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Planning Officer
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23-33 Bridge Street
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Dear Daniel,

Sydney Heritage Fleet Maritime Facility – Flooding and Stormwater Issues

This letter provides a final report resulting from Evans & Peck's review and consideration of the flooding and stormwater issues (including climate change impacts and water conservation and re-use measures) relating to the proposed Sydney Heritage Fleet (SHF) maritime facility at 3 Bank Street, Pyrmont.

This letter develops on Evans & Peck's initial report dated 15 May 2013 and takes account of the matters addressed in the letters from SLR Consulting Australia Pty Ltd (SLR) to Crawford Architects dated 14 and 30 May 2013 (the 30 May 2013 letter appears to simply elaborate on the same matters addressed in the 14 May 2013 letter). The 30 May 2013 letter addresses the matters raised in Evans & Peck's letter dated 15 May 2013.

1 Background

The SHF maritime facility development application (MP11_0001) includes both land and water components. The land component comprises a three-storey building (maritime facility) that includes areas for storage, amenities, displays/exhibitions, the community and a kiosk. The water component comprises a fixed wharf and associated floating pontoon structures to berth the variety of SHF's operating vessels. Evans & Peck understands that the SHF has been granted a 50 year lease on the site at 3 Bank Street, Pyrmont.

The *Environmental Assessment* for the proposed SHF maritime facility was prepared by Hamptons Property Services Pty Ltd (November 2012) and references two specialist reports by SLR that primarily relate to climate change induced flooding, stormwater and water conservation and re-use measures. These two reports are entitled:

- *Climate Change Induced Sea Level Rise* (December 2011) - the 'Sea Level Rise' report.
- *Water Sensitive Urban Design* (January 2012) - the 'WSUD' report.

Both these reports include a number of recommendations regarding further investigations or matters for consideration in the course of the project's detailed design. In general, these recommendations are reproduced in the Statement of Commitments as part of the *Environmental Assessment*.

2 Issues

The subsequent sections of this letter provide a review and assessment of the key SLR findings and recommendations that relate to flooding, stormwater and water conservation and re-use measures at the site, namely:

- Flood risks;
- Stormwater drainage;
- Water conservation and re-use measures; and
- Stormwater quality.

Note that Evans & Peck has not considered any groundwater issues in the scope of this review and thus cannot comment on any findings by SLR that relate to groundwater at the site.

3 Flooding

The Seal Level Rise report notes that the ground floor level has the potential to be *'intermittently and/or permanently inundated'* by 2050 and recommends the design of the proposed SHF maritime facility should be reviewed. The Statement of Commitments reflect this recommendation and state that:

> *The sea wall has been identified as the potential primary defence against the projected sea level rise. Therefore, the proponent will, as part of the operations and maintenance regime of the site, undertake monitoring of the sea wall and assess for the impacts described. In addition, the proponent will stay up to date with actual sea level rise trends. These details will be outlined in an OEMP which will addresses (sic):*
>
> - *Monitoring and Maintenance programs to reduce the risk of movement/erosion of the seawall;*
> - *Any future building adaptability/adaptation measures; and*
> - *Emergency response elements associated with sea level rise, including inundation and extreme events e.g. wave run-up.*
>
> *The proponent will consider the design adaption changes which include:*
>
> - *Raise the sea wall to defend against projected potential sea level rise.*
> - *Develop and construct a "flexible design" whereby in the future the ground floor can be raised.*
> - *Establish all services (particularly electricity) above the projected inundation levels within the ground level building.*
> - *Raise the height of the ground level as part of the current development to accommodate the projected higher sea levels.*
>
> *These design amendments will be undertaken in response to a Conditions of Consent and finalised as part of the Construction Certificate application.*

Notwithstanding the intent of the Statement of Commitments in relation to flood risks, the *Environmental Assessment* does not indicate which adaptation measure(s) would be preferred nor does it provide any details on how the preferred adaptation measure(s) would be implemented.

