



Our Ref: N:\37672 Northbank\Worddocs\Report\Submission NSW DoPI 7 February 2013

7 February 2013

Mr Chris Ritchie
Manager – Industry
Major Projects Assessment
NSW Department of Planning & Infrastructure
GPO Box 39
SYDNEY NSW 2001

Dear Mr Ritchie,

NORTHBANK ENTERPRISE HUB (MP 10_0185)

Thank you for providing a copy of the following submissions in relation to the proposed Northbank Enterprise Hub (NEH) development:

1. Letter from the Hunter-Central Rivers Catchment Management Authority dated 30 October 2012 (received by NEH on 22 January 2013); and
2. Letter from Equatica dated 20 December 2012 (received by NEH on 14 January 2013).

Following the meeting on 31 January 2013 between the NSW Department of Planning & Infrastructure (DoPI), the Office of Environment & Heritage (OEH), Equatica, ADW Johnson, WBM BMT and NEH to discuss the general matters raised in these submissions, we now provide a response to each matter raised.

We have also enclosed with this submission (see Attachment A) the amended Development Plans in response to the email from Emma Barnet dated 24 January 2012. The amended Development Plans clearly demonstrate that Lot 1 DP 534526, which is owned by the State Property Authority, does not form part of the subject development site.

CONTENTS

1. Hunter – Central Rivers Catchment Management Authority	2
2. Equatica.....	8

Attachment A	Amended Development Plans
Attachment B	Local Drainage Plans (Updated)

1. Hunter – Central Rivers Catchment Management Authority

CMA Comment:

Climate Change and Sea Level Rise

The CMA is concerned that the proposed filling of 154ha of wetland and the potential loss of its future value as a saltmarsh retreat area following predicted sea level rise. The CMA also has concerns regarding the sheer volume of fill, 3.7 million cubic metres, including the source and composition of the material and the final height of the development above sea level. The CMA comment that current flood modeling does not account for the predicted sea level rise of 90cm by 2100 and the problems associated with inundation of the development as a result of the combined forces of a major flood event, sea level rise and coastal setup processes.

NEH Response:

The subject site when owned by the NSW Government was rezoned by the NSW Government via the inclusion of the site as a State Significant Site under SEPP Major Projects 2005 (later called SEPP Major Developments). The rezoning of these lands followed the introduction of the Lower Hunter Regional Strategy that identified the subject site as employment lands and also identified relevant conservation lands around the site. The proposed development of the site remains consistent with the outcomes of the Lower Hunter Regional Strategy and rezoning. It is therefore not recognised as a potential saltmarsh retreat area.

Fill volume, source and composition of material has been previously identified in the submission. Runoff control during construction when the fill surface is exposed is proposed in accordance with standard control practices. Runoff flow direction toward the river rather than the conservation wetlands adjacent and monitoring is also proposed.

If in the event that sea level rise is shown to occur over the future generations, we have considered and allowed for several different contingency opportunities for maintaining the proposed development in its current form. There is currently over 2m elevation difference between the invert level of the floodgate for drainage and the peak water level during major storm events, hence potential of 0.9m rise can be accommodated. There is also a very high level of on site storage within the open drains for containing stormwater runoff during major events and as a result providing continuing protection to the adjacent wetlands.

We consider the flood modelling and design to adequately cater for the potential sea level rise over time, and as stated have in place an adaptable design to deal with changes as they may occur.

CMA Comment:

The potential negative impacts of freshwater runoff from the development on the surrounding Tomago Wetlands.

The CMA has been involved with ongoing work to plan and rehabilitate the Tomago Wetlands for nearly twenty years due primarily to its importance as migratory shorebird habitat. The project has received over \$330,000 funding from the State and Federal Governments since 2005 and involves a significant contribution from National Parks & Wildlife Service (NPWS) and major 'in-

kind' support from Hunter Bird Observers Club (HBOC) and other community based organisations. The key restoration activity has been the installation of structures to allow the controlled opening of floodgates and the restoration of tidal saltwater flushing to the wetlands in this area.

The CMA notes that significant impacts on local drainage and flooding are likely to occur as a result of this proposal. The proposed filling of this wetland area to create a development footprint of over 154ha in immediately adjacent to internationally significant Ramsar wetlands will have a major effect on local hydrology and migratory shorebird habitat.

The CMA is concerned that increased levels of freshwater and contaminated runoff from the proposed development, especially during flooding, has the potential to jeopardize the Tomago Wetlands.

NEH Response:

NEH acknowledges the importance of the Tomago Wetlands and has a good track record of working with the relevant authorities to ensure that this remains the case. As outlined in Section 6.22 of the Environmental Assessment Report dated 24 August 2012 (and also confirmed in Attachment G of our submission dated 12 December 2012), there has been careful consideration for the wetland interface strategy that is dedicated to the ongoing protection of the conservation lands of Lot 1002 and Tomago Wetland Rehabilitation Project. Furthermore this plan has been developed in consultation with Port Waratah Coal Services (the adjoining owners) and their consultants to meet their conservation objectives of salt water inundation of Lot 1002. The water management for the proposed development provides for the delineation of freshwater inundation from upslope with discharge to the river and the limits for saltwater inundation, continuing the existing NPWS levee. Additionally, flexibility has been built into the water management system for ongoing adaptive management and adjustment to suit changes to conservation objectives of Lot 1002 adjacent to the proposed development.

