ANNEX B1.5

Water Quality Risk Assessment

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's and Affinity Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Severn Trent Water and Affinity Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

Grand Union Canal Transfer SRO

Affinity Water, Severn Trent Water, Canal & River Trust

ATKINS
Member of the SNC-Lavalin Group

Technical Note

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1. Introduction

Atkins has been commissioned by the Grand Union Canal (GUC) Strategic Resource Option (SRO) Project Management Board (PMB) to undertake the drinking water quality risk assessment following the All Company Working Group Methodology (ACWG). The indicative design and development of the scheme, including control measures for the limiting hazards identified in the water quality risk assessment (WQRA), are being undertaken by another team. This document relates to RAPID Gate 2 of the scheme, which follows RAPID Gate 1 (for Gate 1 scheme information refer to published report *Strategic Solution Gate-1: GUC Transfer SRO – Preliminary Feasibility Assessment*).

The GUC SRO has been identified as a strategic regional water resource option to support long term resilience by redirecting a portion of final effluent (57-115Ml/d) from the Minworth WwTW towards the Affinity Water region via the Coventry Canal and GUC. The transferred water will then be abstracted at a new abstraction location to the southwest of Leighton Buzzard, stored in a new bankside raw water reservoir, then treated to potable standard at a new water treatment works at the abstraction site, before being transferred via a new trunk main to Chaul End Service Reservoir for distribution via the Affinity Water network.

The purpose of this document is to:

- Identify the procedure used to undertake the Gate 2 WQRA (the All Company Working Group (ACWG) methodology)
- Identify the scheme basis and sources of data used to inform the Gate 2 WQRA
- Provide a summary of the updates to the GUC SRO Gate 2 WQRA arising from the workshop held on 21st June 2022, in particular to highlight changes from Gate 1 WQRA, to allow the rest of the project team to develop the scheme design to manage these risks.
- Provide recommendations from the WQRA process including feedback of key risk changes to the Engineering design team and improvements to the monitoring programme to the WQ monitoring team.

The Gate 2 WQRA spreadsheets provided alongside this document provide a full record of the agreed risk assessment for this scheme along with relevant details of the water quality data for all individual limiting hazards.

Justification of scheme design decisions, including selection of appropriate control measures for these risks, is covered elsewhere as part of the wider scheme outputs.

2. Gate 2 ACWG Workshop

The Gate 2 WQRA workshop was chaired by Atkins on 21st June 2022, with representatives from Severn Trent Water and Affinity Water, following the ACWG methodology which has been adopted by all SRO schemes to ensure a consistent approach to drinking water quality risk assessment.

The methodology has been based on existing UK and global regulation and policies and was developed to ensure consistency and coherence with the Regulatory water safety planning requirements mandated by the DWI, when planning for long term changes to the public water supply. Full details on the methodology can be found in the ACWG WQ Risk Framework Report.

Limiting hazards (described as the key drinking water quality hazards which are likely to drive the development and/or viability of the scheme) and their associated risk scores were initially selected during the Gate 1 WQRA workshop (held on 12th and 19th March 2021) based on information provided by the wider scheme team, including Severn Trent effluent reuse concept design produced by AECOM and summarised in the Gate 1 Submission for Minworth SRO; GUC site appraisal produced by WSP and summarised in the Gate 1 Submission for GUC SRO, and the Affinity Water Drinking Water Safety Plans (DWSPs) as summarised in the GUC Gate 1 Submission.

The Gate 2 workshop updated list of limiting hazards and associated risk scores identified in Gate 1, based on monitoring data gathered during the GUC SRO Gate 2 water quality monitoring programme, and information provided on the Gate 2 scheme developments by the wider scheme team, as detailed below.

The Gate 2 scheme route used as the basis for the WQRA update is shown in Figure 2-1.

