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worley.com

18 November 2025

Ref: 311015-00695

Antonia Stuart
Central Coast Council
Email: Antonia.Stuart@centralcoast.nsw.gov.au

Dear Antonia,

FOR DA/1264/2024 (SECTION A), DA/947/2024 (SECTION B) AND DA/1389/2024 (SECTION C)

Three Development Applications (DAs) for the terminal protection structure at Wamberal Beach, NSW, have been submitted to Central Coast Council (Council) for approval. The Development Applications number and reference numbers are as follows:

- PPSHCC-308 – Central Coast - DA/947/2024 - 101 Oceanview Drive, Wamberal 2260 – Coastal Protection Works (Seawall - Section B)
- PPSHCC-311 – Central Coast - DA/1264/2024 - 3-17 Calais Road, Wamberal 2260 – Coastal Protection Works (Seawall - Section A)
- PPSHCC-318 – Central Coast - DA/1389/2024 - 3 Pacific Street, Wamberal 2260 – Coastal Protection Works (Seawall - Section C).

The applicant's responses to issues raised by Worley have not addressed key issues adequately, which behoves Worley to advise Council not to approve the development application.

The key issues are:

1. The structure submitted on the DA drawings has not been designed for the appropriate coastal process conditions, but the applicants' response states that would be done in detailed design. This should have been done for the concept design presented for approval. With a -2 m scour level, the design condition comprises a 10 m high cantilevered concrete secant pile wall, which is a severe design case. The concept design has not been shown to be structurally sound or sound based on geotechnical considerations for global stability and, if the applicant has done the calculations, then these should be submitted to satisfy Worley's concerns.
2. The calculated overtopping volumes presented would be unacceptable for public safety and for the structural integrity of the residences seeking protection. The wave reflector would need to be higher with the possibility for a reduction in level with physical modelling.
3. No details of terminal end controls are provided in the DA drawings. There is no insurance that the end effects are mitigated. This issue has not been resolved.

4. In accordance with Section 27 of Coastal Management Act 2016 and Section 2.12 of State Environmental Planning Policy (Resilience and Hazards) 2021, development consent cannot be given if a seawall will increase the coastal hazard on adjacent land. Approval cannot be given without sand nourishment to mitigate erosion on adjacent unprotected land, which would be required to compensate for locked up storm demand and for increased erosion that would occur on unprotected areas within the coastal compartment. Without compensatory sand nourishment, during storms the seawall will increase the coastal hazard on unprotected land and on the land in front of it.

Worley's engineering referral comments on issues with applicant's response are provided in Table 1, Table 2 and Table 3 attached. Worley have only included critical items that required commentary from Worley in the tables. Issues such as owner's consent, ecology and planning are not part of Worley's scope.

Should you require clarification about any aspect of our letter, please contact Deborah Lam.

Yours sincerely,



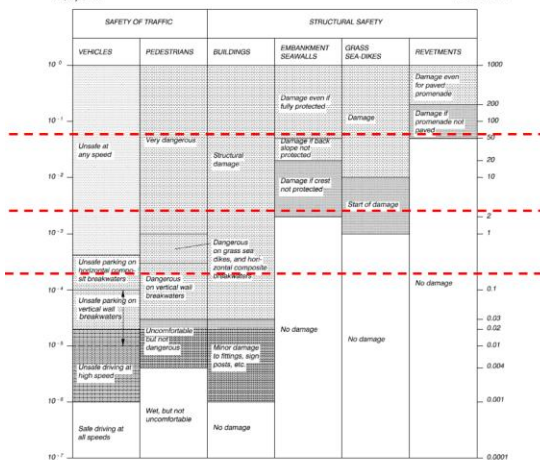
Deborah Lam
Associate Consultant, Coastal Engineering

Table 1 Issues summary for PPSHCC-308 – Central Coast - DA/947/2024 - 101 Oceanview Drive, Wamberal 2260 – Coastal Protection Works (Seawall - Section B)

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
Concept design ocean conditions	Derivation of the design wave conditions is not in accordance with the Shore Protection Manual (USACE, 1984) or the Coastal Engineering Manual (USACE, 2006) and must be amended. Model study results (Hatch, 2023) are not consistent with actual site observations at Wamberal during erosion events. Coastal seawalls subjected to depth-limited breaking waves must be designed for the maximum breaking wave height to which the structures might reasonably be subjected (USACE 1984 p7-8, USACE 2006 pVI-5-64). In determining the breaking wave height for structural design, calculations must start on the assumption that the beach berm has been eroded at the structure face.	While we still consider the assumption of a no-maintenance scenario and a fully eroded beach profile extending to the seawall toe for significant length of the wall – combined with a design storm event – to be highly conservative, we agree to adopt this condition for the purpose of structural design during the detailed design phase and incorporate appropriate wave loading and drainage details in the seawall assessment. For the purposes of estimating design wave at the toe of the structure, a fully eroded beach to level of -1m AHD is considered. Seawall geotechnical stability and structural integrity has been assessed for a design scour of -2m AHD at the toe. The offshore design wave conditions used in Hatch's numerical modelling (H370327-0000-2B5-066-001) are consistent with MHL2872 (2022), based on a 500-year ARI event (inclusive of SLR allowance) with an offshore significant wave height of 9.8m and a peak spectral period of 13s. These conditions were transformed to the nearshore using SWAN, incorporating depth-limited breaking and representative eroded beach profiles, noting that none of the profiles extended beyond -1.0m AHD. The model was validated through using a selected 2-weeks duration of ERA5 hindcast wave data at the model boundary (which earlier in the report was proven to correspond well with the MHL2872 500 ARI conditions) and comparing its output at the Wamberal buoy location with the buoy data for that same period. This comparison showed good agreement. To address the reviewer's request for an analytical approach, Hatch has reviewed the nearshore wave conditions using the following methods: 1. SPM / USACE (1984) method described on p7-8 was applied, and a maximum breaking wave height (Hbmax) of 4.3m was estimated for -1m AHD scour depth (using Hatch's 500 ARI DSWL of +3.1m AHD). Assuming the Hbmax represents H2%, and a crude relationship of $1.4 \times H_s = H_{bmax}$, the associated $H_s = 3.1m$ for the 500 ARI water	The incident wave design conditions described in the response have not been presented in the Basis of Design report and have not been presented in the response. The response states: "In detailed design, Hatch will run the model with a beach profile fully eroded to -1m AHD to the toe of the TPS to verify and compare to the SPM and RM. The structural design will take the Hbmax into account, whilst the Hs will be used for overtopping estimations." The incident wave design conditions described in the response were not but should have been applied to the concept design presented for approval. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		level and offshore wave period. It should be noted that this methodology does not take the offshore wave height into account, only the offshore wave period, water depth and seabed slope. 2. The CIRIA Rock Manual (2007), which is also a reference document in MHL2872, proposes a methodology developed by Van Der Meer (1990) to estimate H_{m0} at wave breaking at a certain depth, which takes the offshore Irribarren number into account. Using this methodology, for the same 500 ARI wave conditions in point 1 above, the wave heights at breaking for -1m AHD scour is 3.7m. 3. Although Hatch (2023) SWAN model did not model -2m AHD scour at the toe of the structure, it did extract wave heights at depths -2m AHD nearshore along the length of the TPS B area (refer Table 4-4). The maximum H_s along TPS B area, at a depth of -2m AHD was 3.7m (output Point 3A). It can be argued that a similar wave height (or smaller) would reach the TPS during 500 ARI offshore conditions should the beach be fully eroded to -2m AHD at the toe (along with the rest of the beach seaward of the TPS). In detailed design, Hatch will run the model with a beach profile fully eroded to - 1m AHD to the toe of the TPS to verify and compare to the SPM and RM. The structural design will take the H_{bmax} into account, whilst the H_s will be used for overtopping estimations. As a side-note – the eroded material from the beach will typically be deposited offshore from the beach, which could create depth-limited conditions earlier, further away from the structure, resulting in a smaller wave at the structure. This is, however, difficult to predict, especially through empirical formulae.	

