FICHTNER

Consulting Engineers Limited

Newhurst Energy Recovery Facility

Encyclis Limited

Environmental Risk Assessment

Package Treatment Plants

ENGINEERING CONSULTING

Document approval

	Name	Signature	Position	Date
Prepared by:	James Sturman		Principal Consultant	05/11/2024
Checked by:	Stephen Othen		Technical Director	08/11/2024

Document revision record

Revision no	Date	Details of revisions	Prepared by	Checked by
00	08/11/2024	For Client comment	JRS	SMO
01				

Contents

1 Introduction 4

2 Detailed assessment – Emissions to water 5
2.1 Assumptions and parameters 5
2.1.1 Effluent flow rate – from PTPs to attenuation pond 5
2.1.2 Effluent composition – from PTPs to attenuation pond 5
2.1.3 Attenuation pond – discharge flow rate 5
2.1.4 Discharge composition – from attenuation pond to Shortcliff Brook 6
2.1.5 River flow rates – Shortcliff Brook 7
2.1.6 River quality data – Shortcliff Brook 7
2.2 Assessment methodology 8
2.3 Assessment steps 9
2.3.1 Identify reported and target standards 9
2.3.2 Assess if receiving water currently meets its reported and target standards 10
2.3.3 Calculate the allowable discharge limit 11
2.3.3.1 Calculation of River Needs Permits (RNC) 11
2.3.4 Inputs to RQP software 12
2.3.5 Outputs from RQP software 13
2.3.6 Decide if it is feasible to meet these limits 13
2.3.6.1 Ammoniacal nitrogen 13
2.3.6.2 SRP (Soluble Reactive Phosphorous) 13
2.3.6.3 BOD 14
2.3.7 Check statutory requirements on emission limits 14
2.3.8 Check non-statutory requirements on emission limits 15
2.3.9 Confirm final discharge and controls 15

3 Conclusions 16

Appendices 17
A RQP software results 18
A.1 RQP software results – Ammonia 19
A.2 RQP software results – SRP 21
A.3 RQP software results – BOD 22
A.4 RQP software results – Word output documents 25

1 Introduction

Encyclis Limited (Encyclis) is applying to the Environment Agency (EA) under the Environmental Permitting Regulations (EPRs) for a bespoke discharge permit, to allow for the discharge of treated domestic effluents to surface water.

There are two package treatment plants (PTPs) proposed at the Newhurst Energy Recovery Facility (the Facility), which will treat domestic effluents from welfare facilities. It is proposed to pump the treated effluents from the PTPs to the on-site attenuation pond, which will have a subsequent discharge to Shortcliff Brook. Further information on the design of the PTPs is provided in the supporting information to the application.

The aim of this report is to assess the environmental risks associated with the proposed discharge to surface water and demonstrate that this does not pose an unacceptable risk to the environment. The assessment has been developed to consider the requirements of the Environment Agency (EA) H1 Guidance. While it is acknowledged that the H1 guidance documents have been withdrawn, it is understood that the requirements of the guidance are still applicable under Environment Agency Guidance *'Risk assessments for specific activities: environmental permits',* which replaced H1 with alternate (albeit less prescriptive) guidance in February 2016.

2 Detailed assessment – Emissions to water

The environmental impact of the discharge of treated effluents to surface water has been evaluated using the guidance and methodology set out within H1 Annex D2. The assessment is supported by the EA's 'River Quality Planning (RQP)' software for calculating River Needs Permits limits.

2.1 Assumptions and parameters

2.1.1 Effluent flow rate – from PTPs to attenuation pond

As described within section 2.1 of the supporting information, the peak discharge volume of treated effluent from the PTPs is 3.5 m^3/day, and takes into consideration the peak flows from the Facility, i.e. during daytime periods where the Facility will have a high occupancy, and the design capacity of the package treatment plants. This equates to a flowrate of approximately 0.0405 l/s.

The peak discharge volume has been calculated using conservative assumptions for plant personnel and visitors present on site. Under normal operations, the PTPs are not likely to discharge at the peak discharge volume. Therefore, the assessment is conservative.

2.1.2 Effluent composition – from PTPs to attenuation pond

The supplier has confirmed the treatment quality of the unit (PTP2) to be as follows:

- Biochemical Oxygen Demand (BOD): 20 mg/l
- Suspended Solid Concentration: 30 mg/l
- Ammoniacal Nitrogen (NH_3-N) Concentration: 20 mg/l

For the purposes of this application, it is assumed that effluent from PTP1 will be the same quality as PTP2. The effluent has been assessed assuming a discharge into the attenuation pond at the guaranteed concentrations listed above. This is a conservative assumption, as the measured levels are expected to fall below the guaranteed levels.

No data was available for phosphate concentrations guaranteed by the package treatment plants. However, average concentrations are available from literature, specifically Natural England's study '*Phosphorus in Package Treatment Plant effluents*' (2016). The report concludes that average concentrations of Soluble Reactive Phosphorus (SRP[1]) in package treatment plant discharges are approximately 5.6 mg/l. Therefore, this concentration has been used in the assessment.

2.1.3 Attenuation pond – discharge flow rate

The current EP for the Facility allows for a discharge point 'SW1' from the attenuation pond to Shortcliff Brook. For the purposes of the assessment, this watercourse is assessed as a 'river' (as the H1 guidance classes surface waters under rivers, estuaries, coastal waters, lakes and canals). The majority of the water within the attenuation pond will comprise uncontaminated surface water from the site surface drainage systems; however, a small quantity is proposed to be made up of treated domestic effluents resulting from the operation of the PTPs. A minimum volume of water will be retained as permanent standing water in the attenuation pond.

[1] Environmental standards relate to SRP and not total phosphorus – refer to section 2.3.1.

The outfall flow limits from the attenuation pond are as follows for the 1 in 1 year (Q1), 1 in 30 year (Q30) and 1 in 100 year (Q100) runoff rates (including climate change allowance):

- Q1 – 14.1l/s;
- Q30 – 14.1l/s; and
- Q100 (+CC) – 30.9l/s.

For the purposes of this assessment, a flow of 14.1 l/s from the attenuation pond has been assumed as this is considered to represent a 'typical' scenario. It is acknowledged that the amount of surface water present in (and being discharged from) the attenuation pond will vary depending on weather conditions, and accordingly the level of dilution of the effluents from the PTPs will also vary. During periods of dry weather, the effluents will be more concentrated in the attenuation pond; however, there is unlikely to be water discharged from the attenuation pond when levels are low. During very wet weather (Q100 + CC), this would result in a large dilution of the effluents from the PTPs, but assuming this flow rate would not allow for a conservative assessment.

The overall flow between the PTPs and the attenuation pond is visualised in Figure 1.