SLR's letter dated 30 May 2013 however, indicates that the following adaptation measures will be implemented:

- *Adopting the ground floor as a workshop (rather than a commercial or residential dwelling) and using robust materials and finishes which will minimise flood damage and social impacts associated with inundation.*
- *Locating power supply points above the projected 100% AEP [Annual Exceedance Probability] 2050 water level in the Harbour.*
- *Adopting a 50 year design life for the development, after which redevelopment/upgrading will most likely occur and any updated sea level projections would be addressed at that time.*

Evans & Peck has since consulted with SLR and clarified that the reference to '100% AEP' should in fact be '1% AEP'. Furthermore, the letter indicates that the raising of the proposed ground floor level (from 1.6 m AHD) by an amount to be determined will be investigated further. Since no further details have been provided on this topic (especially the timing of the investigation), for purposes of this report, Evans & Peck has assumed that the ground floor level will remain at 1.6 m AHD.

Evans & Peck understands that the residual risk of inundation following the implementation of these adaptation measures (presuming the ground floor remains at 1.6 m AHD) and any subsequent financial implications are considered acceptable by SHF.

3.1 Review

Evans & Peck considers that there are three main issues relating to the flooding of the proposed SHF maritime facility, namely:

- Flood damage;
- Public safety with respect to pedestrians using the timber walkway; and
- Safe evacuation of volunteers and visitors.

The level of risk associated with each of these issues is a function of the combined effects and associated degree of uncertainty pertaining to:

- tides and storm surge,
- projected sea level rise due to climate change,
- wave heights, and
- stormwater overflowing into the site from Bank Street (refer to Section 4 of this letter).

Tides and Storm Surge

The Sea Level Rise report refers to Port Jackson still water level statistics provided in the *Fort Denison Sea Level Rise Vulnerability Study (DECC, 2008)* (the Fort Denison report). In this context, '*still water level*' refers to the sea level excluding short-term wave effects. These statistics are based on over 90 years of historic hourly still water level observations at Fort Denison and

account for the combined probability of tide and storm surge effects. Given the extensive dataset from which these statistics have been derived, they can be considered to have a high degree of certainty. Evans & Peck is satisfied that the still water level data from the Fort Denison report represents the most relevant, detailed, reliable and contemporary information in relation to still water levels in Port Jackson (and therefore Blackwattle Bay).

Sea Level Rise

The Sea Level Rise report calculates the predicted future still water levels in Blackwattle Bay by adding the Fort Denison still water level statistics to the projected sea level rise stated in the NSW Government's *NSW Coastal Planning Guideline: Adapting to Sea Level Rise* (Department of Planning, 2010). This guideline provides the following planning benchmarks for sea level rise as a result of climate change in NSW:

- +0.4 m rise by 2050, and
- +0.9 m rise by 2100.

These increases in sea level represent conservative 'high' projections (referring to the upper bounds of the projected sea level rise), as reported in the Intergovernmental Panel on Climate Change (IPCC) *Climate Change 2007: The Physical Science Basis (2007)* report. This report also provides 'low' and 'medium' projections in reference to the lower bounds and middle of the projected sea level rise respectively (which are also reproduced in the Fort Denison report). Although the IPCC report represents the best currently available estimates, the range between the 'low' and 'high' estimates (0.73 m for 2100) indicates a significant degree of uncertainty.

Annexure A to this letter provides a graph showing the 'medium' and 'high' 2050 and 2100 still water level projections for different AEP and the height of the ground floor level of the proposed SHF maritime facility (1.6 m AHD). Since the SHF has a 50 year lease on the property at 3 Bank Street, Pyrmont, the most relevant (and slightly conservative) projections are those relating to the year 2065. The risk of ground floor inundation for various scenarios has been interpreted from Annexure A and expressed in the table below as a percentage probability within a 12 month period. Interpolation of the data from Annexure A indicates that by 2065, the risk of flooding within 12 months would be approximately 28% and 100% assuming 'medium' and 'high' sea level rises respectively. Note that these estimates **do not** include wave effects.