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
Design scour level	Design scour level is recommended to be re-assessed based on the more recent method to determine scour levels for dune revetments and seawalls as published in a paper titled "Design Scour Levels for Dune Revetments and Seawalls" (Nielsen 2023).	A design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design. This value is consistent with the Engineering Design Requirements (EDR, MHL2872, 2022) and reflects conservative practice for open coast structures in NSW. While the Nielsen (2023) paper on scour assessment was not referenced in the EDR, Hatch has undertaken a high-level review of the methodology, which is based on empirical relationships derived from physical-scaled model testing. Its applicability to the Wamberal site will be further considered during detailed design, including a comparison with the current adopted scour level and taking into account the presence of shallow bed rock and medium dense substrates. Geotechnical investigations by Douglas Partners (2023) have informed the current design. Where bedrock and clayey material is shallower than -2.0 m AHD, local adjustments will be made to the scour levels during the detailed design phase in consultation with Council, as appropriate. Current design considers worst-case scenario of scour to -2.0m AHD at toe.	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025																																
Wave overtopping, runoff and property drainage	The applicant shall not be relying upon future beach monitoring and nourishment program to maintain potential overtopping below allowable limits. All sections of the proposed terminal end structure require a groundwater and flood assessment, and would need appropriate adequate drainage design for elevated groundwater and the flood water. The drainage design would need to minimise beach scour at the outlets.	Wave conditions for the TPS design have been established using the approach outline above (see Hatch's response to the comment on Concept design ocean conditions), incorporating both analytical and numerical methods under a conservative assumption of a fully eroded beach profile to -1m AHD. Overtopping rates were assessed in accordance with the guidelines provided in EuroTop (2018), which is the industry standard for wave overtopping over sea defenses. The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> Physical modelling will be considered in the detailed design phase to ensure the wave return walls are optimized to its most effective geometry, to ensure the wall sections ending at +6m AHD dissipate the overtopping effectively, and to inform the volumes for the drainage design. A drainage strategy will be developed during detailed design to manage: - Wave overtopping return flows - Rainfall runoff - Elevated groundwater level The drainage design will include scour protection at outlets and will be informed by site-specific groundwater assessments.		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3	The applicant's response gives the following overtopping results for the design condition: The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> According to the Coastal Engineering Manual, these volumes would be unacceptable for public safety and structural integrity of the residences. Table VI-5-4 Critical Values of Average Overtopping Discharges 		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3
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Steel elements	For the design scour levels and groundwater conditions, the proposed design is compromised for geotechnical global stability and structural integrity. The structure requires ground sand anchors, otherwise it could collapse onto the beach when storm erosion occurs. Ground anchors would increase the cost considerably and may not be feasible due to the proximity of the residences. Applicant is required to undertake groundwater assessment and consider elevated groundwater conditions during flood conditions. Applicant is required to submit a geotechnically stable and structurally sound design such that the impact of the amended design can be assessed. The design needs to address shallow weathered rock condition around 75 to 93 Ocean View Drive in Section B such that impact of the design can be assessed.	It is unclear how the reviewer has determined that the proposed wall design compromises both structural integrity and geotechnical stability. We would appreciate any specific details or evidence of non-compliance with the design guidelines/standards so that Hatch can provide a targeted and informed response. Key aspects regarding the adopted design: As acknowledged in the reviewer's comment, the use of ground anchors would significantly increase costs and risk of foundation damage due to the close proximity of residential dwellings. In response, Hatch has developed a cantilevered wall solution that eliminates the need for ground anchors, thereby eliminating risk to the foundations of nearby residences and requires only a minimal construction footprint compared to that of a wall with anchors or Seabee wall concepts. This solution is designed to provide long-term performance with minimal maintenance over its service life. The cantilevered section is embedded into competent ground (either rock or suitable subgrade layers) to ensure sufficient anchorage (currently it is >15m below design scour level) and geotechnical stability and incorporates appropriate structural detailing. The stability of the cantilever retaining wall has been assessed in accordance with AS 4678 and AS 4997, incorporating appropriate load and material factors. An additional verification has also been carried out using Eurocode 7 load factors. The structural design complies with AS 3600, addressing both serviceability and ultimate limit states. A detailed longitudinal geotechnical section has been developed along the full length of the wall (refer to Appendix 11 of the Basis of Design), outlining the inferred subsurface strata. Geotechnical stability has been assessed based on the most critical section, and a conservative design has been applied uniformly along the entire wall. This design will be refined during the detailed design phase, with adjustments made for individual	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