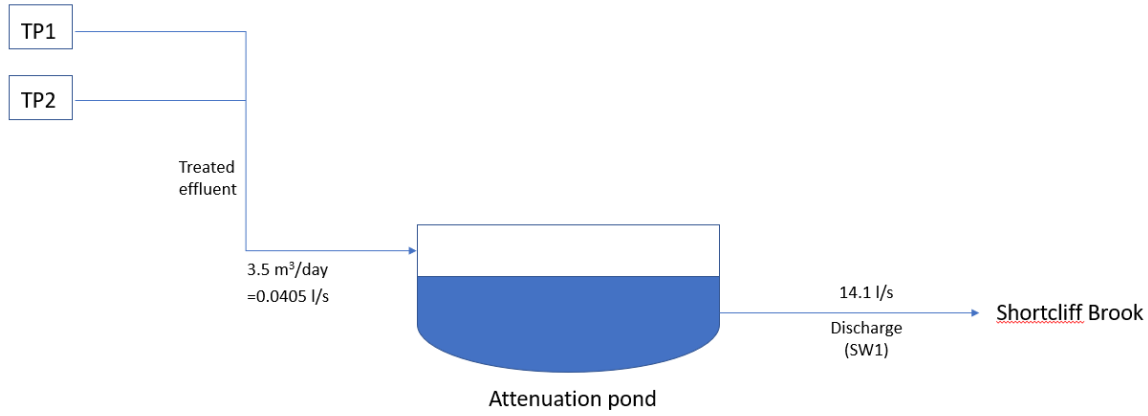


Figure 1: Flow schematic

2.1.4 Discharge composition – from attenuation pond to Shortcliff Brook

The treated effluents from the PTPs will be diluted by the uncontaminated surface water already present in the attenuation pond before being discharged off-site.

The resulting concentration in the discharge can be determined from the flow rate of the effluent into the attenuation pond, the flow rate of the discharge out of the attenuation pond, and applying the logic that all contaminants entering the attenuation pond are released in the discharge, i.e. mineral mass is conserved.

$$Concentration\ in\ discharge = Concentration\ in\ effluent \times \frac{Effluent\ flow\ rate}{Discharge\ flow\ rate}$$

Table 1: Concentrations in discharge to Shortcliff Brook

Substance	Concentration in treated effluent from PTPs to attenuation pond (mg/l)	Concentration in discharge from attenuation pond to Shortcliff Brook (mg/l)
Biochemical Oxygen Demand	20	0.0579

Substance	Concentration in treated effluent from PTPs to attenuation pond (mg/l)	Concentration in discharge from attenuation pond to Shortcliff Brook (mg/l)
Suspended solids	30	0.0868
Ammoniacal nitrogen: NH_3-N	20	0.0579
Soluble Reactive Phosphate	5.6	0.0162

2.1.5 River flow rates – Shortcliff Brook

Details of river flow rates were obtained from the original planning application for an integrated waste management facility at the site (dated 2007). Specifically, '*Chapter 12 – Hydrology*'[2] presents the following flow rates for the Shortcliff Brook:

- Q10 = 3.2 Ml/day (± 20% error) (= 37 l/s).
- Q30 = 1.4 Ml/day (± 15% error) (= 16.2 l/s).
- Q95 = 0.3 Ml/day (± 35% error) (= 3.5 l/s).

The estimated flow rates were provided by the EA. Q10 provides an estimate of high flows for the watercourse, Q30 is the mean flow, and Q95 is a low flow estimate.

The ES chapter goes on to describe how additional flow monitoring was undertaken at the Shortcliff Brook, which corroborated the figures supplied by the EA. Therefore, these figures are considered to be representative of actual flow rates at the Shortcliff Brook.

2.1.6 River quality data – Shortcliff Brook

The Site Condition Report submitted with the original permit application says that "*there are no Environment Agency water quality monitoring stations on the Shortcliff Brook, however, spot sampling was undertaken by RPS in January 2006 at five locations. Full details and the water quality results can be found in the Hydrology section of the planning application*".

Appendix 12.2 of ES Chapter 12 from the original planning application (dated 2007) provides the water quality sampling results. Results for parameters relevant to this assessment have been extracted and are presented in Table 2.

Table 2: Water quality sampling results - Shortcliff Brook (RPS, 2006)

Parameter	LOD/units	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Concentration carried into assessment
Hardness total	<1 mg/l $CaCO_3$	334	312	336	338	335	331 (average)
BOD	<1 mg/l	<1	<1	<1	<1	<1	1*
Total Suspended Solids	<10 mg/l	<10	<10	<10	16	<10	16**

[2] RPS (2007) – Newhurst Integrated Waste Management Facility – Environmental Statement Chapter 12 – Hydrology and Flood Risk.

Parameter	LOD/units	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Concentration carried into assessment
pH value	<1.00 pH Units	8.67	8.59	7.99	8.08	8.40	8.35 (average)

**For the purposes of the assessment, the concentration is conservatively assumed to be 1 mg/l.*

***For the purposes of the assessment, the concentration is conservatively assumed to be 16 mg/l.*

SRP and ammonia were not assessed as parameters in the water quality sample analysis, so concentrations specific to the Shortcliff Brook could not be established. However, data from the EA water quality archive has been extracted and is presented within Table 3.

Table 3: EA water quality data – SRP and ammonia

Parameter	Units	Concentration carried into assessment
Orthophosphate (SRP)	mg/l	0.205
Ammoniacal Nitrogen as N (Total ammonia)	mg/l	0.0798

Note: Data extracted for monitoring point 'Black Brook D/S Blackbrook Reservoir', as this is considered to be most representative of Shortcliff Brook. Shortcliff Brook joins Burleigh Brook and subsequently Black Brook further east to the monitoring point. https://environment.data.gov.uk/water-quality/view/sampling-point/MD-46679100. 98 samples were taken between 2012 and 2021. The average concentrations (excluding samples below the limit of detection) have been carried into the assessment.

2.2 Assessment methodology

The relevant methodology is set out within H1 Annex D2 – "*Assessment of sanitary and other pollutants within Surface Water Discharges*". This guidance covers the "*continuous, such as treated sewage or trade effluents, or process discharges from installations or waste sites*". The assessment methodology implements the requirements of the Water Framework Directive, with a key aspect of the legislation being 'No Deterioration'.

The following pollutants and determinands[3] are relevant to continuous discharges:

- Sanitary:
  - BOD;
  - ammonia;
  - suspended solids;
- phosphorus;
- pH; and
- temperature.

The assessment methodology comprises two tests to determine whether the discharge to surface water is acceptable:

1. it does not cause deterioration in quality of the water body receiving the discharge; and

[3] Dissolved inorganic nitrogen (the sum of nitrate, nitrite and ammonia as N) is also listed as being a relevant pollutant, although this is relation to designated sites including TraC waters. Therefore, this is not relevant to the Shortcliff Brook.

2. the receiving water body meets its target quality standards.

The relevant standards against which the impact of the discharge should be assessed are set out within Appendices C and D of H1 Annex D2 and are discussed further in section 2.3.1.

