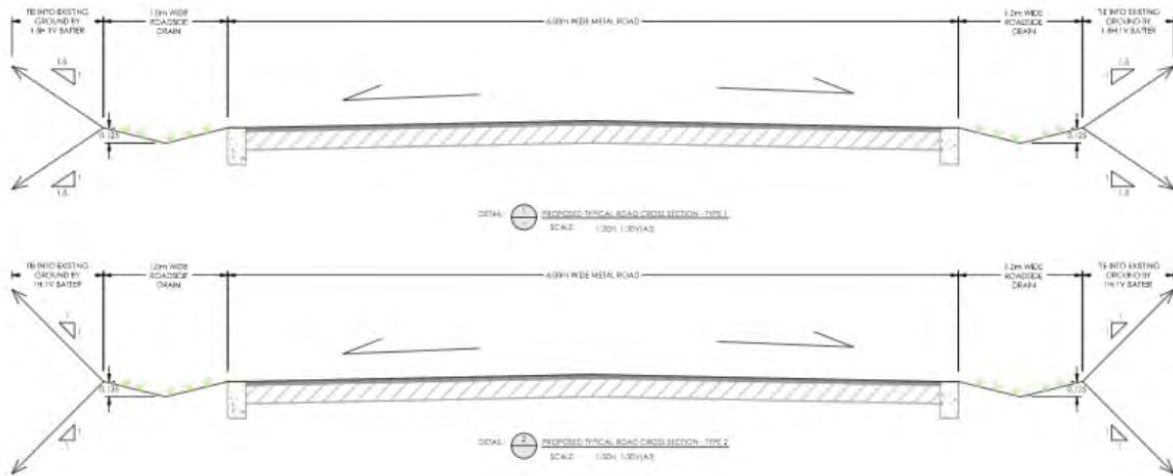


Figure 3: Typical road cross sections - Type 1 (top) and type 2 (bottom) (McCabe, et al., 2018)

Generally, the roading and access tracks can be constructed with cut and fill operations of no greater than 2m depth, however there are localised sections where excavation of up to approximately 10m depth is required, and filling to approximately 7m in depth. The proposed batter slopes are generally no steeper than 1 vertical on 1.5 horizontal, but in some areas are as steep as 1 vertical on 1 horizontal.

The general road construction methodology is as follows:

1. Strip topsoil from the alignment of the road and access tracks and temporarily stockpile in designated stockpile locations for future re-establishment use. The condition of the existing road alignment is very good and where such roads are in place the activity will be more of a widening operation rather than new formation. Plate One below illustrates the nature of these existing road alignments.





Plate 1: Existing access track formation

2. All temporary stockpiles will be located on flat contour with topsoil transported to these locations as necessary. Erosion and sediment control for the stockpiles will be “independent” for that specific stockpile only and will be based on a silt fence or filter sock around the stockpile location. No stockpiles will be placed within 20m of stream systems.
3. Excavation for site tracks, crane pads, and laydown areas will closely follow the topsoil strip and will be taken down to suitable soil formation or bedrock. Where traverse sloping ground is encountered a cut and fill construction will be adopted with aggregate generated from the cutting of the uphill batters and drainage channels being used to form the road embankments to the downhill side of the track.
4. Each layer will be compacted and shaped in order to provide a road profile and finish suitable to accommodate the turbine construction, delivery, and service vehicles.
5. A drainage channel will be formed between the toe of the uphill batter and the edge of the road. This will intercept any rainwater runoff, which will then be directed under the road via appropriate sized pipes or culverts into existing drains where available. Where necessary, additional culverts will be installed to maintain the site hydrology.

6. The road formation will be staged such that as the road is formed a cover of aggregate can be placed over the track surface to achieve a stabilised area. This is referred to as a “cut and cover” methodology and earthworks themselves will progress no more than 24 hours in advance of the stabilised surface. This has the effect of reducing sediment generation and also associated risk. Where Sediment Pits are not installed as per Note 10 below the methodology of cut and cover will be a key and will have emphasis place on this to ensure a stabilised surface remains prior to rainfall.
7. The source of the surface aggregate will be confirmed through the SSESCP which will include from offsite, from specified borrow locations (as per Section 5.7 below) or from the road cut material itself. Many of the road cuts are expected to enable aggregate to be won and therefore this will simply be placed as stabilised material close the same location.
8. The methodology also provides for the ability to avoid concentrating flows to a point where scour and sediment generation can result.
9. Any cut or fill batter slopes will be fenced from stock access and will be revegetated on completion.
10. Where contours allow the installation of “Sediment Pits”, (as per the WRC Guidelines) these will be installed to intercept runoff and capture some sediment prior to discharge. All discharges will be to a grass environment which will act as a further polishing device prior to the runoff entering stream systems.
11. Filter socks will also be installed at the base of fill batters where other alternatives are not practicable.

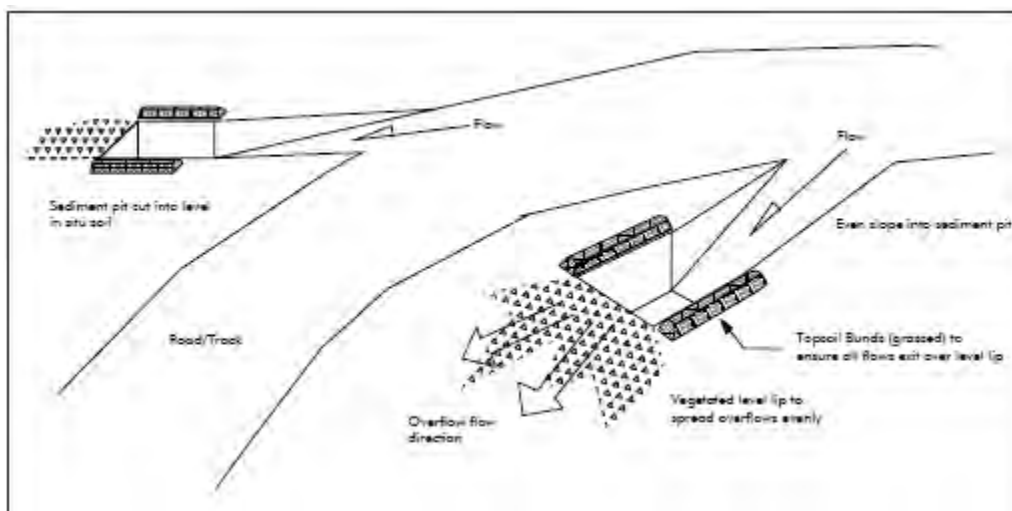


Figure 3: Sediment Pits design from WRC Guidelines

12. In some locations on the access tracks there is the requirement to cross over headwater stream and spring systems. These locations will require culvert placement and will be managed, from an erosion and sediment perspective, as per the streamworks culvert

placement methodology detailed in Section 5.8 Streamworks and culvert construction below. This effectively means working within a dry period with no rain forecast, temporality damming and pumping any flows around the culvert location, installation of the culvert and backfilling and stabilising. A key aspect of this methodology will be to minimise the duration of the culvert placement to consequently reduce risk.

13. For all access tracks in the vicinity of these headwater stream and spring systems the surface runoff will be diverted away from the stream itself via established bunds to minimise direct discharge into the stream system and to utilise grass buffer zones that are available.



Plate 2: Headwater spring directly above existing access track

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the access track formation activity.

5.2 Wind turbine platforms

The Project consists of 24 wind turbines, which all require earthworks to form a level platform for the construction of the turbine. The wind turbines are generally located close to or on top of ridgelines,



or on the upper side of slopes, therefore minimising the contributing water catchment to these platform locations.

The platforms will all be formed solely on virgin material (as opposed to fill), therefore the likelihood of erosion or subsidence is greatly diminished.

