Response to Further Information Request for Question 2c of Joint Witness Statement

Further Information Required:

There appears to be an anomaly in Fig 6-7 (appendix F) with westerly winds showing strong westerly transport. Can this situation be reviewed and what appears to be counter-intuitive, explained.

Response

Appendix F, Figure 6-7 shows that for the storm scenario considered, material eroded from the offshore disposal ground is carried in suspension to the North and the West rather to the East, as might normally be expected from westerly winds.

Analysis of the model results explains the apparent contradiction.

Figure 1 shows a time series of *U* (positive = easterly) and *V* (positive = northerly) current vectors simulated at the real-time ADCP deployed at the channel fairing just outside of Napier Port. The timeseries show that currents are directed almost exclusively eastward.

Figure 2 shows time series of *U* and *V* in front of Westshore at the location of an ADCP unit deployed by the navigation beacons. The currents are directed southerly.

Figure 3 shows time series of *U* and *V* at the offshore disposal ground ('Site 5' in the figure). The results show that the surface layer has currents directed eastward, whilst the bottom layer has currents directed westward. This is interpreted as return flow in the bottom later. The currents at the offshore disposal ground initially are directed south through the entire water column, but then switch to become northerly through the entire water column.

Figure 4 and **Figure 5** show the time series of U and V flow at the 'inner reef' and 'outer reef' locations. At the inner reef the flow is *always* easterly *usually* southerly (sometimes no north or south flow), and this is consistent through the water column. At the outer reef the flow is directed *mostly* eastward in the upper water column, and *always* westward in the lower water column. That is, at the 'outer reef' site the surface flow follows the wind direction, and there is a return flow in the lower water column.

Figure 6 shows the simulated suspended sediment concentration of coarse silt (the material in Appendix F, Figure 6-7). The results show:

(a) Sediment is entrained to the water column by the combined action of waves and currents
(b) The coarse silt is more concentrated in the bottom layer than in the surface layer. Therefore transport of this sediment will be mostly a function of transport within the bottom layer.

That is, the distribution of suspended coarse silt as shown for Westerly wind in Appendix F, Figure 6-7 is a product of spatially varying circulation patterns within the model that vary with position and with depth:

a) Suspension from the OSDG by wave and current action, and subsequent transport in the lower portion of the water column in a *northerly* and *westerly* direction, away from the OSDG.
b) Where wave and current forcing is sufficient to locally suspend sediment higher in the water column this will appear in the model results for the surface layer, which in most locations is directed eastward.

c) Along Westshore (as represented by the ADCP) the flow is directed southward towards the Port, and south of Westshore, adjacent to the Port, the flow is easterly.