To determine if continuous discharges of trade or sewage effluent are likely to be acceptable, the guidance recommends that the following steps are followed:

1. identify the uses, objectives and target standards for the receiving water body of your discharge (section 2.3.1),
2. assess if receiving water currently meets the reported and target standards (section 2.3.2),
3. calculate allowable discharge limits (section 2.3.3),
4. decide if it is feasible to meet these limits (section 2.3.6),
5. check statutory requirements on emission limits (section 2.3.7),
6. check non-statutory requirements on emission limits (section 2.3.8); and
7. confirm final discharge and controls (section 2.3.9).

The assessment has been undertaken In accordance with these steps and is detailed within section 2.3.

2.3 Assessment steps

2.3.1 Identify reported and target standards

The relevant physico-chemical environmental standards for rivers are set out within Appendix D of H1 Annex D2. As identified within section 2.2, pollutants relevant to sanitary discharges include BOD, ammonia and suspended solids. There are standards available for BOD, ammonia and phosphorus, but no standards available for suspended solids. Therefore, suspended solids have been excluded from the scope of the assessments.

Standards for BOD and ammonia vary depending on the river 'type'. As the bed of Shortcliff Brook is at an altitude of approximately 87.5m AOD[4], and total hardness in the river ranges between 312 – 338 mg/l $CaCO_3$ (refer to Table 2), it is understood that Shortcliff Brook is a 'Type 7' river in accordance with the H1 guidance. The relevant environmental standards for Type 7 rivers are set out within Table 4.

Table 4: Environmental standards for BOD and ammonia: Type 7 rivers

Parameter	High	Good	Moderate	Poor
BOD (mg/l) (90 percentile)	4	5	6.5	9
Total ammonia as nitrogen* (mg/l) (90 percentile)	0.3	0.6	1.1	2.5

**This is also known as ammoniacal nitrogen.*

For phosphorus, the standards are for Soluble Reactive Phosphorus (SRP) and similarly vary depending on the type of river. For the purpose of determining the correct SRP standard, Shortcliff Brook is classed as a 'Type 4n' river (upland, high alkalinity) as a result of its altitude and total hardness. The guidance states that "*the standards for phosphorus in rivers are currently under*

[4] SLR – Environmental Permit Application: Site Condition Report (January 2010).

review" and that "*an announcement on the outcome of the review is expected shortly*". The updated standards are available in the document '*Updated recommendations on phosphorus standards for rivers: River Basin Management 2015 – 2021*' produced by the UK Technical Advisory Group on the Water Framework Directive in August 2013. The updated standards are presented in Table 5.

Table 5: Environmental standards for SRP: Type 4n rivers (upland, high alkalinity)

Parameter	High	Good	Moderate	Poor
SRP (µg/l) (annual mean)	24	48	132	898
SRP (mg/l) (annual mean)	0.024	0.048	0.132	0.898

The guidance also recommends checking the impact of effluent temperatures and pH on receiving waters against appropriate standards. Unfortunately, data was not available regarding the temperature and pH of the effluent; therefore, assessment of these parameters could not be undertaken. However, these parameters will be included for in the periodic monitoring of the discharge from the site. Furthermore, it is expected that the discharge will be released from the site at ambient temperatures, as the majority of the discharge will comprise uncontaminated surface water runoff which will be at ambient temperatures. In addition, it is expected that the PTPs will not heat the effluents during the treatment process.

2.3.2 Assess if receiving water currently meets its reported and target standards

The targets/standards for the waterbody are set out within the Humber River Basin Management Plan. It is understood that updated River Basin Management Plans are currently being produced by the EA. A consultation on the draft plans is being undertaken between 22 October 2021 and 22 April 2022.

Using the EA's catchment data explorer, the relevant Water Body ID is "*Wood Brook Catchment (trib of Soar)*" (Ref: GB104028047080)[5]. Data is available which shows the level of deterioration of the waterbody over time and the change in status in relation to different classification items.

The status of the waterbody in relation to targets for each relevant parameter is set out within Table 6. As stated within Appendix D of H1 Annex D2, BOD is not used in clarifying the status of water bodies. Therefore, for this parameter, the status against target standards cannot be determined.

Table 6: Status of waterbody against target standards

Item	Status (2019)	Target standard for 2015 (current River Basin Management Plan)	Target standard for 2027 (draft River Basin Management Plan)
Ammonia	High	Good	N/A – Already met
Phosphate	Poor	Good	Good

Note: Data presented is from 2019 (latest data available).

As can be seen, in relation to ammonia, the waterbody exceeded its target standards.

[5] https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028047080

In relation to phosphate, the waterbody did not meet its 2015 target standard of 'good'; therefore, the target date for compliance is proposed to be extended to 2027 according to the draft plan. However, the EA has a 'low confidence' that this target will be met, giving 'disproportionately expensive' and 'disproportionate burdens' as the reasons.

According to the EA's catchment data explorer, the reasons for not achieving good status (RNAG) and reasons for deterioration (RFD) are as follows:

- poor livestock management – agriculture and rural land management;
- transport drainage – urban and transport; and
- sewage discharge (continuous) – water industry (*i.e. large wastewater treatment works*).

2.3.3 Calculate the allowable discharge limit

The new discharge being applied for should meet the requirements of 'no deterioration' for the receiving water. The procedure for calculating permit limits depends on whether the receiving water meets the reported standards and target standards for each substance/determinand.

The methodology for determining proposed permit limits is set out within Appendix A "*Calculation of River Needs Permits*" (RNC) of H1 Annex D2. The purpose of this appendix is to calculate the allowable discharge concentration for each substance/determinand which would achieve 'no deterioration'. Specifically, parameters of concern include: ammoniacal nitrogen, BOD and phosphorus, as these form the basis of the physico-chemical water quality classification scheme of the Water Framework Directive. BOD is a way of limiting the dissolved oxygen deterioration, although it is not used as part of the formal classification process, as indicated by the note to Table 6.

The EA's preference is for there to be no overall increased polluting load to the water body. For new discharges, the discharge must be managed so that the overall polluting load does not increase for each element (ammonia, phosphorus or BOD). Where this is not feasible or cost effective, the EA may allow a class deterioration of up to 10% in the current water quality, so long as this does not cause a deterioration beyond the class boundary for each parameter.

The calculation of the allowable discharge limits is discussed further in section 2.3.3.1.

2.3.3.1 Calculation of River Needs Permits (RNC)

The RNC provides the calculation of numerical limits that are placed on permits for discharges to rivers. The permit limits are standards that need to be achieved at the discharge in order to meet specified numerical values for water quality standards in the river. The limits can be calculated using the EA's RQP (River Quality Planning) software.

The mixing of a discharge with a river is described by the following Mass Balance Equation, which forms the basis of the calculations in the software:

$$T = \frac{FC + fc}{F + f}$$

where:

- T is the concentration of pollutant downstream of the discharge.
- F is the river flow upstream of the discharge.
- C is the concentration of pollutant in the river upstream of the discharge.
- f is the flow of the discharge.