The turbine platforms are nominally constructed approximately 2.5m to 3.5m below ground surface and approximately a 26m by 26m octagonal shape. This size is conservative and based on the preliminary civil design. For each turbine, a 18m by 18m crane pad is also required to allow for a mobile crane to be positioned for the turbine construction.

Typical turbine platform arrangements are shown on Figure 4 and Figure 5 below.

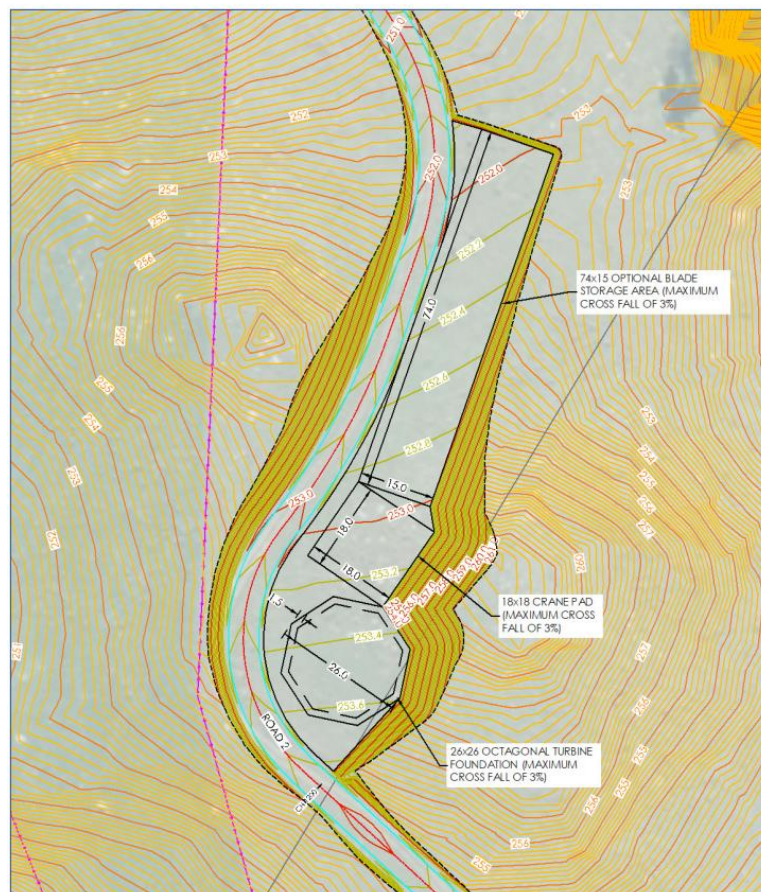


Figure 4: Typical turbine laydown arrangement (McCabe, et al., 2018)

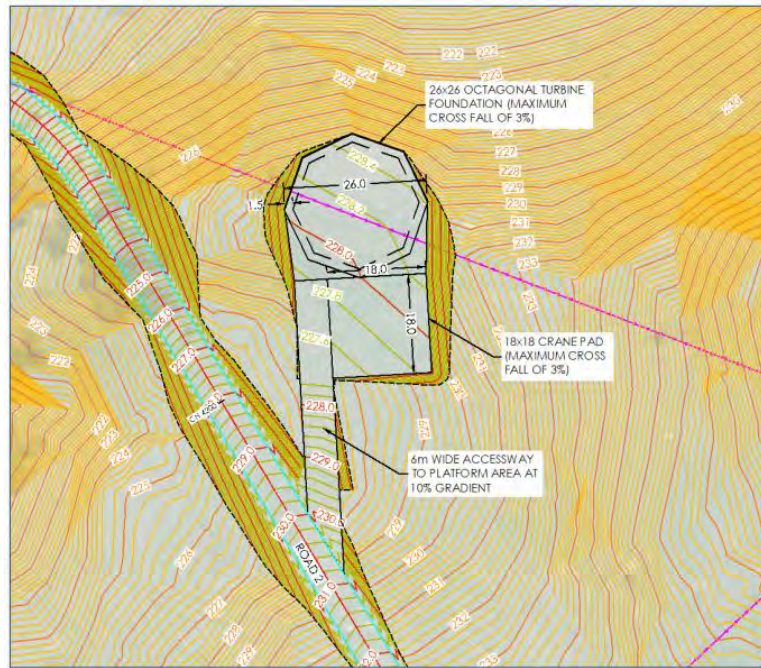


Figure 5: Topography constrained turbine platform arrangement (McCabe, et al., 2018)

Where possible (dependant on the surrounding turbine topography), a laydown/storage area will be sized to allow the laydown of the three turbine blades. Optimally, this will be 74m by 15m. Where the topography does not allow for a laydown area, the turbine components will be picked up by the crane directly from the transporter. The detailed design phase will determine the configuration of each of the 24 turbine platforms and associated crane pad and/or laydown areas.



Plate 3: Turbine 11 location in grass paddock environment





Plate 4: Turbine 19 location in grass paddock environment

In terms of erosion and sediment control these turbine platforms can be treated as isolated areas of work. As can be seen in Plates 3 and 4 above these platforms are all isolated from stream systems and effectively are cut platform activities on grass paddock environments. The overall earthworks footprint for the turbine platform itself and any laydown area is typically less than 2,000m² in surface area. The works will be completed as a single operation and once the cut platform is in place it will be stabilised with aggregate for all weather access. As with the access track formation any surplus material (in particular that from the turbine foundation excavation) will be stockpiled on flat contour with material transported to these locations as necessary. Erosion and sediment control for the stockpiles will be “independent” for that specific stockpile only and will be based on a silt fence or filter sock around the stockpile location. No stockpiles will be placed within 20m of stream systems.

The turbine excavation is anticipated to include a significant amount of aggregate that will then be able to be used directly within the platform, laydown area and also the access roads as necessary. This provides confidence that the stabilised surface can be achieved.

While an immediate cover of stabilised aggregate will be applied to the earthworks surface, for the larger earthworks footprints a formal decanting earth bund will also be established on site as per the WRC Guidelines. Utilising a risk management framework all earthworks associated with turbine platforms (including associated crane pads and laydown areas) of over 1,500m² in surface area will be subject to this decanting earth bund establishment where practicable. For all turbine platforms (including associated crane pads and laydown areas) of less than 1,500m² in surface area the perimeter of the earthworks will be protected with filter socks.



For both of these scenarios the earthworks will all discharge over grass paddock environments which provides a polishing effect prior to entry in stream systems. Stock exclusion is also important and all earthworks will be fenced in this regard.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the turbine formation activity.

5.3 Component assembly and laydown areas

Three component and construction storage areas across the site have been identified. These areas will be utilised for storing the various turbine components while awaiting the construction sequence. These areas will also be utilised for construction machinery and equipment, temporary offices and temporary fuel and hazardous substance storage facilities. The management of this fuel and hazardous substances is further described in Section 5.9 below.

These areas will be approximately 100m by 30m as illustrated below in Figure 6 below and will be stabilised with aggregate to enable all weather access and operation.