Scenario	Risk of Flooding within 12 Months*
Existing/Current conditions	0%
2050, assuming 'medium' sea level rise	4%
2050, assuming 'high' sea level rise	68%
2065, assuming 'medium' sea level rise	28%
2065, assuming 'high' sea level rise	100%
2100, assuming 'medium' sea level rise	100%
2100, assuming 'high' sea level rise	100%

** Not including wave effects.*

Wave Height

Wave height caused by winds and passing vessels has the potential to either cause inundation on its own or exacerbate inundation caused by tide, storm surge and sea level rise. No analysis of the wave climate in Blackwattle Bay has been referenced in the Sea Level Rise report.

With respect to waves caused by winds, an indication of the order of magnitude of the expected wave heights in Blackwattle Bay may be gained by comparison with the calculated wave heights at Fort Denison. The maximum fetch of the proposed SHF maritime facility site is approximately 1.30 km from the west. The western fetch of Fort Denison is approximately 1.65 km, with a corresponding maximum wind wave height of approximately 0.54 m. Due to the longer fetch at Fort Dennison, the wave heights affecting the proposed SHF maritime facility are likely to be in the order of 0.5 m (assuming similar wind conditions).

With respect to waves caused by passing vessels, the Fort Denison report calculates the maximum wave height against Fort Denison to have an upper bound of 1.15 m. This is expected to be significantly greater than at the proposed SHF maritime facility due to the exposure of Fort Denison to commuter ferries and large ocean liners.

Since there is no available data that specifically relates to wave heights in Blackwattle Bay, a degree of uncertainty exists in estimating the expected wave heights at the proposed SHF maritime facility area. Greater certainty could be achieved by estimating the wave height at the proposed SHF maritime facility by applying the science provided in Appendix D of the Fort Denison report. In the absence of such analysis, provision of freeboard allowance above the projected 1% AEP 'high' 2050 water level (1.8 m AHD) would be appropriate.

Freeboard

Traditional floodplain management seeks to protect private and public facilities from flood damage by:

- excluding vulnerable facilities from areas of flood hazard;
- recognising that the acceptable level of risk (as characterised by the Average Recurrence Interval of the 'design flood level' adopted for purposes of setting the floor level) varies depending on the type of development (typically a lower level of risk is acceptable for residential development than for commercial development); and
- including an allowance for freeboard to account for the uncertainty associated with the estimated 'design flood level'.

In the case of the proposed SHF maritime facility at Blackwattle Bay, Evans & Peck has considered the following actors in assessing an appropriate freeboard allowance for uncertainty (summarised from previous text):

- **Tides and storm surge** – *low degree of uncertainty* (requiring no freeboard allowance);
- **Sea level rise** – *high degree of uncertainty* (can be taken into account by adopting a more conservative, or greater, sea level rise estimate within the life of the facility).
- **Wave effects** – *high degree of uncertainty* (a lower degree of uncertainty could be achieved by carrying out an analysis for the proposed SHF maritime facility similar to that contained in Appendix D of the Fort Denison report).

In relation to tide, storm surge and wave effects, the uncertainties are relatively low compared to the uncertainties encountered in major river floods in which rainfall patterns and changes in land

use can have a significant effect. The main uncertainty for the proposed SHF maritime facility site lies in accounting for climate change. The issue remains one of balancing the potential impacts of uncertain rise in sea level (and the future cost of mitigation/adaptation or prevention) against any increased costs incurred during initial construction. In the absence of any further analysis of the wave climate in Blackwattle Bay, adoption of a freeboard of, say 0.5 m, would be appropriate to account for the potential impact of waves from wind and passing vessels.