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		properties or groups of properties sharing similar geotechnical profiles. Hydrostatic effects resulting from tidal lag has also been considered as twice those outlined in Clause 5.8.3 of AS 4997 (Design Guidelines for Maritime Structures). These elevated groundwater effects have been incorporated into the loading conditions for the seawall assessment. According to AS 4997, the minimum tidal lag on the seawalls should be the greater of one-third of the spring tidal range or 500 mm (i.e., the larger of 0.4 m or 0.5 m). However, Hatch has conservatively adopted a tidal lag of 1.0 m, which is twice the recommended minimum, to ensure robustness in the wall design. This will further be reviewed and refined based on site specific ground water level assessment at the detailed design phase with consideration to the drainage design. Though very unlikely, where a cantilevered solution is found to be inadequate during the detailed design due to additional direct wave load (design storm case), additional piles will be installed and connected to main wall capping beam forming a portal frame increasing stability and capacity. The TPS incorporates a secant pile wall system for its vertical component, comprising bored cast-in-situ concrete piles connected at the top by a reinforced concrete capping beam. These piles will be installed into the existing ground using boring techniques, including drilling into weathered rock layers, with sufficient embedment into competent material, either rock or suitable soil strata as determined during the detailed design phase.	
Physical modelling for design verification and optimisation	Physical modelling is mandatory when seawall designs comprise innovative and untested rigid elements such as wave return walls, integrated access stairways, balustrading or	Appropriate physical modelling will be considered during the detailed design phase.	This is entirely non-committal and does not ensure that any modelling would be done. The applicant is to advise what modelling will be done.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
	composite structures. Where designers elect not to undertake physical modelling, adequate factors of safety in design must be demonstrated.		
Terminal end controls	End effects have been observed in the Wamberal and Terrigal area. Ends and gaps in the terminal protection structure at 1 Calais Road and the road reserve and public access way between 4 Surfers Road and 1 Calais Road would be subject to end effects that result in increased erosion. A contiguous seawall along the entire beachfront between the lagoon entrances is required.	We acknowledge that terminal end effects could occur where seawalls terminate adjacent to unprotected areas, as noted in NSW guidance. The Engineering Design Requirements (MHL 2022) anticipate staged delivery and allow for temporary or permanent terminal end controls rather than mandating a fully contiguous wall, which is not feasible without a Council or State-led program. For the proposed TPS, the identified gaps due to non-participating landowners (e.g. at 1 Calais Road and the public accessway) are relatively narrow (compared to the length of the seawall) and located in areas with existing ad-hoc protection and sand buffers. These areas will remain more exposed than protected sections under extreme events. While the erosion associated with gaps in an introduced seawall, as compared to the status quo, has not been well documented in literature, the magnitude and distribution of additional erosion, if any, are known to be highly site specific and influenced by local morphology and longshore processes. To manage this risk, the current design at DA stage has allowed for a conservative and adaptive approach by incorporating: • Landward alignment and buried structure to minimize interaction with active beach processes; • Return walls, tapered transitions and toe protection at terminations. This approach aligns with the EDR and ensures that potential end effects are mitigated through design refinement and adaptive management post-consent, while enabling staged	No details of terminal end controls are provided in the DA drawings. There is no insurance that the end effects are mitigated. This issue has not been resolved.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		implementation, in collaboration with Council and relevant stakeholders.	
Public safety	To address public safety issues, access stairs are required to be extended to a lower level that accommodates future scour and erosion.	The extension of access stairs to accommodate future scour and erosion has been carefully considered. It is not deemed appropriate to extend stairs to design scour levels which are below high-water mark due to public safety concerns and practical limitations. However, the bottom level of the stairs will be further reviewed in the detail design phase taking council and owners inputs for each property and incorporate into the TPS as appropriate.	The bottom of the access stairs are at RL+4.2 and +5.2 m AHD. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.
Beach accessways	Design for the gap at 1 Calais Road and between 4 Surfers Road and 1 Calais Road is required such that the design at these public sand accessways can be assessed. To address beach access issues, access stairs are required to be extended to a lower level that accommodates future scour and erosion. Potential impacts due to public and private accessways shall be assessed, including impacts to dunes, vegetation and visual amenity. Applicant shall consider the consolidation of private accessways to reduce impacts.	Public Beach Access Ways: Temporary closure of public beach accessways is anticipated to be implemented by Council to facilitate maintenance activities. The lower sections of the access stairs will be reviewed and refined in consultation with Council during the detailed design phase. Public Beach Access Stairs: These stairs are intended exclusively for use by the individual property residents. The detailed design will incorporate appropriate safety measures, including lockable gates and handrails. The lower sections of these stairs will also be reviewed and adjusted in consultation with each property owner during the detailed design phase. Potential impact due to public and private accessways: Many of the properties in question are located adjacent to or extend up to the erosion escarpment, with little to no remaining dune system. To minimize disruption to existing vegetation and maintain visual amenity, access stairs have been incorporated into the wall design. Visual impacts will be further reduced through the use of materials and finishes that harmonize with the surrounding coastal landscape. Please refer to the architectural renders submitted with the Development Application (DA) for further detail. Consolidation of Private Accessways: During the preliminary design phase, the potential for consolidating private accessways was explored. However, due to differences in property	Existing stair design does not provide access off the beach during storm conditions. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		ownership, individual access requirements, spatial limitations, and existing infrastructure, shared accessways were generally not feasible. This aspect will be revisited during the detailed design phase, where any viable opportunities for consolidation will be identified and incorporated as appropriate.	
Statutory Considerations			
Clause 27 of Coastal Management Act 2016	Development consent for a seawall can only be given if the development does not increase the coastal hazard on adjacent land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Satisfactory arrangement for the restoration of a beach is required. Compensatory sand nourishment is required to be included with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To address public safety issues, the access stairs are required to be extended to a lower level that accommodates future scour and erosion.	The interpretation of S27 of the CMA is incorrect. The proposal has been designed with the provisions of this Act in mind, and as outlined in the SEE. The references to adjacent land allow for conditions of consent to address the issue and are not a prohibition. Further, the clause is to be applied where the works result in "any increased erosion". In light of the landward nature of the works, the question of "increased erosion" may not be relevant. The Act does not act to restrict consent to a contiguous wall. This is another misinterpretation. The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand nourishment to address long term recession, or storm demand. Based on discussions, the concern here is primarily one of end effects resulting from properties not participating in the DA's. As outlined to the Panel at the initial briefing, it is entirely possible that Council carries out works for the handful of properties which would address end effects upon them, and this would represent a saving beyond what they currently pay for protection / restoration works each year. If the wall were approved and built, then Council would only need to do these works for the few properties – potentially only once. This would require a level of cooperation between the proponents and	Applicant's response includes: "The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand nourishment to address long term recession, or storm demand." The proposed seawall will increase erosion on unprotected land within the coastal compartment as it will lock up existing storm demand sand that would be behind it as well as have end effects. This is evident clearly in the photo from the July 2020 storm shown here. Here, as elsewhere along the beach, the existing storm demand includes sand volumes that would be behind the seawall if built. Hence, should the seawall be built then sand nourishment would be required to compensate for locked up storm demand and for increased erosion that would occur on unprotected areas.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		Council. This is further discussed in the response to the Council RFI's. Refer to previous statement regarding the bottom levels for the stairs. Note that this is not referred to within S 27 of the CMA. All existing debris, non-engineered protection works, and similar materials located along the proposed seawall alignment will be removed and appropriately disposed of prior to the construction. Additionally, sand will be temporarily displaced to facilitate construction activities, as needed. Upon completion of Seawall construction: • The volume of material removed from the site will be replaced with sand • Any displaced sand will be reinstated to pre-construction survey levels. • Additionally, an equivalent volume of sand, corresponding to any sand material considered to be 'locked' behind the seawall, if any, will also be placed on the beach. It is noted, however, that long-term beach erosion due to natural coastal recession is considered part of ongoing coastal processes. As such, the applicant does not propose to address this through additional sand nourishment, which is considered the responsibility of Council, if required. Safe beach access stairs are incorporated into the wall design for each private property, extending below all historical sand levels recorded over the past 50 years. If an emergency evacuation is required to a fully eroded and flooded beach, additional emergency ladders and PFD's may be needed as no dry beach is available. However, such provisions exceed the usual functional requirements of a typical beach accessway. The EDR does not mandate such safety features which are usually implemented for offshore structures surrounded by	

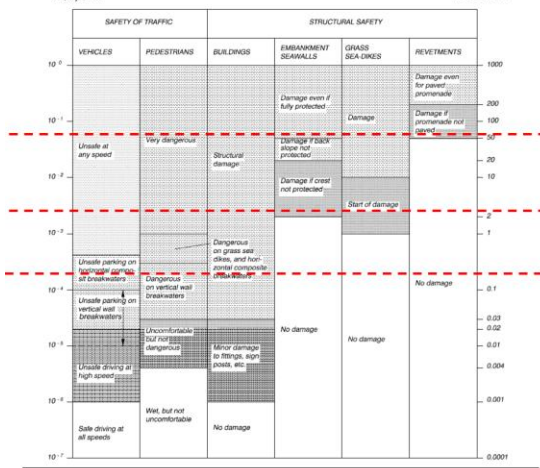
Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		waters. Also refer to the previous responses above for further comments on beach accessways/public safety.	
Section 2.12 of State Environmental Planning Policy (Resilience and Hazards) 2021	Development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Development consent can only be given if the proposed seawall is not likely to reduce public amenity and use of the beach, by providing compensatory sand nourishment with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To manage public safety from coastal hazards, the access stairs are required to be extended to a lower level that accommodates future scour and erosion.	This is also a misinterpretation of SEPP Hazards and Resilience. This Instrument is addressed in the SEE. The SEPP does not limit any consent to only being a contiguous wall. The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up. Refer to previous statements regarding the bottom levels for the stairs.	The SEPP requires that development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. The applicant's response is "<i>The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up.</i>" However, without compensatory sand nourishment, the seawall will increase the coastal hazard on unprotected land and on the land in front of it.