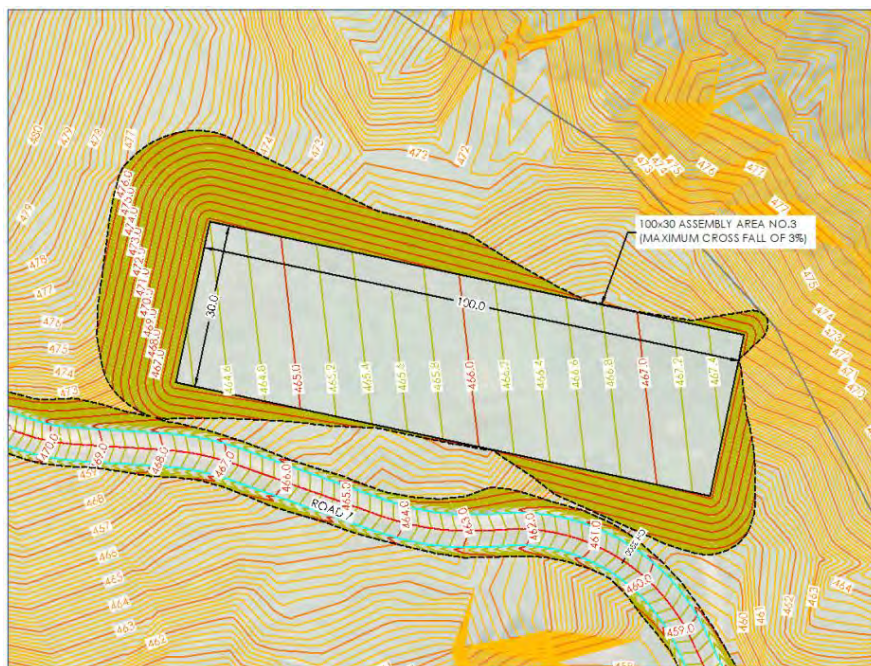


Figure 6: Typical component assembly and laydown area (McCabe, et al., 2018)

In terms of erosion and sediment control, these laydown areas can be treated as isolated areas of work. These areas are all isolated from stream systems and effectively are cut platform activities on grass paddock environments (similar to the turbine platforms).

The overall earthworks footprint for the laydown itself is typically 3,000m² in surface area. The works will be completed as a single operation and once the cut platform is in place it will be stabilised with

aggregate for all weather access. As with the access track formation any surplus material will be stockpiled on flat contour with material transported to these locations as necessary or within the fill site locations.

While an immediate cover of stabilised aggregate will be applied to the earthworks surface, a formal decanting earth bund will also be established for these locations as per the WRC Guidelines. Where the laydown locations are adjacent to, or contiguous with, a fill site then the erosion and sediment controls will be “combined” if practicable to provide for a comprehensive approach to the earthworks area.

For all laydown locations the earthworks will discharge over grass paddock environments which provides a polishing effect prior to entry in stream systems. Stock exclusion is also important and all earthworks will be fenced in this regard.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the laydown areas activity.

5.4 Construction of ancillary structures

The key ancillary structure to be established on site is the substation location. Other ancillary structures such as towers and overhead lines are also to be installed and these will be subject to SDESCPs prior to any associated earthworks. The majority of these activities are very small in terms of surface area and are assessed as able to be managed with filter socks, super silt fences in some locations and progressive stabilisation.

For the substation itself the earthworks are located at the head of a gully system as shown in Plate 5 below. These works will require the installation of a sub surface drain and then filling over this to a level of up to 11m at the south western extent of the substation platform. The batter from this platform will then extend to the natural ground level.

This filling activity, the earthworks associated with Turbine 24 and the access road (road 7 and 12) will all discharge to this same gully feature. At the base of this gully feature a natural platform exists and in this location a sediment retention pond will be established as per WRC Guidelines. It is expected that the works in this area will be relatively focused and therefore a central and single sediment control measure is assessed as the most appropriate device.





Plate 5: Substation General Location

From an erosion control perspective, the two key aspects will be stock exclusion from all earthwork areas, diversion of cleanwater away from the earthworks locations, keeping batter slopes to less than 25 degrees where practicable and progressive stabilisation. As part of this progressive stabilisation the substation batter slopes will be revegetated and planted with scrub species to provide a longer term protection of this area.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the substation activity.

5.5 Underground cable network construction

The preferred method of cable installation is by multiple specialised cable laying machines which will operate once the road access is complete for that specific location. These machines are easily able to cut through coherent rock to form a neat and stable trench, while laying the cable in the trench simultaneously. In addition, there is the ability to also install any necessary subsoil drainage and other utilities at the same time. The cable will be brought to site in drums to be loaded into the cable laying machinery. The cable trench is then backfilled automatically with the necessary material (aggregate material for heat dissipation) a part of the laying process. Once completed the surface will be fully stabilised with either the aggregate cover or a vegetated surface established.



The primary erosion and sediment control is therefore based on a progressive stabilisation with the trench area open able to be stabilised quickly if a forecast rain event occurs. In addition, filter socks will be utilised around all drainage systems and stream channels to ensure there is no direct discharge to these environments.

If dewatering of these trenches is required this will be undertaken via a pump methodology with all pumping to a turkeys nest arrangement prior to a grass environment which is also prior to any discharge into the stream system.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the cable network installation activity.

5.6 Fill placement and management

Approximately 113,500m³ of material will be utilised as engineered fill for the roading alignment, and the balance of 786,500m³ is proposed to be placed within designated cleanfill sites. This surplus material will be used to fill natural depressions and identified fill sites as shown within the Project plans.

From a construction perspective, prior to the placement of fill, the sites will be stripped of topsoil and the area benched. The fill is then nominally track rolled into place. Following the completion of filling, topsoil will be spread and the area re-vegetated. The final grade of the clean fill will be site specific depending on site topography, depth of fill and extent of filling however all batter slopes will be kept to less than 25 degrees to maintain a lower erosion risk overall. This 25 degree slope will also allow for future landuse as a pastoral farming activity.

From an erosion and sediment control perspective the topsoil stripped from the sites will be stored in areas of flat topography and will be managed in an “independent” manner for that specific stockpile only and will be based on a silt fence or filter sock around the stockpile location. No stockpiles will be placed within 20m of stream systems.

The only fill to be placed in these designated fill sites is that associated with the wind farm construction.

For the fill sites themselves the first step that will be undertaken is the confirmation that the fill site is appropriate sited, avoids direct filling over stream systems and where practicable avoids vegetated areas. This exercise has already occurred as part of the advancement of the Project design, however will be able to be fine tuned prior to filling activity. The SSESCPs will confirm this process. As an example; filling as identified at Ch 3200 Road 7 was originally placed over a stream gully and also a small area of vegetation. This fill site has since been “pulled back” to avoid these features and this in itself has a direct benefit in reducing erosion and sediment yield.





Plate 6: Fill Location Ch 3200

Once the extent of the fill is confirmed then a specific sediment control device will be installed which will likely be in the form of a decanting earth bund. This will be designed as per the WRC Guidelines and will be based on the contributing catchment area. Clean water diversions and dirty water diversions as per the WRC Guidelines will also be installed.

The fill sites will operate based on a tip head and therefore there is the ability to manage open areas to minimise the exposed surface. This progressive stabilisation continues as a key element with this activity. The fill sites will however be constantly added to over time and will remain open in this manner until such a time as the fill source for that site is complete.

These fill sites are identified as a potentially higher risk activity due to the ongoing nature of them and the contour of the ground within which they are located. This specific risk identification, and risk management will be addressed within the SS ESCPs that are developed.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the filling activity.

5.7 Quarry Aggregate Extraction

The proposed quarry operations are effectively based on removal of any topsoil and establishment of an aggregate extraction operation. The extraction itself is mechanical and there is no anticipated washing or water use (unless required for dust suppression) on site. Key elements of this operation are:



1. The quarry locations and Turbine 10 erosion and sediment control will be integrated as shown on the erosion and sediment control plans.
2. Works are well isolated from stream systems and have a significant grass buffer zone between works area and headwater streams in valley floor. All flows from the quarry will be directed to the west. There is expected to be some infiltration within the aggregate extraction location itself.
3. Any stripping of topsoil where necessary will be placed in locations with “independent” erosion and sediment controls established.
4. A decanting earth bund will be established as shown below the site. This can be upgraded to a sediment retention pond if the contributing catchment area determines this.
5. Decanting earth bund to capture (through dirty water diversions) quarry, turbine platform and access road.
6. The quarry operation will occur on a quarry platform and discharge via the decanting earth bund. Any stockpiles of aggregate will be on the quarry floor or transported immediately to end use location.
7. Stock exclusion will occur during earthworks activity.

Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the quarry aggregate extraction activity.

