Appendix 16.1 Underwater Noise Modelling Figures

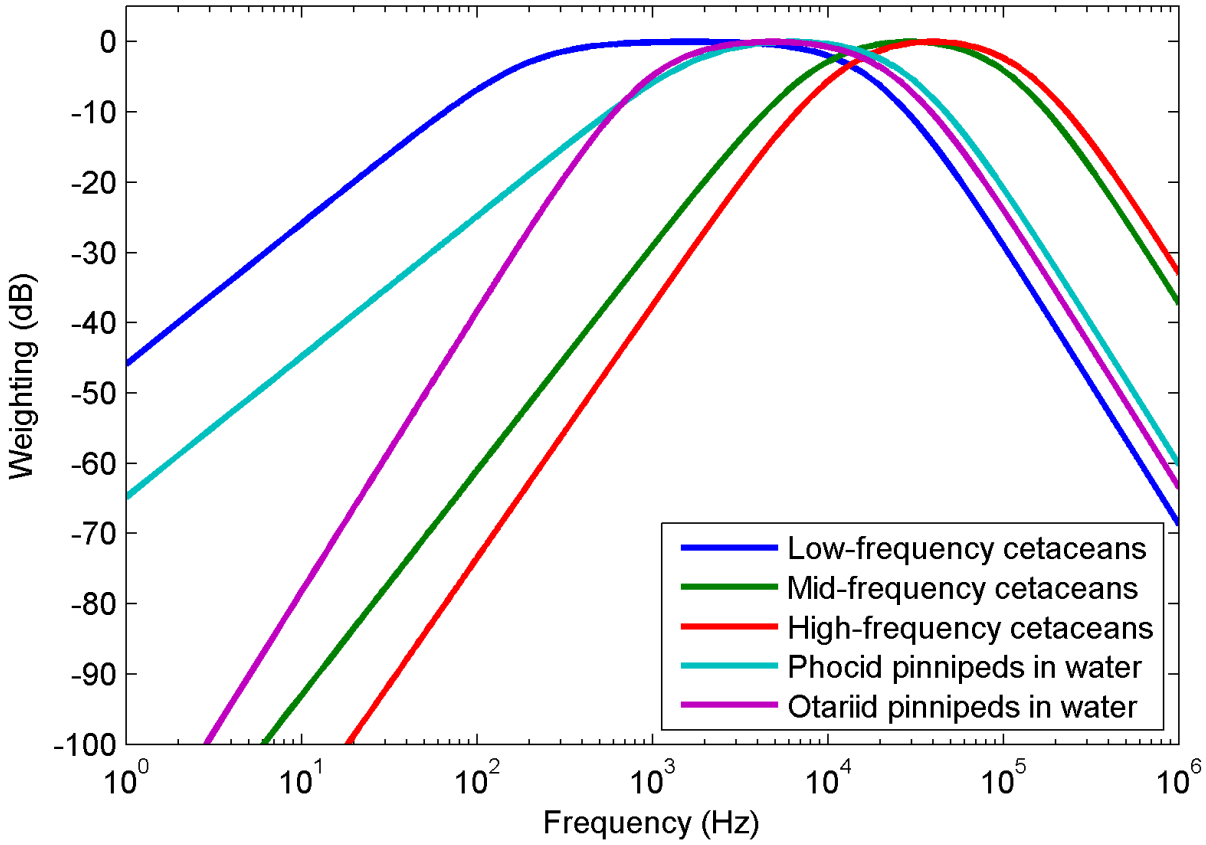


Figure 16.1 - M-weightings Applied to the Raw Source Level Spectrum for Each Mammal Hearing Group (NOAA, 2016)

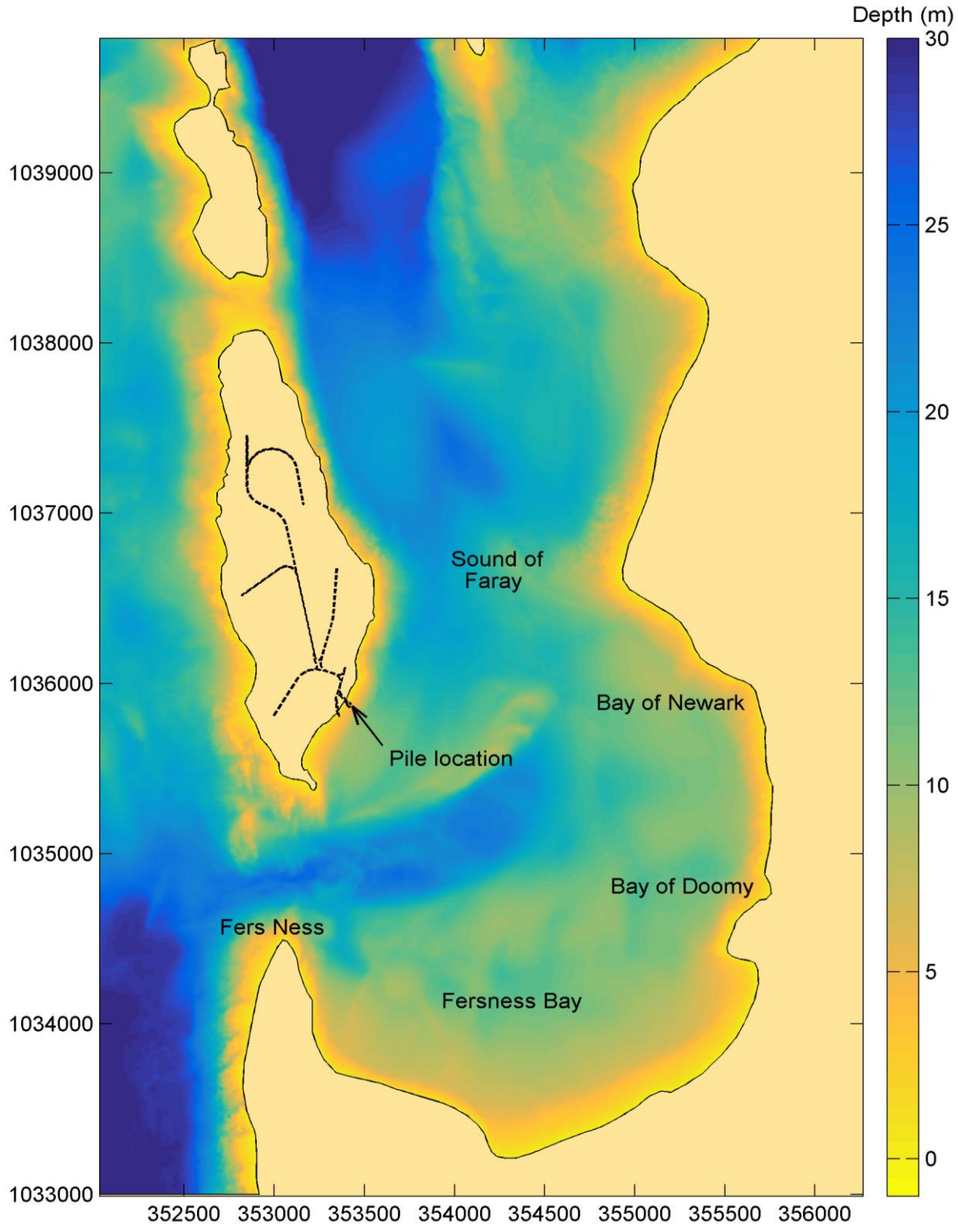
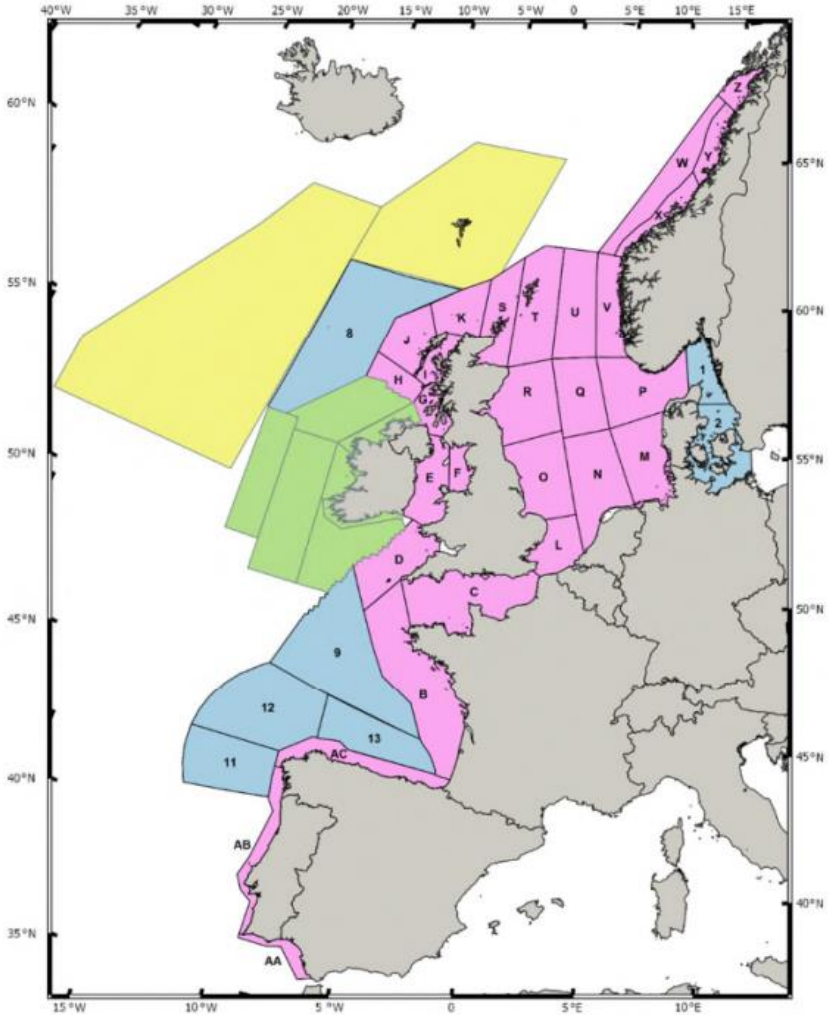