3.2 Assessment

Flood Damage

Evans & Peck is unaware of any specific government guidelines or regulations that define an acceptable level of flood risk for a situation such as the proposed SHF maritime facility. Ultimately, Evans & Peck considers that the Proponent should be responsible for understanding the inherent risk of flooding (including any subsequent costs) and for implementing any mitigation/adaptation or prevention measures appropriate to address the chosen level of risk. Evans & Peck considers that this approach is consistent with that outlined in Appendix K of the NSW Government's *Floodplain Development Manual* (Department of Infrastructure, Planning and Natural Resources, 2005). In relation to commercial development, the manual states that:

> *The greater flexibility of business in managing risk and recovering financially from flooding, means that FPLs [flood planning levels] for industrial and commercial development may be based upon a more frequent flood event. An acceptable level of risk may become a business decision for the owner or occupier.*

This approach to addressing the risk of flooding at the proposed SHF maritime facility is recognised and accepted by SLR in their letter dated 30 May 2013.

In earlier correspondence, Evans & Peck recommended that the Proponent consider the following approaches to address the risk of flood damage to the proposed SHF maritime facility:

1) **Mitigate** the impacts of the projected sea level rise by redesigning the ground floor prior to construction; and/or
2) **Adapt** to the impacts of the projected sea level rise as they occur during the life of the proposed development; or
3) **Prevent** future inundation of the development by utilising the seawall as a levee (this would require raising the level of the seawall at some time in the future, which may compromise access to the existing boat ramp).

Mitigation and adaptation measures that could be implemented include:

- Segregating the ground floor level heights, i.e. raising the levels of different areas of the ground floor to appropriately protect key areas from flooding (particularly the foyer, plant room and lunch room areas); and
- Minimising the risk of flood damage to the lift itself by either:
  - ensuring that any machinery in the lift well is immune from water damage (and that the lift well can be pumped out after a flood); or
  - re-designing the lift access level to ensure that it remains above the adopted design flood level;

- Ensuring all building materials and floor coverings that might be affected are immune from water damage;
- Ensuring all electrical and telecommunications wiring and outlets are located a minimum height of, say, 1.2 m above the ground floor level (i.e. at 2.8 m AHD assuming the ground floor level of 1.6 m AHD remains unchanged);
- Ensuring all storage (including floatable materials, power tools, etc) is located above the adopted design flood level;
- Ensuring all cabinets are located above the adopted design flood level;
- Grading the ground floor level to naturally drain towards Blackwattle Bay.

The SLR letter dated 30 May 2013 indicates that the mitigation/adaptation measures to be implemented include:

- Use of the ground floor level as a workshop relatively immune to flood damages;
- Locating power supply points above the projected 100% AEP 2050 water level; and
- Adoption of a 50 year design life for the proposed SHF maritime facility.

Evans & Peck is satisfied that SHF and its advisors are fully aware of the potential issues relating to the flooding of the proposed SHF maritime facility and have elected to adopt these measures (including further investigation of raising the proposed ground floor level) as a means of addressing their chosen level of acceptable risk. However, Evans & Peck recommends the following refinements to the proposed measures:

- Assurance that any inundation of the ground floor will not damage machinery, electrical or communication equipment in the Plant Room or the lift well; and
- Location of power supply points, telecommunication connections and fixed electrical equipment a minimum of 0.5 m above the projected 1% AEP 'high' 2050 water level (i.e. a minimum elevation of 2.3 m AHD).

The SLR letter dated 30 May 2013 **does not** indicate that the seawall is intended to be used as a flood inundation prevention measure in the future. Nevertheless, should the Proponent choose to prevent inundation by utilising the seawall as a levee in the future, the Sea Level Rise report recommends the Proponent prepares '*monitoring and maintenance programs to reduce the risk of movement/erosion of the seawall*'. The seawall bounding the site is a relatively modern concrete structure (in contrast to the sandstone block structure to the east of the site on the right-hand side in Figure 1). Given the relatively modern construction of the concrete seawall (possibly in conjunction with the construction of the ANZAC Bridge pylon), Evans & Peck considers that any erosion of the concrete seawall from waves in Blackwattle Bay is unlikely to be a significant issue. Evans & Peck considers the comments from the Sea Level Rise report to be more relevant to the sandstone block to the east of the site. However should the Proponent choose to use the seawall for flood prevention in the future, Evans & Peck recommends that the Proponent engage an appropriately qualified professional engineer as part of the detailed design process to assess:

- the structural integrity of the existing concrete seawall,
- the feasibility of raising the seawall in the future,
- the vulnerability of the concrete seawall to erosion or undercutting, and
- the necessity for monitoring and maintenance programs as recommended in the Sea Level Rise report.