5.8 Streamworks and culvert construction

The Wrights Road access to the Project site requires a number of stream crossings where existing culverts are in place and either need full replacement, upgrading or extensions put in place. These are described in full within the ecological report and can be categorised into dry ephemeral gully systems and flowing water courses. The methodologies for the construction of these culverts will be determined on a site by site basis and confirmed within a SDESCP. With respect to this ESCP however, each culvert location has been viewed and assessed as to the appropriateness of the methodologies that follow. This process has confirmed the suitability of these methodologies within the final design details to be included within the SDESCPs.

A key consideration when assessing the appropriate methodology for culvert construction is that there is limited room availability on all the culverts viewed for the installation of a formal diversion around the works location. This will be further investigated as an option within the SDESCPs however it is assessed that the key methodology to be employed will be based on a dam and pump process.

Where pumping is to occur the operation will be carried out as follows:

- Place a temporary non-erodible dam within the existing stream channel upstream of the work area and install a pump approximately 5m upstream of the dam. The pump will pump flows



upstream of the works around the work area and discharge them back into the existing watercourse downstream of the culvert works;

- Sand bags or similar will be used to impound flows for the pump. The inlet of the pump will be supported above the base of the stream and will contain a fish grill, to prevent fish from entering the pump intake structure;
- Sandbags, as a coffer dam, will also be installed downstream from the culvert works to effectively create a works area where any runoff and water captured can be treated prior to discharge;
- The pump flow rate will be equal to the expected dry weather flow for the particular stream;
- The Ecology Report provides for fish management measures however with the controls in place, any fish observed in any of the pools within the work area will be recovered and released downstream;
- Works can commence and will involve the culvert removal, upgrade or extension as required. Any excavated material will be removed from the work area and disposed of within one of the identified fill sites;
- Once all unsuitable and soft material has been removed from the extent of the culvert to be constructed, the area will be backfilled with the required amount of structural fill and the culvert along with any associated wingwalls, retaining walls and backfill will be constructed;
- Any other construction activity associated with the culvert construction, such as the placement of fill, will only be carried out once ESC measures such as super silt fences have been put in place. When the works have been completed, any disturbed and exposed areas of bare earth will be fully stabilised through mulching or vegetation establishment; and
- The pump and coffer dams will be removed and the stream flows can then be passed through the new culvert structure.

This methodology will apply to all stream systems where flow is recorded.

An alternative methodology can apply whereby if an existing culvert is to be extended, a plywood bulkhead, or equivalent, with a flexible bypass pipe can be fixed into the bulkhead of the culvert. The bulkhead will be sealed into the base and sides of the existing culvert. If required a supplementary pump will be used to ensure a dry working environment. The flexible bypass pipe will be a sufficient length to allow low flows to discharge beyond the works area while the works continue.

Where flow is not recorded within ephemeral dry gullies, a similar methodology will occur however pumping will not be required. These works will be completed in a short duration and stabilised as quickly as practicable. Downstream of works in such dry gullies a coffer dam will still be established which will capture any discharges for treatment.

All culvert works

The following will be required for the construction of all culverts:

- Prior to any works commencing on the construction of a particular culvert a period forecast of dry weather sufficient to construct the culvert will be confirmed through appropriate weather monitoring system;
- Culverts are expected to be installed in stages and each stage will be fully constructed and the immediate area stabilised at the end of each working day;
- Any water present within the work area will be pumped to a turkeys nest and then to a grass environment which will be located a minimum distance of 20m from, and discharge away from, the stream environment; and
- On completion of the culvert works, all plant, materials and labour will be demobilised and the site will be permanently stabilised in accordance with the SSESCP for that work area.

In the event of high rainfall during the course of construction of the culvert, or prior to leaving the site for more than a 24-hour period, the following will occur:

- That any loose material that could enter a watercourse is to be removed from the flood plain of the stream;
- Any downstream sand bag barriers will be checked and, if required, removed;
- All existing sediment control measures will be inspected and secured and maintained where required should a significant rain event be forecast. The streambed in the location of the culvert will be fully stabilised to ensure no flows overtopping the upstream dams or bunds can create scour issues. It is expected that this will be achieved through geotextile membrane being appropriately trenched in at the head and toe of the work area; and,
- Extend the working hours subject to compliance with relevant consent conditions, if it is believed to have significant benefit with regard to programme, forecast weather events and environmental impacts.

We consider that the above process, methodology and controls can be effectively implemented on site during construction. Within Appendix A of the ESCP a schematic is provided showing the erosion and sediment control measures and methodologies that will apply to the streamworks and culvert construction activities.



5.9 Concrete and hazardous spill management

Non-sediment contaminants generally consist of site and materials management measures that may directly or indirectly discharge into the receiving environment from site activity. Potential non-sediment contaminants used in construction activity on the Project are listed in Table 2 below with Table 3 also providing the management approach for these contaminants.

Product / work activity	Potential contaminants	Indicator	Non-visible potential contaminants
Adhesives	<ul style="list-style-type: none"> • Adhesives • Glues • Resins • Epoxy • PVC Cement 	Oily sheen or discoloration from some products	<ul style="list-style-type: none"> • Phenols • Formaldehydes • Asbestos • Benzene and • Naphthalene
Concrete	Cement	Discolouration	Alkalinity (High pH)
Flocculants	May be used as a contingency within the site earthworks. Contaminant is specific to Flocculant used but can include pH and aluminium	Clarity	<ul style="list-style-type: none"> • Aluminium toxicity • pH
Sanitary Waste	Portable Toilets, disturbance of sewer lines	Discolouration, sanitary waste	Bacteria, Biological Oxygen Demand, Pathogens
Vehicle and Equipment Use	Equipment operation, maintenance, washing, refuelling	Oil sheen, sediment	Total Petroleum, hydrocarbons, coolants, benzene and derivatives

Table 2: Potential Non-Sediment Contaminants

Product / work activity	Potential contaminant management
Adhesives	<ul style="list-style-type: none"> • Store materials in an area that is not subject to rainfall contact • Use adhesives carefully and clean up any spilled material • Properly dispose of containers in designated disposal areas once empty
Concrete	<ul style="list-style-type: none"> • Concrete truck chutes, pumps and internals should only be washed out into the formed areas awaiting installation of concrete or to specifically designed concrete wash facilities • Unused concrete remaining in trucks shall be returned to the concrete supplier yard • Hand tools should only be washed out into the formed areas awaiting installation of concrete
Flocculants	<ul style="list-style-type: none"> • If flocculants are to be used a specific flocculation management plan will be developed • Ensure the use of flocculants follows an approved flocculant management plan and industry best practice • Regularly measure pH of the discharge from sediment retention devices
Sanitary waste	<ul style="list-style-type: none"> • Place portable toilets away from site vehicle movement areas • Service portable toilets regularly • Empty portable toilets before they are moved
Vehicle and equipment use	<ul style="list-style-type: none"> • Fuel storage tanks, if on site, shall be bunded to store a minimum of 100% of the tank's capacity. No bulk fuel storage is expected for the Project and mobile refuelling will occur. • Procedures and practices shall be put in place to minimise or eliminate the discharge of lubricants, coolants or hydraulic fluids to the receiving environment. • Machinery maintenance will occur only where procedures, spill prevention and control measures and spill kits are in place.

Table 3: Potential Non-Sediment Contaminants Management Approach

6. Key erosion control measures

Erosion control on the Project and where these are utilised is outlined above for the various activities. The erosion control measures will be designed, implemented and maintained in accordance with the WRC Guidelines with some of these illustrated within Appendix B.