- c is the concentration of pollutant in the discharge.

The most commonly used quality standards for rivers are the annual 90th-percentiles for the Biochemical Oxygen Demand (BOD) and Total Ammonia (i.e. ammoniacal nitrogen), and the annual mean standard for Phosphate (i.e. SRP). The 90th-percentiles are standards that will be achieved with the required degree of reliability so long as the concentration specified as the 90th-percentile limit is exceeded for no more than 10% of the time. Similarly, the discharge limits for BOD and Total Ammonia that are derived from the calculations will be expressed as annual means or annual percentiles.

The guidance describes how a single application of the Mass Balance Equation cannot be used to calculate the permit limits, and how a statistical distribution analysis must be undertaken using Monte-Carlo Simulation. The RQP software allows this statistical analysis to be undertaken.

2.3.4 Inputs to RQP software

Using the information and assumptions set out within section 2.1, and the quality standards set out within section 2.3.1, the relevant inputs to the software are set out within Table 7.

Table 7: Inputs to RQP software

Parameter	Units	Ammoniacal nitrogen test	SRP test	BOD test
F (mean river flow rate)	l/s	16.2	16.2	16.2
95 percentile river low flow rate	l/s	3.5	3.5	3.5
C (concentration upstream of discharge)	mg/l	0.0798 (based on 98 samples)	0.205 (based on 98 samples)	1 (based on 5 samples)
f (effluent flow rate)	l/s	0.0405	0.0405	0.0405
c (concentration in effluent)	mg/l	0.0579	0.0162	0.0579
Downstream river target	mg/l	0.3* (90 %ile)	0.048 (annual mean)	4** (90 %ile)

**Although the target standard for ammoniacal nitrogen is 'good', the river actually exceeded its target standard – refer to section 2.3.2. Therefore, the more stringent standard (high) has been used within the assessment, in line with the principle of 'no deterioration'.*

***Although BOD is not used in clarifying the status of water bodies (refer to section 2.3.2), there are still environmental standards available for BOD (refer to Table 4). For the purposes of the assessment, the most stringent standard has been assessed against.*

With regards to standard deviations, the software sets the standard deviation of river quality to 1% of the mean, and the standard deviation of the discharge quality to 0.1% of the mean. For the concentration in the effluent, the minimum number of samples is set to 4.

The software or associated guidance did not specify units to be applied to the input parameters. Therefore, it is understood that the modelling can be done using any set units, provided the units are consistent with each other. Therefore, the unit used for flow rates is litres per second (l/s), and the unit used for concentrations is milligrams per litre (mg/l).

2.3.5 Outputs from RQP software

The output results are presented in Table 8 below.

Table 8: Outputs from RQP software

Parameter	Units	Ammonia test	SRP test	BOD test
Mean downstream river quality	mg/l	0.08	0.2	1
Required discharge quality (River Needs Permit limit)	mg/l	25.2	0	343

2.3.6 Decide if it is feasible to meet these limits

The following must be considered when deciding if it is feasible to meet the limits established within Table 8:

- technical feasibility; and
- cost proportionality.

The feasibility of meeting the limits is discussed further in the following sections.

2.3.6.1 Ammoniacal nitrogen

The required discharge quality (i.e. the River Needs Permit limit) for ammoniacal nitrogen is a concentration of 25.2 mg/l. As described in section 2.1.2, the package treatment plants are guaranteed to meet an ammoniacal nitrogen concentration of 20 mg/l in the resulting effluent, and as described within section 2.1.4, the subsequent quality of the discharge from the attenuation pond following dilution will be a concentration of approximately 0.0525 mg/l. Therefore, the discharge is compliant with the required River Needs Permit limit for ammoniacal nitrogen.

Assuming the discharge is released at a concentration of 0.0579 mg/l for ammoniacal nitrogen, the resulting mean downstream river quality (i.e. the impact of the discharge) for ammoniacal nitrogen is 0.080 mg/l, which compares favourably with the target of 0.3 mg/l to reach a 'high' standard classification (refer to Table 4).

Taking the above into consideration, it will be feasible to meet the proposed River Needs Permit limit calculated by the software for ammoniacal nitrogen.

2.3.6.2 SRP (Soluble Reactive Phosphorous)

The required discharge quality (i.e. the River Needs Permit limit) calculated by the software for SRP is a concentration of 0 mg/l, as the river already exceeds its targets due to a number of reasons – refer to section 2.3.2.

The exceedance of the target for SRP is already apparent from the river quality data presented in section 2.1.6, which indicates an average SRP concentration of 0.205 mg/l, whilst the environmental standard for SRP to achieve a 'good' classification is 0.048 mg/l (as stated in section 2.3.1).

It is not feasible for the treated effluent to meet a concentration of 0 mg/l for SRP. However, as described within section 2.3.3, the EA may allow a class deterioration of up to 10% in the current

water quality, so long as this does not cause a deterioration beyond the class boundary for each parameter.

The results from the RQP software, presented in Appendix A.2 and also Table 8, indicate a downstream river quality of 0.20 mg/l. The concentration calculated for downstream river quality is limited to 2 significant figures by the software. As the average SRP river concentration is approximately 0.205 mg/l, the software rounds down and calculates that the discharge will result in no further deterioration of the river quality. Therefore, the discharge is understood to have an acceptable impact in relation to SRP, and a concentration of 0.0162 mg/l in the discharge will not degrade the current water quality.

Taking the above into consideration, it is not feasible to meet the proposed River Needs Permit limit of 0 mg/l calculated by the software for SRP. However, the modelling has concluded that the discharge will not increase the deterioration of the river, i.e., it is understood that the discharge will have 'acceptable' impacts in relation to SRP. Furthermore, it is understood that SRP is not a typical pollutant subject to regulation in England[6].

Should the EA insist upon imposing a limit for SRP concentration in the discharge, the principle of up to 10% deterioration should be taken into consideration. A high-level sensitivity analysis was undertaken with the software by means of inputting different discharge concentrations for SRP into the model. The software indicates the threshold to be approximately 2.67 mg/l for the mean input discharge concentration of SRP, when the resulting downstream river quality increases from 0.20 to 0.22 mg/l (i.e. an increase/deterioration of 10%). Therefore, 2.67 mg/l could be taken to be an appropriate limit for SRP concentrations in the discharge from the attenuation pond, but it is acknowledged that this would be subject to discussion and agreement with the EA. It is difficult to determine the feasibility of meeting this limit, due to a lack of data regarding SRP concentrations in the treated effluent, and the subsequent discharge.

2.3.6.3 BOD

The required discharge quality (i.e. the River Needs Permit limit) for BOD is a concentration of 343 mg/l. As described in section 2.1.2, the package treatment plants are guaranteed to meet a BOD concentration of 20 mg/l in the resulting effluent, and as described within section 2.1.4, the subsequent quality of the discharge from the attenuation pond following dilution will be a concentration of approximately 0.0579 mg/l. Therefore, the discharge is compliant with the required River Needs Permit limit for BOD.