Figure 1: View of the site of the proposed parkland east of the proposed SHF maritime facility

Public Safety

The risk of flooding of the proposed SHF maritime facility has ramifications for the safety of pedestrians accessing the timber walkway around the seaward side of the site. Sea level rise (and the subsequent increases to the heights of high tides, storm surges and wave heights) has the potential to overtop the level of the walkway. This issue is also raised in the City of Sydney Council's submission in relation to the *Environmental Assessment*. Evans & Peck considers that the most prudent approach to addressing this issue would be to ensure that the walkway is designed to enable the raising of the deck level if required at a later date. The SLR letter dated 30 May 2013 acknowledges that further investigations are required in order to ensure pedestrian safety during a 100 year Average Recurrence Interval (ARI) storm event.

Evacuation

Evacuation of the proposed SHF maritime facility volunteers and visitors to a safe refuge area in the event of a large flood is an important factor in assessing the flood risks to the site. Evans & Peck considers that safe evacuation of the site appears to be assured through the use of the internal stairs and the western foreshore vehicle and pedestrian access leading to higher ground in Bank Street.

4 Stormwater Drainage

The findings and recommendations of the WSUD report with respect to stormwater drainage are:

- A full survey should be conducted to confirm the presence, location and size of the existing drainage infrastructure.
- An analysis of the Bank Street and upper catchment stormwater drainage network should be undertaken in accordance with the City of Sydney Council requirements.
- The risk of local flooding along the low point in Bank Street is caused by the existing drainage system having an expected design capacity between the 1 in 2 and 1 in 10 year ARI storm event.
- Overland flow from Bank Street currently flows across the site in a south-westerly direction into Blackwattle Bay.
- The development should be designed to ensure that an overland stormwater flow path is maintained around the building between Bank Street and Blackwattle Bay by implementing a form of boundary treatment to divert any excess flow (i.e. not drained by stormwater piping) up to and including the 100 year ARI storm event, at a depth of less than 0.2 m and at a velocity of less than 1 m/s in accordance with the City of Sydney Council's *Draft Stormwater Drainage Design Code* (2009).

The WSUD report also states that the City of Sydney Council has advised SLR that there is no requirement for onsite stormwater detention at the site and there is no restriction on the rate of stormwater discharge from the site. However the City of Sydney Council's submission encourages '*on-site detention, treatment and re-use*'. Evans & Peck considers that treatment and re-use of stormwater are appropriate for this site. However stormwater detention for control of the rate of discharge into Blackwattle Bay would fulfil no useful purpose.

The 30 May 2013 letter by SLR recognises that further investigation of stormwater drainage in the vicinity of the proposed SHF maritime facility is required during the next phase of the project's design and will be undertaken in consultation with the City of Sydney Council.

4.1 Review

The *Blackwattle Bay Catchment Area Flood Study* (the Flood Study report) (WMA Water, 2012) indicates that ponding up to 0.5 m deep can be expected in Bank Street adjacent to the north-eastern boundary of the site during a 100 year ARI storm event. The Flood Study report takes into account the City of Sydney Council's stormwater pit and pipe systems which appear to correspond with the drainage system shown in Appendix B of the WSUD report. This indicates that the capacity of the existing stormwater drainage infrastructure in the surrounding streets is much less than the 100 year ARI storm event. As the site is located adjacent to the low point along Bank Street, there is a risk that stormwater flows in excess of the capacity of the surrounding upstream drainage infrastructure will drain towards the low point along Bank Street. These factors should be considered in consultation with the City of Sydney Council during the detailed design of any upgrade to the piped drainage system and an overland flow path. As mentioned previously, this was recognised in SLR's letter dated 30 May 2013.