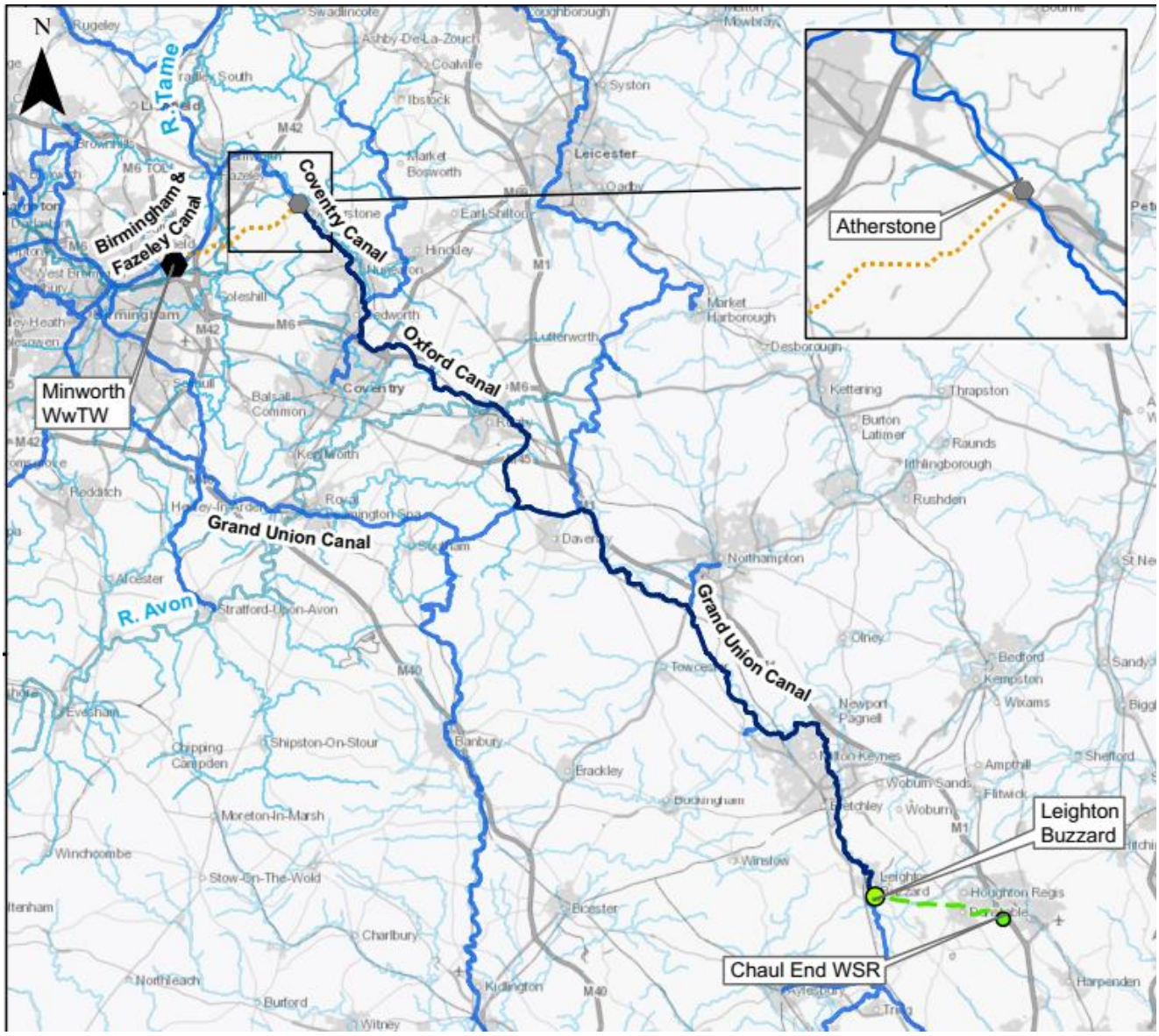

Figure 2-1 - Map Indicating Gate 2 GUC SRO scheme route used as the basis for the Gate 2 Water Quality Risk Assessment

