Department of Planning and Environment

North Byron Parklands wastewater management

Review of additional information

September 2018

Executive summary

The Department of Planning and Environment (DPE) engaged GHD to review the waste water management plans of North Byron Parkland's development application for expansion and addition of the annual festival activities at the Site. GHD identified discrepancies and shortcomings in the proposal as detailed in GHD's report of August 2018.

The Applicant submitted additional information and revised plans to the DPE and this Report provides a high level GHD review and recommendations of the same. Key issues were identified relating to on-site waste water management and re-use of treated waste water.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.2, 1.3, 1.4 and the assumptions and qualifications contained throughout the Report.

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1. Introduction

1.1 Overview

The North Byron Parklands Cultural Events Site, is located at 126 Tweed Valley Way, Yelgun in the Byron Shire local government area. The site currently hosts two major music festivals including the Splendour in the Grass and Falls Festivals under a trial project approval. A proposal is currently with the DPE for assessment, which is seeking permanent approval of the site to host events for up to 50,000 people (SSD 8169). In terms of wastewater and sewage management, the Applicant is proposing to upgrade its existing on-site sewage management system and has considered a number of options for on-site treatment of solid and liquid sewage waste including on-site effluent disposal.

In the previous evaluation of the scheme, a number of shortcomings were identified, and the applicant has since provided further information to the Department of Planning and Environment (DPE) for consideration. However, DPE have advised that Council remains concerned on the scale of the proposal as well as the following aspects:

- Very low wastewater generation rates.
- Staged upgrade of the proposed on-site wastewater treatment system.
- Continued burial of human waste based compost on site.
- Nutrient build up on effluent dispersal areas over time.
- The use of flood prone area for the surface spray irrigation of treated effluent.
- Continued transportation of kitchen festival sullage (trade waste) to Byron and Ballina sewage treatment plants.

Whilst reference is made to a meeting between the applicant and Byron Shire Council's General Manager and Infrastructure Manager regarding acceptance of kitchen sullage there is no confirmation of acceptance by Council's Infrastructure services nor is there any verification from Ballina Shire Council that they will accept the waste. These remain issues that need to be addressed by the applicant in either demonstrating how they comply with Clause 45 Provision of Services of Byron LEP 1988 or Clause 6.6 Essential Services of Byron LEP 2014. The site is not serviced by reticulated water or sewerage and adjoins Coastal Wetlands, the Billinudgel Nature Reserve, and other areas of high value natural vegetation. The DPE needs to be assured that the appropriate management regimes are in place for the Event Site.

The Department of Environment is therefore seeking assistance to review and provide independent advice on a revised Wastewater Assessment Report (W&A 2018) prepared as part of a development application for the permanent use of the North Byron Parklands Cultural Events Site. Revised documents reviewed comprise of:

2018-07-11 Appendix Revised Wastewater Assessment_Copy1

2018-07-11 Appendix F_Revised Potable Water Assessment

2018-07-11_North Byron Parklands_RTS_Jul18

1.2 Purpose of this report

The main purpose of this report is to provide independent advice to the DPE on the proposed revised wastewater management for the site. The key objective is to assess the ability of the proposed scheme to appropriately meet environmental standards and suitable practices.

1.3 Scope and limitations

1.3.1 Work Scope

The scope of work includes the following items:

- Undertake review of Wastewater Assessment Report and relevant chapters of the EIS to determine suitability of the proposed wastewater management approach.
- Engage with Applicant's consultant and Byron Shire Council.
- Where further information has been requested, review Applicant's Response to Submissions Report.
- Undertake additional engagement with Applicant's consultant and Byron Shire Council.
- Prepare final report with recommendations for DPE to consider.

1.3.2 Limitations

This report: has been prepared by GHD for Department of Planning and Environment and *may only be used and relied on by Department of Planning and Environment for the purpose agreed between GHD and the Department of Planning and Environment as set out in section 1.2 of this report.*

GHD otherwise disclaims responsibility to any person other than Department of Planning and Environment arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section 1.4 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Department of Planning and Environment and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.4 Assumptions

GHD has made the following assumptions in the review:

- All the groundwater information used to undertake the assessment was included within the Revised Wastewater Assessment.
- The groundwater level measurements taken were accurate.
- The groundwater quality information was gathered using appropriate sampling methods and practices.

2. Current Management and Proposed Modifications – Original Submission

2.1 General Overview of Current Wastewater Practices

The Parklands site currently operates under a concept plan approval and project approval, granted by the then NSW Planning Assessment Commission (the Commission) on behalf of the Minister for Planning on 24 April 2012 (MP 09_0028). The project approval has been modified on four occasions since this time. The approvals are subject to a trial period, up to the end of August 2019. The approvals allow up to 20 event days a year, comprising 3 small to large events (of up to 35,000 patrons) for up to 10 event days per year, and up to 10 minor community event days (of up to 1,500 patrons).

The proposal is to add more of the same amenities and additional treatment / wastewater disposal facilities to cater for annual attendance of up to 130,288 patrons and staff over 28 days per annum and up to 325 patrons and staff throughout the year at the conference centre, overnight facility and spa. Existing amenities comprise of dry composting toilets, showers, urinals and drinking water dispensing tanks across the camping and festival areas. The proposal is to duplicate these and add plumbed wastewater pump out to the proposed larger treatment facility.

There are currently eight double camping amenities blocks and two single compost toilet blocks, being a total of 246 composting toilets and 192 low flow gas fired showers.

Toilet solid waste is stored in wheelie bins, which are swapped out of the active area during the event and kept in the roofed space between the blocks. Compost seep, men's urinal wastewater and shower greywater are directed to an in-ground 3 kL concrete pump well and then pumped with a grinder pump up to two 23 kL poly storage tanks, contents of which are removed by vacuum trucks.

The installed "greywater" system has a reported capacity of 920 kL, with additional storage for some greywater in various Amenity Block greywater tanks. This is transferred to the management system (large tanks and sand beds) as storage space becomes available.

Blackwater generated from temporary port-a-loos is sent to Byron Shire Council STP under a trade waste agreement. Port-a-loos will be replaced by composting toilets as part of this proposal meaning no blackwater will be sent offsite.

A total of 400 wheelie bins are currently used on the Site for each large event. The composting toilet wheelie bins are placed under the composting seat, with a flexible chute from the toilet seat to an attached wheelie bin lid. This lid is placed over the new wheelie bin to seal the unit. A seepage tube is connected to the base of the wheelie bin and the base of the wheelie bin is filled with straw to reduce solids reaching the drain hole. A piece of Ag pipe is bolted on the inside of each bin to allow liquids to reach the base of the bin and to aerate the compost pile.

Wheelie bins are swapped out of the active area during the event and kept in the roofed space between the toilet and shower sections of the amenity blocks. Seepage is piped to underground wastewater collection tanks at each amenity block for pump out and trucking to the treatment plant. Composting toilet seepage water, urinal, shower and hand basin grey water is trucked to storage tanks and underground disposal. Dried compost from the mobile bins (composted faecal material) is buried on-site above the flood-line. Kitchen and excess other wastewater is trucked offsite to Ballina and Byron Bay STPs (as per event agreements established with Council).