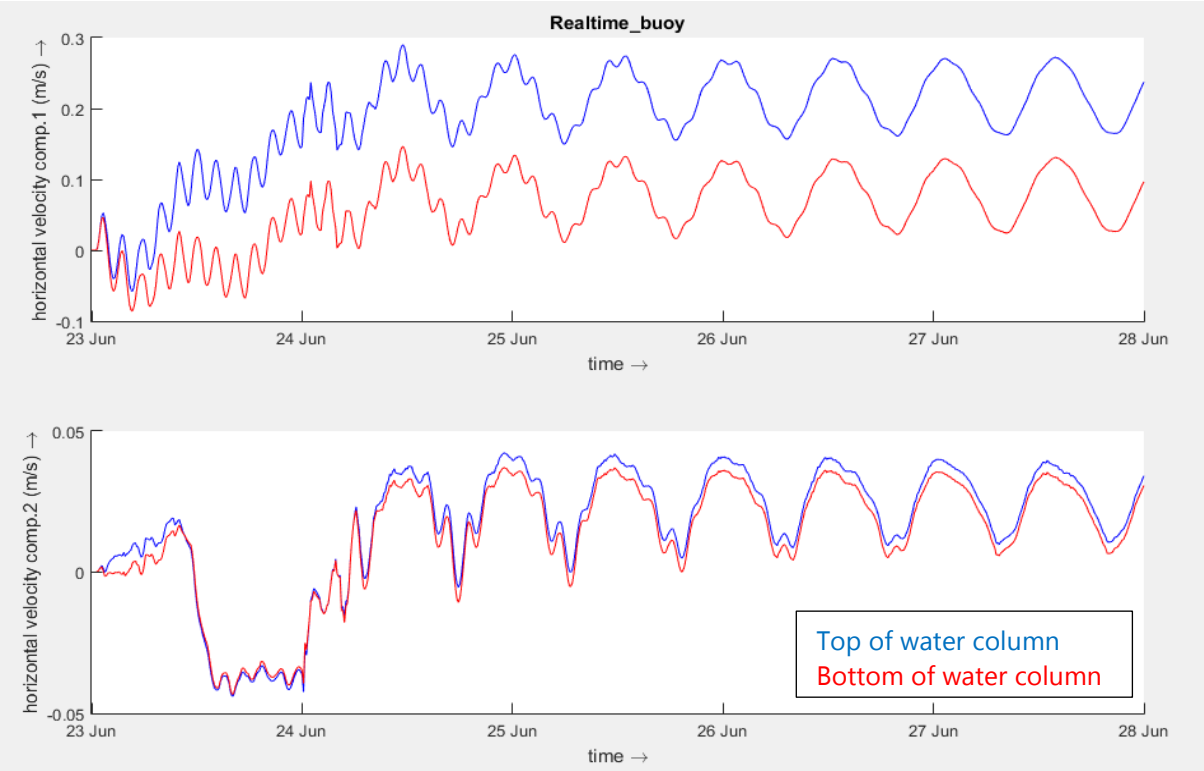

Figure 1: Time series of U (top panel) and V (bottom panel) for ADCP deployed immediately north of Napier Port entrance

