

Customer Challenge Group Paper

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**Title:** Deep Dive on Water Quality

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**Purpose:** To inform the CCG of the company's approach to meeting Water Quality targets and long term planning for the quality of drinking water supplies.

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## 1 Executive Summary

This paper provides an insight into the company's approach to long term planning for the quality of drinking water supplies and provides a summary of the Water Quality performance of South East Water against current and future OFWAT targets.

The paper will look at two key areas relating to water quality:

- The Company's approach to long term planning to maintain and improve the quality of drinking water supplies.
- the performance in current water quality metrics of Mean Zonal Compliance (MZC), discolouration contacts and asset health serviceability; the transition to the recently published metrics which include Compliance Risk index and Discover Water metrics on customer contacts and activities identified to ensure that the company continue to improve performance across all areas.

The Company have identified three water quality specific schemes identified for inclusion within the price review period 2020-25. The first scheme is the continuation of catchment management work initiated in the current business plan period and the installation of additional treatment at Woodgarston WTW as a result of raw water deterioration with respect to nitrate. The second scheme is the installation of treatment and catchment management investigations at College Avenue WTW due to the presence of chromium above the recently published trigger level. The third scheme is the implementation of catchment management controls in five surface water bodies to address the present threat of metaldehyde.

In addition to specific water quality schemes listed above, the Company will continue to invest in all assets as part of the capital maintenance programme which is prioritised to meet water quality requirements, to ensure that the water we supply continues to meet the highest quality standards.

## 2 Long term planning for the quality of drinking water supplies

The company has a risk assessment and risk management approach to the maintenance all drinking water supply systems, assessing risks from source to tap as part of the embedded drinking water safety plan approach (DWSP). These DWSP risk assessments are updated on a monthly basis with analytical results from the scheduled monitoring programme. DWSP also incorporate information from recent water quality incidents and the number of consumer contacts. This information all feed into the company's asset management strategy to ensure that the risk of future non-compliance with the statutory water quality standards and a greater likelihood of a deterioration in the aesthetic quality of drinking water as measured by consumer contacts reporting discolouration or an objectionable taste or odour is minimised.

Any unacceptable risks to human health or consumer acceptability which are identified will lead to a programme of remedial works to address the risk. Where the risk is associated with

a new obligation or a change such as deterioration of source water quality, proposals will be discussed with the Inspectorate to determine whether a legally binding programme of work is required.

The Drinking Water Inspectorate issued a guidance note on the long term planning for the quality of drinking water supplies in September 2017.

<http://www.dwi.gov.uk/stakeholders/guidance-and-codes-of-practice/ltpg.pdf>

This document outlines the main statutory obligations that apply to water companies who are wholly or mainly in England and Wales over the price review period 2020-2025 and beyond. In particular there must be due regard to the need for public water supplies to be safe, clean and compliant with all the regulatory standards, and to provide for a sustainable level of asset maintenance to maintain public confidence in drinking water quality.

In line with issued guidance, SEW have identified a number of statutory and non-statutory drivers for the PR19 period which are summarised below:

- Catchment Management
- Resource and supply management
- Raw water deterioration
- Pesticides
- Water treatment
- Water distribution
- Lead and other point of use considerations
- Radioactivity
- Other emerging risks

Schemes identified under the drivers described above require formal sign off from DWI and will form part of the investment programme.

Companies must also ensure that they allocate sufficient funds for maintaining compliance with the regulatory standards and to prevent drinking water quality deteriorating, this aligns with our own compliance related outcomes.

## **2.1 Catchment management**

The company has a large scale catchment management programme in place during the current business plan period, in line with the National Environment Programme (NEP) as agreed with the Environment Agency. This programme includes work on 6 surface water catchments (covering the rivers Cuckmere, Wallers Haven, Eastern Rother, Ouse, Medway and Thames) and eight groundwater catchments (covering our abstractions at Hartlake, Pembury Springs, Tonbridge, Boxalls, College Avenue, Woodgarston, Borough Green and Beenhams Heath).