The Gate 2 water quality monitoring programme included spot sampling at 10 sites along the proposed transfer route (2 sample locations on the Coventry Canal, 8 sample locations on the GUC), as well as spot sampling of the Minworth WwTW Final Effluent, as shown in Figure 2-2. Continuous monitoring data (using sondes) was also made available for Site 1 and Site 6. Although only a small dataset was available at the time of the Gate 2 workshop, with monitoring at Site 1, 3, 5 and 6 beginning in April 2021 (circled in yellow in Figure 2-2), and spot sampling at the remaining 8 sites (circled in green in Figure 2-2), beginning in April 2022, the Gate 2 monitoring programme provides the most up to date information regarding the water quality for the proposed water source and along the selected transfer route. A full list of the suite of parameters monitored for can be found in the GUC Gate 2 Water Quality Monitoring Report (Annex B1.4)

It is noted that additional treatment is proposed at the Minworth WwTW prior to discharge into the GUC, which will likely alter the final effluent quality. However, as limited information on the future changes at Minworth WwTW was available at the time of the GUC Gate 2 WQRA, the risk assessment is based on the existing Minworth WwTW final effluent water quality.

Monitoring at Site 1 (Minworth WwTW Final Effluent) and Site 6 (proposed abstraction location at Leighton Buzzard) included monitoring for a number of emerging substances (which have been classified as requiring foreseeable protection measures and potential protection measures) as identified in the Thames Water

Emerging Substances Project workshop held with the Environment Agency and Drinking Water Inspectorate on 21st September 2021, and subsequently shared with the ACWG. Additional work around emerging substances has also been undertaken as part of the GUC SRO water quality monitoring programme in Gate 2 (GUC Emerging Substances Technical Note (Annex B1.6)), with the outputs set to inform the Gate 3 monitoring programme.

Hydraulic modelling of the raw water transmission is currently being undertaken by another consultant to estimate the relative influence of the various source flows (including Minworth WwTW final effluent) into the canal system.