Figure 16.2 – Model Geometry Showing Water Depth



[Notes: Area covered by SCANS-III and adjacent surveys. SCANS-III: pink lettered blocks were surveyed by air; blue numbered blocks were surveyed by ship. Blocks coloured green to the south, west and north of Ireland were surveyed by the Irish ObSERVE project. Blocks coloured yellow were surveyed by the Faroe Islands as part of the North Atlantic Sightings Survey in 2015.]

Figure 16.3 SCANS-III blocks (Hammond et al, 2017)

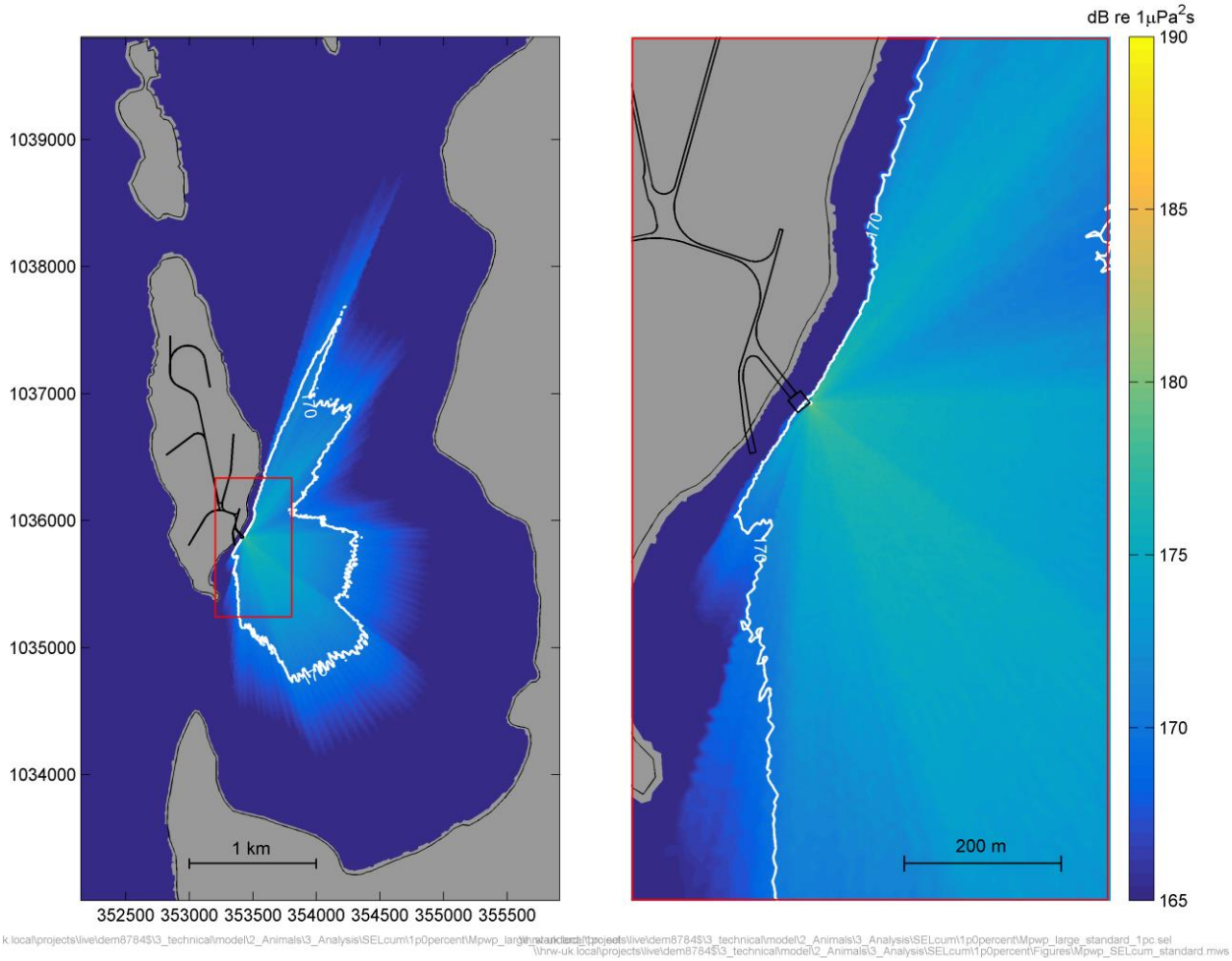


Figure 16.4 – Modelled Cumulative Sound Exposure Level for Pinnipeds (seals) using Standard Mitigation under the assumption of swimming directly away from the noise source and leaving the water at the shoreline (white contour indicates threshold for TTS).

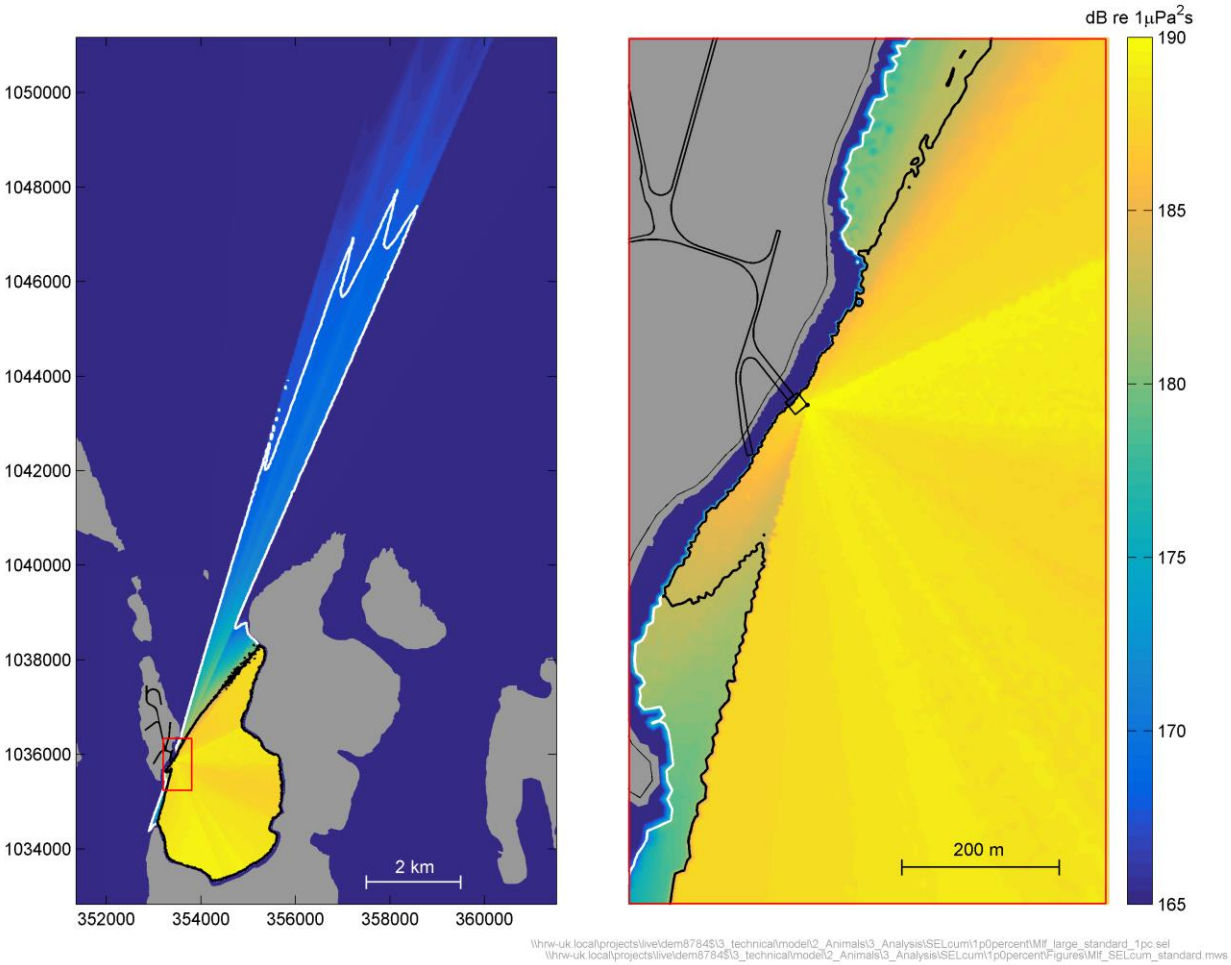


Figure 16.5 – Modelled Cumulative Sound Exposure Level for Low-frequency cetaceans (baleen whales) using Standard Mitigation under the assumption of swimming directly away from the noise source (black and white contours indicate thresholds for PTS and TTS, respectively).