Table 2 Issues summary for PPSHCC-311 – Central Coast - DA/1264/2024 - 3-17 Calais Road, Wamberal 2260 – Coastal Protection Works (Seawall - Section A)

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
Concept design ocean conditions	Derivation of the design wave conditions is not in accordance with the Shore Protection Manual (USACE, 1984) or the Coastal Engineering Manual (USACE, 2006) and must be amended. Model study results (Hatch, 2023) are not consistent with actual site observations at Wamberal during erosion events. Coastal seawalls subjected to depth-limited breaking waves must be designed for the maximum breaking wave height to which the structures might reasonably be subjected (USACE 1984 p7-8, USACE 2006 pVI-5-64). In determining the breaking wave height for structural design, calculations must start on the assumption that the beach berm has been eroded at the structure face.	While we still consider the assumption of a no-maintenance scenario and a fully eroded beach profile extending to the seawall toe for significant length of the wall – combined with a design storm event – to be highly conservative, we agree to adopt this condition for the purpose of structural design during the detailed design phase and incorporate appropriate wave loading and drainage details in the seawall assessment. For the purposes of estimating design wave at the toe of the structure, a fully eroded beach to level of -1m AHD is considered. Seawall geotechnical stability and structural integrity has been assessed for a design scour of -2m AHD at the toe. The offshore design wave conditions used in Hatch's numerical modelling (H370327-0000-2B5-066-001) are consistent with MHL2872 (2022), based on a 500-year ARI event (inclusive of SLR allowance) with an offshore significant wave height of 9.8m and a peak spectral period of 13s. These conditions were transformed to the nearshore using SWAN, incorporating depth-limited breaking and representative eroded beach profiles, noting that none of the profiles extended beyond -1.0m AHD. The model was validated through using a selected 2-weeks duration of ERA5 hindcast wave data at the model boundary (which earlier in the report was proven to correspond well with the MHL2872 500 ARI conditions) and comparing its output at the Wamberal buoy location with the buoy data for that same period. This comparison showed good agreement. To address the reviewer's request for an analytical approach, Hatch has reviewed the nearshore wave conditions using the following methods: 1. SPM / USACE (1984) method described on p7-8 was applied, and a maximum breaking wave height (Hbmax) of	The incident wave design conditions described in the response have not been presented in the Basis of Design report and have not been presented in the response. The response states: "In detailed design, Hatch will run the model with a beach profile fully eroded to -1m AHD to the toe of the TPS to verify and compare to the SPM and RM. The structural design will take the Hbmax into account, whilst the Hs will be used for overtopping estimations." The incident wave design conditions described in the response were not but should have been applied to the concept design presented for approval. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done.

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		4.3m was estimated for -1m AHD scour depth (using Hatch's 500 ARI DSWL of +3.1m AHD). Assuming the H_{bmax} represents $H_2\%$, and a crude relationship of $1.4 \cdot H_s = H_2\%$, the associated $H_s = 3.1m$ for the 500 ARI water level and offshore wave period. It should be noted that this methodology does not take the offshore wave height into account, only the offshore wave period, water depth and seabed slope. 2. The CIRIA Rock Manual (2007), which is also a reference document in MHL2872, proposes a methodology developed by Van Der Meer (1990) to estimate H_{m0} at wave breaking at a certain depth, which takes the offshore Irribarren number into account. Using this methodology, for the same 500 ARI wave conditions in point 1 above, the wave heights at breaking for -1m AHD scour is 3.7m. 3. Although Hatch (2023) SWAN model did not model -2m AHD scour at the toe of the structure, it did extract wave heights at depths -2m AHD nearshore along the length of the TPS B area (refer Table 4-4). The maximum H_s along TPS B area, at a depth of -2m AHD was 3.7m (output Point 3A). It can be argued that a similar wave height (or smaller) would reach the TPS during 500 ARI offshore conditions should the beach be fully eroded to -2m AHD at the toe (along with the rest of the beach seaward of the TPS). In detailed design, Hatch will run the model with a beach profile fully eroded to - 1m AHD to the toe of the TPS to verify and compare to the SPM and RM. The structural design will take the H_{bmax} into account, whilst the H_s will be used for overtopping estimations. As a side-note – the eroded material from the beach will typically be deposited offshore from the beach, which could create depth-limited conditions earlier, further away from the structure, resulting in a smaller wave at the structure. This is,	

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		however, difficult to predict, especially through empirical formulae.	
Design scour level	Design scour level is recommended to be re-assessed based on the more recent method to determine scour levels for dune revetments and seawalls as published in a paper titled "Design Scour Levels for Dune Revetments and Seawalls" (Nielsen 2023).	A design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design. This value is consistent with the Engineering Design Requirements (EDR, MHL2872, 2022) and reflects conservative practice for open coast structures in NSW. While the Nielsen (2023) paper on scour assessment was not referenced in the EDR, Hatch has undertaken a high-level review of the methodology, which is based on empirical relationships derived from physical-scaled model testing. Its applicability to the Wamberal site will be further considered during detailed design, including a comparison with the current adopted scour level and taking into account the presence of shallow bed rock and medium dense substrates. Geotechnical investigations by Douglas Partners (2023) have informed the current design. Where bedrock and clayey material is shallower than -2.0 m AHD, local adjustments will be made to the scour levels during the detailed design phase in consultation with Council, as appropriate. Current design considers worst-case scenario of scour to -2.0m AHD at toe.	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