The company is currently working with the Environment Agency to finalise the requirements of the Water Industry National Environment Programme (WINEP) for the business plan period 2020-25. The scope of this programme has increased considerably since the last business plan, however there are only two identified drivers that present a risk to final water quality in the business plan period 2020-25:

- Metaldehyde in surface water catchments
- Nitrate at Woodgarston WTW

### **Metaldehyde**

Metaldehyde is a molluscicide used as the most prevalent active ingredient in slug pellets, to control slug and snail populations within the UK, Europe and North America. Metaldehyde is used on a variety of crops but oil seed rape and winter wheat are the most commonly affected, slug pellets are also used on crops such as potatoes, cereals and soft fruits.

The investigation phase for Metaldehyde within 6 surface water catchments commenced during the business plan period 2010-15AMP5 (Rother, Cuckmere, Medway/Teise, Wallers Haven, Thames and Ouse). The undertaking for the Rother was signed off as completed by the DWI in 2015. Catchment management for metaldehyde for all remaining catchments is in the delivery phase during the business plan period 2015-20 AMP6, with the key objectives to:

- Achieve a reduction in the number of exceedances above the PCV by 2020;
- Reduce the overall tonnage of slug pellets used containing Metaldehyde in each relevant surface water catchment by 2025;
- Work with key stakeholders to engage with the farming community and promote good agricultural practice surrounding the application of slug pellets;
- Develop and improve the detailed sampling and analysis programme to provide evidence of the effectiveness of mitigation measures.

The proposed approach for the business plan period 2020-25 is to continue and expand the current catchment management approach.

### **Nitrate**

A full catchment investigation was completed in the Woodgarston catchment to identify the possible sources of nitrate leaching into groundwater. The assessment included:

- Characterising the catchment;
- Land use surveys;
- Walkover surveys;
- Studying historical maps and aerial photographs;
- Nitrate modelling;
- Catchment Monitoring;
- Stakeholder engagement;
- Cover crop trials.

The land in the catchment area is primarily used for agriculture, mainly arable and pasture, and has not significantly changed over the past 80 years.

Source Modelling was carried out to understand the potential sources of the nitrate and predict future concentrations. The results of this modelling suggested groundwater nitrate concentrations will exceed the nitrate standard in the period 2020-25 and will continue to rise until 2035. Post-2035 concentrations may decline slightly but will not drop below the PCV unless the inputs of nitrate into the catchment are significantly reduced.

As a consequence of these deteriorating trends, a short to medium mitigation of nitrate treatment is required to safeguard water quality in addition to the identified catchment measures.

## **2.2 Resource and supply management**

South East Water acknowledges the duties and responsibilities outlined within the Water Industry Act, with regard to all aspects including development of water resource plans.

As part of the development of the company's Water Resource Management Plan, the options chosen for investigation were all subject to a water quality assessment to ensure that they would not represent a deterioration in the quality of the source water.

The following aspects were assessed:

- Potential impact on public health, wholesomeness and acceptability to consumers
- Potential impact of mixing different water types
- Potential impact on dosing arrangements in water supply zones, e.g. orthophosphate for plumbosolvency

To confirm that the company complies with its duties on drinking water quality matters in its broader resilience and resource planning arrangements, a written assurance in the form of a signed statement from the Board Level Contact for each company that the company's draft Water Resources Management Plan (WRMP) takes account of all statutory drinking water quality obligations, and that the WRMP includes plans to meet their statutory obligations in full will be submitted to the Inspectorate.

## **2.3 Raw Water Deterioration**

### **Nitrate**

As outlined in section 2.1 above, source modelling carried out at Woodgarston WTW predicts that groundwater nitrate concentrations will exceed the nitrate standard in the period 2020-25 and will continue to rise until 2035 – see Figure 1.