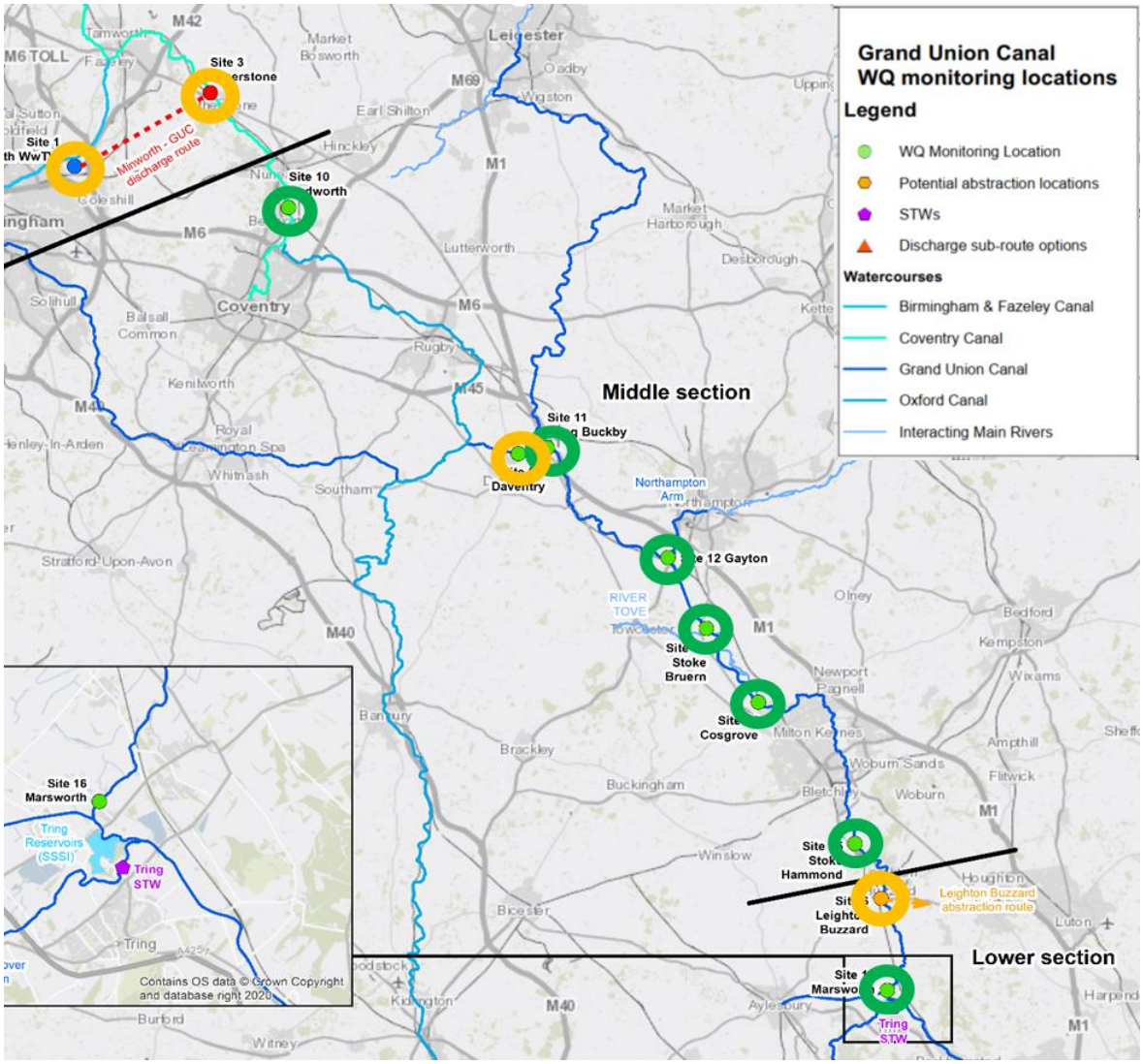

Figure 2-2 - Map Indicating Gate 2 Water Quality Monitoring Locations across the GUC SRO used in the Gate 2 Water Quality Risk Assessment

Monitoring information was also made available for the lower section of the initially proposed SRO route options, including the proposed abstraction locations of Tring, Hemel Hempstead, and The Grove. As the scheme has developed and a preferred abstraction location has been determined (Site 6 - Leighton Buzzard), monitoring at these sites has ceased, and such was not assessed in the water quality risk assessment. Similarly, monitoring along the Birmingham and Fazeley canal, and at Leamington Trough Pound has also ended due to being off the Gate 2 selected route and data from these points were not included in the water quality risk assessment. Online sondes have also been removed from The Grove, Hemel and Tring since April 2022 as these sites are no longer potential abstraction locations given the revised Gate 2 scheme route. Excluded monitoring points are identified in Figure 2-3.