Currently about 1/3 of generated wastewater, sourced from porta-loos, kitchen sullage and non-public wastewater sources, such as laundries and showers, is trucked offsite to a public Sewage Treatment Plant (STP) and a private recycling company. The remaining 2/3 of wastewater consisting of mainly shower greywater, but mixed with urinals and compost seep water is trucked to holding tanks in the wastewater treatment area for on-site land application (Figure 1).

Table 3: Existing Wastewater Streams General Management

Portable toilets	177 kL	BYRON STP
WCT & Urinals	mixed*	
Shower Waste	920 kL	GREYWATER ON-SITE
Shower Waste **	131kL	BYRON STP
Kitchen Waste	259 kL	BALLINA STP

* WCT leachate and urinal waste volumes are not measured separately, these wastes are mixed with shower waste and portable toilet waste and disposed at Byron STP and Parklands.

** Mixed waste from no public areas (performers and staff facilities).

Figure 1 Current wastewater management

2.2 Proposed Wastewater Management

W&A have proposed a combination of biological treatment via septic tanks and a reed bed system. The revised proposal also increases the distance of the treatment system to site users and thereby endeavour to reduce the likelihood of odour complaints and health risks. Other noted improvements include:

- maximised upfront storage during the peak short term rather than post treatment storage in the original design that required a very large treatment system that was oversized for the majority of the year.
- more robust and reliable through parallel treatment rather than single treatment train.
- more robust surface spray irrigation rather than a mix of drip/surface spray, given that drip irrigation can have maintenance and longevity issues.
- provides for a similar application rate of 35 kL/day over 36,000 m^2 disposal area (1 mm / m^2), rather than 50.9 kL/day over 58,000 m^2 area (0.9 mm / m^2).

A significant change to the current practice will involve implementation of the conference centre, with collection of sewage and higher wash water volumes from toilet flushing and washing. The proposed system involves batch compost toilets and partial greywater treatment and disposal on-site, with excess wastewater trucked offsite to Ballina and Byron Bay STPs. It is proposed to continue to remove all medium-large event kitchen waste off-site. The smaller kitchen volumes generated at the conference centre will be stored and treated on-site.

Wastewater will undergo treatment via a reed bed system and chlorine disinfection with effluent proposed to be irrigated. The irrigation site is located on a moderately sloping elevated position underlain by medium clays, with downslope native vegetation. These soils reportedly have good nutrient uptake abilities.

2.3 Previous Findings and Recommendations based on Review

2.3.1 Conclusions

The following key issues were raised on the original EIS submission:

- Water demand for the proposal does not account for staff on-site (including pre and post event set up / clean up days).
- Proposed discharge volumes are stated to be based on historical data yet are only 49.6% of the stated demand for the Proposal. The discharge values adopted in the proposal are not substantiated.
- The wastewater composition for on-site treatment is not substantiated with historical site or other data.
- Proposed wastewater storage capacity of 2.2 ML will fill on day 4/5 of a large event.
- Areas designated for treated wastewater sub-surface discharge, irrigation and compost burial are not proposed to be equipped with infrastructure to control stormwater run-off in case of contamination.
- Significant reed bed overloading will occur on days 5 – 7 of a large event with the consequence that chlorine (or UV) treatment will be ineffective.
- The proposed arrangement allows only for expected year-round average daily flow of 35 kL/day treated wastewater which would theoretically enable two days storage (outside events) in the septic tank and loading of some 1-200 kg BOD/ha.d, on the reed beds which may be suitable. However, BOD monitoring results would need to be confirmed from the proponent and further justification of demand and discharge volumes, before we would be able to regard the acceptability of the system.
- The stated treated water quality for irrigation is considered not to be achievable especially on days 5-7 of a large event.
- The irrigation of treated wastewater on a flood plain area is considered a contamination risk on- and off-site.

Based on the review of the documentation provided and using GHD's technical experience, the number of issues and potential risks highlighted in this report leads to the conclusion that the application is problematic and is likely to impact on the human health and the environment.

2.3.2 Recommendations

Subsequent recommendations were suggested:

- Clarification and substantiation are required for water demand and discharge values.
- Confirmation to be sought from the EPA: a) irrigation allowable on the designated flood prone areas, b) treated water quality for irrigation c) wet weather storage requirements and c) discharge / irrigation control requirements.
- On-site wastewater treatment, storage and disposal requirements to be reconsidered in conjunction with potential hazards and consequences.
- The Applicant should seek permanent agreement with Council for trucked wastewater disposal and confirm quantities per day or event as well as wastewater strength limits acceptable. The possible contributions requirement should also be clarified.

2.3.3 Information required

The following information was also sought for further analysis:

- Quantification of solid waste generation, burial area, tree planting area requirements and sustainability analysis.
- Substantiation of wastewater generation volumes proposed.
- Reconciliation of water demand and wastewater discharge volumes proposed.
- Substantiation of wastewater composition (contaminants loading).
- Substantiation of treatment efficiency to achieve targeted reduced wastewater contaminants loading.

3. Response to Submissions and Modifications to Proposal

3.1 Overview

Parklands' wastewater consultant, Whitehead & Associates (W&A), has provided an updated Wastewater Assessment (W&A, 2018) based on the review and additional consultation. The updated assessment does not include any significant change to the original proposed wastewater management system (as per the EIS), but does include:

- additional water balance assessment.
- review of available borelogs and groundwater data, and wastewater chemistry.
- soil and groundwater investigations within the proposed irrigation area.
- irrigation modelling to confirm that the system would not result in adverse nutrient, salt or pathogen impacts.
- risk assessment.
- clarification of components of the wastewater management system.

The water and wastewater estimates used by W&A were reportedly sourced directly from data obtained from recent Falls Festival and Splendour in the Grass events.

3.2 Water Supply

Currently the Parklands use rainwater and augment the supply with town water brought to site by large tanker trucks. The projected total annual water demand assuming full patronage of the proposed cultural events and an occupancy rate of the conference centre is 11.32 ML pa. It is noted this has actually decreased since the previous submission.

Adequate potable water supplies are reportedly available to the area via the existing combined bulk 580 kL potable water storage tanks and 23 kL potable water storage tank located in the primary flood assembly area. Water is pumped from the bulk tanks to the 23 kL tank, continually filling it as water is used.

The bulk tanks are co-located with their own pump and diesel generator. This water would be used for drinking water supplies for those sheltering on site and would be able to provide up to 10 litres of potable drinking water for each person which would be sufficient for at least 48 hours. In addition, there would be pallets of bottled water supplies which have been delivered for the event and transported to the refuge area.