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Wave overtopping, runoff and property drainage	The applicant shall not be relying upon future beach monitoring and nourishment program to maintain potential overtopping below allowable limits. All sections of the proposed terminal end structure require a groundwater and flood assessment, and would need appropriate adequate drainage design for elevated groundwater and the flood water. The drainage design would need to minimise beach scour at the outlets.	Wave conditions for the TPS design have been established using the approach outline above (see Hatch's response to the comment on Concept design ocean conditions), incorporating both analytical and numerical methods under a conservative assumption of a fully eroded beach profile to -1m AHD. Overtopping rates were assessed in accordance with the guidelines provided in EuroTop (2018), which is the industry standard for wave overtopping over sea defenses. The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> Physical modelling will be considered in the detailed design phase to ensure the wave return walls are optimized to its most effective geometry, to ensure the wall sections ending at +6m AHD dissipate the overtopping effectively, and to inform the volumes for the drainage design. A drainage strategy will be developed during detailed design to manage: - Wave overtopping return flows - Rainfall runoff - Elevated groundwater level The drainage design will include scour protection at outlets and will be informed by site-specific groundwater assessments.		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3	The applicant's response gives the following overtopping results for the design condition: The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> According to the Coastal Engineering Manual, these volumes would be unacceptable for public safety and structural integrity of the residences. Table VI-5-4 Critical Values of Average Overtopping Discharges 		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3
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Steel elements	For the design scour levels and groundwater conditions, the proposed design is compromised for geotechnical global stability and structural integrity. The structure requires ground sand anchors, otherwise it could collapse onto the beach when storm erosion occurs. Ground anchors would increase the cost considerably and may not be feasible due to the proximity of the residences. Applicant is required to undertake groundwater assessment and consider elevated groundwater conditions during flood conditions. Applicant is required to submit a geotechnically stable and structurally sound design such that the impact of the amended design can be assessed.	It is unclear how the reviewer has determined that the proposed wall design compromises both structural integrity and geotechnical stability. We would appreciate any specific details or evidence of non-compliance with the design guidelines/standards so that Hatch can provide a targeted and informed response. Key aspects regarding the adopted design: As acknowledged in the reviewer's comment, the use of ground anchors would significantly increase costs and risk of foundation damage due to the close proximity of residential dwellings. In response, Hatch has developed a cantilevered wall solution that eliminates the need for ground anchors, thereby eliminating risk to the foundations of nearby residences and requires only a minimal construction footprint compared to that of a wall with anchors or Seabee wall concepts. This solution is designed to provide long-term performance with minimal maintenance over its service life. The cantilevered section is embedded into competent ground (either rock or suitable subgrade layers) to ensure sufficient anchorage (currently it is >15m below design scour level) and geotechnical stability and incorporates appropriate structural detailing. The stability of the cantilever retaining wall has been assessed in accordance with AS 4678 and AS 4997, incorporating appropriate load and material factors. An additional verification has also been carried out using Eurocode 7 load factors. The structural design complies with AS 3600, addressing both serviceability and ultimate limit states. A detailed longitudinal geotechnical section has been developed along the full length of the wall (refer to Appendix 11 of the Basis of Design), outlining the inferred subsurface strata. Geotechnical stability has been assessed based on the most critical section, and a conservative design has been applied uniformly along the entire wall. This design will be refined during the detailed design phase, with adjustments made for individual	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

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		properties or groups of properties sharing similar geotechnical profiles. Hydrostatic effects resulting from tidal lag has also been considered as twice those outlined in Clause 5.8.3 of AS 4997 (Design Guidelines for Maritime Structures). These elevated groundwater effects have been incorporated into the loading conditions for the seawall assessment. According to AS 4997, the minimum tidal lag on the seawalls should be the greater of one-third of the spring tidal range or 500 mm (i.e., the larger of 0.4 m or 0.5 m). However, Hatch has conservatively adopted a tidal lag of 1.0 m, which is twice the recommended minimum, to ensure robustness in the wall design. This will further be reviewed and refined based on site specific ground water level assessment at the detailed design phase with consideration to the drainage design. Though very unlikely, where a cantilevered solution is found to be inadequate during the detailed design due to additional direct wave load (design storm case), additional piles will be installed and connected to main wall capping beam forming a portal frame increasing stability and capacity. The TPS incorporates a secant pile wall system for its vertical component, comprising bored cast-in-situ concrete piles connected at the top by a reinforced concrete capping beam. These piles will be installed into the existing ground using boring techniques, including drilling into weathered rock layers, with sufficient embedment into competent material, either rock or suitable soil strata as determined during the detailed design phase.	
Physical modelling for design verification and optimisation	Physical modelling is mandatory when seawall designs comprise innovative and untested rigid elements such as wave return walls, integrated access stairways, balustrading or	Appropriate physical modelling will be considered during the detailed design phase.	This is entirely non-committal and does not ensure that any modelling would be done. The applicant is to advise what modelling will be done.

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	composite structures. Where designers elect not to undertake physical modelling, adequate factors of safety in design must be demonstrated.		
Terminal end controls	End effects have been observed in the Wamberal and Terrigal area. Ends and gaps in the terminal protection structure at Dover Road, Wamberal Surf Life Saving Club, 1 Calais Road, and the road reserve and public access way between 4 Surfers Road and 1 Calais Road would be subject to end effects that result in increased erosion. A contiguous seawall along the entire beachfront between the lagoon entrances is required.	We acknowledge that terminal end effects could occur where seawalls terminate adjacent to unprotected areas, as noted in NSW guidance. The Engineering Design Requirements (MHL 2022) anticipate staged delivery and allow for temporary or permanent terminal end controls rather than mandating a fully contiguous wall, which is not feasible without a Council or State-led program. For the proposed TPS, the identified gaps due to non-participating landowners (e.g. at 1 Calais Road and the public accessway) are relatively narrow (compared to the length of the seawall) and located in areas with existing ad-hoc protection and sand buffers. These areas will remain more exposed than protected sections under extreme events. While the erosion associated with gaps in an introduced seawall, as compared to the status quo, has not been well documented in literature, the magnitude and distribution of additional erosion, if any, are known to be highly site specific and influenced by local morphology and longshore processes. To manage this risk, the current design at DA stage has allowed for a conservative and adaptive approach by incorporating: • Landward alignment and buried structure to minimize interaction with active beach processes; • Return walls, tapered transitions and toe protection at terminations. This approach aligns with the EDR and ensures that potential end effects are mitigated through design refinement and adaptive management post-consent, while enabling staged	No details of terminal end controls are provided in the DA drawings. There is no insurance that the end effects are mitigated. This issue has not been resolved.

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		implementation, in collaboration with Council and relevant stakeholders.	
Public safety	To address public safety issues, access stairs are required to be extended to a lower level that accommodates future scour and erosion.	The extension of access stairs to accommodate future scour and erosion has been carefully considered. It is not deemed appropriate to extend stairs to design scour levels which are below high-water mark due to public safety concerns and practical limitations. However, the bottom level of the stairs will be further reviewed in the detail design phase taking council and owners inputs for each property and incorporate into the TPS as appropriate.	The bottom of the access stairs are at RL+4.2 and +5.2 m AHD. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.
Beach accessways	Design for the gaps at Dover Road, Wamberal Surf Life Saving Club, 1 Calais Road and between 4 Surfers Road and 1 Calais Road are required such that the design at the public sand accessways can be assessed. To address beach access issues, the access stairs are required to be extended to a lower level that accommodates future scour and erosion. Potential impacts due to public and private accessways shall be assessed, including impacts to dunes, vegetation and visual amenity. Applicant shall consider the consolidation of private accessways to reduce impacts.	Wamberal Surf Club is not relevant. It is not a gap and is consistent with the EDR's. Dover Road is not a gap, it is the end of the works as per the EDR's. Public Beach Access Ways: Temporary closure of public beach accessways is anticipated to be implemented by Council to facilitate maintenance activities. The lower sections of the access stairs will be reviewed and refined in consultation with Council during the detailed design phase. Public Beach Access Stairs: These stairs are intended exclusively for use by the individual property residents. The detailed design will incorporate appropriate safety measures, including lockable gates and handrails. The lower sections of these stairs will also be reviewed and adjusted in consultation with each property owner during the detailed design phase. Potential impact due to public and private accessways: Many of the properties in question are located adjacent to or extend up to the erosion escarpment, with little to no remaining dune system. To minimize disruption to existing vegetation and maintain visual amenity, access stairs have been incorporated into the wall design. Visual impacts will be further reduced through the use of materials and finishes that harmonize with the surrounding coastal landscape. Please refer to the	Existing stair design does not provide access off the beach during storm conditions. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.