Assuming the discharge is released at a concentration of 0.0579 mg/l for BOD, the resulting mean downstream river quality (i.e. the impact of the discharge) for BOD is 1 mg/l, which compares favourably with the target of 4 mg/l to reach a 'high' standard classification (refer to Table 4).

Taking the above into consideration, it will be feasible to meet the proposed River Needs Permit limit calculated by the software for BOD.

2.3.7 Check statutory requirements on emission limits

It is understood that the PTPs do not fall under the scope of the Urban Wastewater Treatment Regulations which is relevant to larger discharges of treated sewage effluent from wastewater treatment works.

[6] Natural England study: 'Phosphorus in Package Treatment Plant effluents' (2016).

2.3.8 Check non-statutory requirements on emission limits

We are not aware of any other non-statutory requirements on emission limits from PTPs.

2.3.9 Confirm final discharge and controls

The proposed permit limits for the discharge from the attenuation pond are summarised in Table 9 below.

Table 9: Summary of River Needs Permit Limits

Parameter	Units	Ammoniacal nitrogen	SRP	BOD
Required discharge quality (River Needs Permit limit)	mg/l	25.2	To be agreed with EA	343

The limits have been calculated in accordance with the principle of 'no deterioration' of the receiving watercourse for ammoniacal nitrogen and BOD.

As discussed in section 2.3.6.2, the discharge as currently assessed will have 'acceptable' impacts in relation to SRP. It is understood that SRP is not a typical pollutant subject to regulation in England; however, should the EA require a limit to be applied for releases of SRP, the principle of up to 10% deterioration should be taken into consideration. Analysis with the software indicates that a threshold limit of 2.67 mg/l for SRP would be appropriate for the discharge, as this represents a deterioration of 10% in the receiving watercourse. This is subject to discussion and agreement with the EA.

3 Conclusions

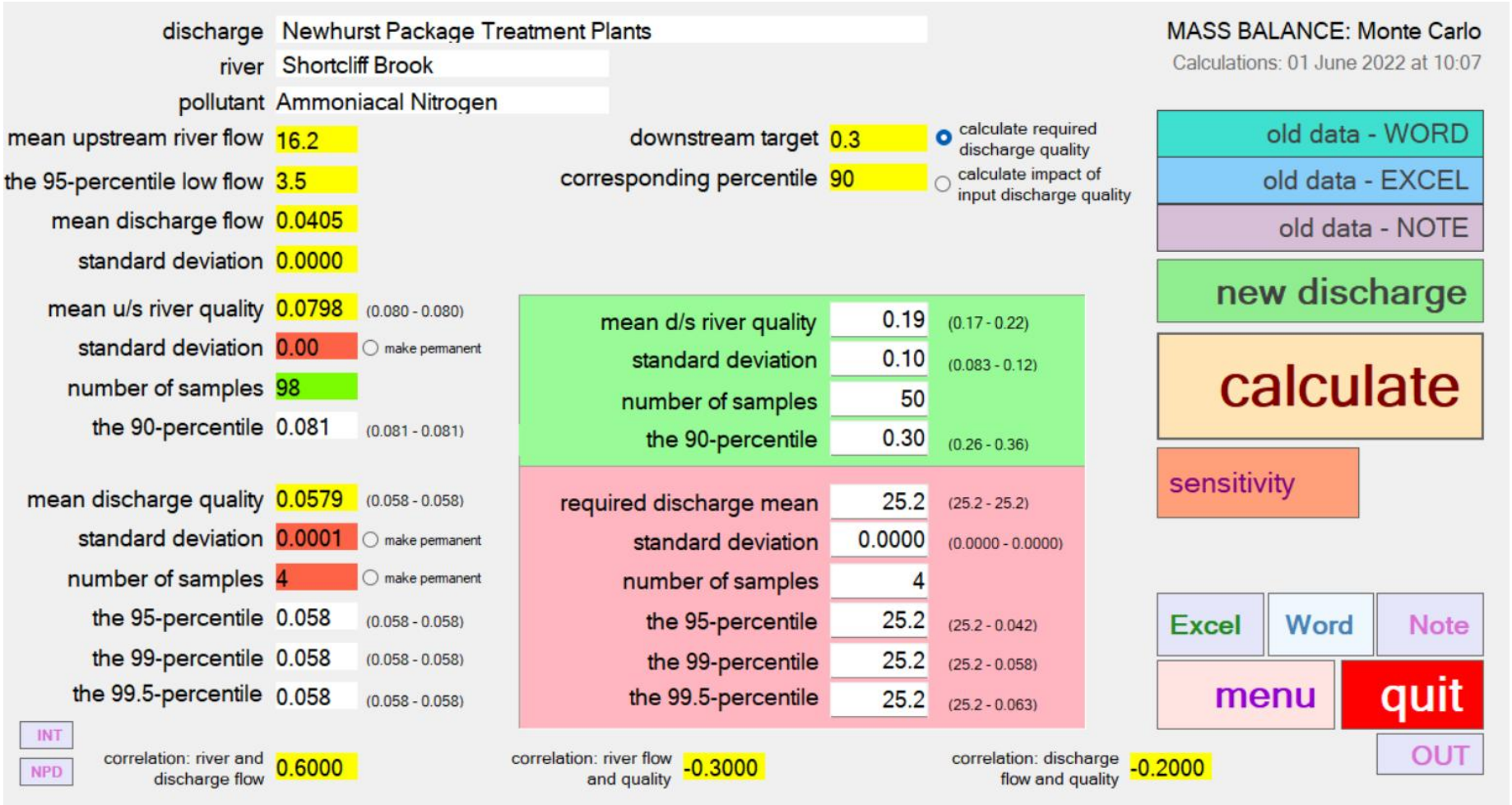
The effluent from the PTPs and subsequent discharge from the attenuation pond is not predicted to have any significant impacts upon the receiving watercourse.