Potable water supplies would also be available via the proposed conference centre facilities, and the proposed 3.4 ML storage reservoir to be located near the top of the hill on the western boundary at an elevation of approximately 60 m AHD, with all rainfall from roofs stored. Parklands has demonstrated an ability to harvest all water requirements from structures located at the venue. Based on median monthly and annual rainfall data and the roof area of the fully developed site, it is estimated that the potential annual yield is between 15.7 ML and 18.1 ML of rainwater.

The rainwater will be collected and pumped to the storage reservoir then redistributed by a network of water pipes. Water sourced from rainfall on roofs was considered the least vulnerable to contamination by pathogens and therefore minimal treatment will be necessary. However, screening of down pipe headers and first flush systems were recommended to help prevent solids entering the drinking water storage and reduce risk of contamination.

Additional water when required will continue to be sourced from the Byron Bay or Rous Water systems and brought to site using tanker trucks.

3.3 Wastewater Management

3.3.1 Initial stage

Additional amenities blocks are proposed around the Site to provide for campers, and replace porta-loos in parts of the event area and the car parking / bus loading area.

A total 56 composting human waste facilities are located in the designated flood free area which are accessible from the flood emergency assembly area without the need for people to traverse floodwaters (i.e. at the top of the amphitheatre). Wheelie bins of the composting waste are stored in a covered area (Ventilated)

The men's urinals, compost seep and shower water all drain to a common pump well, which is emptied via a vacuum truck and transferred to 4 no. x 230 kL storage tanks. These are connected to a field of 6 no. intermittently dosed bottomless sand filters (20 m long x 1.5 m wide) with manual release valves operated by staff to Effluent Management Areas (EMA) ~ 3 kL/day from each tank.

During the event , 8 no. vacuum trucks transfer wastewater from storage to long term greywater storage tanks in north west area of site and from there to Byron STP by Summerland Environmental on a 24 h / d basis

Compost from the wheelie bins are buried after 3 months.

The Site is claimed to be suited to on-site wastewater management and has the capacity to manage the predicted loads from the proposed five-day large events at 6 month intervals, a three-day medium event, five single-day small events, and two single day minor events, plus the operation of a 180 person conference centre (future – refer below) and ancillary 120 person overnight accommodation and small day spa.

It is noted that the Parklands' wastewater management system is largely 'off-grid', limited metered data is available on wastewater production. However, it is reported that wastewater estimates had been successively refined after each year's events and following introduction of compost toilets, with the 2017 estimates providing the most realistic rates:

- a total of 510 kL of wastewater was exported off-site (with 800 kL retained in storage), totalling approximately 1.3 ML captured and disposed/treated.
- A total of 2.34 ML of potable water was imported to the festival site.

It was noted in the submission, that these values correspond well with that modelled by W&A for the current festivals of 1.4 ML generation and JED Civil's estimate of 2.34 ML water demand.

There are water meters installed on the outlets of the four greywater holding tanks at Parklands. Data indicates a reduction of "grey water" flow from 2 ML in 2016 to 1.3 ML in 2017?? (stored on 4 tanks) – reportedly from introduction of composting toilets.

The overall proposed wastewater management system involves:

- Reuse of compost solids for tree planting on the Site.
- Treatment of wastewater to a secondary level in a reed bed system.
- Disinfection of secondary treated effluent using chlorine disinfection.
- Application by surface spray irrigation with reserve storage and standby infiltration sand beds.

In accordance with the pre-existing approvals, it is proposed to convert the temporary wastewater treatment into a permanent solution, such that the volume of wastewater stored and treated on-site will be increased, reducing significantly the volumes being trucked to Byron and Ballina STPs for treatment.

There are an additional eleven amenities blocks proposed, which will be constructed as per the original seven amenities blocks, though vacuum trucks will progressively be replaced with permanent rising mains to the treatment plant.

Due to the differences and risks associated with storing and treating trade waste quality effluent from kitchen sullage during the medium-large events compared to the blackwater/greywater mix that is/will be generated from the amenities and conference centre, it is proposed to continue to remove all medium-large event kitchen waste off-site. The smaller kitchenette volumes generated at the conference centre will be stored and treated on-site.

An on-site treatment system is proposed which includes a three day withholding wet weather storage and an above floodplain emergency land application area, plus a pre-event withholding period of up to 4 weeks per event, which can be used in cases of direct flood situations or to catch up on the irrigation cycle following these events. The land application area is reportedly based on a detailed water balance that accounts for higher rainfall periods (i.e. a lower land application rate to account for increased soil moisture) and use of vegetation uptake zones adjacent to drains. The proposed irrigation area involves 36,000 m^2 footprint (more than double the claimed hydraulic loading requirement of approximately 17,000 m^2).

The treatment system is claimed to be a fully secondary treated and disinfected effluent. The irrigation area for effluent application is located in the northeast corner of the Parklands site, with no adjacent dwellings or public areas. The surrounding property to the north is agricultural in nature and owned by Parklands' investors. The nearest dwelling is located about 660 m to the northeast of Parklands. Spray irrigation is allowed for considering the distant location of nearest residences. It is noted that historically councils in NSW have struggled with spray irrigation at domestic properties due to poor design, installation, maintenance and operation.

In meeting with Byron Shire Councils' Director of Infrastructure Services and the General Manager on the 12th of April 2018 to discuss wastewater quality issues. It was determined that a blending rate of 50% "black water" to 50% "greywater" would guarantee an acceptable receiving strength of wastewater directed to Council's STPs. Once the on-site treatment system is constructed, disposal to BSCs STP will not be required as greywater and blackwater will be treated onsite. It is noted the following have been required to undertake disposal to Council STPs:

- All wastewater loads to be delivered to Council's STP to be diluted at a ratio of 50:50.
- Onsite ammonia testing to be conducted for all loads prior to departure to confirm ammonia levels are at or below 400 mg/L.
- Including the above blending requirements into a one-year contract.
- Parklands to develop a concise procedure covering the above blending requirements and audit the implementation (or otherwise) of this procedure.

The on-site treatment system is proposed to be staged and has been designed to treat the stored wastewater (Wastewater from each event will be stored in holding tanks before being incrementally treated over the ensuing five to six months). W&A have undertaken detailed storage calculations to confirm storage requirements, which seems suitable.

It was reported in the submission that the development of the on-site treatment systems was to allow the venue to maintain its triple bottom line of financial responsibility, as well as social and environmental credentials and aspirations. The proposed septic tank and reed bed

system will be low energy. However, GHD is concerned about the apparent contaminant concentration, what the reed bed will be capable of removing and also the disinfection ability noted. GHD is also significantly concerned about the intended apparent storage of high strength wastewater for several months.

W&A note that reed beds have a high acceptance rate and maintenance/installation contractors in the Northern Rivers of NSW with proven BOD/TSS/TN/FC retardation rates. While GHD are not disputing this, there needs to be some proven technologies indicated for a treatment system of this size. Many reed beds have been installed for real grey water systems (i.e. shower and washwater, but they do not include urine or seepage from compost material, which contains high organics).