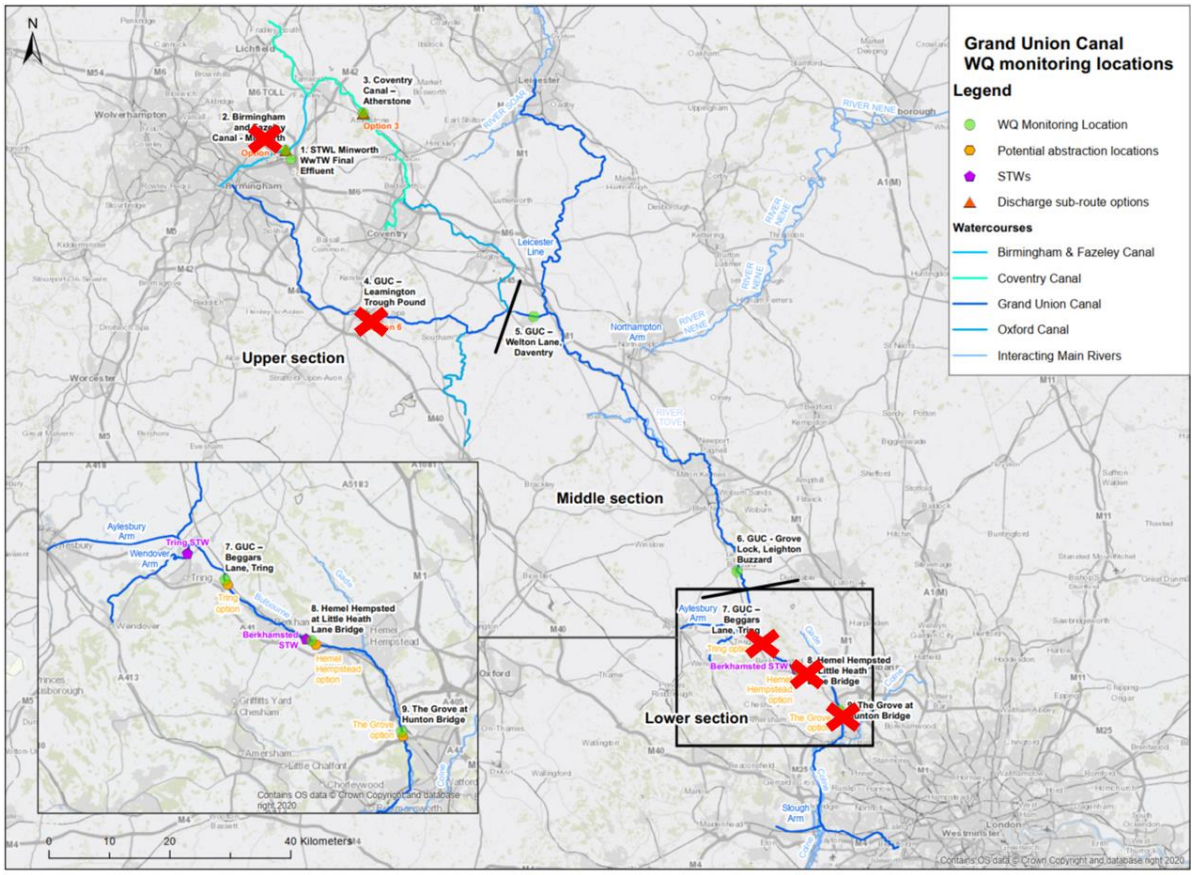

Figure 2-3 - Map Indicating Water Quality Monitoring Locations excluded from Gate 2 Water Quality Risk Assessment due to being outside of the proposed route

2.1. Updates to the Gate 2 WQRA

Following a review of the new Gate 2 water quality monitoring programme data, two new limiting hazards were identified and added to the parameter list.

Manganese was added as a new limiting hazard during the Gate 2 workshop, as all sampled concentrations for manganese at Site 3 (on the Coventry canal) exceeded the prescribed concentration or value (PCV) of 50µg/l. Much of the sampled manganese was detected in dissolved form which could affect the control method/ treatment strategy. Manganese was also detected at concentrations above the PCV in all samples at Site 1, and in 1 out of 7 samples at Site 6 (the remainder of samples at site 6 contained manganese at concentrations below the PCV).

Sulphate was also added as a new limiting hazard during the Gate 2 workshop following a review of the Gate 2 monitoring programme data. Monitoring data at Site 3 indicated elevated concentrations of sulphate were present in the raw water after 12 out of 14 samples returned sulphate concentrations above the PCV of 250mg/l. Sulphate exceeded the PCV in 1 out of 7 samples at Site 6 with no exceedances of the PCV detected at Site 1. The remainder of samples at sites 3, 6 and 1 contained sulphate at concentrations below the PCV. Sulphate was added as a limiting hazard due to its potential to drive treatment selection.