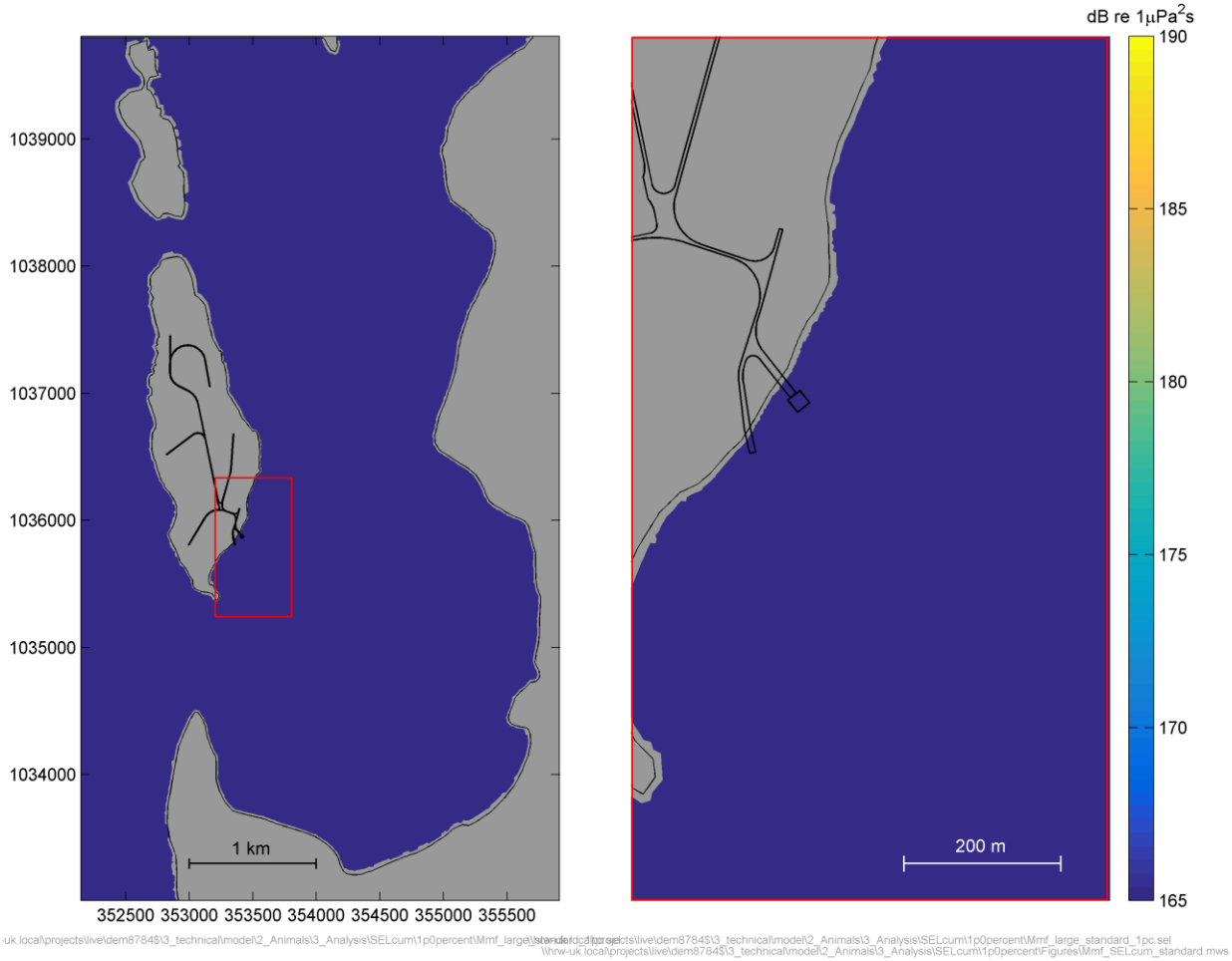


Figure 16.6 – Modelled Cumulative Sound Exposure Level for Mid-frequency cetaceans using Standard Mitigation under the assumption of swimming directly away from the noise source (no thresholds exceeded).

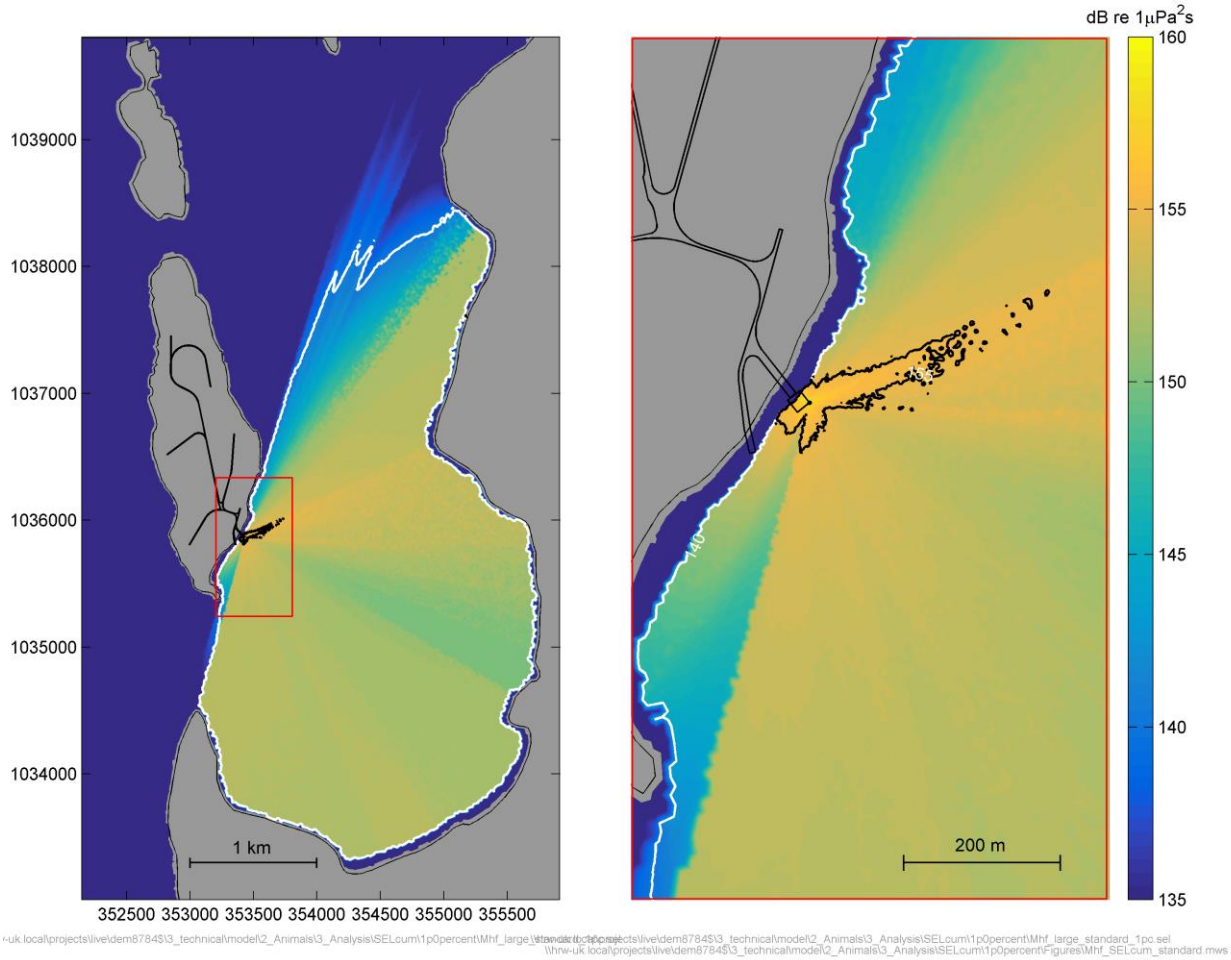


Figure 16.7 – Modelled Cumulative Sound Exposure Level for High-frequency cetaceans (harbour porpoise) using Standard Mitigation under the assumption of swimming directly away from the noise source (black and white contours indicate thresholds for PTS and TTS, respectively).