3.3.2 Future advent of Conference centre

The Conference centre has a 180 person capacity – with staff and public toilets. There are 30 pods which provide accommodation for up to 4 people, with bathroom, shower, toilet, and kitchenette. The centre will also include spa facility, showers and toilets.

It is proposed to utilise wet composting toilets (WCT) for all pods and the day spa reception area, which operate with 500 mL flushing mechanisms. Standard 4-star flushing toilets would be utilised in the conference centre amenities.

Showers will have water saving heads, and will drain to wet well and pumped to storage tanks to be treated at the on-site treatment system.

It is planned to combine all greywater and compost seep liquid wastewater streams from each event and the conference centre in a series of holding tanks, and to treat and apply the wastewater at a throttled daily rate, gradually reducing the storage volume in the holding tanks between the two large events each year.

So the overall wastewater management (refer Figure 2) involves:

- Ongoing use of dry compost toilets in dedicated amenities blocks for the festival precinct.
- A mix of micro flush compost toilets at conference accommodation and associated day-spa and flushing toilets at the conference centre.
- Festival kitchen sullage to be collected and trucked offsite to Ballina or Byron Bay STPs (544 kL/annum).
- Collection of compost seep, hand basin and shower greywater, urinal water, and conference centre kitchen sullage in a series of pump-wells, and transfer to a treatment system located near existing temporary holding tanks.
- Installation of minimum 2.38 kL storage capacity in eight storage tanks.
- Construction of septic tanks, and a custom reed bed treatment system of 467 m^2 area capable of treating 35 kL/day to a secondary standard, with chlorine disinfection. The treatment system consists of four parallel treatment trains.
- The treated effluent to be applied to the land over 36,000 m^2 via surface spray irrigation, with a backup short term application area of the existing 24 Intermittently Dosed Sand Filter Beds.

It is noted in the revised document that further details and design solutions will be required for the actual s68 application to operate the On-Site Sewage Management System (OSMS) with Byron Shire Council, and a comprehensive Wastewater Management Plan (WWMP) to be prepared.

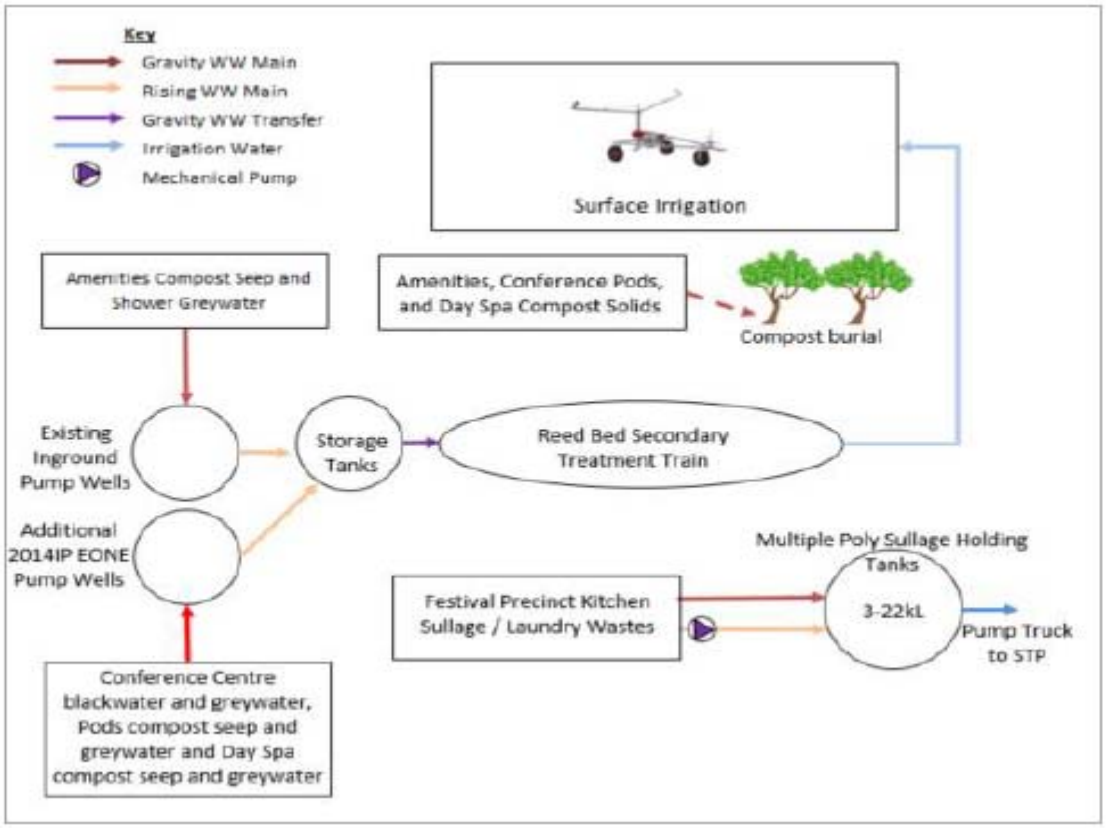

Figure 2 Proposed wastewater management

3.3.3 Volume and Characterisation of Wastewater

Estimates for volume generated over the year involve:

- Annual volume of some 9,235 kL wastewater generated.
- The design peak daily wastewater generation large festivals is 540 kL/day.
- Smaller wastewater generation rates of 266 kL/day for medium ranging down to 6 kL/day for minor festival days were calculated.
- The conference centre could generate up to 17 kL/day during full capacity.

W&A note that the volume of estimated wastewater is based on review of events and following introduction of compost toilets, with the 2017 estimates providing realistic current rates. The claim that water supply values correspond well with modelling and water delivery (ratio of 0.6 wastewater to water), is considered on the low side, and GHD suggest that 0.75 – 0.85 may be more likely, but can only be confirmed with monitoring.

GHD still consider the numbers used for wastewater production rates seem low, and they are certainly very low compared to published figures, although it is noted that event values have been used and it is also acknowledged that the installed water use reduction measures (timed showers, dry compost toilets, etc.) will contribute to lower volumes generated.

The greatest discrepancy is considered to be the allowances for the conference and spa centre, which based on expected occupancy rate and general allowances would be around 40 – 60 % more than what W&A have nominated. Again, it is acknowledged that there will be wastewater reduction from standard allowances with installation of composting toilets and water saving devices, but if people are staying in accommodation, they do not tend to minimise usage of water. It is also noted that the characteristics adopted (Table 11 in Appendix E submission) are more concentrated than sewage (despite contradiction in the page above that there will be “low strength influent of similar to weaker strength effluent compared to a domestic system”).

3.3.4 Suggested performance of treatment system

The pre- W&A concept comprised a mechanical sewage treatment plant (regarded as relatively standard) using activated sludge biological treatment for nutrient reduction. The current revised proposal was developed by W&A reportedly from first principles and is based on septic tanks (primary treatment using sufficient detention time) and adoption of reed beds (natural system) to produce an equivalent secondary standard effluent quality. However, the proposed sizing of the system is considered of insufficient capacity and reliability under the site conditions, to achieve the targeted results.