NEH considers its wetland interface strategy to adequately demonstrate our detailed understanding of how to both protect our own site and the environmentally sensitive surrounds.

CMA Comment:

Impacts of the development on Threatened Species including the Eastern Grass Owl, 9 species of native bat and the Grey-headed Flying Fox and the potential for negative impacts on habitat for migratory bird species.

The CMA has concerns related to the impact that the proposal will have on biodiversity, threatened species and migratory shorebirds at the site. It is reported in the flora and fauna study by Ecobiological that a significant portion of the north/south vegetation corridor will be severed as a result of the development of Lot 1001.

This area contributes to the broader regional linkages that make up the Biodiversity 'Green Corridor' between Port Stephens, Hexham Swamp and the Sugarloaf Range south to the Watagans. This corridor is highly significant and recognised by the community and government as a very important resource for the conservation of regional Biodiversity. The area was officially identified as a 'coastal climate managed fauna retreat corridor' by Department of Environment and Climate Change in 2007 (now Office of Environment and Heritage).

The CMA notes that the proposal will result in the loss of at least one group of Eastern Grass Owls from the study area. Ecobiological completed a study of Grass Owls in the area in 2011 and identified 7 'Groups'. Although the consultant's report states that the loss of one Group is unlikely to reduce the long term viability of the local population they also state that further habitat loss and the effects of cumulative development may place the local population under extreme pressure for survival in the medium to long term. This proposal needs to be considered within the context of existing and future proposals planned for this area and the cumulative impacts that it will have on the Eastern Grass Owl population.

Hunter Bird Observers Club (HBOC) have been conducting monthly surveys over several years to document the results of restoring Tomago Wetlands as habitat for shorebirds , particularly international migratory shorebirds ,through the reinstatement of tidal flows. One measure of success is the numbers of waterbirds which appear after the restoration indicating that it is helping to redress the decline of many species of migratory shorebirds in the Hunter Estuary where some species show a decline as much as 80% and several species show declines of 50%. All migratory shorebirds are listed under the Environment Protection and Biodiversity Conservation Act.

The shorebird season 2012/2013 (September to April) has shown to date (October 2012) an increase in the diversity and numbers of shorebirds and an increase in other waterbirds such as Royal Spoonbills, Australian White Ibis, Black Swan, White- faced Heron, White-necked Heron, Australian Spotted Crake. So far this season seven species of migratory shorebirds have been seen: Latham's Snipe, Pacific Golden Plover, Marsh Sandpiper, Common Greenshank, Sharp-tailed Sandpiper, Eastern Curlew and Bar-tailed Godwit compared with previous years when only Sharp-tailed Sandpiper and Latham's Snipe have been present. Numbers of the resident shorebird Black-winged Stilt have increased and two additional resident shorebirds have been present, Black-fronted and Red-kneed Dotterel. Although numbers are small, they are significant in that they show that the wetland is becoming suitable once again as shorebird habitat with the prospect of improved functioning over time.

The Australasian Bittern is listed as endangered under national and state legislation and has always been present on site.

NEH Response:

Corridor

The subject site when owned by the NSW Government was rezoned by the NSW Government via the inclusion of the site as a State Significant Site under SEPP Major Projects 2005 (later called SEPP Major Development). The rezoning of these lands followed the introduction of the Lower Hunter Regional Strategy that identified the subject site as employment lands and also identified relevant conservation lands around the site. The proposed development of the site remains consistent with the outcomes of the Lower Hunter Regional Strategy and rezoning. The ecological work completed for the project does not identify any specific impacts on any corridors.

Eastern Grass Owl

The Ecological report has determined that the proposed impact on the Eastern Grass Owl across the region is not considered significant and this has been accepted by OEH. The subject site since 2006 has been identified in the Lower Hunter Regional Strategy as Employment lands with other lands

identified nearby for conservation. The proposed development does not impact on those lands identified for conservation.

Shorebirds

The Ecological report has established that the proposed development will have no significant impacts on shorebirds. The ecological reports includes reference to work completed by the Hunter Bird Observers. It is envisaged that an EPBC referral will be completed, despite the site not having development adjoining the immediate RAMSAR Wetlands.

CMA Comment:

Proposed Clearing of Endangered Ecological Communities (EEC) and Offsets

The CMA notes that there are 3 EECs proposed to be removed as part of the development proposal including Swamp Sclerophyll Forest (1.4ha); Swamp Oak Floodplain Forest (14.82ha) and Freshwater Wetlands on Coastal Floodplains (70.59ha). The CMA recommends retaining the 1.4ha of Swamp Sclerophyll Forest into the development proposal due to its habitat value, relatively small size and function as a visual and particulate screen and to incorporate the other EEC communities where possible.