The likelihood scores for 3 existing limiting hazards identified in the Gate 1 workshop were revised following an improved understanding of the magnitude of the risk based on the Gate 2 water quality monitoring programme data.

The likelihood score for lead was increased after concentrations in the raw water were detected at higher values than anticipated in Gate 1, with some samples above the limit in the Revised Drinking Water Directive

(DWD)[1] of 5µgPb/l, but still lower than the current UK regulatory limit of 10µgPb/l, driving the likelihood score to increase.

The limiting hazard of trihalomethanes (THM) / THM Formation Potential also had an increased likelihood score following a discussion around the concentrations of THM pre-cursors, organic material- sampled as total organic carbon (TOC) in the raw water, as well as the nature of the raw water conveyance route being via a navigable canal.

The likelihood score for algae was also increased following a review of sonde data from Site 6 along the GUC confirming high concentrations of Chlorophyll, as well as visual identification of algal blooms from the monitoring team. It was noted that Microcystin LR (a microcystin toxin containing the amino acids leucine (L) and arginine (R) released by cyanobacteria and with a limit of 1µg/l in the Revised DWD) was sampled for at Site 1 and at Site 6, however values were below the limit of detection (LOD) of <5µg/l. It was recommended to feed this back to the monitoring programmes lab to investigate the potential to reduce the LOD so that subsequent monitoring can inform assessment of likely concentrations against the Revised DWD limit.

It is also recommended that the limit of detection for certain Chromium (VI) (LOD 7ug/L, DWI action limit 3ug/L) is investigated with the analysis laboratory. This is so that an assessment can be made to whether the sampled Concentrations challenge the limits set in the DWI Information Letter 02/2017[2].

Scoring for the likelihood of emerging substances and parameters which do not currently have a regulated limit or proposed limit such as tributyltin, triclosan, Personal Care Products and Detergents remained high and were noted as parameters which require further investigation. It is recommended that in Gate 3, any guidance, guideline values or health-based impacts by the DWI or World Health Organisation (WHO) should be investigated to allow for a more informed approach of how the likelihood of emerging substances should be scored.

Scoring of the consequence for each limiting hazard has been based on guidance from the DWI's Compliance Risk Index[3] where possible. However, it was agreed in the workshop that the consequence scores for ammonium and sulphate should be increased to reflect the seriousness of the parameters at the point of compliance. Concentrations seen for ammonium may cause a risk to the disinfection processes whilst sulphate may lead to a risk to customer acceptability. Consequence scores for corrosivity and algae which did not have a given consequence value in the CRI were updated in line with other SROs to ensure consistent scoring across schemes.

The WQRA also includes commentary regarding the control measures proposed by the engineering design in the GUC site appraisal produced by WSP and summarised in the Gate 1 Submission for GUC SRO. The revised Gate 2 limiting hazards list and scores will be provided to the engineering design team to ensure that the proposed treatment processes are suitable to mitigate all limiting hazards. Most control measures for the limiting hazards were identified in the 'Treatment' stage of the assessment, by reducing the likelihood of certain limiting hazards in the treated water prior to distribution to the supply network and consumer. However, Corrosivity and Taste were also highlighted as needing control measures in the 'Distribution' stage. Customer engagement has been identified as a control method around the potential change to Taste due to the introduction of a surface water source into a region currently supplied predominantly by ground water sources. Such customer engagement is expected to follow the guidance provided by the Britain Thinks customer engagement methods study as presented to the ACWG, which focused on the timescales of engagement with consumers around a source change, as well as customer attitudes to acceptability of source water changes in the supply network. Further work around corrosivity and customer acceptability will be required to understand the extent of, and need for, conditioning when treated GUC water is blended with existing water sources in the network.

