

Our Ref: 210674

12 July 2022

Chris Larkin
Byron Shire Council
70 - 90 Station Street
Mullumbimby NSW 2482

Dear Chris,

Byron Bay Sewerage Treatment Plant Third Party Review – Condition Satisfaction

Barker Ryan Stewart have been contracted by Byron Shire Council to carry out a Third Party Review of condition satisfaction in line with the 'Byron Bay Sewerage Augmentation Scheme – Conditions of Approval'.

It is understood that Byron Shire Council seek to confirm that continued compliance with the conditions of approval has been met, with particular attention to conditions 6, 8 and 9 relating to the capacity of the sewerage treatment plant.

This letter relates to conditions 6, 8 and 9.

Condition 6

West Byron STP shall not accept flows for treatment in excess of 6.95 ML/day Average Dry Weather Flow (ADWF). This is the plant's treatment capacity. Council shall continuously monitor the Average Dry Weather Flow (ADWF) entering the upgraded West Byron STP to assess the load on the plant in relation to the plant's treatment capacity. When 80% treatment capacity is reached, Council shall investigate feasible strategies for management of sewage flows above the capacity of the plant. In the event that load exceeds 100% treatment capacity, Council shall meet to discuss appropriate courses of action to prevent further exceedances.

The West Byron STP inflows for the latest reporting period as shown in the *Byron Bay Sewage Treatment System EPA Licence No. 3404 Annual Return Summary Report 27 April 2021 to 26 April 2022* show an average flow of 5,496kL/day (say 5.5ML/day). Note that this is an annualised average flow, in a reporting period with rainfall of ~2,520mm which is approximately 35% higher than the average rainfall for the area according to Australian Government Bureau of Meteorology records from 1892 to 2022, hence the ADWF is expected to be lower than this. Using the 5.5ML/day as a conservative number for ADWF, this represents 79.1% of the maximum ADWF treated flows of the West Byron STP, slightly below the 80% trigger for investigations to commence on feasible strategies for management of sewage flows above the capacity of the plant. While the average flows in the latest higher-than-average-rainfall reporting period and hence ADWF are shown to be lower than the 80% threshold, it is understood that Byron Shire Council have commenced the investigation process of plant upgrades and other management strategies for sewage flows above the capacity of the plant.

The below graph from the January 2020 quarterly report to the Byron Bay Wastewater Steering Committee shows the trend in actual measured flows to the West Byron Sewage Treatment Plant (STP) from 2002 to 2019, while also showing approved Equivalent Tenements (ET's). A line of best fit shows a linear relationship with both the ET approvals and the annual daily average flows to the STP.



Figure 1 – Measured Flows to West Byron STP as provided in January Quarterly Report

The following observations can be made from the above graph

- Drought conditions such as those experienced in 2019 correspond to lower measured flows to the STP
- Prediction of flows for 2022 based on the line of best fit show flows in the range of ~5.25-5.35ML/day average (ADWF), which substantiates the approximation of current average flows being 5.5ML/day.

Council have noted that they have never monitored the ADWF flows as per the definition in condition 3 of the consent as this has potential to obtain skewed results due to the large flow variations over the three flow periods (summer peak in December/ January and over Easter; a winter low and the "shoulder period" during the remaining time), noting that ADWF in the winter can be as low as 60% of the summer peak.

On 22 March 2018 Council Resolution 18-193 adopted the Policy - Water and Sewer Equivalent Tenements 2018 that includes the Dry Weather Flow definition: *The average daily flow to the treatment works during seven consecutive days without rain (excluding a period which includes public holidays) following seven days during which the rainfall did not exceed 0.25 millimetres on any one day.* The ability to redefine how 'Average Dry Weather Flows' are calculated is documented as part of condition 3.

While the above definition of ADWF is current, it is understood that Council measure ADWF figures on an average of the full years flow totalised daily at the Byron STP. The top 20% and bottom 10% of data are removed from the calculations to exclude rainfall effect and recording anomalies from the figures used. The result is the annual ADWF as measured by Council. Further redefinition of ADWF to suit this measuring technique is believed to be pursued by Council.

The treatment capacity of the West Byron STP of 6.95ML/day (AWDF) has not been exceeded based on the latest reporting period showing inflow to the plant, and as such this condition is currently satisfied.