The CMA expects the proponent to develop an offset package using either the Environmental Outcomes Assessment Methodology (EOAM) or Biobanking methodology and carried out by a qualified Biobanking practitioner. At the very least the proponent should incorporate the principles underpinning Biobanking and/or the EOAM in the development of offsets that meet the 'improve or maintain' test.

The CMA would appreciate the opportunity to review the package once completed.

The CMA notes that the amount of offset required could be reduced by retaining the Swamp Sclerophyll Forest and other EECs as outlined above. As the EIS does not contain adequate details of a specific offset package, the CMA is unable to properly assess or support the proposal at this time.

NEH Response:

NEH has had significant discussions and meetings with the Department of Planning & Infrastructure (DoPI) and OEH regarding the offsets package. After considering over 150 offset sites, NEH has identified and will shortly contract to acquire a site with strong biodiversity values in NSW. NEH will provide its offset consistent with the requirements of NSW DoPI and OEH.

CMA Comment:

Consistency with the Hunter-Central Rivers Catchment Action Plan

The Catchment Action Plan (CAP) is a whole-of government approach to natural resource management which has been endorsed by the NSW Government. The CAP contains specific guiding principles that outline how natural resource management should occur in the Hunter-Central Rivers region to improve or maintain environmental outcomes. The guiding principles for

biodiversity, land use planning and estuary and marine have particular relevance to this project. The CMA requests that these CAP guiding principles be taken into consideration both in the EIS and during implementation for the life of the project.

The following is a list of specific guiding principles with particular relevance to this proposal.

1. The Landuse Planning Guiding Principles outlined in the CAP include "New release areas for residential and industrial development should be restricted to lands without significant natural resource constraints, including those areas already cleared of native vegetation (including significant native grassland), areas outside rural resource land, areas with less than 20% slope or those not comprising highly erodible soils (including acid sulfate soils)". This development clearly does not meet this Guiding Principle in the CAP and therefore cannot be supported by the CMA.
2. Minimising habitat destruction and improving the condition of habitat- The CMA will support in principle planning measures which reduce or avoid impacts of development on threatened species and communities such as Regional Conservation Plans and the Biodiversity Offsets 'Biobanking' scheme.
3. Maintain or improve the condition of estuary and marine areas -If estuarine or marine aquatic habitat must be disturbed as a result of development then other areas of wetland habitat should offset this loss.
4. To prevent species, populations and ecological communities from becoming threatened or extinct, it is important to preserve high quality saltmarsh, mangrove, estuarine, seagrass, marine and marine shoreline habitat that remains in the long-term. It is also important to improve degraded saltmarsh, mangrove, estuarine, seagrass, marine and marine shoreline habitat to increase the limited wetland habitat that now exists.
5. Habitat should be restored to a healthy state so native species are able to outcompete exotic species.
6. The cumulative impacts of development activities on our natural resources should be taken into consideration in landuse planning.
7. The use and development of natural resources should be sustainable.
8. Where practical, future development should be restricted to primarily cleared land. Where loss of vegetation is unavoidable, native vegetation offsets should be used.

The CMA is also concerned about access arrangements to the Tomago Wetland restoration site should the development be approved. The CMA requires continued access for monitoring and evaluation purposes at this site.

NEH Response:

1. The site rezoning process has already been completed by the NSW Government which has determined that the locality is suitable as an employment zone. The proposed development is consistent with the objectives of the zone.

2. The proposed development has achieved an appropriate balanced outcome relative to the objectives of the Lower Hunter Regional Strategy. In addition to retention of on site habitat / vegetation an appropriate offset package has been developed.
3. An aquatic ecology report (refer to Appendix E of the EA Report dated 24 August 2012) has been submitted that establishes the proposed development has no significant adverse impact on estuarine or marine aquatic habitat.
4. The proposed development has maintained where possible EEC on site and has otherwise provided for an improved outcome through the offset process.
5. Existing habitat retained on site and new plantings will be typically of native vegetation maintained to a high standard.
6. This is a matter for determination as part of the land use rezoning process, and which has already been determined for this locality. In addition the proposed development provides for an appropriate offset arrangement.
7. The proposed development provides for a sustainable outcome, via the retention where possible of on site natural resources as otherwise make a significant contribution via an appropriate offset package.
8. The subject site is substantially cleared land. Where the existing native vegetation is proposed to be removed offsets are being provided for.

Access Arrangements - The proposed development will maintain and indeed improve access arrangements to nearby Tomago Wetland Restoration area.

We trust this adequately addresses the questions raised by the CMA.

2. Equatica

Equatica Comment:

Regional flooding

We note that the justification for not addressing impacts on flood levels immediately upstream of the site is due to current landuses. This is generally not considered a relevant factor.

NEH Response:

We understand that Equatica is satisfied with the flood modelling and results presented with respect of regional flooding. We note however that a separate document clarifying the regional flooding results will be forwarded to Equatica and OEH in due course.

The focus of this response is on the local drainage system and interactions to the wetlands, being the content of the letter dated 20 December 2012.