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		architectural renders submitted with the Development Application (DA) for further detail. Consolidation of Private Accessways: During the preliminary design phase, the potential for consolidating private accessways was explored. However, due to differences in property ownership, individual access requirements, spatial limitations, and existing infrastructure, shared accessways were generally not feasible. This aspect will be revisited during the detailed design phase, where any viable opportunities for consolidation will be identified and incorporated as appropriate.	
Statutory Considerations			
Clause 27 of Coastal Management Act 2016	Development consent for a seawall can only be given if the development does not increase the coastal hazard on adjacent land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Satisfactory arrangement for the restoration of a beach is required. Compensatory sand nourishment is required to be included with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To address public safety issues, the access stairs are required to be extended to a lower level	The interpretation of S27 of the CMA is incorrect. The proposal has been designed with the provisions of this Act in mind, and as outlined in the SEE. The references to adjacent land allow for conditions of consent to address the issue and are not a prohibition. Further, the clause is to be applied where the works result in "any increased erosion". In light of the landward nature of the works, the question of "increased erosion" may not be relevant. The Act does not act to restrict consent to a contiguous wall. This is another misinterpretation. The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand nourishment to address long term recession, or storm demand. Based on discussions, the concern here is primarily one of end effects resulting from properties not participating in the DA's. As outlined to the Panel at the initial briefing, it is entirely possible that Council carries out works for the handful of properties which would address end effects upon them, and this	Applicant's response includes: "The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand nourishment to address long term recession, or storm demand." The proposed seawall will increase erosion on unprotected land within the coastal compartment as it will lock up existing storm demand sand that would be behind it as well as have end effects. This is evident clearly in the photo from the July 2020 storm shown here. Here, as elsewhere along the beach, the existing storm demand includes sand volumes that would be behind the seawall if built. Hence, should the seawall be built then sand nourishment would be required to compensate for locked up storm demand and for increased erosion that would occur on unprotected areas.

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	that accommodates future scour and erosion.	would represent a saving beyond what they currently pay for protection / restoration works each year. If the wall were approved and built, then Council would only need to do these works for the few properties – potentially only once. This would require a level of cooperation between the proponents and Council. This is further discussed in the response to the Council RFI's. Refer to previous statement regarding the bottom levels for the stairs. Note that this is not referred to within S 27 of the CMA. All existing debris, non-engineered protection works, and similar materials located along the proposed seawall alignment will be removed and appropriately disposed of prior to the construction. Additionally, sand will be temporarily displaced to facilitate construction activities, as needed. Upon completion of Seawall construction: • The volume of material removed from the site will be replaced with sand • Any displaced sand will be reinstated to pre-construction survey levels. • Additionally, an equivalent volume of sand, corresponding to any sand material considered to be 'locked' behind the seawall, if any, will also be placed on the beach. It is noted, however, that long-term beach erosion due to natural coastal recession is considered part of ongoing coastal processes. As such, the applicant does not propose to address this through additional sand nourishment, which is considered the responsibility of Council, if required. Safe beach access stairs are incorporated into the wall design for each private property, extending below all historical sand levels recorded over the past 50 years. If an emergency evacuation is required to a fully eroded and flooded beach,	

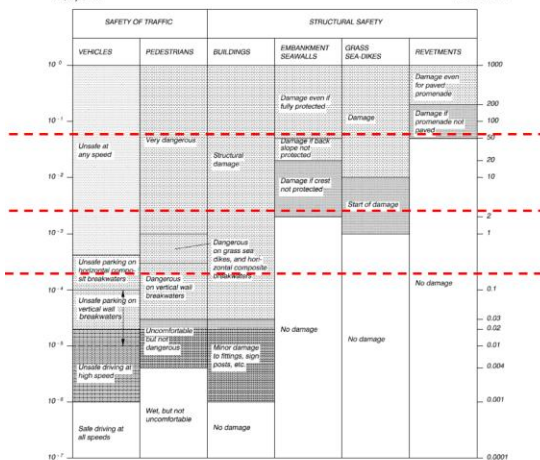
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		additional emergency ladders and PFD's may be needed as no dry beach is available. However, such provisions exceed the usual functional requirements of a typical beach accessway. The EDR does not mandate such safety features which are usually implemented for offshore structures surrounded by waters. Also refer to the previous responses above for further comments on beach accessways/public safety.	
Section 2.12 of State Environmental Planning Policy (Resilience and Hazards) 2021	Development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Development consent can only be given if the proposed seawall is not likely to reduce public amenity and use of the beach, by providing compensatory sand nourishment with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To manage public safety from coastal hazards, the access stairs are required to be extended to a lower level that accommodates future scour and erosion.	This is also a misinterpretation of SEPP Hazards and Resilience. This Instrument is addressed in the SEE. The SEPP does not limit any consent to only being a contiguous wall. The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up. Refer to previous statements regarding the bottom levels for the stairs.	The SEPP requires that development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. The applicant's response is "<i>The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up.</i>" However, without compensatory sand nourishment, the seawall will increase the coastal hazard on unprotected land and on the land in front of it.

Table 3 Issues summary for PPSHCC-318 – Central Coast - DA/1389/2024 - 3 Pacific Street, Wamberal 2260 – Coastal Protection Works (Seawall - Section C)

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
Concept design ocean conditions	Derivation of the design wave conditions is not in accordance with the Shore Protection Manual (USACE, 1984) or the Coastal Engineering Manual (USACE, 2006) and must be amended. Model study results (Hatch, 2023) are not consistent with actual site observations at Wamberal during erosion events. Coastal seawalls subjected to depth-limited breaking waves must be designed for the maximum breaking wave height to which the structures might reasonably be subjected (USACE 1984 p7-8, USACE 2006 pVI-5-64). In determining the breaking wave height for structural design, calculations must start on the assumption that the beach berm has been eroded at the structure face.	While we still consider the assumption of a no-maintenance scenario and a fully eroded beach profile extending to the seawall toe for significant length of the wall – combined with a design storm event – to be highly conservative, we agree to adopt this condition for the purpose of structural design during the detailed design phase and incorporate appropriate wave loading and drainage details in the seawall assessment. For the purposes of estimating design wave at the toe of the structure, a fully eroded beach to level of -1m AHD is considered. Seawall geotechnical stability and structural integrity has been assessed for a design scour of -2m AHD at the toe. The offshore design wave conditions used in Hatch's numerical modelling (H370327-0000-2B5-066-001) are consistent with MHL2872 (2022), based on a 500-year ARI event (inclusive of SLR allowance) with an offshore significant wave height of 9.8m and a peak spectral period of 13s. These conditions were transformed to the nearshore using SWAN, incorporating depth-limited breaking and representative eroded beach profiles, noting that none of the profiles extended beyond -1.0m AHD. The model was validated through using a selected 2-weeks duration of ERA5 hindcast wave data at the model boundary (which earlier in the report was proven to correspond well with the MHL2872 500 ARI conditions) and comparing its output at the Wamberal buoy location with the buoy data for that same period. This comparison showed good agreement. To address the reviewer's request for an analytical approach, Hatch has reviewed the nearshore wave conditions using the following methods: 4. SPM / USACE (1984) method described on p7-8 was applied, and a maximum breaking wave height (Hbmax) of	The incident wave design conditions described in the response have not been presented in the Basis of Design report and have not been presented in the response. The response states: "In detailed design, Hatch will run the model with a beach profile fully eroded to -1m AHD to the toe of the TPS to verify and compare to the SPM and RM. The structural design will take the Hbmax into account, whilst the Hs will be used for overtopping estimations." The incident wave design conditions described in the response were not but should have been applied to the concept design presented for approval. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done.