W&A note that over the last four years approximately 1.8 ML of greywater has been disposed annually at a design application rate of 12 mm/m^2/day. Inspection of the application areas at regular intervals over that period has not shown any surfacing or short circuiting of greywater. **GHD comment:** site inspection will reveal ponding but not short circuiting of greywater i.e. ingress into groundwater or surface water. During the site inspection by GHD it was observed how rainwater readily ponded on the target irrigation area and rainwater continuously drained into waterways via the subsurface drainage pipes which discharged into drains carrying water off-site (refer previous GHD report and site photos showing drainage water into environmental flow). This is regarded as being of significant concern if residual contaminant in treated wastewater could ingress the surrounding waterways.

The proposed area of irrigation is 3.6 ha, and based on the proposed wastewater volume of some 9.2 ML pa, seems to be appropriately sized to meet typical hydraulic requirements, but the main issues are likely to be related to nutrient loading and this is discussed below.

Stated performance of the proposed treatment system and comparison with industry accepted performance levels are as follows:

Table 1 Stated performance of proposed on-site treatment system

Process Unit	Contaminant	Effluent Quality, mg/L	Adopted / allowed for reduction	Typical reduction[Ref]
1	2	3	4	5
Septic Tank	BOD	150 mg/L	67 %	25 – 35 %
	SS	26 mg/L	80 %	50 – 65 %
	TN	190 mg/L	50 %	0 – 20 %
	TP	22.8 mg/L	40 %	0 – 10 %
	Faecal Coliforms	1 x 10^5 cfu/100mL	2 log removal	0- 0.5 Log removal
Reed beds	BOD	8 mg/L	95 %	35 – 85 %
	SS	3 mg/L	88 %	50 – 85 %
	TN	48 mg/L	75 %	10 – 60 %
	TP	19.8 mg/L	13 %	0 – 30 %
	Faecal Coliforms	1 x 10^2 cfu/100mL	3 log removal	0.5 - 2.5 Log removal

Reference: Mount barker case study, South Australia and GHD waste water treatment experience.

As can be seen comparing the W&A stated contaminant reduction (column 4) vs industry accepted reduction values (column 5), unrealistic treatment efficiencies have been adopted for the proposed effluent treatment system. GHD is not convinced that the stated relatively low concentrations of contaminants in treated effluent (column 3) will be achieved.

The reed bed loading at 112 kg BOD/ha.d is probably a little high, but it is considered that the BOD load will be approximately double what has been allowed for (which means that the BOD loading on the reed beds will be significantly above accepted criteria). Most reed bed systems are designed for smaller equivalent population than this proposed system and do not treat

concentrated urine based wastewater (i.e. they have been designed to treat real grey water which is typically from the kitchen, laundry and showers).

Consequently, it is considered that a low nutrient level i.e. treated water quality suitable for irrigation re-use, will not be achieved by the proposed treatment system. GHD's estimate is that N and P levels likely will be closer to 150 – 200 mg/L and 30 – 35 mg/L respectively in the irrigated effluent.

In addition, GHD considers that a reed bed system is not capable of achieving SS concentration in the effluent < 5 – 10 mg/L. The proposed use of chlorine may also be problematic and it is considered there is an error in the estimated dosage of disinfectant. Suggested chlorine dosage is 0.48 kg tablets per day, stating that the product is of 65 % chlorine concentration. However, tablets are typically granular calcium hypochlorite and based on molecular weight available chlorine is about 49 %, which means that some 1 kg of tablets will be required daily to treat 35 kL/day. However, GHD consider that the state of effluent is likely to require significantly more than this. A risk arising from relying on high chlorine levels to achieve the desired outcome is that chlorinated organics constitute environmental issues and risks.

Notwithstanding the supposed issues with the originally recommended mechanical package treatment plant (activated sludge treatment), the reported overstated performance of the proposed reed beds, is of significant concern. Associated with this, are other risks of the proposed system:

- GHD do not regard urine as grey water, and so, the presumed wastewater will be significantly more contaminated than normal grey water, which means that intuitively, insufficient allowance has been made in the design of the current proposed system,.
- There are some gross misrepresentation / reliance of likely performance from septic tanks.
- Stored wastewater being treated over time: GHD are not aware of any systems that store wastewater for the period of time suggested for this proposal (> 3-4 months).

3.3.5 Air quality / odour

While there are some statements about odour minimisation, GHD is concerned about the following aspects which are likely to contribute to odour and general area amenity:

- Storage of wastewater effluent over several months awaiting treatment.
- Septic tank storage / operation.
- Overloading of reed beds.
- Storage of compost / human waste in bins (acknowledging this is the current practise, but increase in number of bins is likely to increase odour potential).

While mitigation measures are claimed will be developed as part of the Wastewater Management Plan, including measures to ensure the appropriate management of wastewater and minimise generation of odours, there is no specific details in the documents in regards to this.

3.4 Summary

Table 2 Comparison of previous submission and revisions

	Previous submission	Revised value / infrastructure	Comments

Water Usage	15.6 ML pa.	11.32 ML pa	Basis sounds plausible but this represents a significant change in volume
Wastewater generated		9.32 ML pa	No change, justification of values provided
Wastewater storage	2,200 kL	2,800 kL	8 no. storage tanks To allow for sludge accumulation and higher than expected flows. Storage provided over 423 day cycle
Septic tanks		77 kL total volume, 4 no. parallel 19.25 kL septic tanks	No change
Reed beds	4 no. beds, total area of 244 m^2	4 no. beds, total area of 466 m^2	Increased to provide reliability, robustness based on reviewed influent quality

Based on the above, there are still considered to be issues, notwithstanding the apparent reported correlation with existing generation rates:

- Low wastewater volume estimate from the conference centre.
- Odours from storage of effluent – outloading – any aeration proposed – GHD are unaware of any treatment facilities storing large volumes of effluent for extended periods of time.
- Use of effluent for irrigation and apparent inability to cater for the concentration of contaminants.

4. Management of effluent irrigation

4.1 Hydraulic loading to the irrigation areas

Section 9.1 of the Revised Wastewater Assessment discusses the water balance models created by W&A to determine the suitable effluent irrigation rates. Two water balance models were created to check the sizing of the irrigation area, including:

- The Byron Shire Council OSMS Design Model (used for the initial sizing of the irrigation area).
- The Medli V2 model for the irrigation area to confirm the suitability of the selected area for grass growth, leaching, nutrient impacts and pathogen impacts.

Hydraulic models have been developed using the 9.32 ML pa of wastewater generation predicted for the development. As discussed in section 3.4 of this report, the wastewater volumes predicted by W&A, appear low or overly conservative, but are not unfeasible. An assessment of the water balance provided by W&A has been made assuming that the wastewater volumes used are feasible, while also taking the conservative approach that they may under-estimate to wastewater volumes possible from the development.