Equatica Comment:

Local Flooding and Drainage

There is a risk that the proposed development will have adverse impacts on drainage from neighbouring properties, as there are some properties along Tomago Road that drain through the site. The development has the potential to impede drainage from these properties, particularly in events where there is a large volume of runoff which fills site storages and can only drain slowly to the Hunter River.

Additional information is required to demonstrate how this risk will be addressed, including:

- *Additional information, including a catchment map of the areas north and west of Tomago Rd which drain through the site (if any areas west of Tomago Rd do drain through the site) as this is currently unclear;*
- *Additional information is requested on the storage assessment including:*
 - *A marked up plan showing the surface area of all storage areas (channels, overflow wetland, landscaped areas subject to ponding) with existing contours overlaid on this map;*
 - *The normal water level of the overflow wetland (as this will reduce storage volume available);*
 - *How the bioretention system provides any storage below 0.7 m AHD (as stated); and*
 - *It is noted that the calculated storage included in this response (285 ML) is different to that estimated by WBM of 100 ML (original submission).*
- *Additional information on the calculation of the drawdown time as:*
 - *5 to 10 days is a long duration over which drawdown occurs;*
 - *Due to the long drainage times of the storages (5 to 10 days) the analysis of relatively short rainfall events (e.g. 3 hours) is not a relevant comparison. The assessment needs to consider durations of 5 to 10 days; and*
 - *No mention has been made of increasing capacity of the existing flood gates.*

- *We note that there is low lying property upstream (Sheet 6 of 6) which could potentially be affected by afflux noting the long distances from the outlets to the low lying land on these properties;*
- *In consideration of all these issues, and as recommended in our reply on 16 November 2012, we recommend undertaking hydraulic modelling of the drainage system in the minor and major events to show hydraulic grade lines of the stormwater drainage system in an appropriate range of minor events with durations relevant to the length of drawdown.*

NEH Response:

Catchment Plan

External catchment delineation has been added to Sheet 1 of the existing set of plan sheets from the previously submitted Attachment 'B' (see submission dated 12 December 2012). Survey has confirmed that the box culvert under Tomago Road east of Tomago House has an invert level of 2.3mAHD. The box culvert is 1.2m wide x 0.3 high. The upslope catchment area of Lot 1001 is approximately 45ha over highly permeable sands and contains a number of sinks or low points which would accumulate stormwater prior to runoff to the culvert. Surface runoff is expected to be very low, whilst contribution to groundwater flows will be very high by comparison to conventional stormwater runoff and infiltration. The culvert level does however give good indication for peak acceptable levels of ponding within Lot 1001 without impeding any upstream flows drained through this culvert. BMT WBM's peak flood level for Channel 2 which will take this runoff is approximately 2.1mAHD, indicating that flow is not impeded during this event. Similarly, piped drainage from the small industrial subdivision north of Centurion Civil and Industrial Switchgear also within the catchment is also unimpeded.

Storage Areas

The existing contours and downstream storage areas have been overlaid and are indicated on Sheet 7. The area of channel widths is unchanged from Figure 6-1 of the BMT WBM Flooding and Drainage Assessment, August 2012 (see Appendix F of the EA Report) and the typical sections re-presented in this current submission (unchanged from our submission 12 December 2012).

There is approximately 29 hectares of storage area over landscaped areas between the levee bank and the fill platform extent. The average natural surface level is approximately 0.8mAHD. Digital terrain model results indicate a volume of 130ML of storage in this area measured from natural ground to the perimeter berm crest level of 1.2mAHD (and bound by the Hunter River levee bank). No allowance has been made for the storage within the decorative pond indicated on the plans, that will be similar to the overflow wetland. Only a very small proportion of this storage lies on the western side of the 900mm dia floodgate. As described previously, the overflow wetland area is 10 hectares, providing 100ML when measured from the long term groundwater level 0.2mAHD in this area up to 1.2mAHD perimeter berm crest level, or 70ML when starting levels are assumed to be 0.5mAHD. To clarify, there is no duplication of the channel storages with this downstream storage area outside the fill platform.

Normal water level of overflow wetland

Groundwater modelling indicates that the water level in the overflow wetland is predicted to be 0.2mAHD as the long term average post development. This level is equivalent to the base invert

level of the overflow wetland being created. The overflow wetland area lies adjacent to the floodgate outlet with invert level of -0.86mAHD, having approximately 1m of head at this elevation at low tide. The area is expected to remain ponded with standing water after rainfall, potentially 5-10 days after the event, depending on starting conditions such as tide/river level, storm duration and rainfall pattern and any lead up prior rain events.

Bioretention system provides storage below 0.7mAHD

This point is made from text contained under Section 2 Analysis 'Channel storages in smaller storms' summary in Attachment 'B'. We agree that there is no bioretention system storage below 0.7mAHD. To clarify, the storage measure provided was a summed total availability for stormwater from within the channel storage above a base groundwater level 0.5mAHD to 0.7mAHD combined with the void storage in the gravels of the bioretention system. This was intended to quantify the capacity of the lower base level of the stormwater system for runoff from only minor storms and provides a guide to the stage/storage of the water management system.