4.2 Assessment

Evans & Peck agrees with the findings of the WSUD report in that greater certainty regarding the presence, location and size (essentially the capacity) of the existing stormwater drainage infrastructure is required. Nevertheless, findings from the WSUD report and the Flood Study report indicate that the capacity is much less than the 100 year ARI storm event. An overland stormwater flow path will therefore be required to convey excess flow up to the 100 year ARI storm event in accordance with the City of Sydney Council's *Draft Stormwater Drainage Design Code*. To comply with this code, the flow will need to have a depth of less than 0.2 m and a velocity of less than 1 m/s. Suggested Conditions of Approval relating to the overland stormwater flow path are provided to ensure that the ponding within Bank Street is not exacerbated by the development.

Evans & Peck recommends that the most prudent option of ensuring an overland stormwater flow path around the site would be to implement a form of boundary treatment to redirect excess flow around the western side of the building along the proposed driveway. This would eliminate the need to convey overland flow around the eastern side of the building along the proposed ramped pedestrian foreshore access, which does not lie within the boundary of the proposed development site.

The NSW Government's *Practical Consideration of Climate Change* (Department of Environment and Climate Change, 2007) predicts that extreme rainfall intensities in the Sydney metropolitan catchments (defined as the 1 in 40 year 1 day rainfall event) are expected to increase by up to 12% by 2030 as a result of climate change. Evans & Peck recommends that future increases to Sydney metropolitan rainfall intensities should be considered as part of the ongoing analysis and liaison with the City of Sydney Council in relation stormwater drainage from Bank Street.

The SLR letter dated 30 May 2013 indicates that further investigation of the following factors will be considered in consultation with the City of Sydney Council during the next phase of detail design of the project:

- The findings of the Flood Study report (particularly relating to the existing upstream stormwater drainage infrastructure capacity).
- The overland flow path design.
- Increased rainfall intensities as a result of climate change.
- Pedestrian safety during a 100 year ARI storm event.

Evans & Peck is generally satisfied with this approach to managing stormwater drainage and suggested Conditions of Approval are provided in Section 7 below.

5 Water Conservation and Re-use Measures

The WSUD report recommends the proposed SHF maritime facility adopt the following water conservation and re-use measures to ensure no adverse effects on the future water demand:

- A 15 kL rainwater tank to store captured water from the green roof area for re-use in toilets.
- Waterless urinals.
- Consideration of 4-star efficiency rated toilets, sinks, basins and bathroom taps and showers.

5.1 Review and Assessment

Evans & Peck agrees with the findings of the WSUD report in relation to implementing water conservation and re-use measures to ensure that the proposed SHF maritime facility minimises future water demand. Furthermore, Evans & Peck considers that the outlet level of the rainwater tank should be constructed either:

- above the adopted design flood level (refer to Section 3), or
- equipped with a non-return valve to prevent backflow from any sea level rise, tides, storm surges and/or waves from Blackwattle Bay.

The SLR letter dated 30 May 2013 acknowledges and agrees with Evans & Peck's recommendation to appropriately locate the 15 kL stormwater harvesting tank to ensure no damage or ingress from flood/sea waters.

6 Stormwater Quality

The WSUD report states that the design objectives for stormwater quality were based on the *Interim Reference Guideline for the South East Queensland Concept Design Guidelines for WSUD* (Catchment Management Authorities, 2012). These guidelines include specifications for the required percentages of post-development mean annual loads to be achieved for various types of pollutants. These percentages are generally consistent with those adopted by councils located within the Sydney metropolitan area.

The SLR findings and recommendations with respect to stormwater quality and management are based on the stormwater quality assessment outlined in the WSUD report. This assessment was modelled using MUSIC (Model for Urban Stormwater Improvement Conceptualisation) to estimate stormwater improvement elements and model the 'Pre' and 'Post' development pollutant loading.