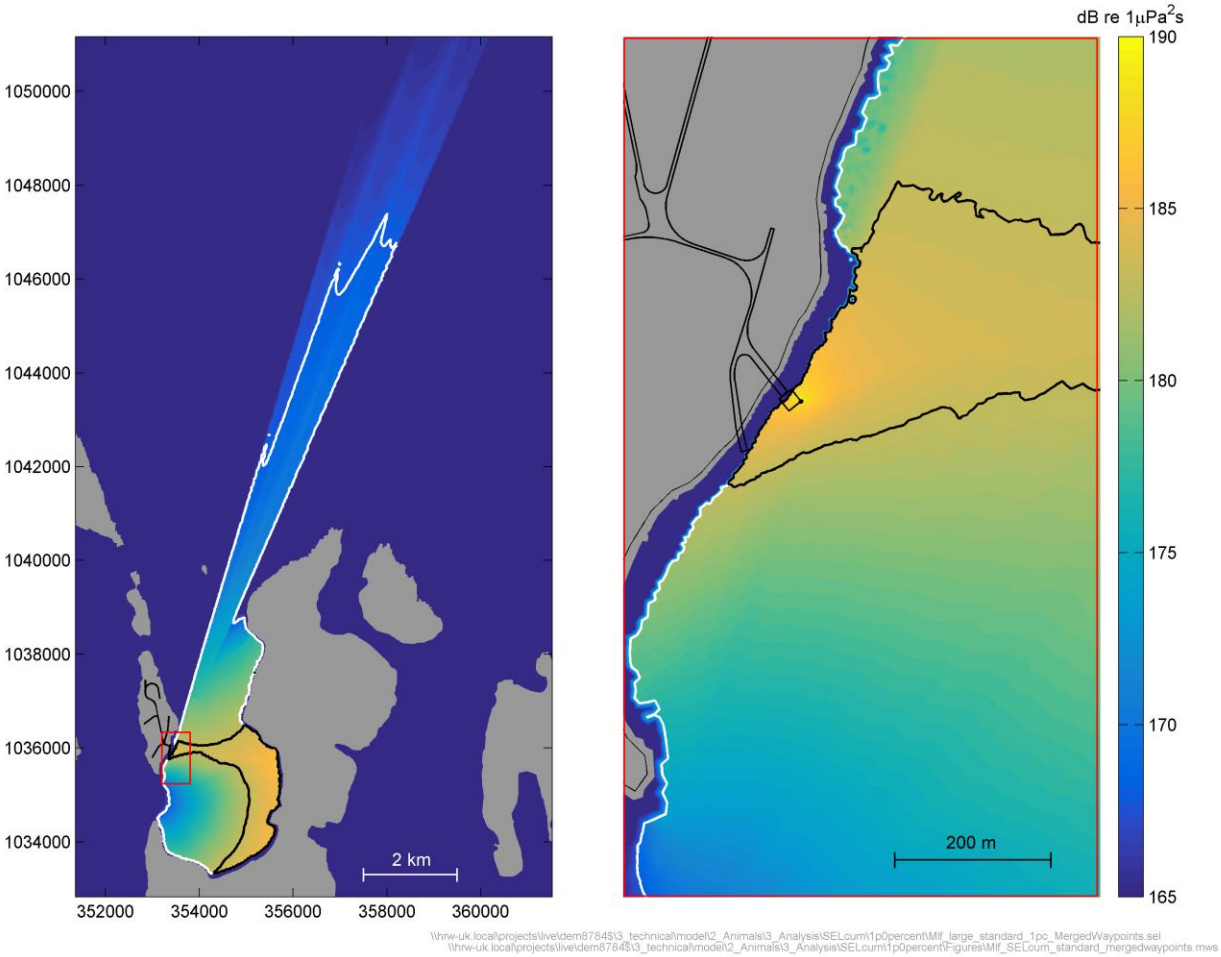


Figure 16.8 – Modelled Cumulative Sound Exposure Level for Low-frequency cetaceans (baleen whales) using Standard Mitigation under the assumption of escaping via quickest exit route (black and white contours indicate thresholds for PTS and TTS, respectively).

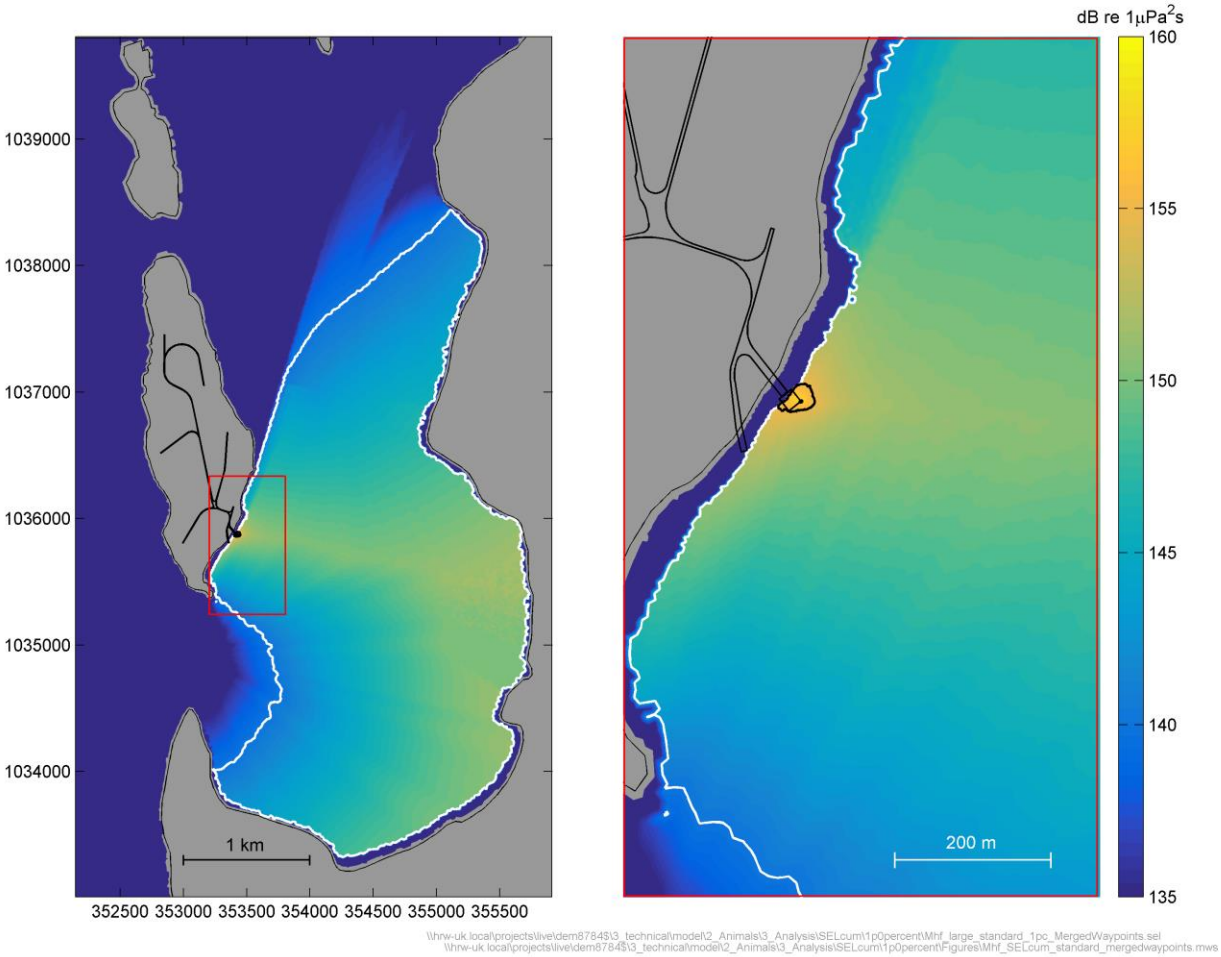


Figure 16.9 – Modelled Cumulative Sound Exposure Level for High-frequency cetaceans (harbour porpoise) using Standard Mitigation under the assumption of escaping via quickest exit route (black and white contours indicate thresholds for PTS and TTS, respectively).