Difference to WBM storage

The BMT WBM report indicating 100ML of storage is referring to the overflow wetland storage of 10 hectares. The description didn't include any of the channel storage or aboveground storage of landscaped area adjacent to the overflow wetland. The ADWJ comment regarding 285ML is from Section 2 Analysis 'Channel storages in larger storms' summary in Attachment 'B' is a different reference. Further clarification of the storage areas is provided on Sheets 1 and 7.

5-10 days long duration

It is accepted this is a longer duration for drawdown than conventional development, however there is no consequence to the proposed development or adjoining lands when this water remains in the channels for this period of time. In our view this is a positive in terms of increased residence time for improving water quality (although not relied upon in the water quality modelling). It is also an ecological benefit to have continuing ephemeral freshwater wetland corridors up through the site, adjacent to the conservation wetlands.

Capacity for longer durations

The BMT WBM 1 ARI year, 7 day maximum runoff volume is predicted to be 210ML post development (From BMT WBM Stormwater Assessment, 17 August 2012) for the modelled period of 1999 to 2006. WBM has completed a check of the rainfall data for the entire record period for Williamstown (1953 to 2010) and compared this with the rainfall totals for the modelled period (1999 to 2006). The maximum 7-day average runoff volume of 58ML/day (i.e. total of 7 x 58 = 406ML) shown in the plots in the WBM report occurred in May 2001 over a 7 day period where a total rainfall of 238mm fell. Within the entire record for Williamstown this 7 day total is only exceeded for four 'events'. The May 2001 event is then approximately a 10 year ARI 7-day event based on the entire record.

The five highest 7-day rainfall totals on record for Williamstown are:

9/5/2001	238mm
12/6/64	241mm
7/5/98	243mm

28/4/63 270mm
 8/2/90 527mm

Within a 7 day event, it is expected that for half the event period the floodgates will drain on the diurnal cycle and for the remainder, river levels will most likely be too high and the runoff stored on site. Total storage on site is approximately 400ML, based on a starting storage of 0.5mAHD in the channels with no outflow. The 0.5mAHD starting storage is considered to be conservative due to the long term modelled level of 0.2mAHD from groundwater modelling and a monitored peak level of 0.6mAHD from the adjacent site (described further below). Results of longer duration rain events are shown below in Table 1.

Table 1 – Runoff containment results for maximum 7 day rain events

Rainfall Total (mm)	Approximate Runoff Total (ML)	Approx. Equivalent ARI	Overtopped Perimeter Berm/Discharge to Wetland
120	210	1 year	No
238	406	10 year	No
241	413	10 year	No
243	418	10 year	No
270	483	20 year	Potentially*
527	1100+	>100 year (1.5 times the volume of the 100 year, 48hr storm)	Yes

*- dependent on initial conditions, river/tide levels and rainfall pattern over the duration.

It is considered that in terms of wetland impact assessment, the on site capacity for post development runoff storage for storms of 7 day durations up to 10 years recurrence interval and potentially 20 year recurrence is a significantly high level of protection and positively demonstrating that the development can be completed without hydrological impact to the downstream wetlands. As a result this demonstrates having met objectives for water management of the proposed development.

Upgrade of existing floodgates

The assumption is correct, no upgrade of the existing floodgates is proposed with the development of Lot 1001.