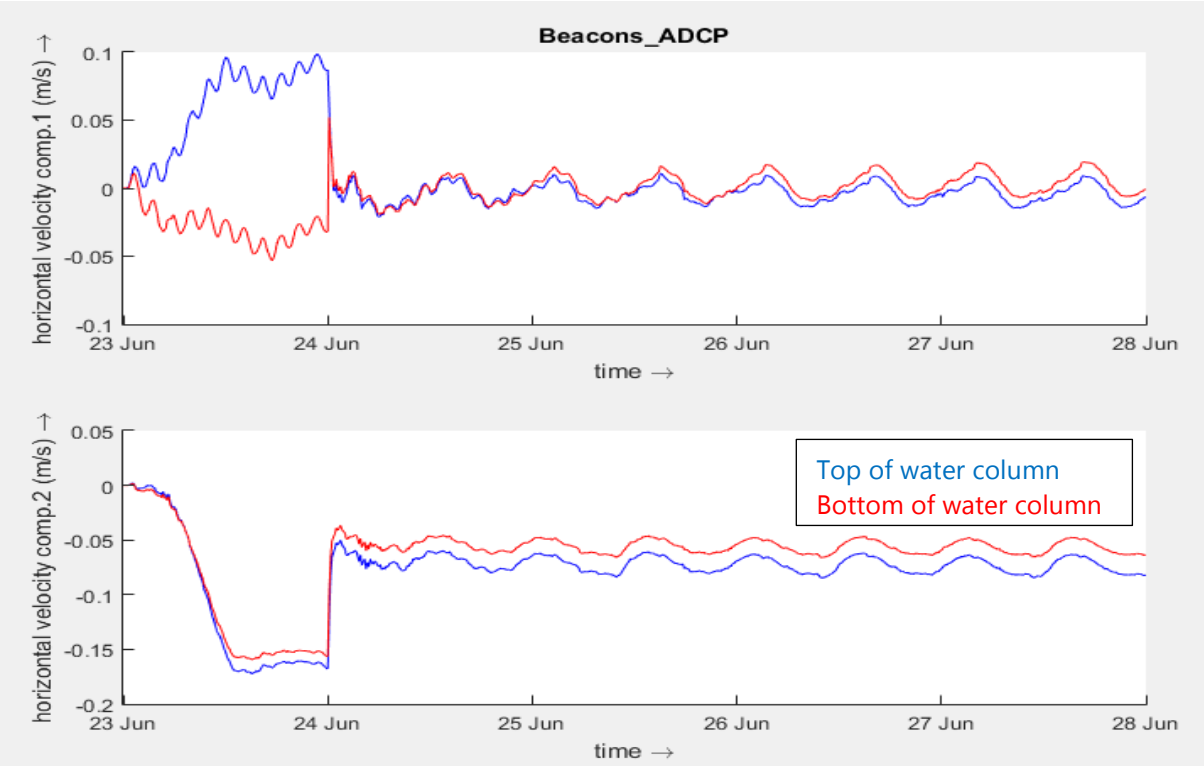

Figure 2: Time series of U (top panel) and V (bottom panel) for ADCP deployed adjacent to Westshore

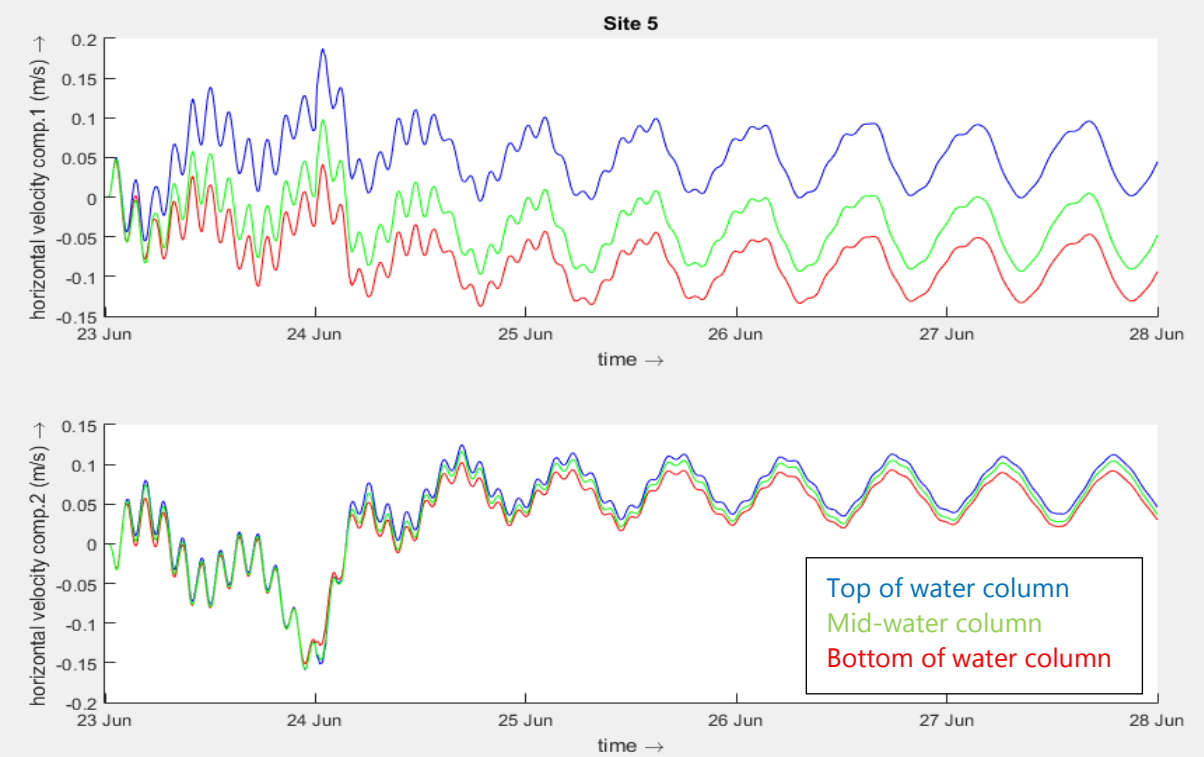

Figure 3: Time series of U (top panel) and V (bottom panel) for the offshore disposal ground.