A detailed assessment and check of the calculations completed was not completed of the hydraulic models, however, the assumptions used have been examined and the following observations are made:

- The water balances state that 36,000 m^2 is required to dispose of 8,780 kL annually, with the remainder of the total 9,235 kL trucked from site to trade waste. This appears generally consistent with the information provided on wastewater generation for the site.
- Section 9.1.4 of the Revised Wastewater Assessment indicate that whereas only 36,000 m^2 is required for irrigation, there is a total of 265,550 m^2 available as potential irrigation area in the broad camping area and another 15,780 m^2 in the grassed amphitheatre area. This indicates considering the area available alone, even if wastewater volumes have been underestimated, there is sufficient area available to dispose of water.
- Climate data utilised for onsite models and the plant selected (Cynodon dactylon pasture) appear appropriate for this assessment and the quality of the wastewater to be applied.
- Modelling indicates that rainfall run-off constitutes the proportion of drainage through the site, with no discernible contribution from irrigation

The above information, and the discussion in the report, indicates that the irrigation is feasible and sustainable. However, a high-level review of the provided information raised a number of concerns as discussed below.

For instance, the figures in the Revised Wastewater Assessment indicate a very small portion of the available area for irrigation within the camping area as selected for irrigation. The area selected as EMA2 is located at the north-eastern extent of the site, corresponding to the areas where the shallowest groundwater was encountered and therefore the highest risk of waterlogging. This area is also the closest portion of the site to existing waterways. The report is not explicit as to why these areas were selected for irrigation rather than areas further to the west within the camping ground. It is presumed the reasoning behind the selected area is that it is further from potential receptors of spray irrigation, therefore reducing health risks. A cursory examination of figures appended to the report indicate that there is more than sufficient area to irrigate areas located further west without posing health risks to site users, provided adequate controls are provided.

The Revised Wastewater Assessment details assumptions used in the hydraulic modelling. Most of the assumptions made in the modelling appear appropriate, however, the following are noted as in need of further consideration:

- Wastewater application rates – minimum of 0 m^3/day, maximum of 35 m^3/day. A flow weighted average appears to have been used for the model of 24.04 m^3/day. Information provided in Appendix E of the report indicates that wastewater volumes will often be at the maximum rate of 35 m^3/day for much of the year, cycling between 17 m^3/day and 0 m^3/day between April and July with no irrigation applied during major events (i.e., mid-year for Splendour in the Grass, over the New Year period for the Falls Festival, and another break-likely attributed to another major event-for October-November). A flow weighted average is likely to be adequate to estimate annual loadings, but maximum loading rates should be conservatively used to assess the likelihood of irrigation drainage to shallow groundwater at any irrigation event/month. It is not clear on cursory assessment if this has been included in the modelling.
- Assumptions of rainfall loadings used in the model – Appendix E of the assessment notes that irrigation triggered when soil water deficit reaches 1 mm and rainfall is less than or equal to 50 mm. Section 9.3 states also that irrigation will not occur when there has been 10 mm of rain or greater on the day of irrigation. Given that the soils in the proposed irrigation area are prone to waterlogging and there is a shallow water table pre-existing, there are concerns that portions of the site may not be suitable for irrigation after 10 mm of rainfall (i.e., already waterlogged). This means that the model may over-state how many days in the year the site may be suitable for irrigation. It is not clear from the information shown if this could be offset by a larger irrigation area than allowed for.
- Run-off to site drainage – the proximity to site drains at regular intervals at the site and the shallow water table indicates that significant recharge of the groundwater beneath the site is almost certain. The Medli modelling indicates that the contribution of irrigation effluent to this run-off volume is very small. ***The main issue is not the hydraulic load to drainage, but the concentration of nutrients and contaminants in the drainage water; which is discussed further below***.

4.2 Nutrient and contaminant loading of irrigation area

Nutrient loadings to the irrigation area associated with the irrigation of effluent to the nominated irrigation area are provided in Section 9 of the Revised Wastewater Assessment. The models, utilising the nitrogen and phosphorus concentrations predicted by the assessment, indicate of low risk of groundwater contamination from nitrate and adequate phosphorus absorption capacity of the soil of approximately 28 years, longer than the predicted lifespan of the proposed development.

However, as discussed in section 3 of this report, it is considered that the nutrient loads predicted in effluent generated from the proposed treatment process have been largely underestimated. GHD's assessment notes that nitrogen in the effluent may be 150 mg/L to 200 mg/L and phosphorus 30 mg/L – 35 mg/L; much higher than the concentrations used for the Medli model created for the 36,000 m^2 irrigation area (48 mg/L nitrogen and 19.8 mg/L phosphorus). If the concentrations of nutrients in the wastewater have been underestimated (for the reasons stated in section 3), this will increase the potential load of nutrients to the land and discharge to the underlying shallow groundwater. In particular, the following is noted:

- The phosphorus absorption capacity of the soil will be exhausted far sooner than the 28 years stated. Once the phosphorus absorption capacity of the soil is exhausted, there is potential for phosphorus contamination of groundwater.

- The concentration of nitrates discharging to onsite drainage at the site will likely increase from the stated 0.81 mg/L; the report has stated a threshold limit of 1 mg/L as acceptable discharge, higher nitrogen concentrations will likely result in an exceedance of this value. It is noted that there is no reference to where the 1 mg/L acceptable limit is sourced from and that the nitrogen concentration in the groundwater based on the 2010 groundwater quality results ranges from 1.52 mg/L to 2.03 mg/L.
- If the final nutrient concentrations are nitrogen > 100 mg/L and phosphorus > 20 mg/L, this classifies as 'high' strength effluent in accordance with the NSW Environmental Management Guidelines – Use of Effluent by Irrigation.
- It is noted that the Revised Wastewater Assessment characterises the site, especially EMA 2, as having 'moderate to major' site constraints for both site physical characteristics (i.e., depth to water table) as well as chemical characteristics (i.e., pH, cation exchange capacity, exchangeable sodium percentage, and phosphorus sorption capacity). Sites posing 'major' constraints to irrigation with effluent, are poor candidates for irrigation with 'high' strength effluent. On this basis, it is important that the efficacy of the proposed wastewater treatment to achieve the final contaminant levels is confirmed.

The concerns regarding the accuracy of the wastewater treatment standards achievable as stated in this report therefore also translate into concerns regarding the accuracy of the nutrient balance calculations.

4.2.1 BOD, SS and thermotolerant coliforms

Section 3.3.4 discusses concerns regarding the ability of the proposed wastewater system to meet the stated treatment standard.

