Vibration Monitoring

1. During the site clearance, enabling works and construction (including reinstatement) phase of the proposed development, the vibration levels from the works will be monitored continually. A number of monitoring locations have been identified, four of which (on SEPIL owned lands) are shown on Figure 1 (below). Three other private landowners have also agreed to have vibration monitoring equipment on their property for the duration of the construction activities. The private landowners are situated in the townlands of Aghoos, Glengad and Rossport.

   It is important to note that the privately owned properties are not shown on Figure 1 as the landowners in question did not wish to be identified at this stage.

   The applied maximum threshold for vibration is set at 12.5mm/s[1] peak particle velocity (ppv).

   Vibration and groundborne noise will be measured for the following activities:

   - enabling works and haulage
   - piling operations
   - tunnelling and haulage
   - site reinstatement

   In addition, vibration monitoring will be undertaken at properties at the request of the local residents.

   Requirements for vibration monitoring equipment will be detailed in the Environmental Management Programme. This will be subject to agreement with the planning authority.

   Groundborne noise and vibration measurements will be carried out in compliance with:

   - Advice contained in "Measurement & Assessment of Groundborne Noise & Vibration", Association of Noise Consultants (UK) 2001.
   - All relevant existing national and European legislation.

   At monthly intervals, a vibration monitoring report ('Vibration Monitoring Report') shall be submitted to the planning authority. The report shall contain the following details at a minimum:

   - Map of monitoring locations.
   - Photographs of the monitoring locations and installed equipment.
   - Results of survey.
   - Interpretation of results.
   - Statement of compliance with peak particle velocity limit.
   - In the event of non compliance, likely reasons for the non compliance and remediation measures required must be detailed.
   - The manufacturer, model type and serial number of all vibration equipment.
   - Calibration certificates for all vibration equipment used.

[1] HK TGN May 2010, and Geoteknikk i vegbygging, Veiledning, Håndbok 016, Statens Vegvesen, June2010.

- A description of the survey details including exact locations where vibration monitoring was conducted.
- The time and date of each measurement.

A vibration prediction model shall be used conforming to the requirements of Section 9 of ISO 14837 Part 1 for the purpose of predicting the propagation of groundborne vibration from the Tunnel Boring Machine (TBM) to at least four representative locations at a range of distances up to 1,000 metres from the TBM. The results of the measurements shall be used in verification of the predicted vibration levels. Results from the vibration modelling will also be used to verify the vibration predictions for haulage traffic and sheet piling.