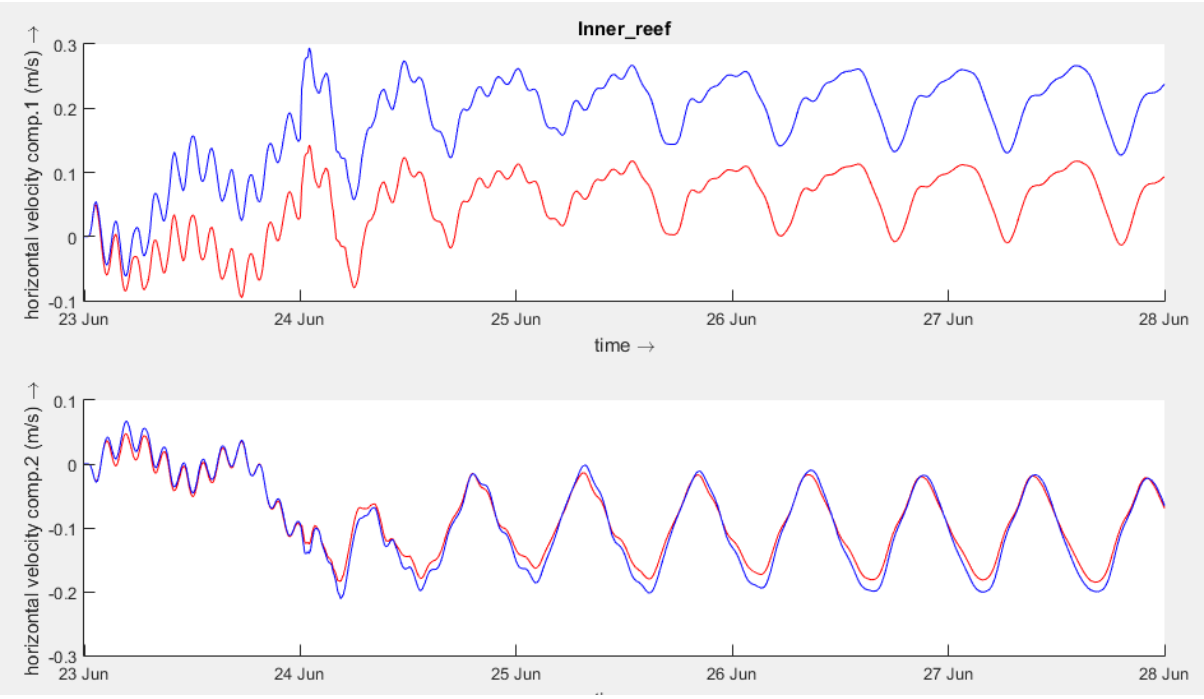

Figure 4: Time series of U (top panel) and V (bottom panel) for 'Inner Reef'.