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		however, difficult to predict, especially through empirical formulae.	
Design scour level	Design scour level is recommended to be re-assessed based on the more recent method to determine scour levels for dune revetments and seawalls as published in a paper titled "Design Scour Levels for Dune Revetments and Seawalls" (Nielsen 2023).	A design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design. This value is consistent with the Engineering Design Requirements (EDR, MHL2872, 2022) and reflects conservative practice for open coast structures in NSW. While the Nielsen (2023) paper on scour assessment was not referenced in the EDR, Hatch has undertaken a high-level review of the methodology, which is based on empirical relationships derived from physical-scaled model testing. Its applicability to the Wamberal site will be further considered during detailed design, including a comparison with the current adopted scour level and taking into account the presence of shallow bed rock and medium dense substrates. Geotechnical investigations by Douglas Partners (2023) have informed the current design. Where bedrock and clayey material is shallower than -2.0 m AHD, local adjustments will be made to the scour levels during the detailed design phase in consultation with Council, as appropriate. Current design considers worst-case scenario of scour to -2.0m AHD at toe.	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025																																
Wave overtopping, runoff and property drainage	The applicant shall not be relying upon future beach monitoring and nourishment program to maintain potential overtopping below allowable limits. All sections of the proposed terminal end structure require a groundwater and flood assessment, and would need appropriate adequate drainage design for elevated groundwater and the flood water. The drainage design would need to minimise beach scour at the outlets.	Wave conditions for the TPS design have been established using the approach outline above (see Hatch's response to the comment on Concept design ocean conditions), incorporating both analytical and numerical methods under a conservative assumption of a fully eroded beach profile to -1m AHD. Overtopping rates were assessed in accordance with the guidelines provided in EurOtop (2018), which is the industry standard for wave overtopping over sea defenses. The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> Physical modelling will be considered in the detailed design phase to ensure the wave return walls are optimized to its most effective geometry, to ensure the wall sections ending at +6m AHD dissipate the overtopping effectively, and to inform the volumes for the drainage design. A drainage strategy will be developed during detailed design to manage: - Wave overtopping return flows - Rainfall runoff - Elevated groundwater level The drainage design will include scour protection at outlets and will be informed by site-specific groundwater assessments.		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3	The applicant's response gives the following overtopping results for the design condition: The estimates for the $H_s = 3.1\text{m}$, with $T_{m-1,0} = 11.8\text{ s}$ wave at the toe of TPS, resulted in the following mean overtopping volumes based on EuroTop 2018: <table> <tr> <th></th><th>Crest height +8m AHD</th><th>Crest height +6m AHD</th><th>Crest height +7m AHD</th></tr> <tr> <th></th><th>q (l/s/m)</th><th>q (l/s/m)</th><th>q (l/s/m)</th></tr> <tr> <td>No bull nose</td><td>44</td><td>175</td><td>86</td></tr> <tr> <td>With bull nose</td><td>0.33</td><td>58</td><td>3</td></tr> </table> According to the Coastal Engineering Manual, these volumes would be unacceptable for public safety and structural integrity of the residences. Table VI-5-4 Critical Values of Average Overtopping Discharges 		Crest height +8m AHD	Crest height +6m AHD	Crest height +7m AHD		q (l/s/m)	q (l/s/m)	q (l/s/m)	No bull nose	44	175	86	With bull nose	0.33	58	3
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Steel elements	For the design scour levels and groundwater conditions, the proposed design is compromised for geotechnical global stability and structural integrity. The structure requires ground sand anchors, otherwise it could collapse onto the beach when storm erosion occurs. Ground anchors would increase the cost considerably and may not be feasible due to the proximity of the residences. Applicant is required to undertake groundwater assessment and consider elevated groundwater conditions during flood conditions. Applicant is required to submit a geotechnically stable and structurally sound design such that the impact of the amended design can be assessed.	It is unclear how the reviewer has determined that the proposed wall design compromises both structural integrity and geotechnical stability. We would appreciate any specific details or evidence of non-compliance with the design guidelines/standards so that Hatch can provide a targeted and informed response. Key aspects regarding the adopted design: As acknowledged in the reviewer's comment, the use of ground anchors would significantly increase costs and risk of foundation damage due to the close proximity of residential dwellings. In response, Hatch has developed a cantilevered wall solution that eliminates the need for ground anchors, thereby eliminating risk to the foundations of nearby residences and requires only a minimal construction footprint compared to that of a wall with anchors or Seabee wall concepts. This solution is designed to provide long-term performance with minimal maintenance over its service life. The cantilevered section is embedded into competent ground (either rock or suitable subgrade layers) to ensure sufficient anchorage (currently it is >15m below design scour level) and geotechnical stability and incorporates appropriate structural detailing. The stability of the cantilever retaining wall has been assessed in accordance with AS 4678 and AS 4997, incorporating appropriate load and material factors. An additional verification has also been carried out using Eurocode 7 load factors. The structural design complies with AS 3600, addressing both serviceability and ultimate limit states. A detailed longitudinal geotechnical section has been developed along the full length of the wall (refer to Appendix 11 of the Basis of Design), outlining the inferred subsurface strata. Geotechnical stability has been assessed based on the most critical section, and a conservative design has been applied uniformly along the entire wall. This design will be refined during the detailed design phase, with adjustments made for individual	Tie-backs were required for the Collaroy TPS, which appears to be of a similar design. That the wall as presented would be stable without tie-backs at the top of the wall needs to be confirmed with a submission of design calculations, which are advised to have been undertaken. This is required for structural (bending moment and shear forces) and geotechnical global stability. If a 10 m high cantilevered wall solution that eliminates the need for ground anchors is being proposed, then the design calculations are required now to satisfy Worley concerns. This is a critical issue for the TPS design and Worley cannot sign-off the concept design without this having shown to be done. The applicant is to present how a design local scour level of -2.0m AHD has already been incorporated into the structural capacity and geotechnical stability assessments of the current TPS design.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
		properties or groups of properties sharing similar geotechnical profiles. Hydrostatic effects resulting from tidal lag has also been considered as twice those outlined in Clause 5.8.3 of AS 4997 (Design Guidelines for Maritime Structures). These elevated groundwater effects have been incorporated into the loading conditions for the seawall assessment. According to AS 4997, the minimum tidal lag on the seawalls should be the greater of one-third of the spring tidal range or 500 mm (i.e., the larger of 0.4 m or 0.5 m). However, Hatch has conservatively adopted a tidal lag of 1.0 m, which is twice the recommended minimum, to ensure robustness in the wall design. This will further be reviewed and refined based on site specific ground water level assessment at the detailed design phase with consideration to the drainage design. Though very unlikely, where a cantilevered solution is found to be inadequate during the detailed design due to additional direct wave load (design storm case), additional piles will be installed and connected to main wall capping beam forming a portal frame increasing stability and capacity. The TPS incorporates a secant pile wall system for its vertical component, comprising bored cast-in-situ concrete piles connected at the top by a reinforced concrete capping beam. These piles will be installed into the existing ground using boring techniques, including drilling into weathered rock layers, with sufficient embedment into competent material, either rock or suitable soil strata as determined during the detailed design phase.	
Physical modelling for design verification and optimisation	Physical modelling is mandatory when seawall designs comprise innovative and untested rigid elements such as wave return walls, integrated access stairways, balustrading or	Appropriate physical modelling will be considered during the detailed design phase.	This is entirely non-committal and does not ensure that any modelling would be done. The applicant is to advise what modelling will be done.