The NSW Effluent Reuse Guidelines (DEC 2004) provides limited, high-level guidance for BOD, SS and microbial quality of effluent for irrigation; more detailed advice in this regard is provided in the Australian Guidelines for Water Recycling, which indicates the following minimum standards for municipal use (i.e., open space irrigation with restricted public access following irrigation): BOD < 20 mg/L, SS < 30 mg/L, E.coli < 100 cfu/100 mL. Information provided in this report indicates that there is doubt regarding if the proposed treatment system can meet this minimum standard of treatment for end use. The Revised Wastewater Assessment states a minimum of 15 m from the point of the edge of irrigation to the nearest drain, which discharges to groundwater; 15 m is the absolute minimum allowed for the Australian Guidelines and will be insufficient if the water quality is less than stated in the Revised Wastewater Assessment.

4.2.2 Other considerations

The onsite soils have an extremely low soil pH (< 5) for both irrigation areas. Irrigation with effluent on soils with a very low or very high soil pH may result in toxicity of nutrients and/or other chemical elements in the soil. If the soil is not free-draining (i.e., waterlogged) an anaerobic soil environment may persist at times, this may already occur under natural/pre-existing site conditions, however, the application of high strength effluent to soils that are acidic and are not free-draining may adversely alter chemical conditions and the concentration of potential contaminants – such as ammonia and nitrate, that is discharged to groundwater and waterways.

Very high sodicity of soils in EMA 2 (CEC = 27) indicates this soil will require significant amelioration prior to any irrigation occurring. The Revised Wastewater Assessment quotes management through the application of gypsum or lime. Gypsum should not be used as a soil conditioner at this site as it will further reduce the soil pH, only lime should be used. Significant amelioration with lime would be required to reduce the CEC in this area to acceptable levels (i.e., less than 10, ideally less than 5). On this basis, an alternative irrigation area, further from

potential drainage lines (that could receive run-off from poorly structured, waterlogged soils) would be more suitable.

5. Groundwater and surface water impacts from irrigation

Section 4.1, 4.2 and 4.3 of the Revised Wastewater Assessment discusses the groundwater conditions at the site. The information drawn upon utilising work by Gilbert and Sutherland in March 2010 as well as work conducted by W&A in June 2018.

A detailed assessment and check of the information provided in the Revised Wastewater Assessment was not completed. The following sections breakdown the observations and concerns during GHD's review.

5.1 Groundwater level information

The Revised Wastewater Assessment discusses groundwater level information within section 4.3.1, GHD notes the following observations in regards to the groundwater level information presented:

- The Revised Wastewater Assessment states that there is "*no discernible groundwater flow direction based on groundwater intercepts below ground surface levels*". Groundwater flow cannot be determined based on depths below ground level, all groundwater levels need to be compared to a standard datum such as metres Australian Height Datum (mAHD). If the nature of the topography is very flat as descripted in assessment, it is likely that the hydraulic gradients would be low; however, groundwater contour maps of the site are needed to support this.
- The Revised Wastewater Assessment states "*the presence of the drains suggests that seasonal shallow groundwater would flow to the drains with localised mounding (< 0.05 m) in the centre of the paddocks midway between the drains".* GHD agrees with the general logic that groundwater may flow to the drains with localised mounding in the centre of the paddock (however no evidence is provided for the depth quoted for the mounding).
- The groundwater depths quoted in section 4.3.1 of the Revised Wastewater Assessment for the site range from 0.3 m to 1.7 m below ground surface with seasonal waterlogging noted to be occurring (as per table 5 of the Revised Wastewater Assessment). Given the shallow groundwater depths, waterlogging may occur due to irrigation when the site is irrigated outside of the "seasonal waterlogging" period.
- In relation to the seasonal changes in groundwater levels, two record points (and albeit not at the same monitoring locations) approximately 8 years apart does not allow for the rigorous assessment seasonal variability of groundwater levels. Collection and presentation of monthly or quarterly time –series groundwater level data is required, preferably over a number of years, along with rainfall data, is needed to interpret seasonal variability of the water table. As there are some shallow groundwater levels, monthly data collection is suggested as a minimum in the higher risk areas. This time-series groundwater level data could also be used to provide interpreted groundwater level contours across the site, and interpreted depth to groundwater map in the drier (summer) and wetter (winter) periods to better identify the water logging risk.
- Within the Revised Risk Assessment, registered groundwater bores are discussed in table 4 and 5, regional groundwater flow is discussed in section 4.3.1, however no groundwater contour information (as noted above) or map showing the location of neighbouring

registered groundwater bores is included in the assessment. The groundwater information at the registered groundwater bores (such as groundwater levels if available in mAHD and aquifer monitored) would help inform the regional groundwater contours. The contours would then give an appreciation if any of the registered groundwater bores or groundwater dependent ecosystems (GDE's) would likely be a receptor if the wastewater was to contaminate the groundwater.

- The soil permeability discussion in the Revised Wastewater Assessment (section 4.2.3) presents information from boreholes located near EMA 1 and near the centre of the site but not at any bores located within or near EMA 2 where depth to seasonal water table and groundwater have been assigned major risks in the assessment (table 5 and 4 respectively).
- Table 8 in the Revised Wastewater Assessment specifies the location of each bore in relation to EMA 2; some bores are listed in table 8 as being within EMA 2 however figure 5 shows that only bores H18-606/2, H18-606/4, H18-606/5, BH22, BH23 and BH17 are within the zones designated as EMA 2. The table also does not provide groundwater level information for bores near EMA 1 or the remainder of the site.
- It is observed that the Revised Wastewater Assessment does not include a conceptual model with the inclusion of a hydrogeological cross section. The assessment should include a hydrogeological cross section that features onsite and offsite groundwater levels, groundwater flow, direction of run-off, potential offsite groundwater receptors (i.e. GDE's, waterways, bores), site drainage and hydraulic properties of groundwater bearing units underlying the site (eg. permeability).

5.2 Groundwater quality information

The Revised Wastewater Assessment discusses the main groundwater quality information within section 4.3.2, GHD notes the following observations in regards to the groundwater quality information presented:

- Section 4.3.2 of the Revised Wastewater Assessment discuss the groundwater chemistry collected at the site in 2007 and 2010. The report states that the "groundwater chemistry indicates that groundwater at the Site has already been impacted by land clearing and groundwater lowering and historical sugar cane". Although changes in groundwater chemistry and physical properties is likely from the aforementioned land use changes; there is insufficient groundwater chemistry provided in the assessment to indicate this.
- The same section of the assessment, it was stated that groundwater guidelines were not available so the groundwater quality data was just compared to the ANZECC (2000) Freshwater and Lowland River guidelines. However, the National Water Quality Strategy (ANZECC/ARMCANZ 1994) lists beneficial uses (also termed environmental values) to be protected. Criteria have been developed to characterise water quality relative to these beneficial uses and are outlined in the Australian and New Zealand Guidelines for Freshwater and Marine Water Quality, the Australian Drinking Water Guidelines and the Australian guidelines for managing risks in recreational waters. Additionally the NSW aquifer interference policy (AIP) is not discussed or assessed against in the revised wastewater assessment; this policy indicates that activities with the potential to contaminate groundwater are considered to be an aquifer interference activity. The key national and NSW specific groundwater policy and guidelines related to groundwater should be discussed and used in the assessment process. It should be noted that under S120 of the Protection of the Environment Operations Act 1997, it is an offence to pollute waters unless permitted under a licence.