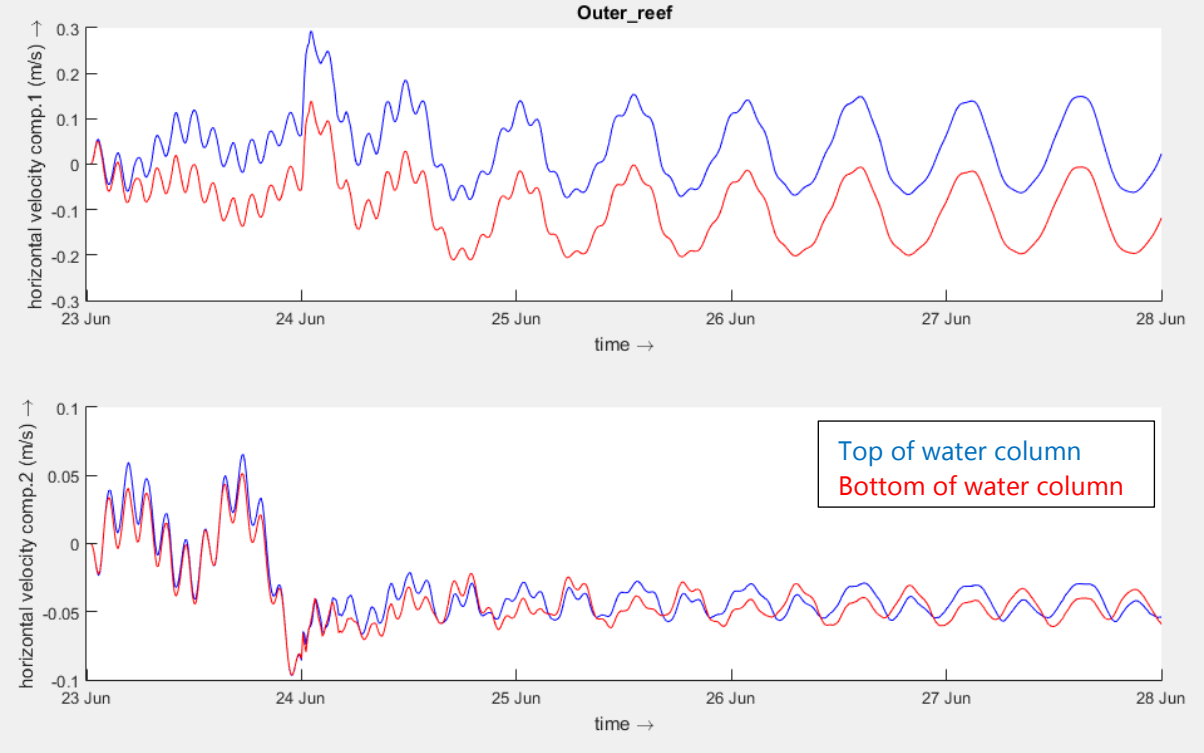

Figure 5: Time series of U (top panel) and V (bottom panel) for 'Outer Reef'

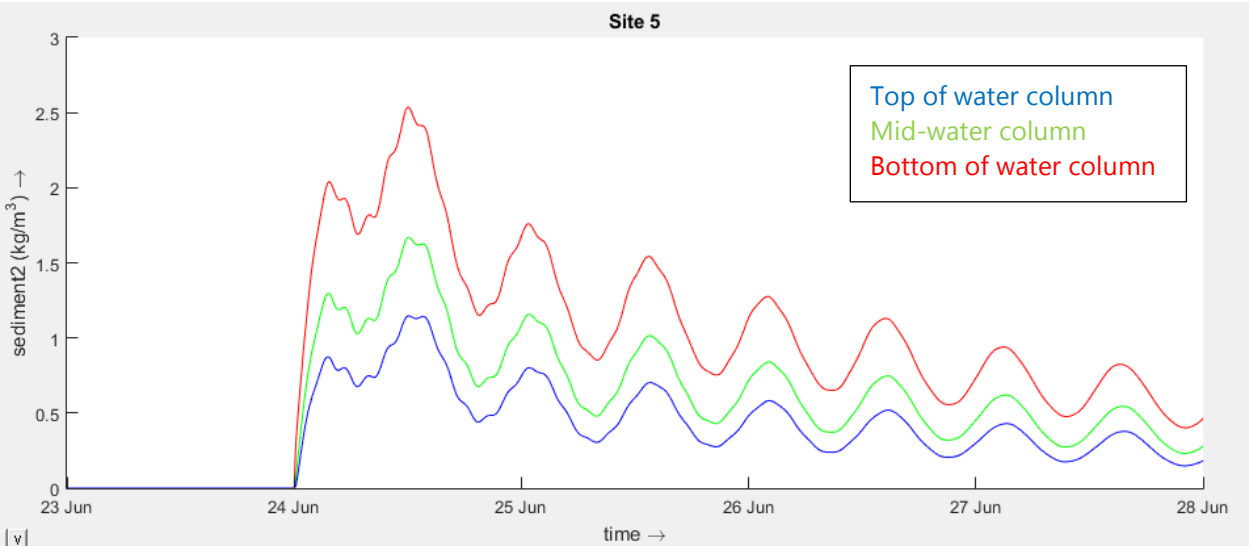

Figure 6: Simulated time series of suspended sediment concentration immediately above the offshore disposal ground ('Site 5' in figure) for coarse silt