Condition 8

The transfer of sewage flows from South Byron STP to West Byron STP catchment shall be conditional upon:

- (i) West Byron STP satisfactorily meeting all applicable performance requirements as per construction contract requirements and as specified in the plant's Environment Protection Licence and in this approval; and
- (ii) the availability of a reuse project(s) capable of accepting a minimum of 326 ML/yr of treated effluent as determined in the Effluent Management Strategy.

i) It is assumed that prior to the transfer of sewage loads from South Byron STP to West Byron STP, that the West Byron STP was shown to satisfactorily meet all applicable performance requirements as per construction contract requirements and as specified in the plant's Environment Protection Licence and in the consent approval;

ii) The 326ML/ year effluent reuse requirement has been set to meet the critical nutrient parameter, being total nitrogen (TN), in the receiving environment - see *Byron Bay Sewerage Augmentation Scheme Environmental Impact Statement Volume 2 Section 9.7 (EIS)*. The requirement for nutrient re-use was set such that the instream nutrient concentrations in Belongil Creek would be maintained at or below the pre-transfer loadings (year 2000 loadings) after the transfer of sewage from South Byron STP to West Byron STP.

Appendix K of the *Byron Bay Sewerage Augmentation Scheme Environmental Impact Statement Volume 3 'Effluent Reuse Calculations'* notes the potential reuse projects available to satisfy the effluent reuse target are:

- Establishment of the 24ha Melaleuca regeneration area in southern portion of West Byron STP site*
- Continued effluent re-use on 3.9ha of land at Byron Bay Golf Club

* Trees noted to be planted at a rate of approximately 5 ha per annum. The trees take approximately 8 years to achieve maturity and therefore optimal re-use capacity over the whole site would occur approximately 12 years after commissioning.

The effluent re-use rates for the 24ha Melaleuca regeneration area are given in Table 9.13 below.

**Table 9.13 MELALEUCA REGENERATION AREA – EFFLUENT RE-USE RATES
(BOLTON 2001)**

Year after commissioning	Dry (ML/yr)	Average (ML/yr)	Wet (ML/yr)
1	8.2	7.7	2.4
2	23.5	19.2	5.8
3	53.3	40.3	11.0
4	109.0	96.0	23.5
5	193.4	173.8	49.0
6	297.1	273.1	87.8
7	414.2	389.8	138.2
8	531.4	509.8	196.3
9	622.6	595.2	247.2
10	685.0	658.6	285.1
11	720.0	692.6	307.2
12	734.4	705.6	316.8

Figure 2 – Effluent Re-Use Rates for 24ha Melaleuca Regeneration Area as per EIS Volume 2

The EIS notes that the 3.9ha Byron Bay Golf Club has the capacity to provide the following effluent re-use:

Rainfall Year	Effluent Reuse Capacity
Dry	11.0 ML/ year
Average	10.6 ML/ year
Wet	6.2 ML/ year

Table 1 – Byron Bay Golf Club reuse capacity with 3.9ha area

Total combined effluent re-use for the 24ha Melaleuca regeneration area and Byron Bay Golf Club, according to the EIS:

Table 9.14 COMPOSITE EFFLUENT RE-USE RATES FOR PROJECT

Year	Dry (ML/yr)	Average (ML/yr)	Wet (ML/yr)
0	11.0	10.6	6.2
1	19.2	18.3	8.6
2	34.5	29.8	12.0
3	64.3	50.9	17.2
4	120.0	106.6	29.7
5	204.4	184.4	55.2
6	308.1	283.7	94.0
7	425.2	400.4	144.4
8	542.4	520.4	202.5
9	633.6	605.8	253.4
10	696.0	669.2	291.3
11	731.0	703.2	313.4
12	745.4	716.2	323.0

Figure 3 – Combined Effluent Re-Use Rates for 24ha Melaleuca Regeneration Area and Byron Bay Golf Club as per EIS Volume 2

From above it can be seen that:

- In Wet years – the two re-use projects provide **99%** of the required effluent re-use to meet the 326ML/ yr target.
- In Average years - the two re-use projects provide **219%** of the required effluent re-use to meet the 326ML/ yr target.
- In Dry years - the two re-use projects provide **228%** of the required effluent re-use to meet the 326ML/ yr target.

The West Byron STP itself reuses approximately 0.08L/day (based on metered usage) on site via the treatment process and for wash down purposes, totalling 29.2ML/ year.

With the 24ha Melaleuca Regeneration area, the Byron Bay Golf Club and the West Byron STP on site reuse, it is clear that there are re-use projects capable of accepting a minimum 326ML per year of treated effluent in the worst case 'Wet' scenario, with the 'Average' and 'Dry' year scenarios having reuse capacity >200% of the target rates.

As such, Condition 8 part (ii) is satisfactory.