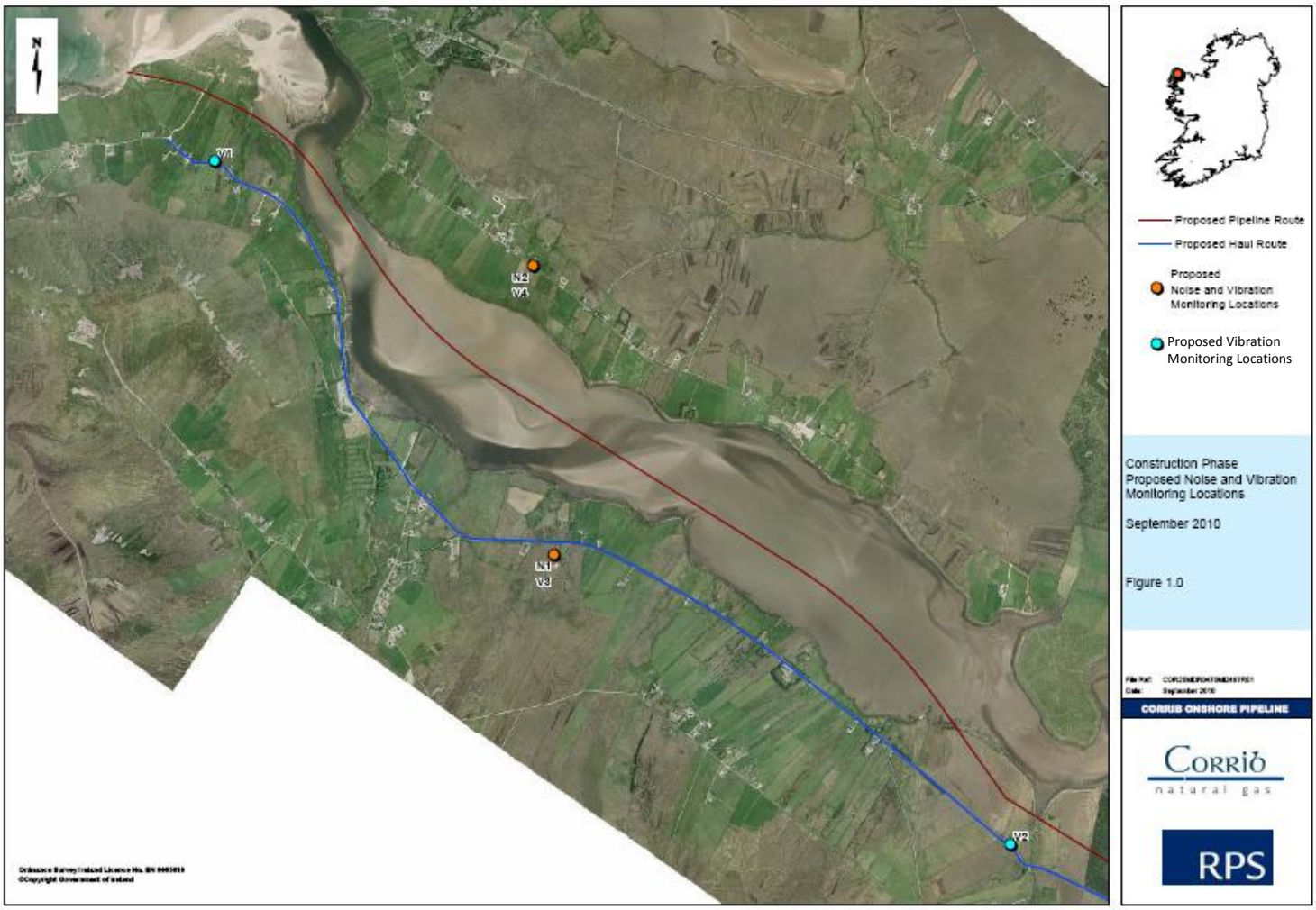

Figure 1. Vibration (and Noise) Monitoring Locations

2. a) Underwater groundborne vibration will be measured at transects perpendicular to the tunnel trajectory:
   - Approximately one week after the launch of the TBM from Aghoos.
   - Monthly during the tunnelling works.

   The length of the transects shall be maximised on each occasion as far as practicable having regard to water depth and tidal conditions.

   b) Measurements shall be undertaken in the bay channel every month.

   A monitoring report detailing the measurements undertaken in respect of a) and b) shall be submitted to the planning authority within 2 weeks of the monitoring taking place.

   The underwater groundborne vibration levels will be monitored for the TBM operations as it advances along the proposed route through the bay. Levels of underwater vibration will be monitored using a V901 calibrated low frequency geophone (Vibrock Ltd) or equivalent. To allow underwater vibration measurements at the low levels expected in Sruwaddacon Bay, the analogue signal from the geophone may be amplified prior to digitisation and storage. Vibration data will be captured at a sample rate of 10,000 bits per second. Measurements will be taken at a total of three locations recorded over several hours to cover a significant period of the flooding tidal cycle. Sample locations will be as follows:

   - Location 1: Downstream channel area
   - Location 2: Central channel area
   - Station 3: Variable location immediately above the TBM

   Positions are as shown in Figure 2 below:

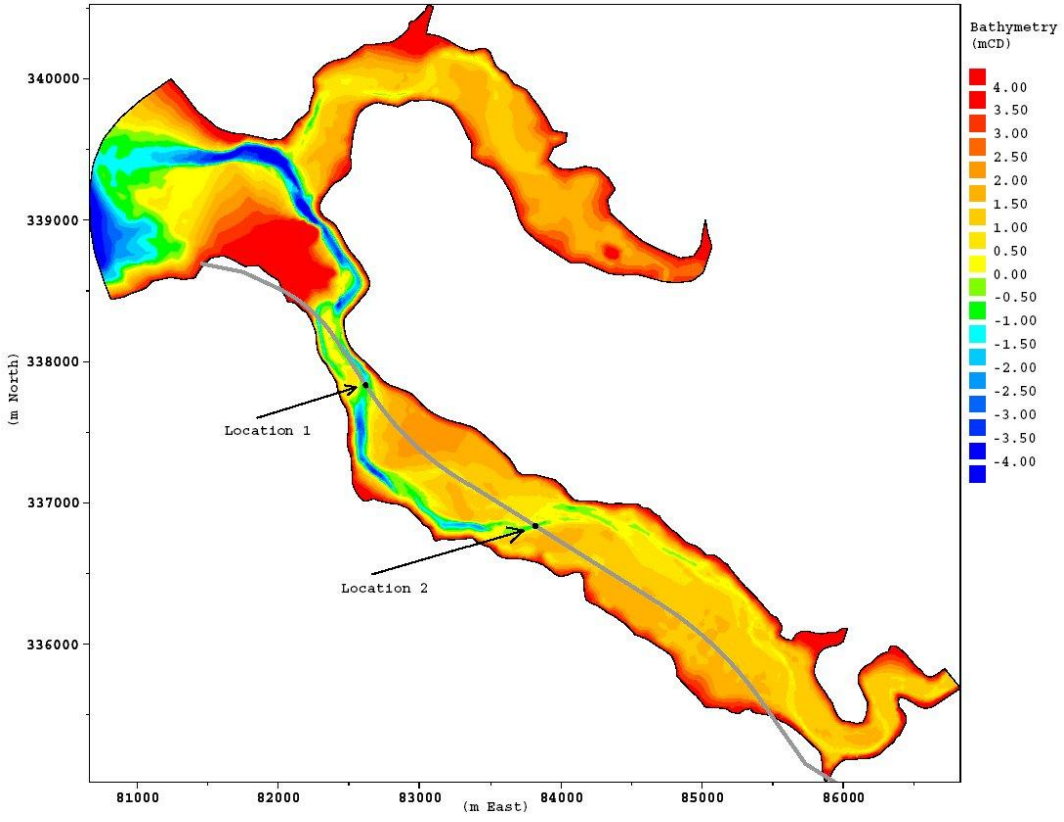

Figure 2: Underwater Groundborne Vibration Monitoring Locations