Part of this assessment includes a site analysis of the expected levels of nitrogen and phosphorous in the stormwater runoff from the site based on typical pollutant loading rates for urban land development.

The WSUD report recommends the implementation of the following measures with respect to stormwater quality and management during the *construction phase* of the project:

- The designation of a wash-out area;
- The sheltering/covering of stockpiles; and
- A Construction Environmental Management Plan.

With respect to stormwater quality and management during the *operational phase* of the project, the WSUD report found that the proposed green roof and 15 kL rainwater harvesting tank system would marginally improve the quality of stormwater being discharged from the site and thus not adversely affect the surface water or groundwater resources. The report recommends that a Maintenance Plan be prepared as part of the detailed design phase in order to outline how stormwater quality improvement measures will be operated and maintained.

6.1 Review

The green roof appears to capture the majority of rainwater that would fall directly onto exposed surfaces of the proposed SHF maritime facility (as opposed to surfaces located beneath the ANZAC Bridge deck). This stormwater is designed to be held in the 15 kL rainwater harvesting tank (prior to any excess discharge into Blackwattle Bay) and used as supply for toilet flushing, thus reducing the potable water demand. Except for the entry forecourt (which is graded so that rainwater runoff flows back onto Bank Street), all other rainwater falling onto directly exposed surfaces other than the green roof appears to drain naturally towards Blackwattle Bay.

The MUSIC modelling results from the WSUD report demonstrate that the implementation of the water quality improvement measures (i.e. the green roof and rainwater harvesting tank) will marginally improve the quality of stormwater being discharged from the site into Blackwattle Bay, but will not achieve the City of Sydney Council stormwater pollution reductions targets. The SLR letter dated 30 May 2013 proposes to offset this deficiency by the provision of street trees or vegetated bio-filtration rain gardens in Bank Street. Evans & Peck considers that stormwater pollutant loads (such as nitrogen and phosphorous) from hard-paved areas of the site are unlikely to have any significant impact on the quality of stormwater entering Blackwattle Bay.

In accordance with the *Environmental Assessment*, 'heavy duty' restoration and maintenance activities will not occur as part of the proposed SHF maritime facility. Nevertheless, Evans & Peck considers that there may be potential for pollution of Blackwattle Bay caused by stormwater runoff from running maintenance activities that may occur in the open forecourt area, such as *'brass polishing, deck cleaning and occasional touch-up painting'* (*Environmental Assessment*).

6.2 Assessment

Evans & Peck considers that the Proponent should prepare and implement a Stormwater Management Plan for the *construction phase* of the project, as recommended in the WSUD report. This should include the implementation of the western stormwater overland flow path and a temporary boundary treatment prior to site construction works in order to minimise the potential for overland flow from Bank Street across the site into Blackwattle Bay during construction.

With respect to the *operational phase* of the project, Evans & Peck recommends that a stormwater pollution trap be provided that is capable of collecting litter, sediments and hydrocarbons from

runoff from the forecourt area around the ANZAC Bridge pylon, workshop and vessel maintenance areas prior to discharging into Blackwattle Bay. This pollution trap should be constructed and operated in accordance with the *Environmental Action for Marinas, Boatsheds and Slipways* (DECC, 2007).

Furthermore, Evans & Peck agrees with the SLR recommendation that a Maintenance Plan should be prepared as part of the detailed design phase in order to outline how stormwater quality improvement measures will be maintained. This Maintenance Plan should apply to the:

- green roof and rainwater harvesting tank system,
- western stormwater overland flow path, and
- stormwater pollutant trap.

The SLR letter dated 30 May 2013 states that street trees or vegetated bio-filtration rain gardens will be provided to filter road runoff and deliver pollutant reduction in order to address any stormwater quality shortcomings. Evans & Peck concurs with this approach to further improve stormwater quality. The letter also acknowledges that a stormwater pollutant trap capable of intercepting sediment, metals and hydrocarbons is a suitable stormwater improvement device.