Condition 9

Additional load at West Byron STP will not be accepted until:

- (i) the transfer of 100% of the sewage flows from South Byron catchment;
 - (ii) West Byron STP satisfactorily meeting all applicable performance requirements as specified in the plant's Environment Protection Licence and in this approval;
 - (iii) availability of sufficient reuse capacity to accommodate 100% of the volume of treated effluent generated by the additional load; and
 - (iv) availability of treatment capacity as defined in Approval Condition 6 above.
- (i) It is understood that the transfer of 100% of the sewage flows from South Byron catchment has occurred
 - (ii) It is assumed that the West Byron STP has been shown to satisfactorily meet all applicable performance requirements in the plant's Environment Protection Licence and in this approval, and evidence of such is provided in regular 'Annual Return Summary Reports' produced by Byron Shire Council as part of the EPA Licencing agreement.
 - (iii) The condition requires reuse capacity be available at a rate of 100% of the volume of treated effluent generated by additional loads. Since the West Byron STP augmentation approval date there have been 2,791 ET's approved by Council, hence reuse capacity is required to be shown with a quantity of at least 2,791 ET's. Based on Council's *Policy - Water and Sewer Equivalent Tenements 2018* which specifies that 1 sewer ET = 590L/day, 2,791 ET's = 1.65ML/day or 601ML/year.

The condition does not specify if the availability of reuse capacity is to come from projects that satisfy the provided definition of a 'reuse projects', as per Condition 3, or not. The condition also fails to specify if the volume of treated effluent capacity is to be calculated on Dry, Average or Wet conditions. Considering ET's are defined in the *Byron Shire Policy - Water and Sewer Equivalent Tenements 2018* as 'the average residential water consumption of 630 litres per day per dwelling and sewerage loading of 590 litres per day per dwelling', average flows will be used.

Reuse Capacity Available

The available reuse capacity will be the lesser of:

- a) The capacity of the system to deliver the treated effluent
- b) The reuse capacity of the sites receiving the treated effluent

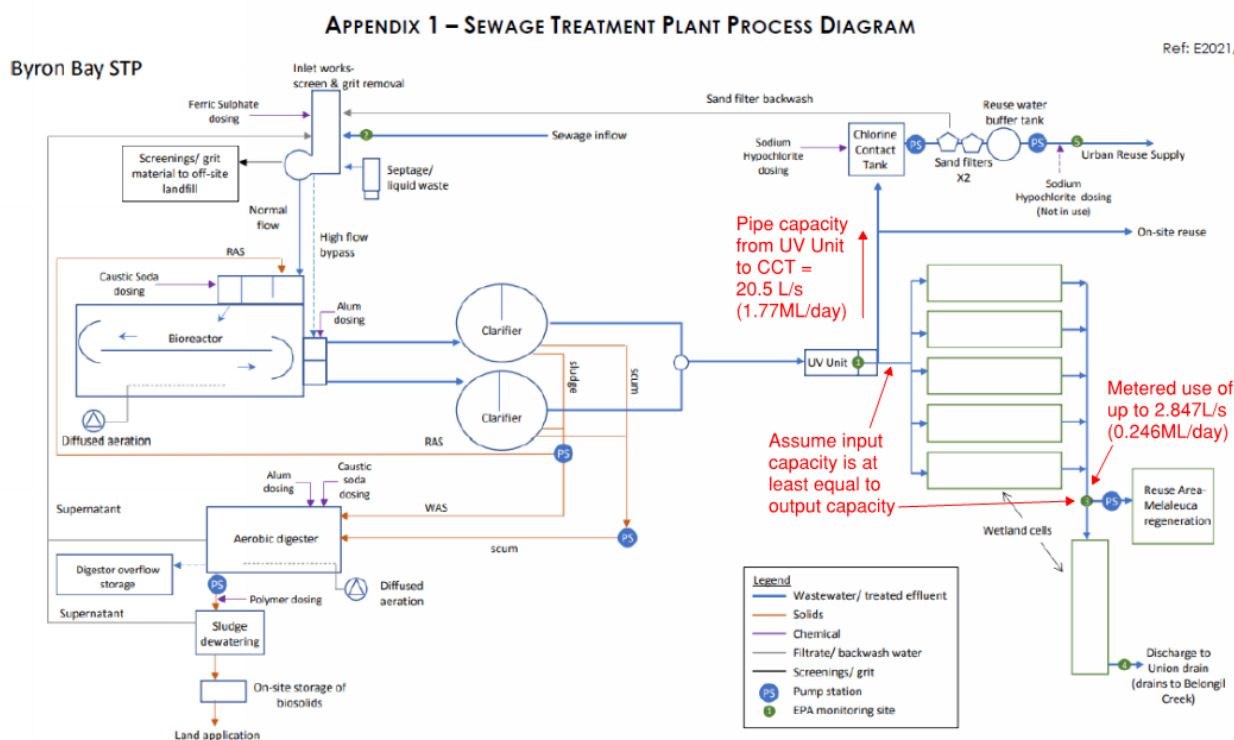
Capacity of the system to deliver the treated effluent

Measured flows show that the operating capacity of the reuse system to produce treated effluent is 26 litres per second. This data was recorded in real time by the West Byron STP Tertiary Filter Flow Meter over a period from April 2019 to July 2020. The 26 litres per second or 2.25ML/day, is reduced by 10% for filter backwash purposes equating to 2.02ML/ day or 3,427 ET.