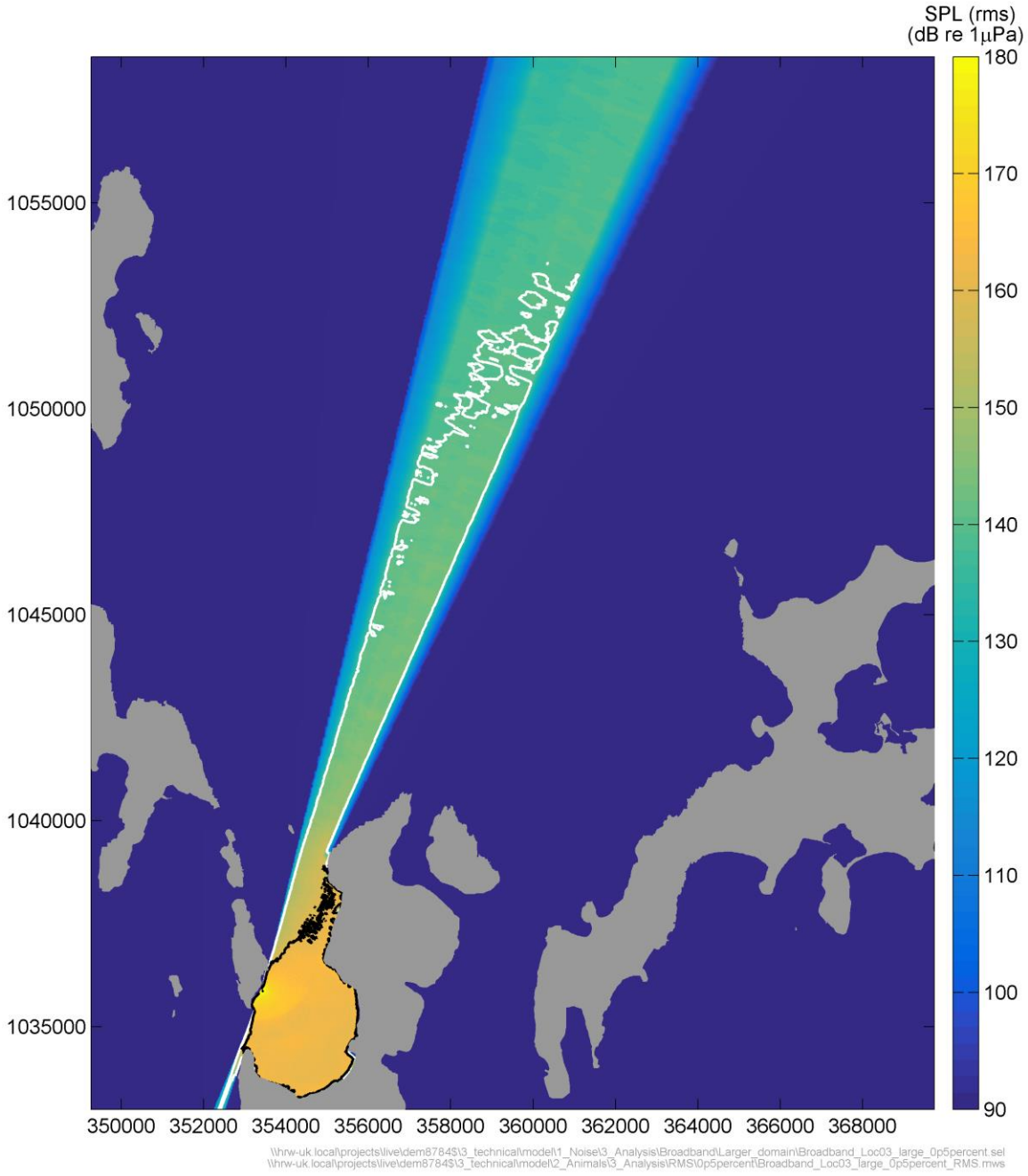


Figure 16.10 – Modelled Areas of Behavioural Disturbance for Marine Mammals using Standard Mitigation (black and white contours indicate thresholds for high-level and low-level disturbance, respectively).

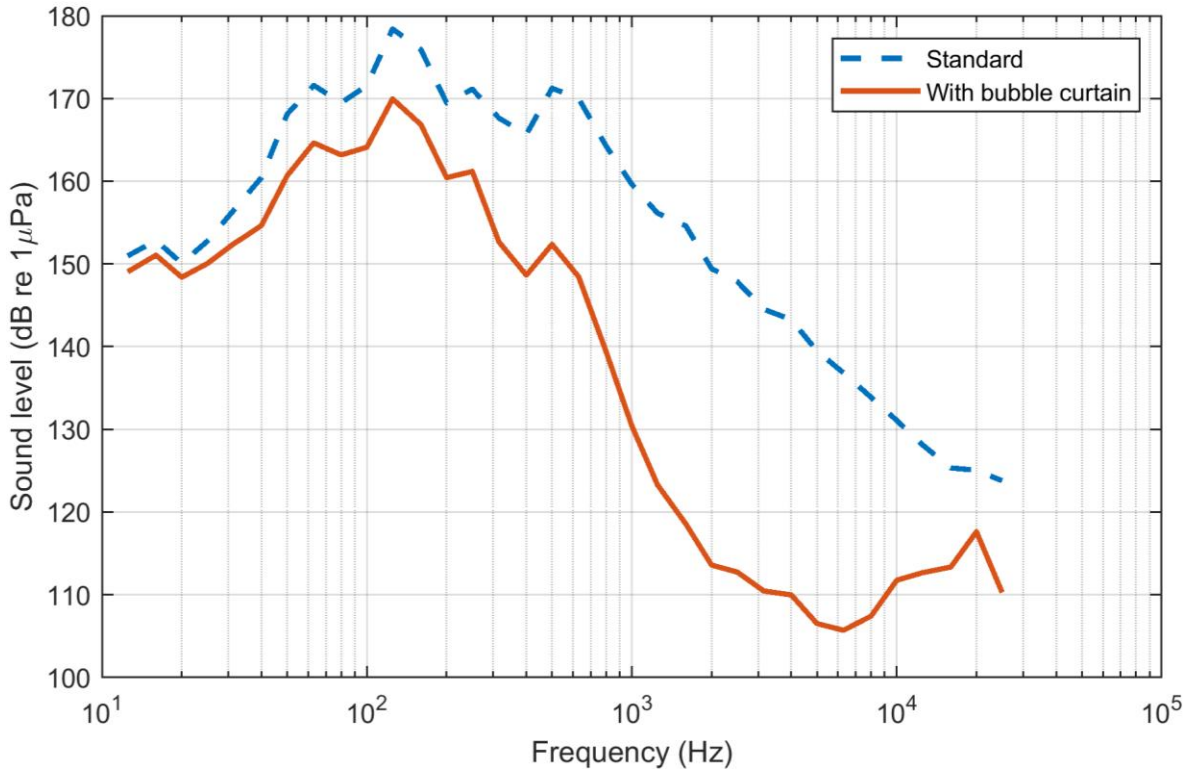


Figure 16.11 – Third-octave Centre Frequency Source Level Spectrum for Standard Mitigation and with Additional Bubble Curtain Mitigation.