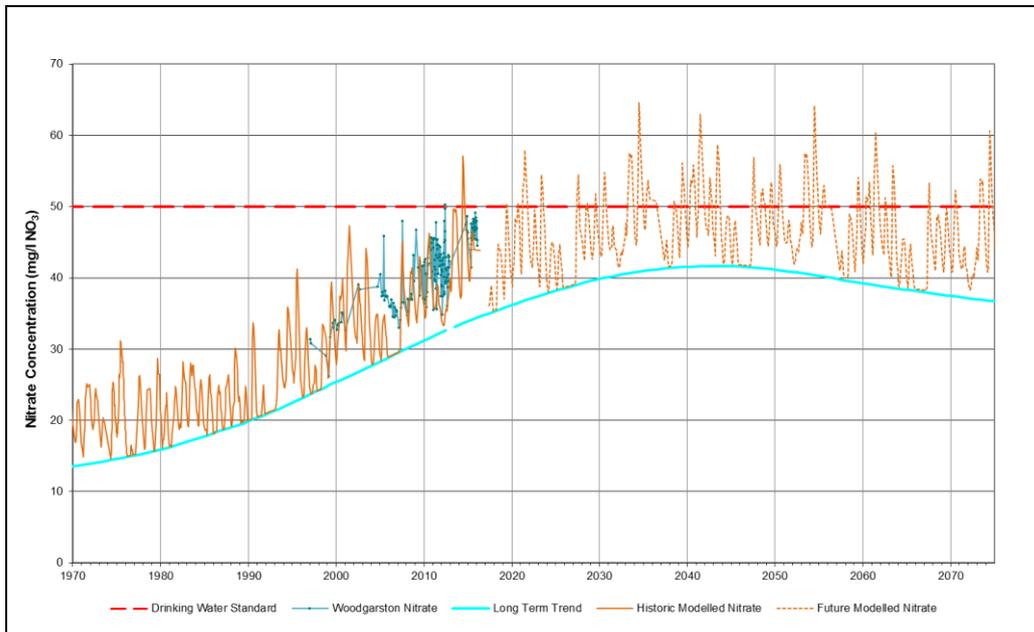


Figure 1: Modelling of Woodgarston No. 2 borehole Nitrate concentration (1970 – 2075)

As a consequence of these deteriorating trends, a short to medium mitigation of nitrate treatment is required to safeguard water quality in addition to the identified catchment measures.

The installation of an ion exchange plant to reduce the nitrate concentrations is proposed at Woodgarston WTW. This approach, along with the continuation of catchment management initiatives is endorsed by the Environment Agency. A scheme has been submitted to the DWI detailing the investment need.

## 2.4 Pesticides

The company have advanced treatment at all surface water sites and high risk ground water sites to mitigate the risk of pesticides. Treatment performance is monitored and assessed as part of the DWSP approach.

Metaldehyde is the only pesticide of concern currently within SEW. Catchment management measures in place to address metaldehyde issues are discussed in section 2.1.

## 2.5 Water treatment

The company have introduced a risk assessment and risk management approach to the maintenance of drinking water supplies consistent with the obligations set out in the 2016 Regulations, through the development of our Drinking Water Safety Plans. This work has been utilised to inform and support the development of the Company's PR19 investment programme. A comprehensive review of information about recent water quality incidents,

breaches of standards and the number of consumer complaints all feed into the company's asset management strategy to ensure that the risk of future non-compliance with the statutory water quality standards and a greater likelihood of a deterioration in the aesthetic quality of drinking water as measured by consumer contacts reporting discolouration or an objectionable taste or odour is minimised.

The company is considering resilience across all areas of the business operation. At a catchment level we are seeking to improve raw water quality, and ultimately reduce the treatment need through co-ordinated delivery of catchment management with key stakeholders. We are also targeting strategic investment at our treatment works and in the distribution network to improve the company's response to a number of identified resilience issues, including single sources of supply, drought and metaldehyde.

The company continues to work with the industry and DWI to develop the framework for the use and verification of on-line monitors.

It is not anticipated this will lead to any significant net increase in costs that will qualify for specific business plan proposals at PR19.