Appendices

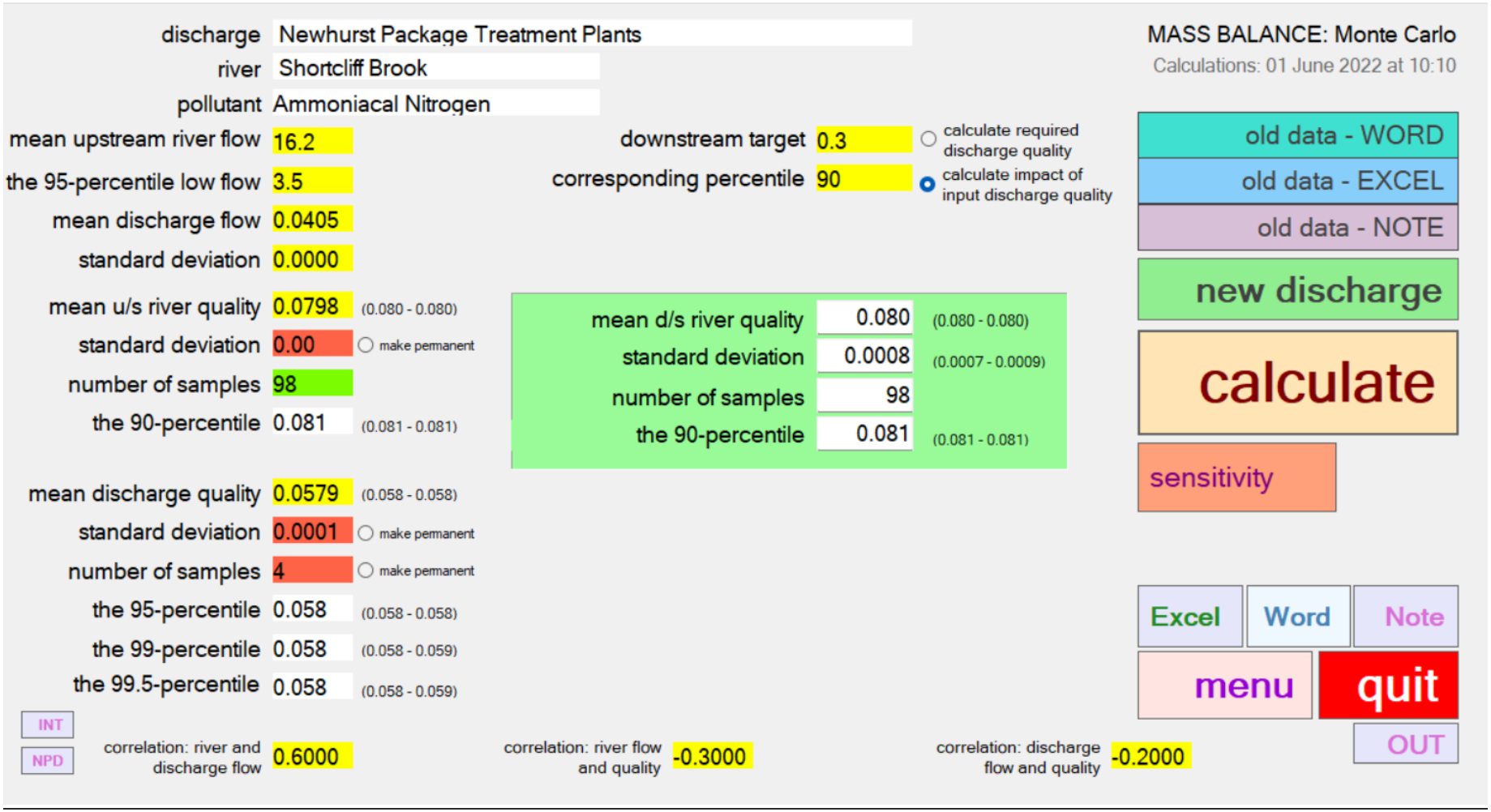
A RQP software results

A.1 RQP software results – Ammonia

Calculate River Needs Permit limits (calculate required discharge quality)

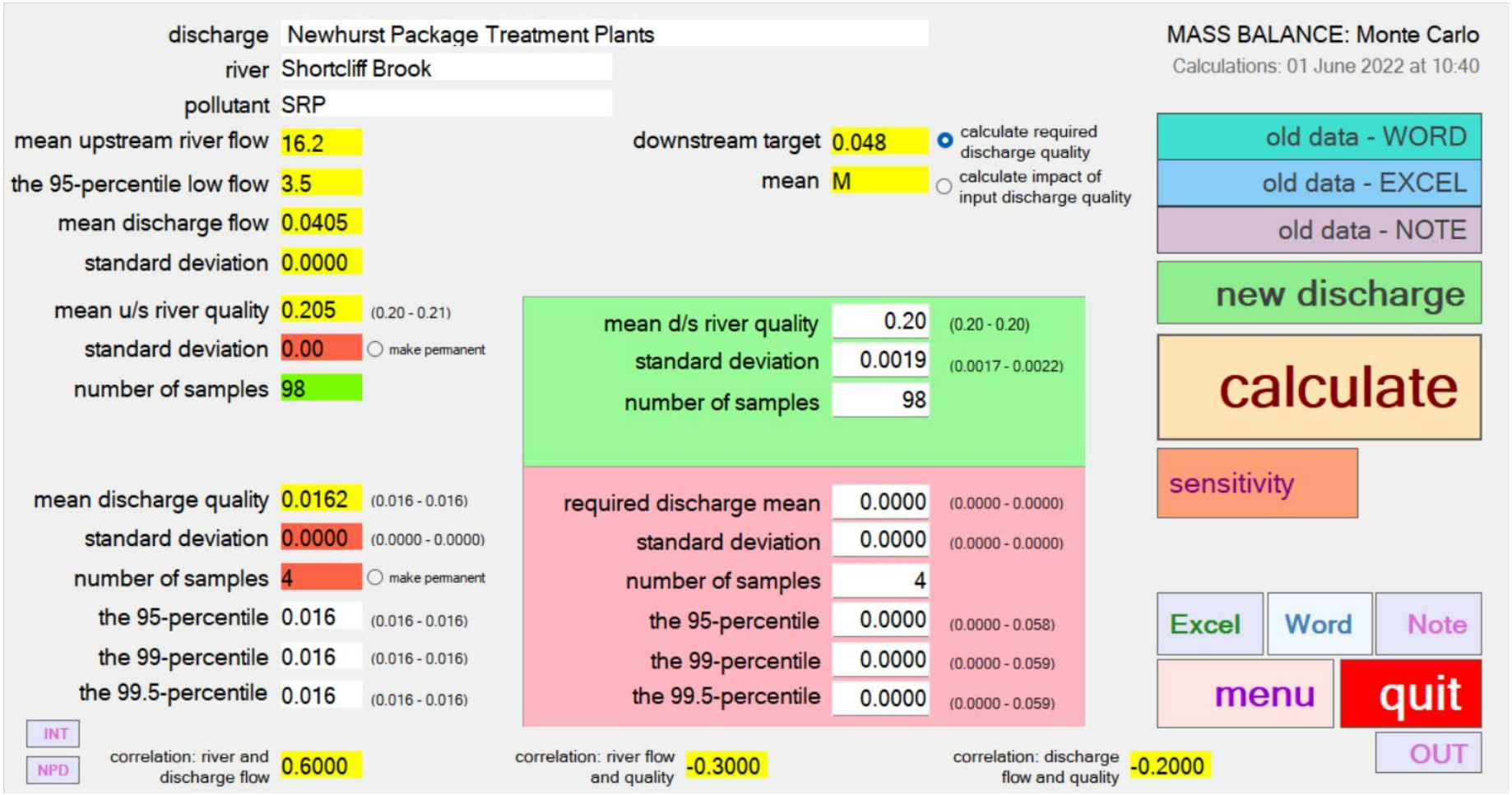


Downstream river quality (impact of discharge)