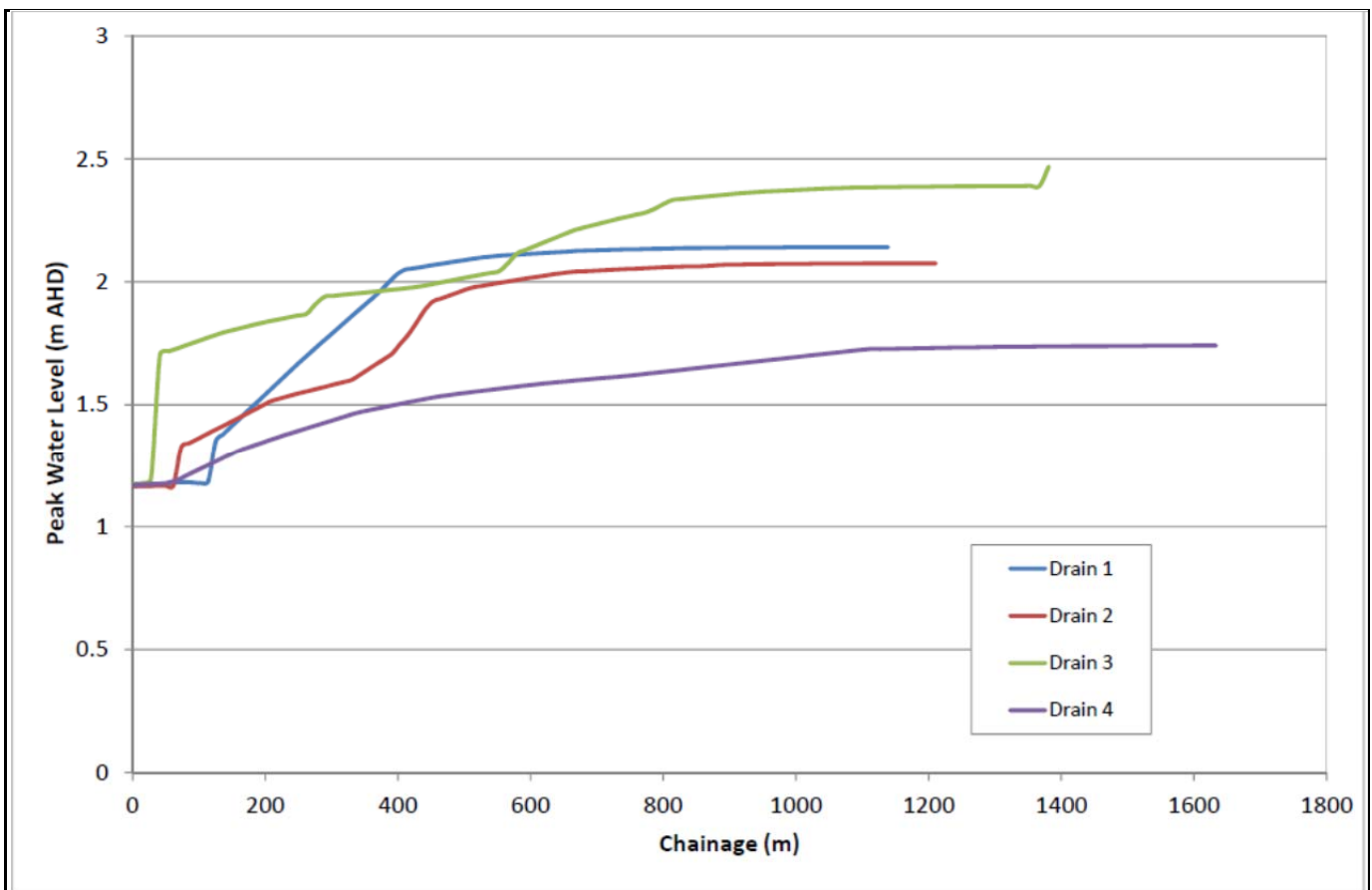
Distance to Outlets

This matter is addressed under the 'Catchment Plan' heading above.

Hydraulic Modelling

We can confirm that BMT WBM has completed hydraulic modelling of the stormwater drainage system. Refer to the plots below of the peak water level during the 100 year, 2 hour event which was the critical storm to the sizing of the open channels.

Plots – Stormwater Drainage System



Equatica Comment:

Water Quality

The following questions remain over the water quality strategy:

- What is the regional groundwater level at the location of the bioretention systems?
- The bioretention surface level is at 1.5 m AHD. The development level is at 2.5 m AHD. Assuming there is 600 mm cover to the stormwater pipe at the road boundary this only allows 400 mm for the stormwater pipe/culvert itself if there is to be free drainage to the bioretention system surface. Please confirm that this will be feasible.
- The bioretention system inlet design is non-standard and is not recommended. Relevant design guidelines should be adopted.

NEH Response:

Regional Groundwater Level

The regional groundwater level is variable through the site and for site coverage had to be a broad scale model. The bioretention systems are located in close proximity to the open channel trunk

drainage so as to remain free of groundwater. The base level of the bioretention at 0.7mAHD was selected after continuous monitoring results through wet periods from the MP07_0086 site adjacent. Peak levels were of the order 0.6mAHD associated with a large rainfall event on an already waterlogged system (approximately 140mm of rainfall over 5 days in July 2011 following above average rainfall through April, May and June), hence a minimum level of 0.7mAHD was selected for the bioretention systems.

Bioretention levels/pipe cover

The assumed 400mm cover is feasible. The channel sections A-G from Attachment 'B' indicate the low flow connections with bioretention systems at the lowest points of the road, 2.5mAHD. This is the lowest level of the roads. Road levels increase for minimum road level and earthworks gradings and additionally low flows are conveyed to the bioretention systems at regular intervals. High flow bypass, where larger pipe sizes may be required are indicated on the channel section plans and shown to bypass the higher flows entering the trunk drainage channels. Detailed design will be required, however the levels provided in concept are sufficient to demonstrate the cover and alike for drainage works to be installed and meet requirements and functions.

Bioretention system non standard

A standard condition can be accepted in this regard to design the bioretention systems in accordance with best practices.

Equatica Comment:

Hydrology

Changes in hydrology are a potential concern for the wetlands adjacent to the site, including SEPP14 and Ramsar-listed wetlands.

While it is noted that a monitoring strategy is in place, and that we concur that monitoring is a good practice to observe changes, modelling is the only available tool which allows predicted impacts due to proposed changes in landuse. Monitoring is not able to predict these changes prior to the changes occurring. Modelling is therefore recommended to demonstrate that the proposed strategy is feasible.