Suggested Conditions of Approval to address stormwater pollution issues are provided Section 7 below.

7 Conditions of Approval

Evans & Peck suggests the following draft Conditions of Approval for the proposed SHF maritime facility. These suggested Conditions of Approval assume that the current design of the proposed SHF maritime facility remains unchanged.

Flooding

- Flood compatible materials and finishes should be adopted throughout the ground floor in order to minimise flood damage associated with inundation. Particular attention should be directed at ensuring that the inundation of the ground floor will not damage equipment in the Plant Room or lift well.
- Power supply points and mechanical, electrical and communications equipment should be located a minimum of 0.5 m above the projected 1% AEP 'high' 2050 water level (i.e. a minimum elevation of 2.3 m AHD).
- The Proponent must ensure the public safety of pedestrians accessing the timber walkway from flooding from Blackwattle Bay, including the effects of waves.
- The Proponent must provide clear access and an evacuation plan to ensure the safe evacuation of volunteers and visitors to a safe refuge area in the event of a large flood.

Stormwater Drainage

- The final SHF maritime facility combined stormwater drainage capacity (i.e. piped and overland flow) must be designed in consultation with the City of Sydney Council to convey flow up to the 100 year ARI storm event and not exacerbate the current level of ponding in Bank Street adjacent to the north-east boundary of the site. The detailed design should consider the following factors:
  - Any relevant findings of the *Blackwattle Bay Catchment Area Flood Study*.
  - Future increases to Sydney metropolitan rainfall intensities (as identified in the NSW Government's *Practical Consideration of Climate Change*).

- The requirements of the City of Sydney Council's *Draft Stormwater Drainage Design Code* in relation to the flow conditions along any overland flow path during a 100 year ARI storm event (maximum depth 0.2 m; maximum velocity 1 m/s).

Water Conservation and Re-use Measures

- The Proponent must adopt the following water conservation and re-use measures to ensure no adverse effects on the future water demand of the SHF maritime facility:
  - A 15 kL (minimum) rainwater tank to store stormwater runoff from the green roof area for re-use in toilets. The level of the tank outlet must be located at a minimum elevation of 2.3 m AHD (i.e. the projected 1% AEP 'high' 2050 water level plus a 0.5 m freeboard allowance) to prevent backflow from any sea level rise, tides, storm surges and/or waves from Blackwattle Bay.
  - Waterless urinals.
  - 4-star efficiency rated toilets, sinks, basins and bathroom taps and showers.

Stormwater Quality

- For the *construction phase* of the SHF maritime facility, the Proponent must prepare and implement a Stormwater Management Plan. This plan must include an Erosion and Sediment Control Plan and systems, processes and procedures for the implementation, operation and management of:
  - temporary boundary treatment and stormwater overland flow path to direct any overflow from Bank Street around the works area;
  - procedures for management of any spills; and
  - management of all excess spoil and construction wastes.
- For the *operational phase* of the SHF maritime facility, the Proponent must install and operate a stormwater pollution trap in accordance with DECC's *Environmental Action for Marinas, Boatsheds and Slipways*. The stormwater pollution trap must be capable of collecting litter, sediments and hydrocarbons to treat runoff from all hard-paved areas of the SHF maritime facility prior to discharging into Blackwattle Bay.
- For the *operational phase* of the SHF maritime facility, the Proponent must prepare and implement a Stormwater Management Plan. This plan must include systems, processes and procedures for the implementation, operation and maintenance of:
  - the green roof and rainwater harvesting facility/tank system,
  - the stormwater pollution trap, and
  - chemical, oil or fuel spills.

Yours faithfully,

EVANS & PECK PTY LTD

Dr Steve Perrens
Principal

8 References

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[1] The *Stormwater Drainage Design Code* (City of Sydney Council, 2012) was unable to be sourced.

Annexure A: Still Water Level Projections