## 2.6 Water distribution

The company introduced a discolouration strategy to reduce the number of customer contacts received and reduce iron and manganese concentrations in the distribution system. The strategy covers a number of areas including:

- Continual review of customer contacts to identify WSZs with persistent problems.
- Enhanced operational sampling to gain understanding of metals concentrations within WSZs.
- Use of online water quality monitors, installed in strategic locations, to gain real time understanding of sediment movement and pressure changes in the system.

The above information, coupled with other factors including planned work and burst history is used to develop a discolouration action plan to implement across the business. Two key actions are currently being taken as part of this work:

1. The development of an annual systematic flushing programme covering approximately 1400 km, or 10%, of the company's mains network to remove historic deposits.
2. Installation of SeaQuest dosing at key water treatment works where elevated customer contacts without distinct hotspots have been identified in the downstream supply system. SeaQuest is an approved chemical, dosed into the water supply system which inhibits corrosion of water mains and prevents discolouration of supplies at the customer tap.

In certain circumstances the mains distribution system is investigated to ascertain the mains condition. This is completed by evaluation of mains cut-outs or internal CCTV surveys. This enables the company to make key decisions on long-term mitigation such as mains replacement or rehabilitation. Rehabilitation can be completed in a number of ways including, cleaning, relining or slip-lining of the existing main. The company are currently developing a toolkit to identify the best mitigation strategy for specific issues.

Alongside the above work a number of other improvements in the working methodology in distribution system have been implemented including:

- Calm valve operation scheme which ensures any changes to the distribution system as gradual and the effects of valve operation are minimised.
- Introduction of winter and summer settings are treatment works to improve the Company's taste and odour performance.
- Regular flushing of certain locations where deposits are known to accumulate historically such as dead-ends and hydraulic null-points.

## 2.7 Lead

Water companies implement a risk based strategy to achieve compliance with the lead standard. The Inspectorate expects Water Companies to continue to maintain and implement these strategies and keep the associated risk assessments under constant review. These strategies should be agreed with the local health authorities and support agreed targeted action with effective communications aimed at vulnerable customer groups. The Inspectorate is supportive of the investigation of and trials associated with lining techniques for communications and service pipework.

The Inspectorate expects the strategy to include, but not limited to, the items detailed below:

### 1. Identification of high, medium and low risk zones

South East Water has in place an enhanced sampling programme at customer properties to monitor lead concentrations. Sample results are incorporated into South East Water's DWSP and regularly reviewed to confirm each water supply zones risk status. Currently no zones are classified as at high risk for elevated lead concentrations.

### 2. Continuation of, and if necessary further enhancement to plumbosolvency control measures

South East Water dosed Orthophosphoric acid at 26 treatment works throughout the region to control plumbosolvency and minimise the lead at the customer tap, benefiting a population of ~500,000 customers. The effectiveness of this dosing is regularly reviewed to ensure it is fully optimised and adjustments are made where required. South East Water has not identified any areas which would benefit from additional dosing to control plumbosolvency.

### 3. Replacement of lead communications pipes where the standard is not met, and consideration of the benefits of replacement of the customer service pipe.

Customer tap samples may be taken in accordance with the Water Quality Regulations, at the customer's request or in accordance with SEW's enhanced monitoring programme. If any failure occurs through these sampling programmes South East Water will complete a detailed investigation. This investigation including a Water Fittings

Inspection at all properties where lead concentrations at the customer tap are detected above the standard, to identify the cause of the lead exceedance.

South East Water will replace all lead communications pipes which are found during the Water Fittings Inspections and will advise the customers of all necessary actions which should be taken, including the replacement of any other lead pipe work which is found. Following the completion of work on a property to remove lead pipe work South East Water will take additional samples to confirm the effectiveness of the remedial works. In some instances additional work may be required (e.g. removal of lead solder) to achieve full compliance.

