

Expected duration of piling at site locations 1 and 2.

Location 1 was the modelling location for demolition of the northern arm (no piling proposed here). Location 2 was the modelling location for piling at the Western Wharf (on the east side of the development). Chapter 5 of the ES sets out an estimated duration for the Western Wharf piling of 16 weeks (undertaking 2 piles per day).

Design and placement of bubble curtain as mitigation, plus modelled evidence of reduction in sound attenuation across the estuary for category 2 hearing fish.

Tables below from the underwater noise technical annex are included that provide modelling output results for piling impact radii for both category 2 (highlighted yellow) and category 3 fish. The figure outputs are only provided for category 3 fish as a worst case. Results for stationary and fleeing fish are included, and with soft start only, as well as with bubble curtains as mitigation.

Note the following from the model outputs:

- For fleeing fish, with soft start only, impact footprint does not extend across the Carrick Roads channel (see Figure 7.18).
- For stationary fish, with soft start only, only the impact footprint for TTS extends across the Carrick Roads channel (see Figure 7.20).
- With bubble curtain, the modelling shows a reduced impact footprint, including reduced TTS and impact footprint does not extend across the Carricks Roads channel.
- Please note previous communications around the practicalities of bubble curtains, so if this is included in condition wording, we'd welcome wording to be included around their use such as 'reasonably practical', or something along those lines.

Table 7.5: Distances from the pile to impact radii for fish for percussive piling with soft-start at Location 2

	TTS			Recoverable Injury			Mortality		
	R _{max}	R ₉₅	R _{mean}	R _{max}	R ₉₅	R _{mean}	R _{max}	R ₉₅	R _{mean}
Fleeing (SEL _{cum}) (swim bladder involved in hearing)	1500 m	1300 m	650 m	460 m *	400 m	210 m	460 m *	390 m	170 m
Fleeing (SEL _{cum}) (swim bladder not involved in hearing)	1500 m	1300 m	650 m	460 m *	400 m	210 m	460 m *	360 m	210 m
Stationary (SEL _{cum}) (swim bladder involved in hearing)	4100 m	3600 m	1700 m	1700 m	1300 m	880 m	1300 m	860 m	630 m
Stationary (SEL _{cum}) (swim bladder not involved in hearing)	4100 m	3600 m	1700 m	1700 m	1300 m	880 m	940 m	580 m	450 m
SPL _{peak}				460 m	270 m	230 m	460 m	270 m	230 m

Table 7.7: Distances from the pile to impact radii for fish (percussive piling with soft start and bubble curtain at Location 2)

	TTS			Recoverable Injury			Mortality		
	R _{max}	R ₉₅	R _{mean}	R _{max}	R ₉₅	R _{mean}	R _{max}	R ₉₅	R _{mean}
Fleeing (SEL _{cum}) (swim bladder involved in hearing)	460 m *	410 m	220 m	0 m	0 m	0 m	0 m	0 m	0 m
Fleeing (SEL _{cum}) (swim bladder not involved in hearing)	460 m *	410 m	220 m	0 m	0 m	0 m	0 m	0 m	0 m
Stationary (SEL _{cum}) (swim bladder involved in hearing)	1700 m	1600 m	820 m	280 m	270 m	210 m	140 m	140 m	120 m
Stationary (SEL _{cum}) (swim bladder not involved in hearing)	1700 m	1600 m	820 m	280 m	270 m	210 m	80 m	80 m	70 m
SPL _{peak} **				30 m	30 m	30 m	30 m	30 m	30 m



Figure 7.18: Predicted SEL_{cum} impact footprint for fleeing fish for percussive piling, with a soft start procedure, at the Western Wharf (Location 2)

Notes: TTS - yellow; PTS - orange; mortal injury - red

Source: Uses Google Earth imagery



Figure 7.20: Predicted SEL_{cum} impact footprint for Category 2 stationary fish for percussive piling, with a soft start procedure, at the Western Wharf (Location 2)