In general, the erosion control measures to be applied to the Project are summarised as follows:

Erosion Control Measure	Purpose	Typical application Note: Design details to be confirmed in relevant SSESCPs
Sediment pit	Detain runoff flows from road surfaces and earthworks to allow heavier sediment particles to drop out and retain the maximum sediment onsite.	To drain water tables along access road construction activities. All sediment pits to discharge to grass environments. Design as per Section 2.6 of WRC Guidelines.
Clean water diversion or bund and dirty water diversion bund	Intercept and convey runoff from undisturbed catchments to stabilised ground or stream. Dirty water diversions divert flows to sediment retention devices for treatment.	All clean water drains to discharge to stabilised ground or a constructed stabilised outlet. These drains may be stabilised dependent upon soil type and slope for the specific area of works. Design as per Section 2.1 of WRC Guidelines.
Pipe drop/ flume structures (clean or dirty water)	Convey a concentrated flow of clean or dirty surface runoff down a slope and minimise causing erosion.	May be used to convey run-off down incomplete cut and fill batter slopes, either to keep separate clean and dirty water, or to convey flows to treatment devices without scouring of the batter. Design as per Section 2.14 of WRC Guidelines.

Erosion Control Measure	Purpose	Typical application
Rock check dams	Reduce the velocity of flow within the channel and prevent scour of the channel surface. Check dams also allow for some settlement of suspended solids within the channel.	<p>Note: Design details to be confirmed in relevant SSESCPs</p> <p>May be used where diversion channel velocities are causing scour in the base of channels.</p> <p>Design as per Section 2.9 of WRC Guidelines.</p>
Stabilised entrance ways	Stabilised pads at site entry and exit points to minimise these areas from becoming a source of sediment and also help to reduce dust generation and tracking of sediment to public roads.	<p>For all site access points.</p> <p>Design as per Section 2.13 of WRC Guidelines and associated factsheet.</p>
Contour drains	Temporary ridges or excavated channels that are constructed to convey water across a slope at a minimum gradient. They reduce the slope length and therefore the velocity of water flowing down disturbed slopes and hence reduce the erosive power of construction runoff.	<p>For all earthworks areas prior to forecast rain events.</p> <p>Design as per Section 2.2 of WRC Guidelines.</p>
Construction staging and sequencing	As a key principle for erosion and sediment control, the extent of exposed soil and length of time that area is exposed has a direct influence on the sediment yield leaving a particular area of the site. Earthworks and construction activities will be staged and sequenced in order to limit the area of exposed soil required to complete an element of the work. Open earthworks areas will be progressively stabilised to reduce the potential for erosion to occur.	

Stabilisation	<p>Stabilisation will include mulching, hydroseeding, geotextiles and the use of hard fill/aggregate material.</p> <p>Progressive and rapid stabilisation of disturbed areas will be ongoing throughout the earthworks. Stabilisation will particularly apply at stockpile areas and batter establishment to reduce both erosion and dust generation.</p> <p>Design as per Section 2.11 of WRC Guidelines.</p>
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Table 4: Erosion Control Measures

7. Key sediment control measures

Sediment control on the Project and where these are utilised is outlined above for the various activities. The sediment control measures will be designed, implemented and maintained in accordance with the WRC Guidelines or the prescribed WRC factsheets with some of these illustrated within Appendix B.

In general, the sediment control measures to be applied to the Project are summarised as follows:

Sediment Control Measure	Purpose	Typical application Note: Design details to be confirmed in relevant SSESCP
Sediment retention ponds (SRPs)	Detain runoff flows so that deposition of transported sediment can occur through settlement.	Primary device to treat run-off from higher risk locations and areas of earthworks where the catchment is between 0.3- 5 ha. Design as per Section 3.1 of WRC Guidelines and the associated WRC factsheet.
Silt fence/ Super silt fence	Detain runoff flows so that deposition of transported sediment can occur through settlement.	Used to treat un-concentrated run-off (or "sheet-flows") from batter slopes or roads. Due to wind conditions on the Project these will focus on super silt fences where utilised. May also be used on the downslope side of work near waterbodies. Design as per Section 3.2 and 3.3 of WRC Guidelines.
Decanting earth bunds (DEBs)	Detain runoff flows so that deposition of transported sediment can occur through settlement.	Primary device to treat run-off from areas of earthwork, where the maximum catchment is 0.3 ha. Design as per Section 3.6 of WRC Guidelines and associated WRC factsheet.

Silt / Filter socks	Temporarily impound sediment-laden runoff, slowing down the flow rate and allowing sediment to settle out of the water.	May be used on short batter slopes (pinned to ground) and around watercourses and vegetated or protected areas. Can provide secondary containment and treatment where it is not possible to direct flows to a water treatment device. Design as per associated WRC factsheet.
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Table 5: Sediment Control Measures

8. Chemical treatment

Flocculation (the chemical treatment of a sediment retention device) is a methodology used to improve the effectiveness of sediment retention devices, particularly where fine grained soils are expected at the Project site or where a higher risk location is noted such as direct discharges into stream systems. For this Project the majority of the sediment retention devices to be used will discharge overland through grass paddock environments and it is assessed will not likely result in large volumes of sediment entering stream systems. It is for this reason that as part of the current assessment that no chemical treatment is proposed.

It is however also recognised that there may be locations, or activities, where monitoring during earthworks demonstrates that there is a need to implement a more effective erosion and sediment control approach. As part of this the ability to implement chemical treatment is considered as a key tool that should remain if required.

If therefore through the monitoring process (as detailed in Section 10 below) it is found that chemical treatment is required to be implemented a process will be initiated with WRC whereby bench testing will occur to determine the appropriate chemical, dose rate and dosing methodology. This will be undertaken and detailed within either a new SSES CP or an updated SSES CP as required.

This detail will include:

- specific design details of the chemical treatment system;
- monitoring maintenance (including post-storm) and contingency programme;
- details of optimum dosage (including catchment specific soil analysis and assumptions, consideration of any environmental effects);
- where it is considered necessary, procedures for carrying out an initial treatment trial; and
- Details of the person or bodies that will hold responsibility for the maintenance of the chemical treatment system and the organisational structure which will support the system.

The methodology of application will likely be in the form of a rainfall activated shed in addition to the use of batch dosing methodologies. These details will again be confirmed within the SSES CP process.

9. Dust management

Earthworking activities on the Project have the potential to generate dust that may be considered to be a nuisance in times of dry and windy weather. Any potential dust generation is assessed to be well removed from potential receptors, however, dust management is still important from an environmental perspective. To manage any potential effect, the standard procedure is to minimise, identify and acknowledge these effects.

The main practice to be used to control dust on the Project is the application of water to keep soil moisture high enough to prevent dust generation and discharge.

For each area of works, consideration will be given to the following elements which will be identified and confirmed within the SSESCPs:

- The potential effects of dust problems if dust causes a nuisance off site;
- The soil characteristics of the site and whether the timing of operations will help or hinder dust control; and
- Considerations to the earthworks methodology to reduce the dust problems such as progressive stabilisation of earthworks areas as necessary.

Stabilised access roads will be fully utilised and will be maintained as such with a progressive cover of aggregate. This in itself will reduce dust generation.

Mulch and general revegetation will also be utilised to assist with dust management in particular with respect to stockpiles and fill site establishment. Where dust generation is the predominant issue then water applications will be utilised as the initial treatment option.

10. Maintenance, monitoring and reporting

The overall approach to monitoring is to ensure that what is implemented on site is appropriate and can be adapted as necessary over time to ensure that the best water quality outcomes can be achieved as necessary. This will include an integrated approach whereby the Project team itself will undertake monitoring as detailed below and in addition to this a regular Waikato Regional Council inspection is expected to occur whereby specific consent condition monitoring will also occur.

For each SSESCP location this monitoring will be confirmed and any specific monitoring requirements identified.

Prior to the commencement of construction, pre-commencement photographs will be taken in the vicinity of the proposed discharge points and any receiving environments near these works. These records will show the visual state of the receiving environment at and within the vicinity of the discharge point prior to works commencing. This photographic record will be compiled into a log book and will allow a visual comparison of before, during and at completion of the construction of the Project.