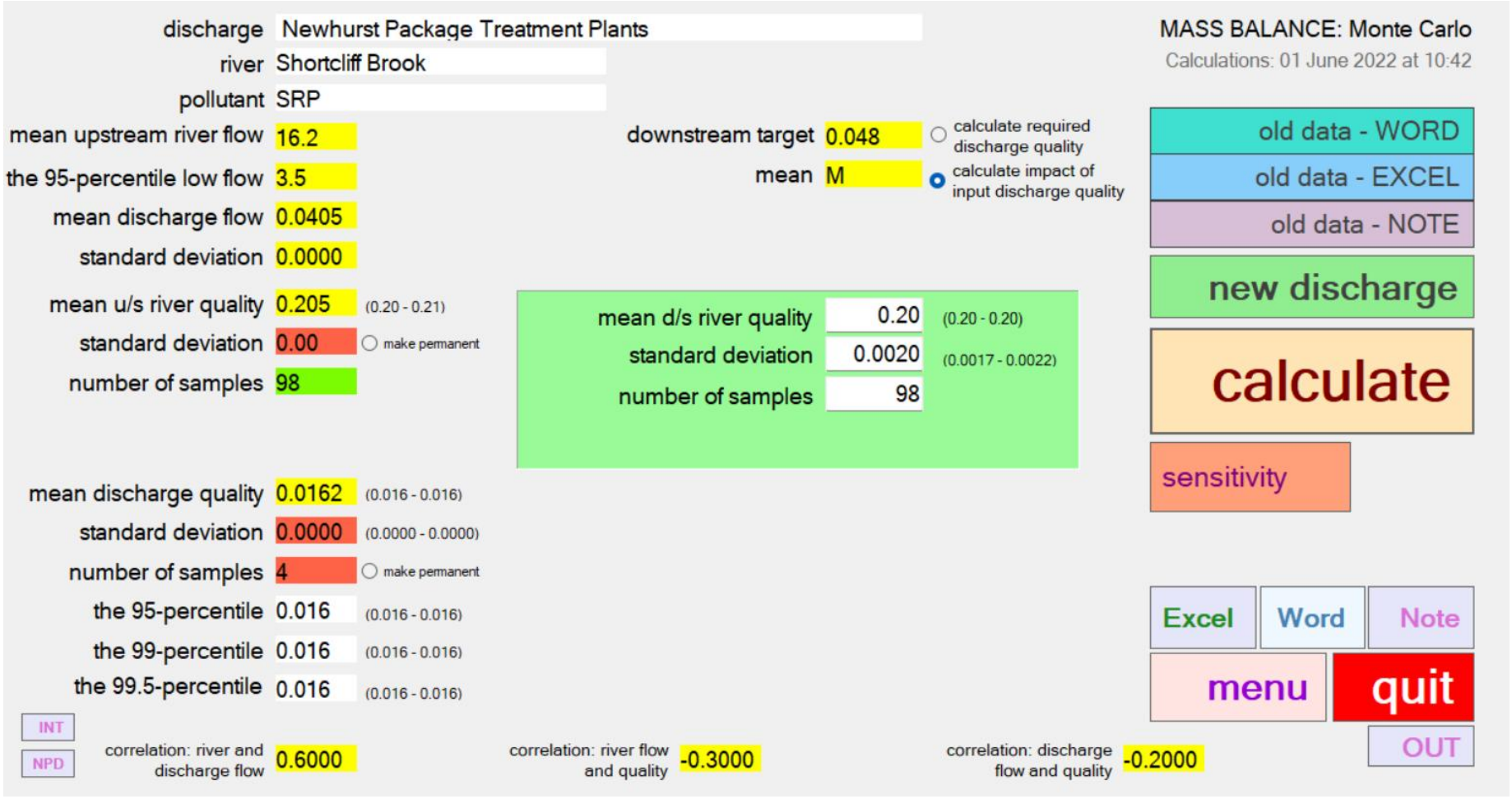


A.2 RQP software results – SRP

Calculate River Needs Permit limits (calculate required discharge quality)