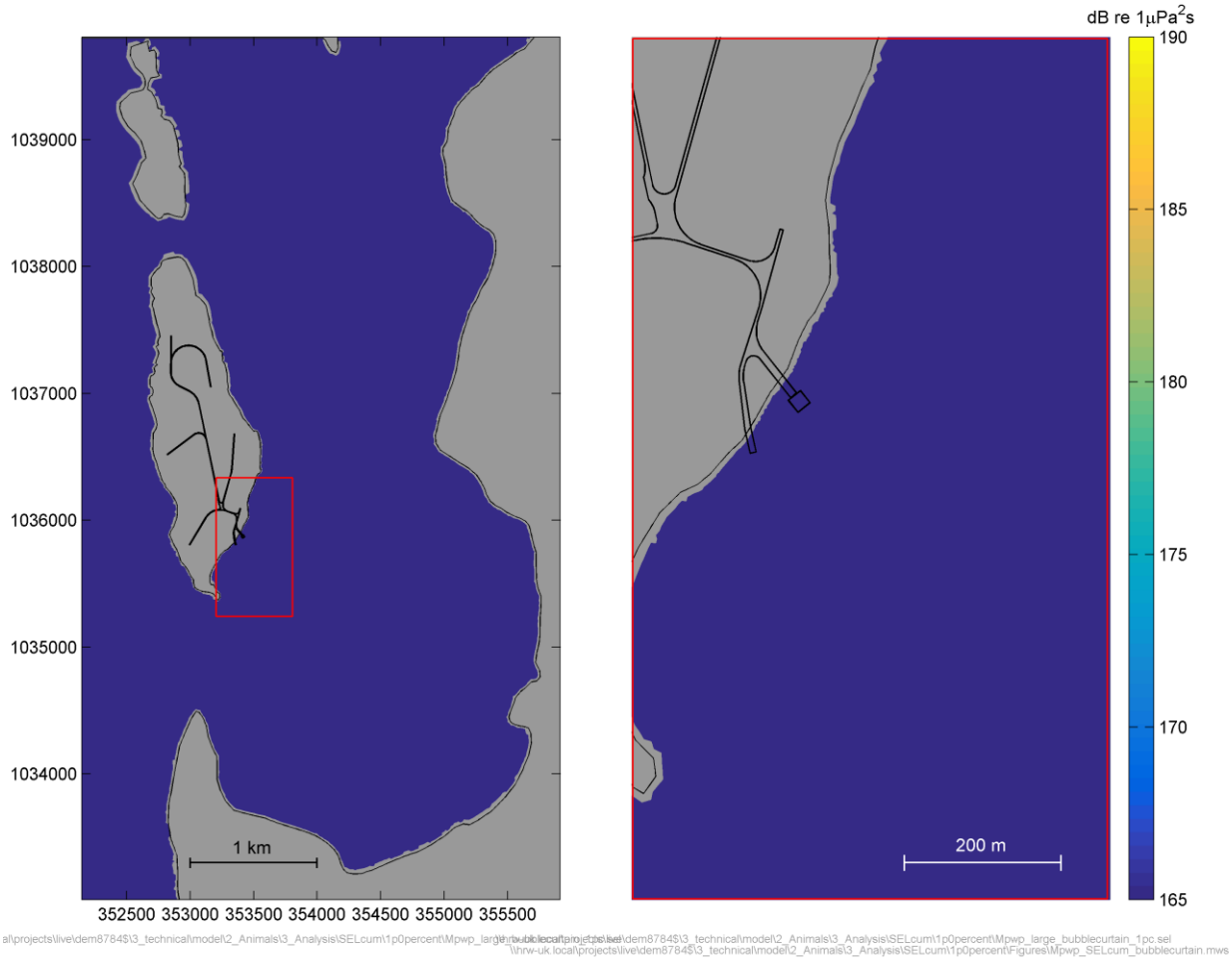


Figure 16.12 – Modelled Cumulative Sound Exposure Level for Pinnipeds (seals) using Additional Bubble Curtain Mitigation under the assumption of swimming directly away from the noise source and leaving the water at the shoreline (no threshold exceedance).

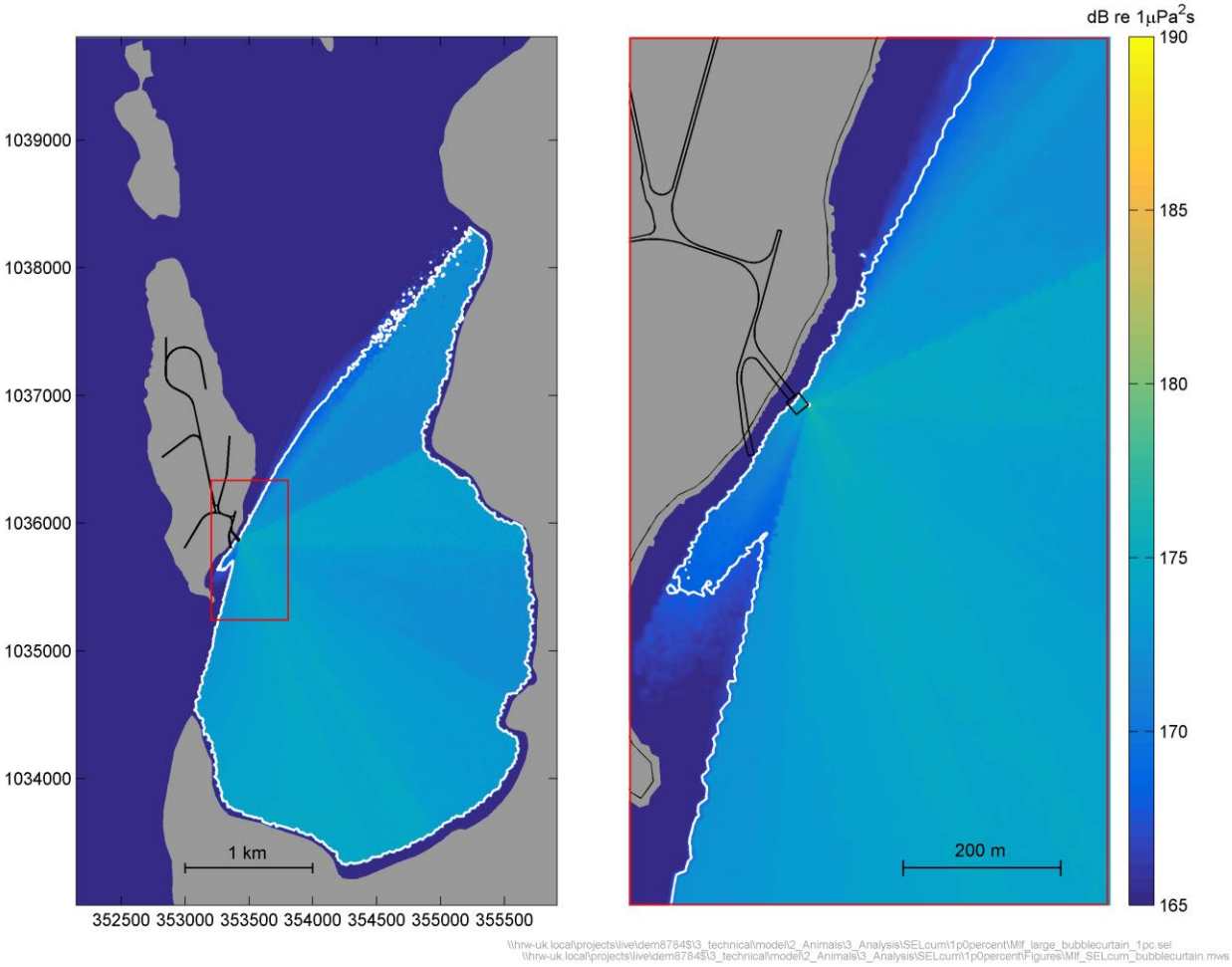


Figure 16.13 – Modelled Cumulative Sound Exposure Level for Low-frequency Cetaceans (Baleen Whales) using Additional Bubble Curtain Mitigation under the assumption of swimming directly away from the noise source (white contour indicates threshold for TTS).

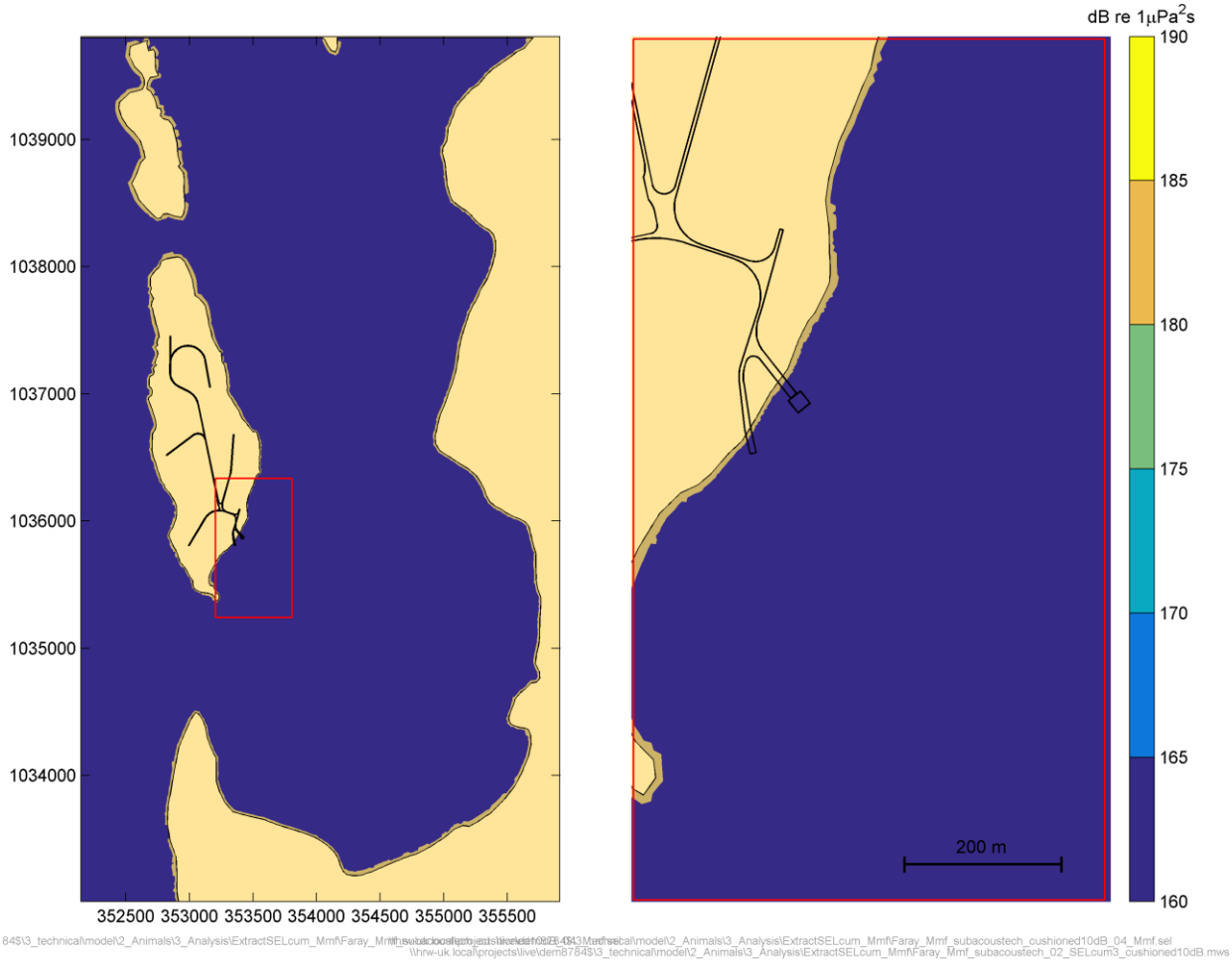


Figure 16.14 – Modelled Cumulative Sound Exposure Level for Mid-frequency cetaceans using Additional Bubble Curtain Mitigation under the assumption of swimming directly away from the noise source (no threshold exceedance for either TTS or PTS).