10.1 Rainfall Monitoring

To assist with identification of higher risk periods, such as during rainfall events, the Project will utilise on site manual rainfall gauges to provide data for the Project relating to both rainfall quantities which will assist with confirming adequacy of the erosion and sediment control measures and methodologies.

In addition, the Project will utilise rain forecasting (such as metvuw) to understand forecast weather patterns and therefore enable more focused management of higher risk activities during rainfall periods. This may include ensuring that any works within stream or channel systems are fully stabilised prior to rain events to minimise scour and erosion. This will also support the recommended 14 day maximum period of leaving exposed areas with no works occurring and will act as a further critical risk reduction element.

10.2 Routine Device Monitoring

The appropriate installation, location, maintenance, and monitoring of control devices and associated methodologies will ensure compliance of the measures with the relevant standards and conditions of consent. For a significant portion of the Project, the key methodology is based around a cut and cover exercise where stabilisation will be established over a short duration period and utilised as an erosion protection layer.

The purpose of this monitoring is to ensure that all practices, control measures and devices are constructed, operated and maintained so they remain in full compliance with conditions of consent and fully effective in minimising discharges at all times. Device monitoring will largely target erosion and sediment control activities including silt fences, stabilisation including mulching, decanting earth bunds and sediment retention ponds.



This monitoring is aimed at the early detection of activities or problems that have the potential to result in adverse environmental effects. The devices monitoring will act as a trigger for more detailed monitoring should this be required.

This monitoring will utilise a check list system whereby any issues identified are documented and the necessary actions identified including appropriate timeframes. This formal check list (based on the checklist as provided within Appendix C) will occur on a weekly basis for all earthwork locations and in between these checks, daily checks of controls will continue by site staff. It is essential that the monitoring of devices include inspections during rain events so that the success of the devices and controls can be reviewed and improved if appropriate.

Monitoring of these devices will include qualitative monitoring of the following:

- Integrity and effectiveness of all erosion control and sediment treatment devices;
- Activities on site;
- General site conditions and other activities occurring within the catchment; and
- General status of the immediate receiving environment.

The details of the visual (qualitative) inspections will be recorded.

Where actual problems with the integrity and/or effectiveness of the devices are observed (i.e. for both erosion and sediment control and other on-site activities) these will be rectified immediately.

10.3 Triggered Device Monitoring

In addition to the Routine Device Monitoring, there will be more detailed inspections of devices, on-site practices and other catchment activities that will be undertaken in response to certain “triggers”. The triggers for these more intensive / repeat investigations include observations such as:

- Activities observed to be happening on-site that are likely to compromise the effectiveness or integrity of that site’s erosion and sediment controls;
- Taking into account antecedent climatic conditions, a conspicuous change of water colour at the downstream receiving environment that is very different to the colour that is normally associated with conditions at the same site, and with such change in colour not evident at upstream locations above the construction zone;
- Obvious accumulation of sediment in the vicinity of the discharge points, or anywhere else within or in proximity to the active construction zones;
- Streambank collapse or obvious signs of channel erosion / instability in the immediate receiving environments;



- Visual reports / evidence of changes to downstream community structure (e.g. fish kills, death or discolouration of instream plant communities, increased weed growth); and
- Spillage / accident reports by site personnel.

If the results of any routine device monitoring identify any of these triggers, then a more detailed response will occur as follows:

- Ascertain that in all probability the issue is associated with the Project earthworks;
- Inform and liaise with Waikato Regional Council;
- Ascertain the magnitude of the adverse effects (this may involve undertaking immediate monitoring of the ecological variables);
- If the effects have been more than minor, ascertain what response is necessary including any ecological response;
- Determine how to monitor the effectiveness of the response(s); and
- Implement and monitor the response.

A continual feedback loop is included in this process until it has been verified that the implemented responses have been successful. Changes to earthwork site practices or to specific devices may also need to be implemented to avoid any future similar events.

If chemical treatment is utilised within the erosion and sediment control methodologies then a specific chemical treatment management plan will be developed and this will include monitoring of associated discharges from these devices.

10.4 Other Monitoring Requirements

In addition to the devices and flocculation treatment monitoring, the other on-site activities such as storage of hazardous chemicals, refuelling facilities and practices, stock-piles and dust control will also all need to be regularly checked and inspected. The intention underlying these checks is to ensure that they are being properly maintained at all times, and that they remain within the specified standards including consent conditions.

Contingency measures (such as the requirement for spill kits to be present) form part of the responsibility of the Project.

It is further noted that streamworks activities have the potential for direct discharges into the freshwater environment and within this activity specific monitoring of water quality upstream and downstream of these activities will occur and will be documented within the SSESC. This will include undertaking some visual water clarity measurements during such activities at both upstream and downstream locations during works.



11. Site responsibilities

The Project will engage site personnel whom will have responsibility for erosion and sediment control and associated environmental issues. This will include monitoring compliance with the imposed consent conditions and meeting with consent authorities as required.

12. ESCP review and amendments

This ESCP is a live document, and as such it will be reviewed routinely and updated during the course of the Project to reflect material changes associated with construction techniques, communication, monitoring results, mitigation, compliance or the natural environment.

It is expected that these amendments would require certification from consent authorities imposed under likely consent conditions prior to any on-site activities reliant upon the change commencing.

References

McCabe, Kelly and Turner, Jack. 2018. *Kaimai Wind Farm - Assessment of Environmental Effects.* Auckland : Tektus Consultants Limited, 2018.

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— **February 2014.** *Earthworks series - erosion and sediment control factsheet: Silt fence.* Hamilton : Waikato Regional Council, February 2014. 3842.

— **December 2014.** *Earthworks series no. 2 - erosion and sediment control factsheet: Sediment retention pond (SRP).* Hamilton : Waikato Regional Council, December 2014. 4035.

— **January 2009.** *Erosion and Sediment Control - Guidelines for Soil Disturbing Activities.* Hamilton : Waikato Regional Council, January 2009. Technical Report No. 2009/02.