- The groundwater quality provided in table 9 of the Revised Wastewater Assessment is at least 8 years old and may not be representative of current groundwater quality underlying the site.
- The assessment specifies in section 4.3.2 that given the elevated phosphorous and nitrogen, any future irrigation regimes would not be required to meet a zero addition but no increase from baseline conditions; this sentence does not make sense, if there is to be no increase from baseline conditions then that would mean zero addition is required. It is also noted that there is no reference or specification of the baseline concentrations.

5.3 Impact to groundwater from irrigation

The Revised Wastewater Assessment discusses the risks of EMA 1 and EMA 2 in relation to "Groundwater" and "Depth of Seasonal Watertable" in table 4 and 5 of the report respectively. These tables do not provide a clear explanation as to why the levels of constraints have been adopted.

In the current form, GHD have determined that there is insufficient information provided in the Revised Wastewater Assessment to accurately determine the risks to groundwater.

5.4 Impact to surface water from irrigation

In section 4.1 of the Revised Wastewater Assessment, the nearest waterways to the site were identified to be Billinudgel Creek about 1 km to the east and Crabbe Creek around 1 km to the north. GHD notes that Billinudgel Creek also runs to the south of the existing camping zone shown in Figure 2 and is within 500 m of the camping zone and runs through the site boundary.

It is likely that groundwater and surface water run-off that flows into the drains will end up flowing into these creeks. Further information is needed to assess the risks to these creeks and whether potential increased nutrient loads to the creek will have an adverse impact to the creeks ecological value.

6. Regulations and Standards

Effluent recycling is encouraged in NSW where it is safe and practical to do so.

Water quality requirements for beneficial reuse for pastureland, involves treatment to secondary treatment as follows:

- BOD < 20 mg/L
- TSS < 30 mg/L
- TN / TP dependent on land strata by typically < 40 and < 7 mg/L respectively
- Faecal coliforms < 1,000 cfu/100 mL

If the parklands are regards as recreational area then the contaminant levels will be reduced further. GHD has not defined this.

The main issues really arise from the wastewater quality suggested – it is not considered that the proposed treatment system will meet the effluent quality defined in table 2.

Also, given that that urine is certainly part of the wastewater, the effluent should not be considered as true grey water.

7. Summary, Conclusion & Recommendations

The proposed on-site management for wastewater at the site to cater for major events and year round conference and minor events is a mix of disposal routes and has been defined as follows:

- Ongoing use of compost toilets in dedicated amenities blocks for festival precinct;
- A mix of micro flush compost toilets at conference accommodation and associated day-spa and flushing toilets at the conference centre;
- Festival kitchen sullage to be collected and trucked offsite to Ballina or Byron Bay STPs (544 kL/annum) or Summerland Environmental;
- Collection of compost seep, hand basin and shower greywater, urinal water, and conference centre kitchen sullage in a series of pump-wells , and transfer to a treatment system located near existing temporary holding tanks;
- Installation of minimum 2.38 kL storage capacity in eight storage tanks;
- Construction of septic tanks and a custom reed bed treatment system of 467 m^2 area capable of treating 35 kL/day to a secondary standard, with chlorine disinfection. The treatment system consists of four parallel treatment trains;
- The treated effluent to be applied to the land over 36,000 m^2 via surface spray irrigation, with a backup short term application area of the existing 24 Intermittently Dosed Sand Filter Beds.

As Byron Council have noted it will require appropriate design, management, operational/ qualified expertise, maintenance, monitoring, co-ordination, liaison, quality assurance, auditing and reporting to be successful. However, there are considered to be some shortcomings in the proposed design, which are as follows:

- Potential underestimation of wastewater volumes from conference centre
- Characteristics of the wastewater defined as low strength, but includes urine, and so is more concentrated than grey water (and sewage)
- Exaggeration of contaminant reductions over the treatment system, potentially overloading the irrigation area in terms of nutrients;
- Lack of definition about Summerland Environmental and how they deal with waste
- Lack of trade waste agreement with Bryon and Ballina Councils to cater for kitchen waste
- Storage of large volumes of untreated wastewater for several months which is likely to lead to vector issues and odours
- Ability of proposed system to achieve secondary treated effluent quality (especially in regards to nutrient reduction and bacteriological quality)
- Need to reconsider disinfection system
- Odour generation from storage of wastewater and also compost / human waste wheelie bins
- Irrigation nutrient overloading due to insufficient biological treatment and controls.

Waste water treatment: GHD concludes, based on the information reviewed, that the proposed on-site waste water treatment system will not achieve and maintain the treatment levels required for irrigation re-use and consequently will constitute an environmental contamination

risk if implemented as such. Detailed design of the currently proposed treatment system will not resolve the issues identified. The implementation of waste water treatment technology and system capacity suitable to manage and treat the waste water volume and contaminant levels to reliably achieve contaminant reduction to suit irrigation will have to be done at the Development Application and S68 application stage. An approved conceptual design would then be detail designed and approved for construction as a subsequent stage.

Treated waste water land application: GHD have identified deficiencies in the groundwater information presented including the currency of the data, the time period of data presented, missing information, comparison of groundwater information against relevant national and NSW guidelines and use of groundwater information to support conclusions presented in the Revised Wastewater Assessment.

8. References

Australian and New Zealand Environment and Conservation Council / Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) 1994, *Water Quality Management – An outline of the policies*, April 1994

Whitehead & Associates Environmental Consultants (W&A) 2018, *Wastewater Assessment for North Byron Parklands*, prepared for Byron Venue Management Pty Ltd, July 2018.

Appendices

Appendix A – Review document references

Documents provided by the DPE reviewed by GHD:

Document Ref. No.	Title/Description
DOC17/627209	North Byron Parklands Environmental Impact Statement, dated 11 December 2017 https://majorprojects.accelo.com/public/1abeb2daf0ed4e1c713c1e846df024ce/03_North%20Byron%20Parklands_EIS_Dec17_Part%203.pdf
DOC 17/627209-06	Appendix R – Wastewater Assessment for North Byron Parklands, dated 8 December 2017 https://majorprojects.accelo.com/public/d4bd82c3a8f0189304ef2d261e616a6b/Appendix%20R_Wastewater%20Assessment.pdf
DOC 18/496173	North Byron Parklands – Response to Submissions Report dated 11 July 2018 (Attachment)
DOC 18/496182	Appendix E – Revised Wastewater Assessment dated 27 June 2018 (Attachment)
DOC 18/496185	Appendix F – Revised Potable Water Assessment dated June 2018 (Attachment)

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Document Status

Rev.	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	M Laginestra J Stephens	C Joubert		P Chier	Pp 	10 Sept 2018
0	M Laginestra J Stephens	C Joubert		J Perrin		18 sept 2018
						

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