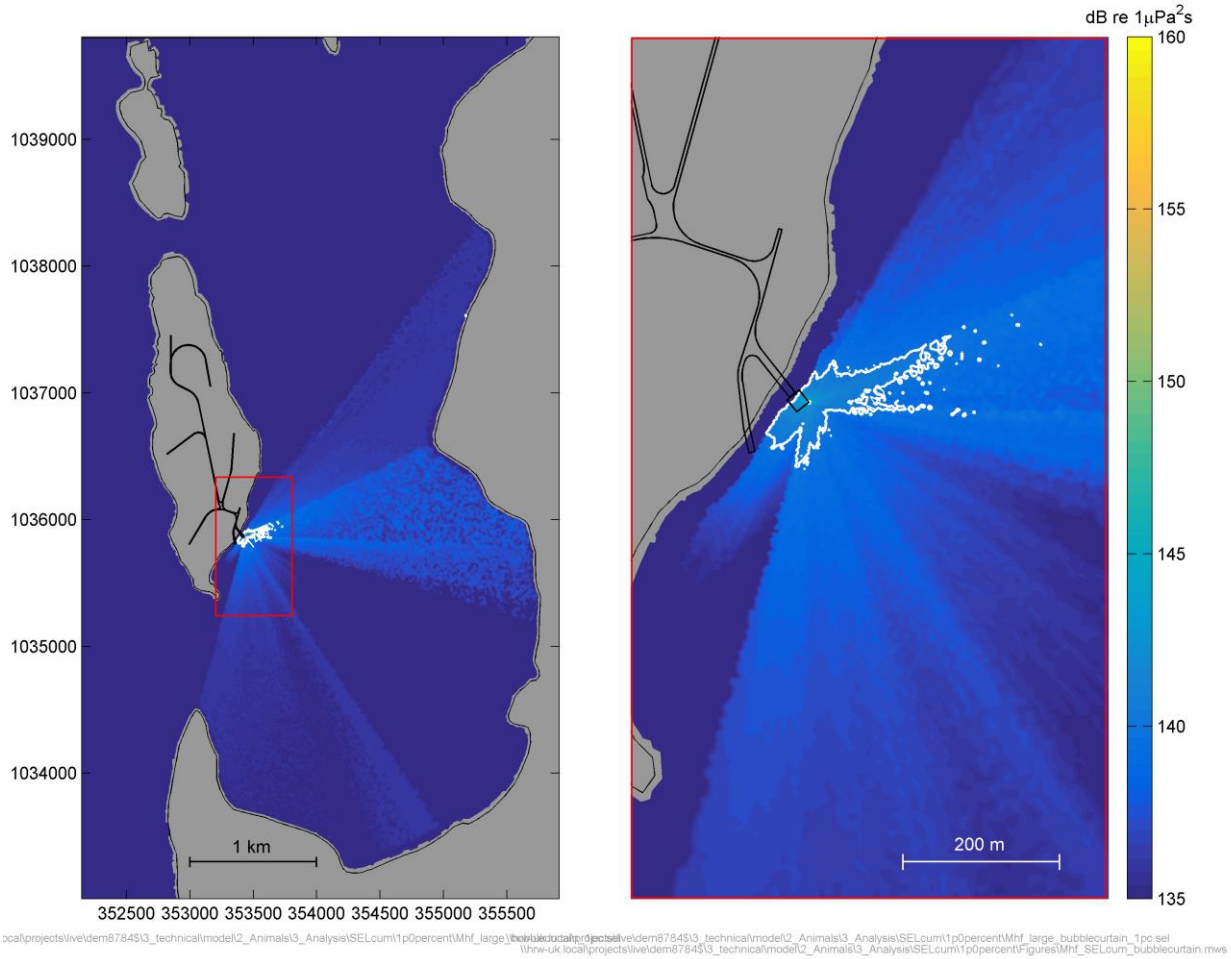


Figure 16.15 – Modelled Cumulative Sound Exposure Level for High-frequency cetaceans (harbour porpoise) using Additional Bubble Curtain Mitigation under the assumption of swimming directly away from the noise source (white contour indicates threshold for TTS).

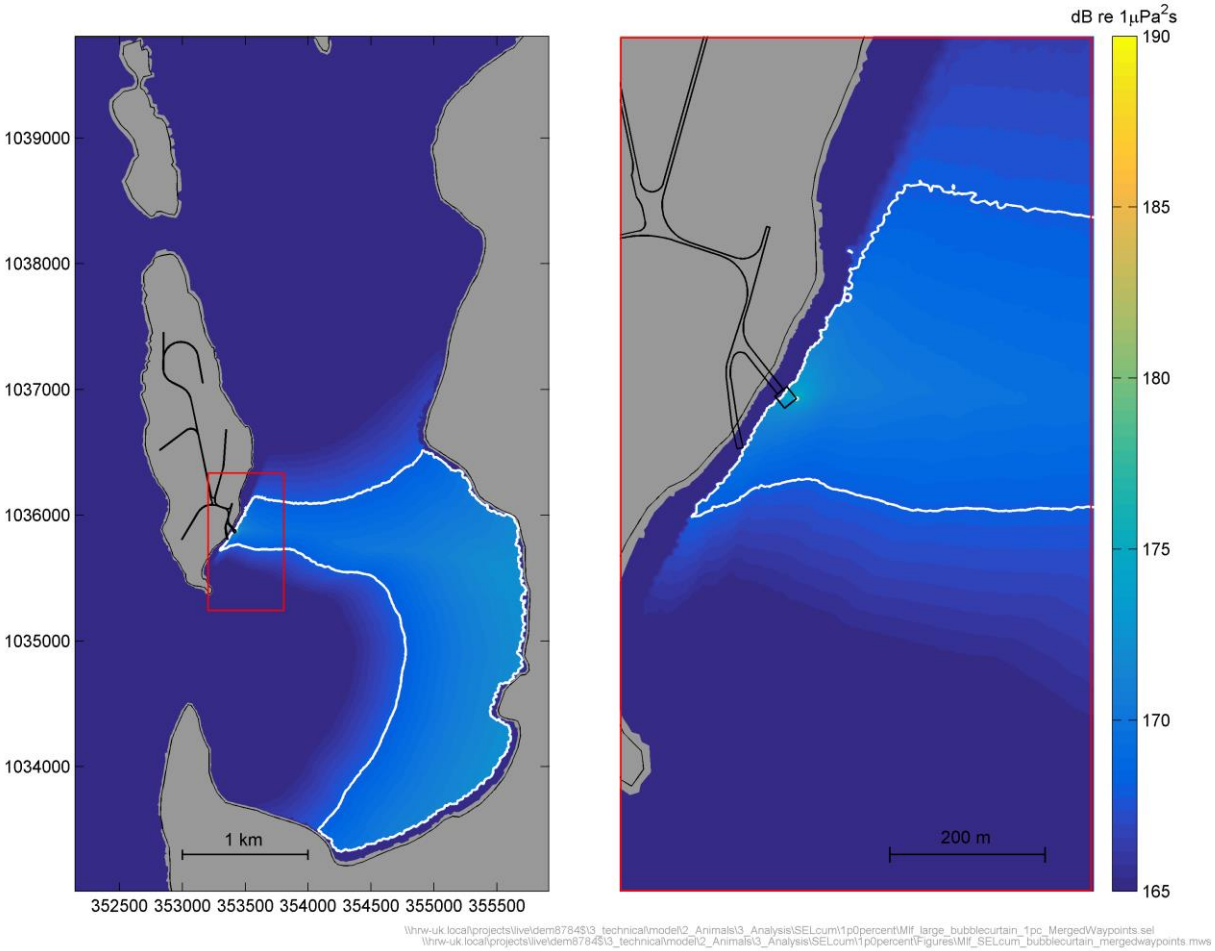


Figure 16.16 – Modelled Cumulative Sound Exposure Level for Low-frequency cetaceans (Baleen Whales) using Additional Bubble Curtain Mitigation under the assumption of escaping via quickest exit route (white contour indicates threshold for TTS).