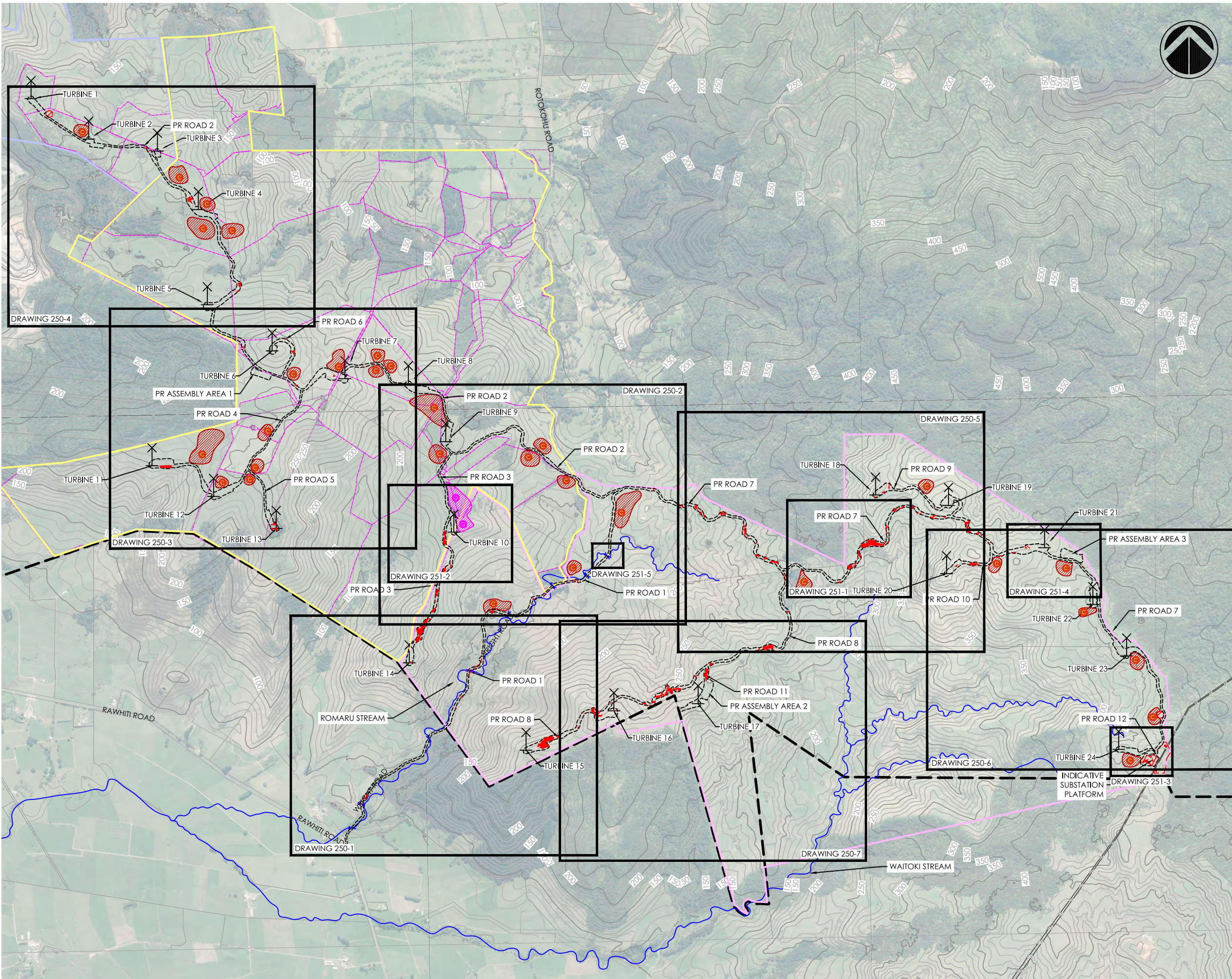
Appendices

Appendix A: ESC Indicative Plans and Slope Plans

Appendix B: Typical ESC Design Details

Appendix C: Weekly ESC Check List

Appendix A: ESC Indicative Plans and Slope Plans



Notes:

1. FOR INFORMATION PURPOSES ONLY.
2. BOUNDARIES, CONTOURS AND OTHER BASE INFORMATION SHOWN IS INDICATIVE ONLY AND PRIMARILY INFORMED BY AERIAL LIDAR SURVEY BY SYNERGY POSITIONING SYSTEMS LTD IN APRIL 2016.
3. COORDINATES SHOWN ARE IN TERMS OF MT EDEN 2000 CIRCUIT AND LEVELS ARE RELATIVE TO THE AUCKLAND 1946 VERTICAL DATUM.
4. THE PROPOSED ROAD ALIGNMENT, TURBINE PLATFORMS, AND OVERALL EARTHWORKS ARE BASED ON AN INDICATIVE ROAD ALIGNMENT AND REMAIN SUBJECT TO DETAILED DESIGN.

LEGEND

- EXISTING PARCEL BOUNDARY
- JACKSON PROPERTY BOUNDARY
- ROTOKOHU FARMS PROPERTY BOUNDARY
- DENIZE BROTHERS PROPERTY BOUNDARY
- HDC/MPDC TERRITORIAL BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXTENT OF EARTHWORK
- PROPOSED TURBINE LOCATION
- EXISTING TRANSPOWER NATIONAL GRID LINES
- PROPOSED ROAD CENTER LINE AND EDGE OF CARRIAGEWAY
- EXISTING FENCE
- INDICATIVE QUARRY SITE
- INDICATIVE CLEANFILL SITE
- EXISTING CULVERT
- PROPOSED UPGRADED CULVERT
- STREAM (WRC REGIONAL MAP)
- EXISTING SLOPE TRIANGLE GREATER THAN 25°

A | ADDITIONAL PLAN FOR S92 RESPONSE | LT | 12.10.18

REV: DESCRIPTION: BY: DATE:
 STATUS: **RESOURCE CONSENT**

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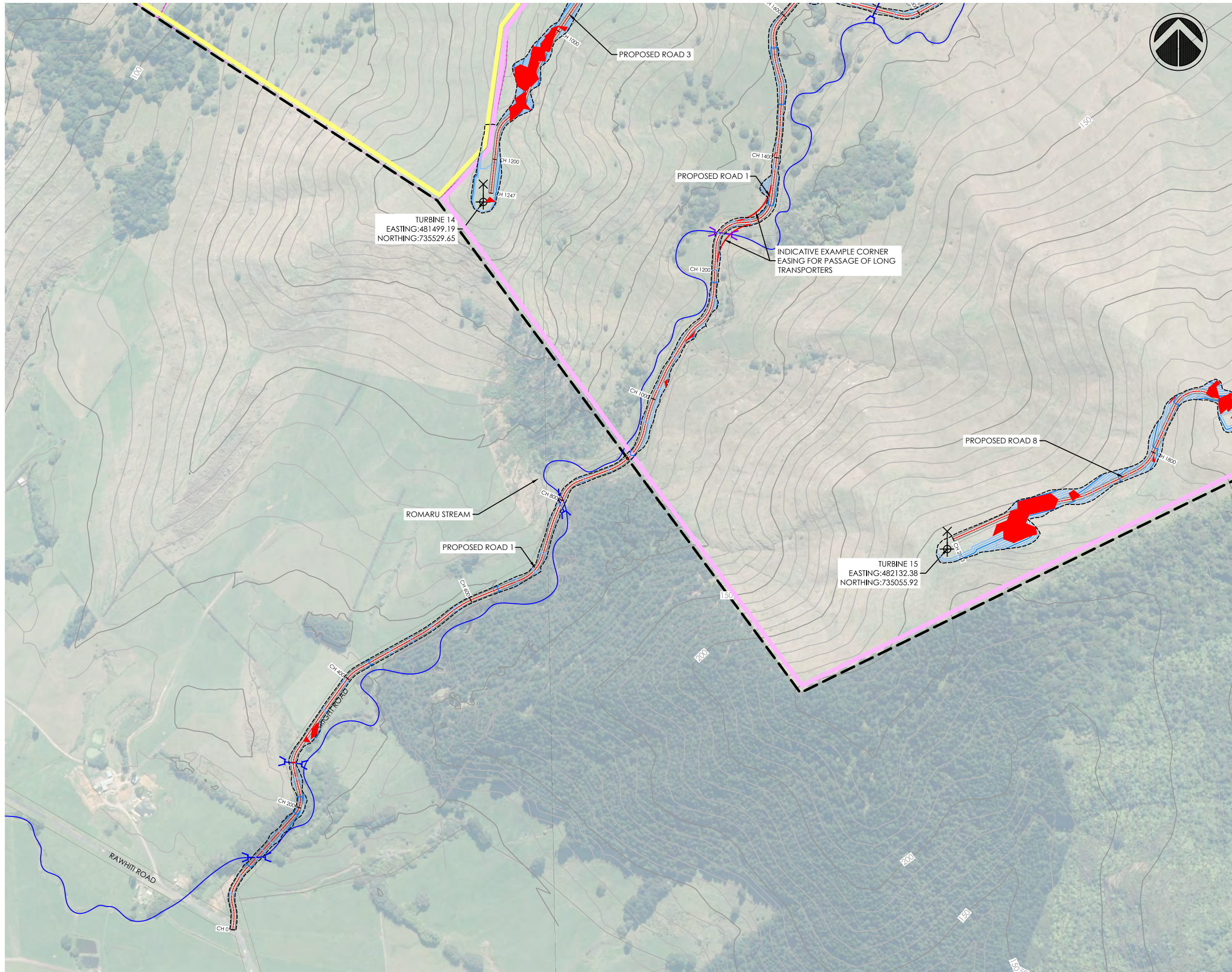
SURVEYOR: SYNERGY POSITIONING SYSTEMS LTD
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SITE: KAIMAI WIND FARM
 ROTOKOHU ROAD, PAEROA