The report '*ASSESSING THE DEMANDS & SUPPLY CAPACITY OF THE BYRON BAY URBAN RECYCLED WATER SCHEME*' by Planit dated 6 February 2018 assessed the capacity of the STP infrastructure to deliver the treated effluent, and found that the maximum theoretical flow from the UV tank to the Chlorine Contact Tank (CCT) is 20.5L/s (1.77ML/ day or 3,002 ET's), this however is only the pipe for the STP onsite reuse and urban reuse and does not account for the reuse flows from the UV Tank to the wetland cells and then into the Union Drain or the Melaleuca regeneration area. The *Byron Bay Sewage Treatment System EPA Licence No. 3404 Annuals Return Summary Report (27 April 2021- 26 April 2022)* showed (via flow meter) that flows at EPA monitoring site (3), downstream of the wetland cells, were up to 0.246ML/ day in the reporting period.

Assuming the pipe or other delivery capacity upstream of the wetland cells is at least the same as the capacity downstream, the theoretical capacity of the piped system to convey treated flow is 1.77ML/ day + 0.246ML/day = 2.016ML/ day or 3,416 ET's.

See below diagram using extract from *Byron Bay Sewage Treatment System EPA Licence No. 3404 Annuals Return Summary Report (27 April 2021- 26 April 2022)*.



#E2022/47382 - 2021-22 Annual EPA Compliance Reports for Byron Bay STS Licence #3404

11

Figure 4 – Diagrammatic of STP Process, extract from *Byron Bay Sewage Treatment System EPA Licence No. 3404 Annual Return Summary Report 27 April 2021 to 26 April 2022* with annotations in red

Reuse capacity of the sites receiving the treated effluent

Reviewing the most recent *Byron Bay Sewage Treatment System EPA Licence No. 3404 Annuals Return Summary Report (27 April 2021- 26 April 2022)*, reuse is provided by the Melaleuca regeneration area, West Byron STP onsite reuse and urban reuse.

Urban reuse is metered and noted in the above report to average 999kL/ day or 364.6ML/ yr for the reporting period. Again it is noted that the reporting period was a wetter than average year, hence reuse demand would be expected to be lower than an average rainfall year. Urban reuse has been metered since 2006 with reuse values up to 424.7ML/ yr (2019), however for the purpose of this report it is conservatively assumed the capacity of the urban reuse system is 364.6ML/ yr as per the most current reporting period metered reuse.

The effluent reuse capacity of the Melaleuca regeneration area is specified previous as per the EIS and noted as 705.6ML/ yr in an 'Average' rainfall year.

Onsite reuse within the STP has been shown (metered) as 29.2ML/ yr in the most recent reporting period.

Source	Effluent Reuse	Capacity or Metered
24ha Melaleuca Regeneration Area	705.6 ML/ yr	Capacity
West Byron STP on site	29.2 ML/ yr	Metered
Urban Reuse	364.6ML/ yr	Metered
Total	1099.4ML/ yr	

Table 2 – Effluent Reuse by source

Assuming the capacity for reuse is equal to the metered reuse (being a conservative approach), the Melaleuca regeneration area, West Byron STP onsite reuse and urban reuse total 1,099.4ML/ yr or 3.01ML/day capacity. With a reuse capacity available to offset additional loads of 3.01ML/ day, this allows additional loads of up to 5,105 ET's.

Even in a wet year where the 24Ha Melaleuca Regeneration area is limited in effluent reuse to 316.8ML/ yr, with the urban reuse of 364.6ML/ yr and the onsite STP reuse of 29.2ML/ yr the combined total of these reuse components totals 710.6ML/ yr which is 3,300 ET's – again which is conservative as it takes the capacity of the urban reuse as the metered flows, when in the past there have been metered flows up to 424.7ML/ yr (2019).

Therefore, the capacity of the reuse system is limited by the infrastructure to deliver the treated effluent at **2,016ML/ day or 3,416 ET's**. This is conservative as part of the makeup of these flows is based on metered reuse, and capacity must be at least this amount. Considering the next limiting factor is the ability of the STP to produce treated effluent and is within 11 ET's of this, assuming a capacity of 3,416ET's is deemed appropriate.

This shows that at least 3,416 ET's could have been approved since the West Byron Augmentation approval date, and 2,791 ET's have been approved as per Oct 2021 quarterly report. The reuse capacity provided is shown to be larger than the volume of treated effluent from the additional loads, with an excess of 625 ET's (as per Oct 2021 quarterly report).

- (iv) The ongoing Annual Summary Reports provided by Byron Shire Council indicate that the West Byron STP has available treatment capacity to provide for up to 6.95ML/ day (ADWF).



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