Modelling needs to address the following:

- *With regards to hydrology ADW Johnson response states that drying hydrology is important. However this has not been translated to quantifiable objectives;*
- *With regards to hydrology it is clear from ADW Johnson's response that the strategy allows some flows to discharge to sensitive wetlands off site. When water levels in events ponds above approximately 1.2 to 1.4 m AHD, it appears that water will overtop the perimeter berm directly into SEPP14 wetlands, and possibly also affect the Ramsar listed wetlands.*
 - *The frequency of this occurrence has not been documented;*
 - *The volumes of this occurrence have not been documented;*

- *The frequency and volumes have not been compared to quantifiable objectives for the wetlands; and*
 - *These flows have not been compared to existing hydrology to determine impacts.*
- *We recommend following the procedure outlined in Water Sensitive Urban Design Solutions for Catchments above Wetlands; Appendix B: Catchment Hydrologic Indices and Urban Water Management Performance Objectives. In particular note the step by step process in Appendix B. We note that the work done to date by WBM on hydrology shows significant changes to hydrology although we also note that this is for the total site runoff and not for that portion of runoff draining to adjacent wetlands. This analysis will allow a demonstration that the proposed strategy it is capable of meeting its stated objectives. Currently this has not been demonstrated.*

In addition, there needs to be more information provided on how flows will move through the drainage and storage systems at the downstream end of the site, as it is not clear how flows will be prevented from escaping beyond the end of the bund and into the wetlands. This could potentially be addressed with a section through the overflow wetland area showing the normal water level and how water is detained, particularly on the southern side of the overflow wetland rehabilitation area beyond where the perimeter berm ceases.

NEH Response:

Hydrology

In Section 6.22 of the Wetland Interface Strategy of the Environmental Assessment Report, we had previously identified the wetland vegetation types downstream, the hydrology and overview interaction of the Lot 1001 site relative to these wetlands. As requested, we now provide further detail in accordance with the procedures of “*Water Sensitive Urban Design Solutions for Catchments above Wetlands; Appendix B: Catchment Hydrologic Indices and Urban Water Management Performance Objectives.*” Hunter & Central Coast Regional Environmental Management Strategy (HCCREMS) as to how we arrived at these conclusions and worked collaboratively with the adjoining land owners to meet their preferences and objectives.

The plan view attached (Sheet 1) has been revised to add the wetland locations of interest as per the Wetland Interface Strategy of the Environmental Assessment Report. The assessment is shown in Table 2 below.

Table 2 – Wetland hydrologic objective summary

Location Identifier	Description	HCCREMS Classification	Hydrologic Objectives	Frequency of Duration	Reference Duration	Hydrologic Pathways	Catchment sources of inflows	Potential Impacts	Mitigation/ Intervention Post Development
'A'	Retained Freshwater Wetland (within Lot 1001)	Shallow Marsh (70%) and Deep Marsh (30%)	Drying Hydrology – Low Flow Duration & Low Flow Spell	Shallow Marsh 3 – 6 months Deep Marsh 1.5-3 years	Shallow Marsh – 30- 60 days Deep Marsh – 2-3 years	Groundwater expression (window to groundwater), overbank flow, rainfall fed	Regional groundwater, upstream of North/South Drain floodgates, NPWS conservation lot	HCCREMS identifies drying hydrology as critical. Additional freshwater could turn the shallow marsh to deep marsh.	Perimeter drain to river. Low flows/base flows prevented from entering systems to preserve drying hydrology opportunities. Adjustable pit control.
'B'	Retained Swamp Oak Forest (within Lot 1001)	Forest Swamp Wet	Drying Hydrology – Low Flow Duration & Low Flow Spell	1-1.5 years	60 days	Groundwater expression (window to groundwater), overbank flow, rainfall fed	Regional groundwater, overbank flow, rainfall fed	Additional freshwater could lead to shallow/deep marsh development	Perimeter drain to river. Low flows/base flows prevented from entering systems to preserve drying hydrology opportunities. Adjustable pit control.
'C'	Overflow Wetland Rehabilitation Wetland (within Lot 1001)	Not applicable to assessment. To be formed, not existing.	-	-	-	-	-	-	-
'D'	Swamp Oak Forest North	Forest Swamp Wet	Drying Hydrology – Low Flow Duration & Low Flow Spell	1-1.5 years	60 days	Groundwater expression (window to groundwater), rare overbank flow, rainfall fed	Regional groundwater, overbank flow, rainfall fed	Additional freshwater could lead to shallow/deep marsh development	Perimeter drain to river. Low flows/base flows prevented from entering systems to preserve drying hydrology opportunities. Adjustable pit control.
'E'	Swamp Oak Forest South	Forest Swamp Wet	Drying Hydrology – Low Flow Duration & Low Flow Spell	1-1.5 years	60 days	Groundwater expression (window to groundwater), rare overbank flow, rainfall fed	Regional groundwater, overbank flow, rainfall fed	Additional freshwater could lead to shallow/deep marsh development	Perimeter drain to river. Low flows/base flows prevented from entering systems to preserve drying hydrology opportunities. Adjustable pit control.