TITLE: PRELIMINARY CIVIL ENGINEERING
 DRAWINGS

SUBTITLE: EROSION AND SEDIMENT CONTROL
 OVERVIEW PLAN

SCALE AT A3: 1:20000	DATE: 12.10.18	DRAWN: LT	CHECKED: JT
PROJECT NO: T15022	DRAWING NO: 250	REVISION: A	



Notes:

1. FOR INFORMATION PURPOSES ONLY.
2. BOUNDARIES, CONTOURS AND OTHER BASE INFORMATION SHOWN IS INDICATIVE ONLY AND PRIMARILY INFORMED BY AERIAL LIDAR SURVEY BY SYNERGY POSITIONING SYSTEMS LTD IN APRIL 2016.
3. COORDINATES SHOWN ARE IN TERMS OF MT EDEN 2000 CIRCUIT AND LEVELS ARE RELATIVE TO THE AUCKLAND 1946 VERTICAL DATUM.
4. THE PROPOSED ROAD ALIGNMENT, TURBINE PLATFORMS, AND OVERALL EARTHWORKS ARE BASED ON AN INDICATIVE ROAD ALIGNMENT AND REMAIN SUBJECT TO DETAILED DESIGN.

LEGEND

- EXISTING PARCEL BOUNDARY
- JACKSON PROPERTY BOUNDARY
- ROTOKOHU FARMS PROPERTY BOUNDARY
- DENIZE BROTHERS PROPERTY BOUNDARY
- HDC/MPDC TERRITORIAL BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXTENT OF EARTHWORK
- PROPOSED TURBINE LOCATION
- EXISTING TRANSPOWER NATIONAL GRID LINES
- PROPOSED ROAD CENTER LINE AND EDGE OF CARRIAGEWAY
- EXISTING FENCE
- INDICATIVE QUARRY SITE
- INDICATIVE CLEANFILL SITE
- EXISTING CULVERT
- PROPOSED UPGRADED CULVERT
- STREAM (WRC REGIONAL MAP)
- EXISTING SLOPE TRIANGULAR GREATER THAN 25°

A | ADDITIONAL PLAN FOR S92 RESPONSE | LT | 16.10.18

REV: DESCRIPTION: BY: DATE:
 STATUS: **RESOURCE CONSENT**

TEKTUS Consultants Ltd
 PO Box 80212 Green Bay
 Auckland 0643 NZ
 p. 09 827 1191
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 www.tektus.nz

CLIENT: VENTUS ENERGY (NZ) LTD
 10/215 ROSEDALE ROAD, ALBANY
 AUCKLAND 0632

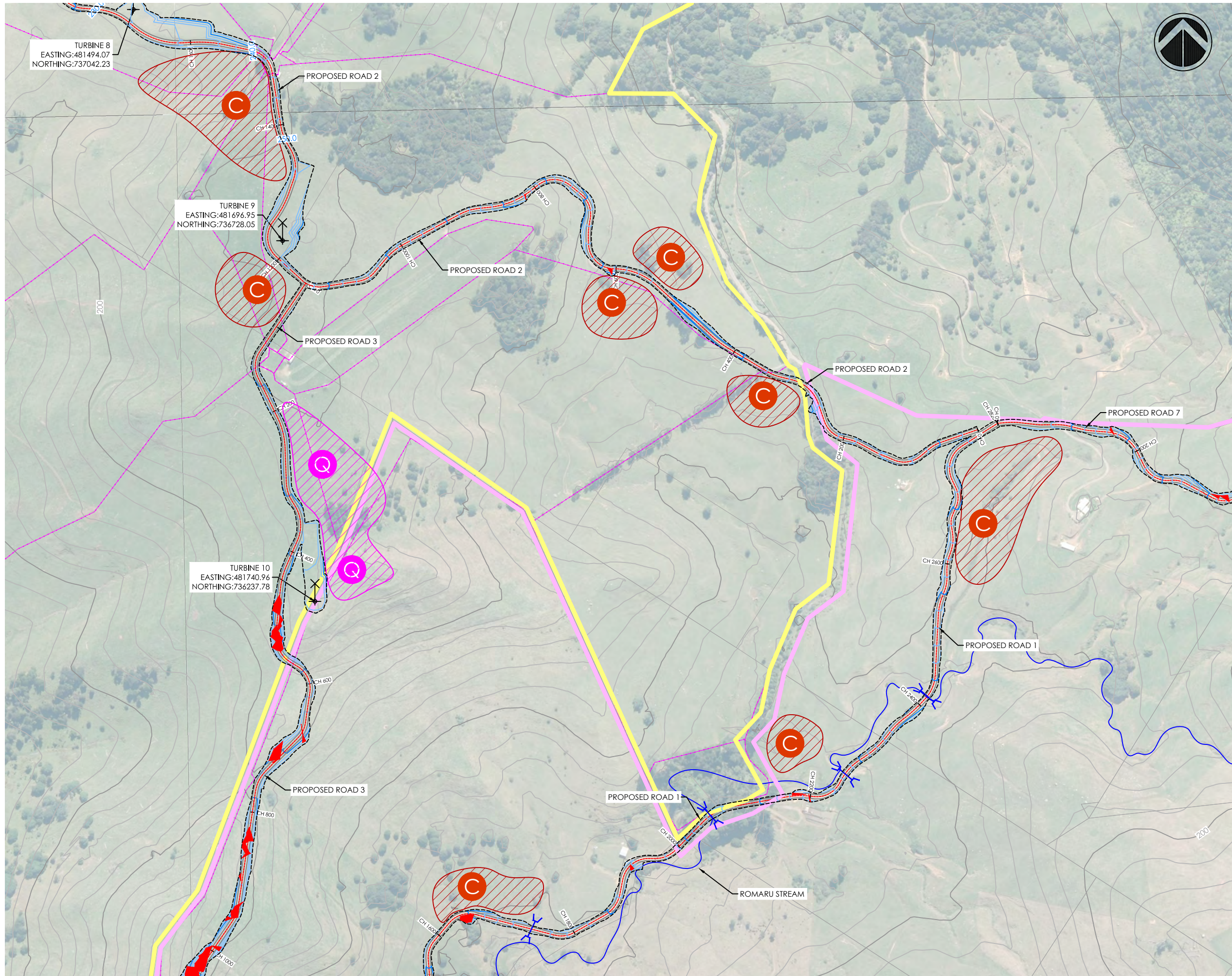
SURVEYOR: SYNERGY POSITIONING SYSTEMS LTD
 3/52 ARRENWAY DRIVE, ALBANY,
 AUCKLAND 0632

SITE: KAIMAI WIND FARM
 ROTOKOHU ROAD, PAEROA

TITLE: PRELIMINARY CIVIL ENGINEERING
 DRAWINGS

SUBTITLE: EROSION AND SEDIMENT CONTROL
 OVERVIEW DETAIL PLAN SHEET 1

SCALE AT A3: 1:5000	DATE: 16.10.18	DRAWN: LT	CHECKED: JT
PROJECT NO: T15022	DRAWING NO: 250-1	REVISION: A	



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A | ADDITIONAL PLAN FOR S92 RESPONSE | LT | 16.10.18

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	STATUS:		
	RESOURCE CONSENT		

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TEKTUS

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AUCKLAND 0632

SURVEYOR:
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AUCKLAND 0632

SITE:
KAIMAI WIND FARM
ROTKOHU ROAD, PAEROA

TITLE:
PRELIMINARY CIVIL ENGINEERING
DRAWINGS

SUBTITLE:
EROSION AND SEDIMENT CONTROL
OVERVIEW DETAIL PLAN SHEET 2

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:5000	16.10.18	LT	JT
PROJECT NO:	DRAWING NO:		REVISION:
T15022	250-2		A