Full details including the complete list of limiting hazards, risk scores, as well as further reasoning for their inclusion and scoring can be seen in the accompanying GUC SRO Gate 2 Water Quality Risk Assessment (WQRA) spreadsheet (Annex B1.5).

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[1] Directive (EU) 2020/2184 of the European Parliament and of the council on the quality of water intended for human consumption, DWI, 2020 https://eur-lex.europa.eu/eli/dir/2020/2184/oj

[2] DWI Information Letter 02/2017 Further Guidance On Chromium In Drinking Water, 2017 https://dwi-content.s3.eu-west-2.amazonaws.com/wp-content/uploads/2020/11/24102155/02-2017.pdf

[3] DWI Compliance Risk Index (CRI), Drinking Water Inspectorate, 2018 (DWI-Compliance-Risk-Index-CRI_Def.pdf (ofwat.gov.uk))

3. Conclusions

The Gate 2 WQRA workshop was held on 21st June 2022 with stakeholders from Severn Trent Water and Affinity Water. This workshop reviewed and updated the GUC SRO limiting hazards and their corresponding risk scores using information gathered during the GUC SRO Gate 2 water quality monitoring programme. Although the number of sample points are limited, the monitoring programme provided sample data for a wider range of parameters compared to monitoring information available in Gate 1, and hence a more informed understanding of the water quality risks has been determined during Gate 2.

Based on the Gate 2 monitoring dataset, the limiting hazards of Lead, THM/THM Formation Potential and Algae were agreed to have an increase of likelihood scores. Two parameters: Manganese and Sulphate, were added as new limiting hazards due to concentrations measured in the Coventry Canal. Control measures have been identified and captured in the Water Quality Risk Assessment, including the processes at the new water treatment works, as well as customer engagement regarding a change in source.

4. Recommendations

It is recommended that the revised Gate 2 limiting hazards and scores are issued to the engineering design team, to ensure that the control measures are sufficient to mitigate the risks. New limiting hazards have been added in Gate 2: Manganese and Sulphate, as well as a clarified position of limiting hazards identified in Gate 1 such as Nitrate and Detergents.

Recommendations have been made to the water quality monitoring team around the inclusion of a greater suite of emerging substances. It has been advised that the 'PFAS 51' suite of PFAS substances identified in the GUC Emerging Substances Technical Note (Annex B1.6) will be added to the monitoring programme in advance of Gate 3, now that analytical suites are available, which will enable a better understanding of the Total PFAS risk. The GUC SRO Emerging Substances Review also includes the recommendation that the monitoring programme remains flexible and adaptable to account for substances that may increase or decrease in significance over time. Online sonde monitoring will continue at Minworth and Leighton Buzzard, as well as at a new location at Atherstone (potential discharge location) in Gate 3, notwithstanding further changes to the scheme design.

It has also been recommended that the limit of detection for certain compounds such as Microcystin LR and Chromium (VI) is investigated with the analysis laboratory. This is so that an assessment can be made to whether the sampled concentrations challenge the limits set in the Revised DWD and DWI Information Letter 02/2017 respectively. Emerging substances which do not currently have a prescribed limit or proposed limit will require further investigation into any guidance or guideline values (such as information and research available from WHO and DWI) to allow a better understanding of how to score the likelihood of these parameters, and update during a future WQRA workshop.

Further work around corrosivity and customer acceptability is recommended to understand the need for, and extent of, conditioning when treated GUC water is blended with existing water sources in the network.

It is recommended that the WQRA is further updated in Gate 3, in line with the ACWG methodology, using monitoring data collected from the Gate 3 water quality monitoring programme. This will provide a greater number of sample points and allow for a more informed understanding of the likelihood of limiting hazards in the catchment.

Post-meeting note: A DWI meeting was held on 7th July 2022 to inform the DWI of the Gate 2 WQRA process to date, including key changes resulting from the Gate 2 ACWG workshop. Minutes of this meeting are available separately through the Programme Management Office ([redacted].

Author names redacted