Further to Table 2 we make the following additional commentary on the hydrologic objectives at all of the wetland locations

Drying Hydrology

Drying Hydrology is the key hydrologic consideration for water management control on Lot 1001. The downstream wetlands are supported by water sources from a range of different catchments and types and only a small intermittent, less frequent proportion of discharge from Lot 1001 passes to 'D' and 'E' off site.

The overbank flow from Lot 1001 to these wetland areas is not frequent. This is due to extensive on site ponding within lower lying areas of Lot 1001 before overflow discharge into Lot 1002 and confirmed by site topography which for the large majority slopes back internally away from the common boundary with Lot 1002. It is confirmed by site observation and vegetation types along these flowpaths that flows are irregular. This indicates long drying durations for hydrologic analysis should be long, 60 days or greater. As described in HCCREMS, this is difficult to achieve where development sites flow directly toward wetlands and usually requires a flow diversion to be adopted for low flow duration and low flow spell objectives to be achieved. A flow diversion has been adopted for the water management at this site where baseflow discharge is via a perimeter drain to the Hunter River.

Additionally, the perimeter drain and perimeter bank for the diversion of freshwater to the river are a necessity for the effective continuing expansion of the Tomago Wetland Rehabilitation Project. The perimeter bank providing an effective limit to saltwater tidal inundation extents and a continuation of the existing NPWS levee is already in place for this purpose. The objective of providing drying hydrology with diversion will also assist in the establishment of the proposed and desired saltmarsh species on Lot 1002. We note that PWCS as the owners of Lot 1002 with their subconsultants are also proposing a perimeter berm along the same boundary for these same reasons.

With the existing discharge points identified, we are nonetheless providing discharge control pits with facility for increasing, decreasing or closing off discharges toward Lot 1002, passing through the perimeter berm. Monitoring will be undertaken as described in the Environmental Assessment Report.

Discharges to Lot 1002

Groundwater modelling indicates that regional groundwater flow pre to post development will remain unchanged. Due to hydraulic conductivities being low, this is only 5% of the recharge along the common boundary with Lot 1002.

The frequency of overtopping of the leveeperimeter bank is expected to be very low. Long duration events over 7 days do yield a greater volume, increasing storage, however then opportunity commences for drawdown by tidal discharge to the Hunter River. We acknowledge the request to review the performance under 7 day volumes as a good test of the capacity. From the results of Table 1 there still remains capacity for on site storage for all recorded storms except for the 1990 storm event which was exceptionally large. It is concluded overtopping may occur in a 20 year 7 day event, depending on several factors. This is considered to be a very high level of protection and

higher on site capacity than the existing uncontrolled discharges from Lot 1001 to Lot 1002 in long duration major events. It has to be expected that low lying areas containing wetland vegetation will be inundated during these major events, hence they are not critical to the assessment. Flooding hydrology is not critical to these wetland types who are inundated from several catchment sources. Based on the drying hydrology, the critical hydrological objective, being addressed with a perimeter drain, the conservation objectives proposed for Lot 1002 and this type of rare event not being critical to downstream wetland vegetation types, we consider the water management to not be having any adverse impact on the downstream wetlands.

We have previously indicated that subject to initial conditions and river levels at the time of the peak rainfall and rainfall pattern, the following major design storms are likely to overtop the perimeter berm:

- 100 year, 12 hour storm (and longer duration 100 year storms)
- 50 year, 24 hour storm (and longer duration 50 year storms)

It is considered that we have adequately addressed this point in the above additional information, in particular the maximum 7 day duration events requested to be reviewed.

Flows Escaping

At your request we have prepared a section through the overflow wetland that is contained within Sheet 6. This clearly demonstrates that low flows will not escape at this location.

In summary, it has been demonstrated through the water management system that:

- Design will not impede upstream drainage;
- Design has been made for the drying hydrology (the critical hydrology to the downstream wetlands and wetlands maintained on site) via a perimeter drain to the Hunter River;
- Freshwater and saltwater delineation via the perimeter berm for the enhancement and continuing expansion of the Tomago Wetland Rehabilitation Project, continuing the NPWS levee;
- A high level of containment of on site flows during major storms prior to overtopping the perimeter berm into Lot 1002;
- A monitoring program for the ongoing monitoring of the wetlands post development;
- Design of an adjustable, flexible water management system has been provided with the range to match different objectives for ongoing change if required; and
- There is an overall willingness shown by NEH to work with PWCS as the owners of Lot 1002 and its consultants and the Tomago Wetland Rehabilitation Project to meet conservation objectives and enhance the downstream wetlands where possible.

Should you have any questions in relation to the contents of this submission or would like to discuss any matter further, please do not hesitate to contact Craig Marler on (02) 49785100 or craigm@adwjohnson.com.au.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Craig Marler', with a long, sweeping underline that extends to the right.

Craig Marler
Project Director & Principal Planner
ADW Johnson

Enc: Attachment A Amended Development Plans
 Attachment B Local Drainage Plans (Updated)

Attachment A
Amended Development Plans

Attachment B
Local Drainage Plans (Updated)