Notes: TTS - yellow; PTS - orange; mortal injury - red

Source: Uses Google Earth imagery

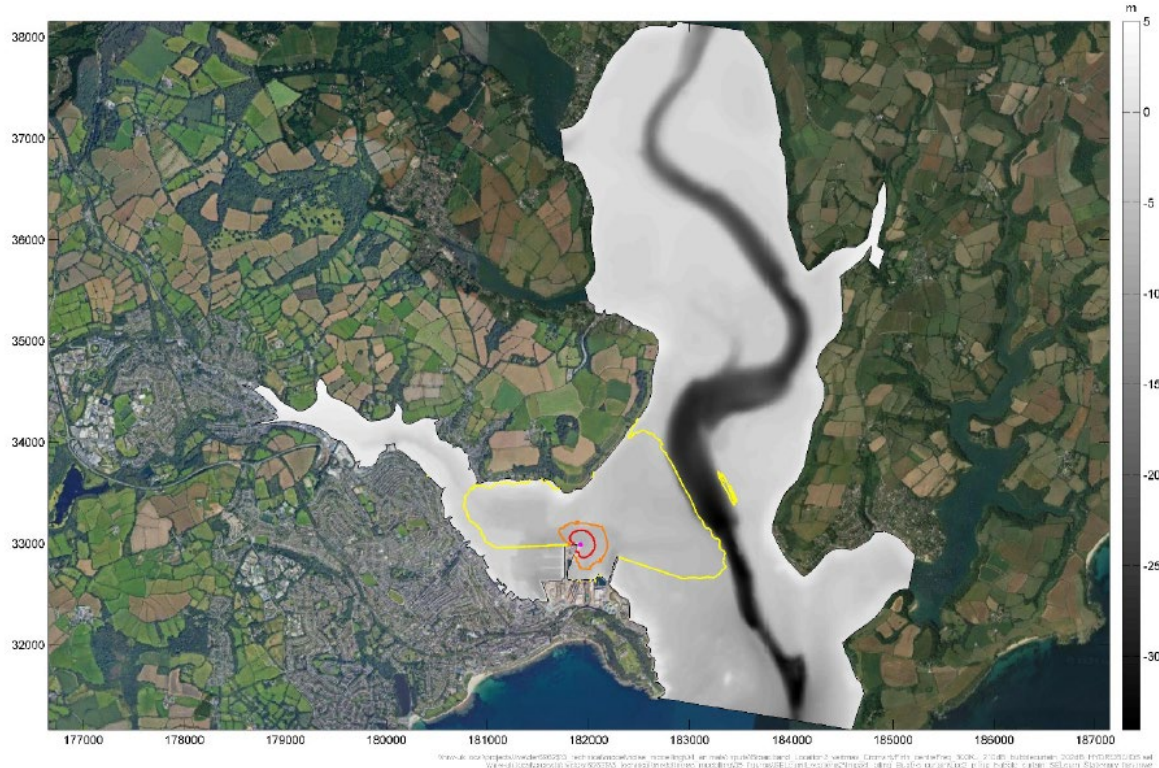


Figure 7.25: Predicted SEL_{cum} impact footprint for the stationary fish (category 3) for percussive piling, with a soft start procedure and a bubble curtain, at the Western Wharf (Location 2)

Notes: TTS - yellow; PTS - orange; mortal injury - red

Source: Uses Google Earth imagery

Timings of piling works around tidal periods, including maximum piling operation times.

Piling is being restricted in terms of timings as set out below, and therefore there is no proposal to specify a further restriction on piling according to tidal state. However, given the natural tidal cycle, there will be periods when the piling will be undertaken at and around low-tide, and therefore with a reduced depth of water column.

Pile timings are proposed to be restricted as follows:

- One piling rig would be utilised to undertake the piling.
- It is estimated that approximately six hours is required for the installation of each pile, of which approximately two hours would comprise percussive piling.
- Piling would be undertaken during the day-time only and therefore up to two piles could be undertaken per day.
- This could therefore result in up to a total of 4 hours of percussive piling on a given day – consisting of two lots of two hours, which allows for the completion of one pile, mobilisation to the next pile location, and completion of another pile within a day.

Full list of mitigatory measures employed at these specific sites to reduce piling disturbance.

The following measures are set out in the outline CEMP:

- The Contractor(s) will produce a detailed method statement for piling and demolition. The method statements will confirm final choice of plant, programme/duration of activities, and working methodology.
- Piling would not occur at night-time.
- Only one piling rig would be active at a time, with no more than four hours of percussive piling per day.
- Vibro-piling would be utilised where reasonably practicable and where appropriate to achieve required pile depths.
- Soft-start methodology would be utilised for percussive piling.
- Use of a Marine Mammal Observer(s) during impact piling, in line with JNCC guidance: Statutory nature conservation agency protocol for minimising the risk of injury to marine mammals from piling noise (2010).

Proposed acoustic monitoring during works (as suggested by HR Wallingford) with protective limits and actions taken if they are exceeded.

Passive Acoustic Monitoring (PAM) or marine mammal observers were proposed by HR Wallingford. This was specifically with respect to marine mammals to further mitigate the potential for marine mammals to become trapped further upstream to the west of Falmouth Docks, by alerting the contractor to their presence in the vicinity of the proposed development. It is not applicable to fleeing fish. The mitigation taken forward in the ES (see Chapter 9 Marine Ecology) was the Marine Mammal Observer and not the PAM, as in our experience, the Marine Mammal Observer is a more effective form of mitigation for identifying both cetaceans and pinnipeds in the area (as opposed to PAM).