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
	composite structures. Where designers elect not to undertake physical modelling, adequate factors of safety in design must be demonstrated.		
Terminal end controls	End effects have been observed in the Wamberal and Terrigal area. Ends and gaps in the terminal protection structure at 1 Pacific Street would be subject to end effects that result in increased erosion. A contiguous seawall along the entire beachfront between the lagoon entrances is required.	We acknowledge that terminal end effects could occur where seawalls terminate adjacent to unprotected areas, as noted in NSW guidance. The Engineering Design Requirements (MHL 2022) anticipate staged delivery and allow for temporary or permanent terminal end controls rather than mandating a fully contiguous wall, which is not feasible without a Council or State-led program. For the proposed TPS, the identified gaps due to non-participating landowners (e.g. at 1 Calais Road and the public accessway) are relatively narrow (compared to the length of the seawall) and located in areas with existing ad-hoc protection and sand buffers. These areas will remain more exposed than protected sections under extreme events. While the erosion associated with gaps in an introduced seawall, as compared to the status quo, has not been well documented in literature, the magnitude and distribution of additional erosion, if any, are known to be highly site specific and influenced by local morphology and longshore processes. To manage this risk, the current design at DA stage has allowed for a conservative and adaptive approach by incorporating: • Landward alignment and buried structure to minimize interaction with active beach processes; • Return walls, tapered transitions and toe protection at terminations. This approach aligns with the EDR and ensures that potential end effects are mitigated through design refinement and adaptive management post-consent, while enabling staged	No details of terminal end controls are provided in the DA drawings. There is no insurance that the end effects are mitigated. This issue has not been resolved.

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		implementation, in collaboration with Council and relevant stakeholders.	
Public safety	To address public safety issues, access stairs are required to be extended to a lower level that accommodates future scour and erosion.	The extension of access stairs to accommodate future scour and erosion has been carefully considered. It is not deemed appropriate to extend stairs to design scour levels which are below high-water mark due to public safety concerns and practical limitations. However, the bottom level of the stairs will be further reviewed in the detail design phase taking council and owners inputs for each property and incorporate into the TPS as appropriate.	The bottom of the access stairs at at RL+4.2. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.
Beach accessways	Design at 1 Pacific Street is required such that the design at the public sand accessways can be assessed. To address beach access issues, the access stairs are required to be extended to a lower level that accommodates future scour and erosion. Potential impacts due to public and private accessways shall be assessed, including impacts to dunes, vegetation and visual amenity. Applicant shall consider the consolidation of private accessways to reduce impacts.	1 Pacific St is not part of the DA, accordingly no impact to any current beach access will occur.	There is a beach accessways located between Section B and C. Existing stair design does not provide access off the beach during storm conditions. It is recommended that the public safety requirement for the stairs be addressed as part of the DA or be added to the consent conditions.
Statutory Considerations			
Clause 27 of Coastal Management Act 2016	Development consent for a seawall can only be given if the development does not increase the coastal hazard on adjacent	The interpretation of S27 of the CMA is incorrect. The proposal has been designed with the provisions of this Act in mind, and as outlined in the SEE. The references to adjacent	Applicant's response includes: "The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand

Policy or Statutory Considerations	Issues raised by Worley February 2025	Applicant's response on October 2025	Worley's response November 2025
	land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Satisfactory arrangement for the restoration of a beach is required. Compensatory sand nourishment is required to be included with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To address public safety issues, the access stairs are required to be extended to a lower level that accommodates future scour and erosion.	land allow for conditions of consent to address the issue and are not a prohibition. Further, the clause is to be applied where the works result in "any increased erosion". In light of the landward nature of the works, the question of "increased erosion" may not be relevant. The Act does not act to restrict consent to a contiguous wall. This is another misinterpretation. The satisfactory arrangements referred to also only apply where the works result in "any increased erosion". The applicants are not required to provide sand nourishment to address long term recession, or storm demand. Based on discussions, the concern here is primarily one of end effects resulting from properties not participating in the DA's. As outlined to the Panel at the initial briefing, it is entirely possible that Council carries out works for the handful of properties which would address end effects upon them, and this would represent a saving beyond what they currently pay for protection / restoration works each year. If the wall were approved and built, then Council would only need to do these works for the few properties – potentially only once. This would require a level of cooperation between the proponents and Council. This is further discussed in the response to the Council RFI's. Refer to previous statement regarding the bottom levels for the stairs. Note that this is not referred to within S 27 of the CMA. All existing debris, non-engineered protection works, and similar materials located along the proposed seawall alignment will be removed and appropriately disposed of prior to the construction. Additionally, sand will be temporarily displaced to facilitate construction activities, as needed.	nourishment to address long term recession, or storm demand." The proposed seawall will increase erosion on unprotected land within the coastal compartment as it will lock up existing storm demand sand that would be behind it as well as have end effects. This is evident clearly in the photo from the July 2020 storm shown here. Here, as elsewhere along the beach, the existing storm demand includes sand volumes that would be behind the seawall if built. Hence, should the seawall be built then sand nourishment would be required to compensate for locked up storm demand and for increased erosion that would occur on unprotected areas. 

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		Upon completion of Seawall construction: • The volume of material removed from the site will be replaced with sand • Any displaced sand will be reinstated to pre-construction survey levels. • Additionally, an equivalent volume of sand, corresponding to any sand material considered to be 'locked' behind the seawall, if any, will also be placed on the beach. It is noted, however, that long-term beach erosion due to natural coastal recession is considered part of ongoing coastal processes. As such, the applicant does not propose to address this through additional sand nourishment, which is considered the responsibility of Council, if required. Safe beach access stairs are incorporated into the wall design for each private property, extending below all historical sand levels recorded over the past 50 years. If an emergency evacuation is required to a fully eroded and flooded beach, additional emergency ladders and PFD's may be needed as no dry beach is available. However, such provisions exceed the usual functional requirements of a typical beach accessway. The EDR does not mandate such safety features which are usually implemented for offshore structures surrounded by waters. Also refer to the previous responses above for further comments on beach accessways/public safety.	

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Section 2.12 of State Environmental Planning Policy (Resilience and Hazards) 2021	Development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. Development consent can only be given to a contiguous seawall along the entire beachfront between the lagoon entrances. Development consent can only be given if the proposed seawall is not likely to reduce public amenity and use of the beach, by providing compensatory sand nourishment with the seawall construction to match erosion due to long term recession, storm demand and due to the sand that would be locked up behind the seawall. To manage public safety from coastal hazards, the access stairs are required to be extended to a lower level that accommodates future scour and erosion.	This is also a misinterpretation of SEPP Hazards and Resilience. This Instrument is addressed in the SEE. The SEPP does not limit any consent to only being a contiguous wall. The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up. Refer to previous statements regarding the bottom levels for the stairs.	The SEPP requires that development consent for a seawall can only be given if the development does not increase the coastal hazard on other land. The applicant's response is "<i>The SEPP does not require that the proponents provide sand nourishment to address long term recession, storm demand, or sand locked up.</i>" However, without compensatory sand nourishment, the seawall will increase the coastal hazard on unprotected land and on the land in front of it.