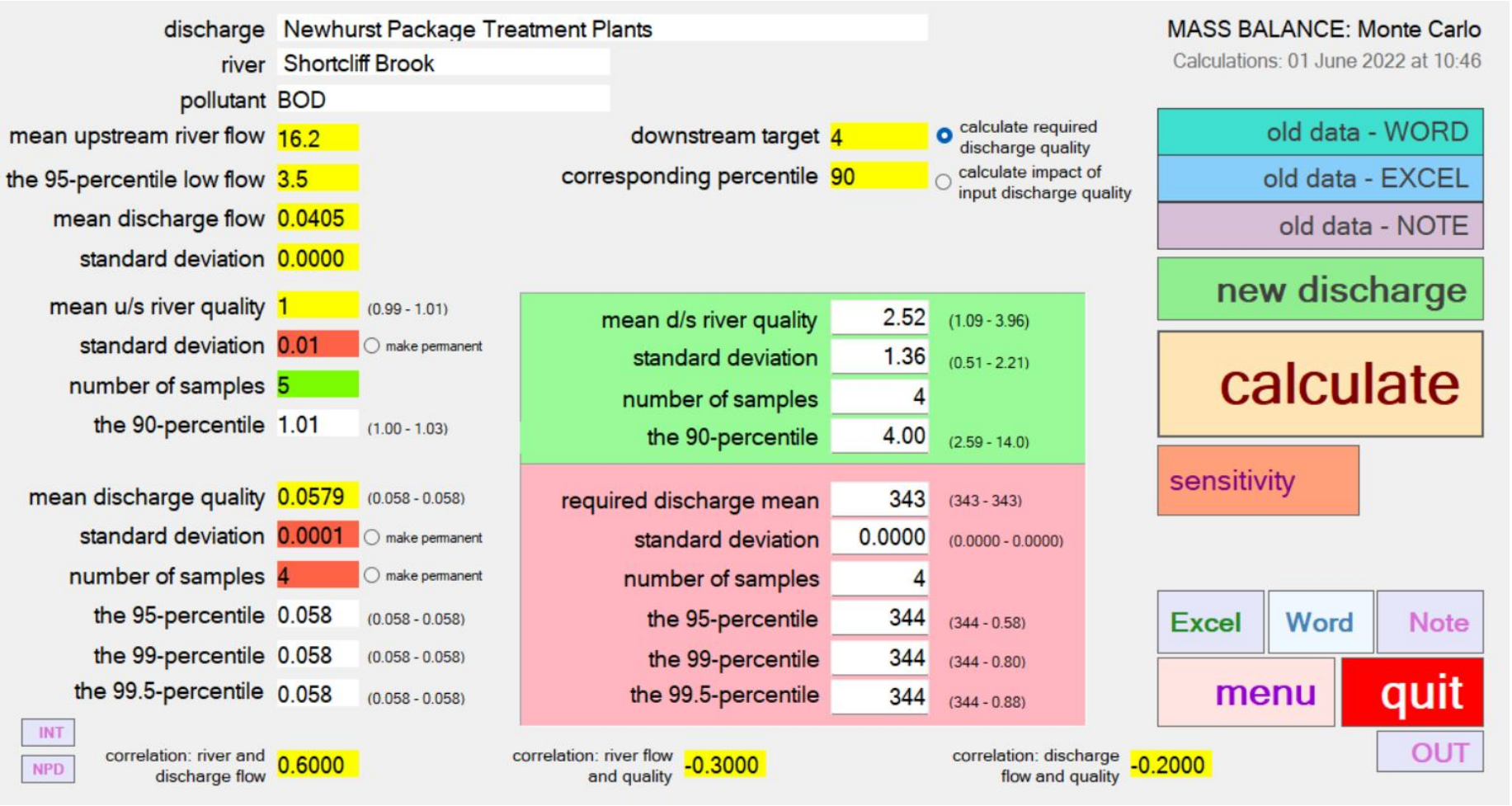


Downstream river quality (impact of discharge)

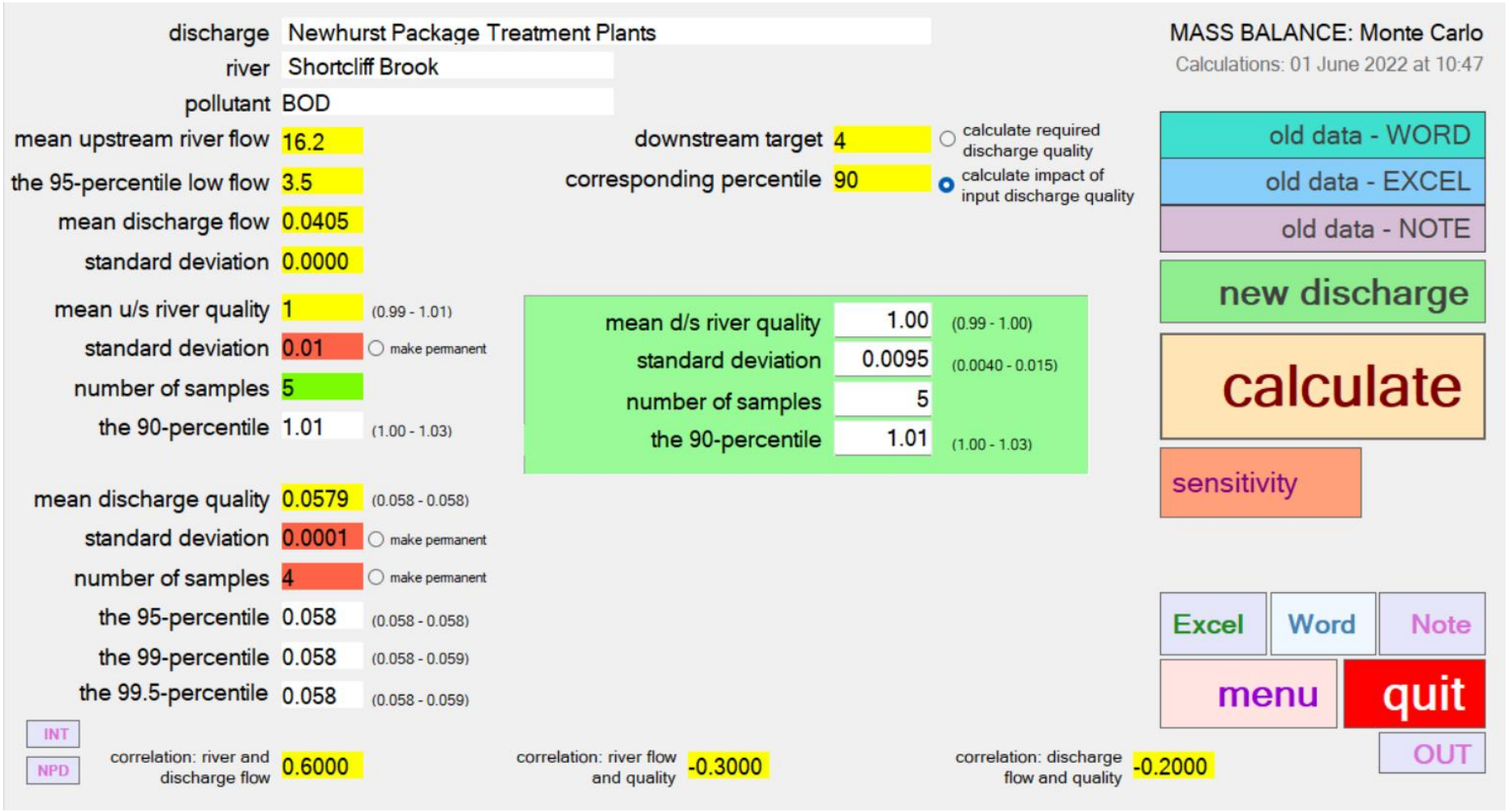


A.3 RQP software results – BOD

Calculate River Needs Permit limits (calculate required discharge quality)



Downstream river quality (impact of discharge)


discharge
Newhurst Package Treatment Plants
river
Shortcliff Brook
pollutant
BOD
mean upstream river flow
16.2
the 95-percentile low flow
3.5
mean discharge flow
0.0405
standard deviation
0.0000
mean u/s river quality
1
(0.99 - 1.01)
standard deviation
0.01
make permanent
number of samples
5
the 90-percentile
1.01
(1.00 - 1.03)
mean discharge quality
0.0579
(0.058 - 0.058)
standard deviation
0.0001
make permanent
number of samples
4
make permanent
the 95-percentile
0.058
(0.058 - 0.058)
the 99-percentile
0.058
(0.058 - 0.059)
the 99.5-percentile
0.058
(0.058 - 0.059)
INT
NPD
correlation: river and discharge flow
0.6000
downstream target
4
calculate required discharge quality
corresponding percentile
90
calculate impact of input discharge quality
mean d/s river quality
1.00
(0.99 - 1.00)
standard deviation
0.0095
(0.0040 - 0.015)
number of samples
5
the 90-percentile
1.01
(1.00 - 1.03)
correlation: river flow and quality
-0.3000
correlation: discharge flow and quality
-0.2000
MASS BALANCE: Monte Carlo
Calculations: 01 June 2022 at 10:47
old data - WORD
old data - EXCEL
old data - NOTE
new discharge
calculate
sensitivity
Excel
Word
Note
menu
quit
OUT

A.4 RQP software results – Word output documents

ENGINEERING + CONSULTING

FICHTNER

Consulting Engineers Limited

Kingsgate (Floor 3), Wellington Road North,
Stockport, Cheshire, SK4 1LW,
United Kingdom

t: +44 (0)161 476 0032
f: +44 (0)161 474 0618

www.fichtner.co.uk