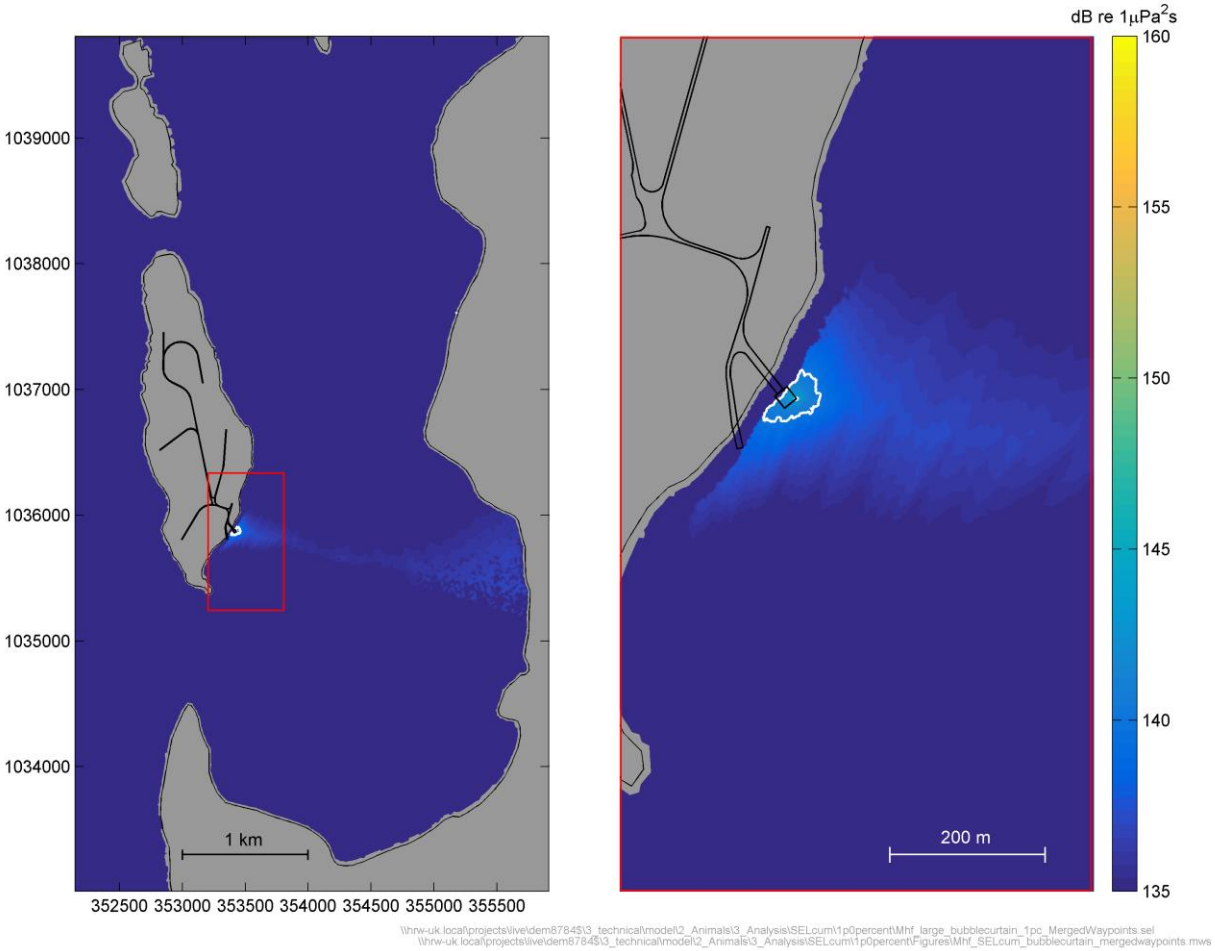


Figure 16.17 – Modelled Cumulative Sound Exposure Level for High-frequency cetaceans (harbour porpoise) using Additional Bubble Curtain under the assumption of escaping via quickest exit route (white contour indicates threshold for TTS).

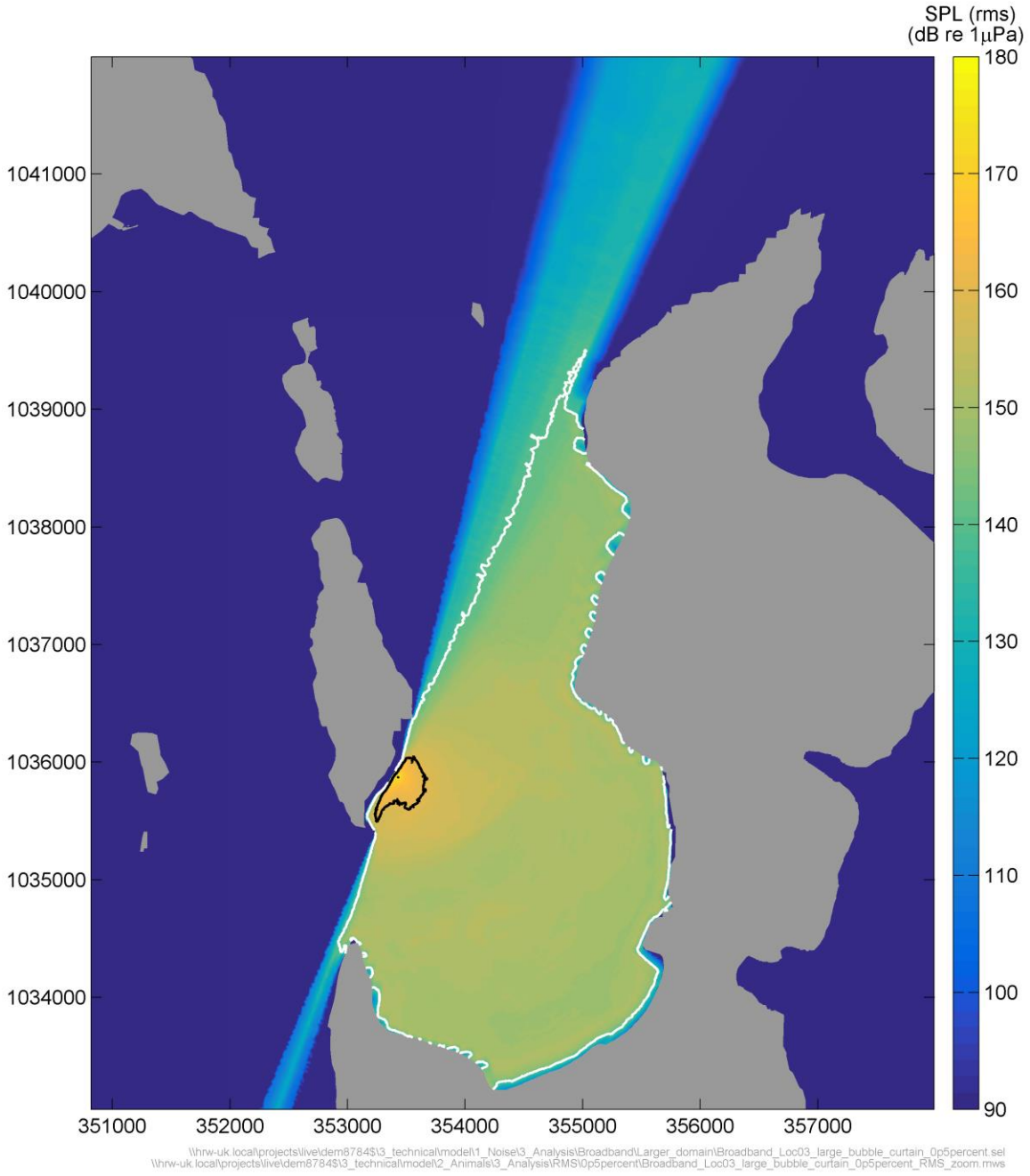


Figure 16.18 – Modelled Areas of Behavioural Disturbance for Marine Mammals using Additional Bubble Curtain Mitigation (black and white contours indicate thresholds for high-level and low-level disturbance, respectively).

References

Hammond, P.S., Lacey, C., Gilles, A., Viquerat, S., Börjesson, P., Herr, H., Macleod, K., Ridoux, V., Santos, M.B., Scheidat, M., Teilmann, J., Vingada, J., Øien, N. (2017). *Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys.* Available at: https://synergy.st-andrews.ac.uk/scans3/files/2017/05/SCANS-III-design-based-estimates-2017-05-12-final-revised.pdf. Accessed on 20 January 2021.

NOAA (2016). *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts.* National Oceanic and Atmospheric Administration, Technical Memorandum NMFS-OPR-55, July 2016.