4. Consideration of the benefits of opportunistic lead communications and service pipe replacement (e.g. in association with the installation of meters)

South East Water is currently completing a compulsory metering programme throughout its area. If any lead communication pipework is found during the installation of a meter it will be replaced. The customer will also be provided with appropriate advice. In addition, if lead communication pipework is determined through other planned or reactive work, this pipe work would also be replaced.

5. Work with Local Authorities to identify vulnerable customers and identify appropriate solutions e.g. when refurbishment work is completed in local authority housing

South East Water is planning to develop and expand its communication and education regarding the risks associated with lead in association with the local authorities.

6. Work with health protection teams to identify vulnerable customers and identify appropriate solutions, e.g. schools and nurseries

South East Water is currently completing Water Fittings Inspections at all schools throughout its area. If any lead pipework is determined during these inspections appropriate actions plans are put in place and monitored by SEW to ensure completion. South East Water will continue to develop and expand its communication and education regarding the risks associated with lead in association with the health protection teams.

7. Have in place a communication and education strategy to make consumers, and other stakeholders, aware of the risk of lead in tap water, what can be done to mitigate the risk and who has responsibility for the lead pipe work

Information may be found on South East Water's website regarding the risk associated with lead pipework and appropriate mitigating actions. Information is also available on the website regarding customer responsibility for service pipework. All customers are entitled to a free sample to determine lead concentrations in their drinking water on request.

South East Water is fully supportive and engaged with industry wide awareness campaigns through Water UK and WRAS.

South East Water will continue to develop and expand its communication and education regarding the risks associated with lead.

## 2.8 Radioactivity

South East Water have carried out catchment risk assessments, taking into account the geology and any artificial sources that could lead to an increase in natural background levels of radioactivity utilising data obtained from the Environment Agency (EA), to verify the results of monitoring undertaken.

No radioactivity has been detected in any of South East Water's supply sources, and the catchment risk assessment confirms that it is unlikely to be detected, as a consequence the company have applied for and been granted a waiver under regulation 6(12) [6A3] from monitoring for indicative dose (ID), tritium and radon is not required.

The company will continue to review risk assessments when new information comes to light and operational monitoring at a low frequency will be continued.

## 2.9 Other emerging risks

### 2.9.1 Chromium

DWI released two information letters (04/2015 and 02/2017) with respect to the presence of chromium at levels of potential health concern, but significantly below the current PCV of 50 µg/l. In 02/2017 identified three WTWs in the United Kingdom where the average concentration of Chromium leaving site was above 3 µg/l – College Avenue WTW was one of these. South East Water has continued to monitor the raw and treated water for both Chromium and introduced Chromium VI monitoring in May 2017. This monitoring has confirmed the treated water regularly exceeds 3 µg/l for both Chromium and Chromium VI.

Catchment solutions are planned as part of the South East Water's AMP7 NEP programme but a treatment process is required to ensure the treated water is always reduced to less than 3 µg/l.

The options appraisal has been carried out and has identified the installation of either ion exchange or coagulation and filtration would be suitable treatment options for the removal of chromium to acceptable concentrations at College Avenue.

Reverse osmosis treatment would be an effective treatment process for Chromium. The costs associated with this option are considerably higher than for either ion exchange or coagulation and filtration and this option has now been discounted.

Further investigation and assessment is required to identify which solution (ion exchange or coagulation and filtration) would be most appropriate to be carried forward, incorporating the following considerations:

- Continuation of investigation and monitoring of the raw water trends and variability
- Continuation of the investigation of the source of the chromium in the catchment and aquifer and management of the source.

- Pilot trials for the two proposed solutions, issues of concern include the impact of the raw water quality (solvents and nitrates) on the performance of each option.
- Availability of (Reg. 31 approved) ion exchange resin in the UK

A scheme has been submitted to the DWI detailing the investment need.

### 3 Water quality performance 2015-20

#### 3.1 Mean zonal compliance (MZC)

The overall Mean Zonal Compliance is a measure of the Water Quality at customers' taps against both the European Directive and National parameters in Schedule 1 of the Water Supply (Water Quality) Regulations. The measure is comprised of the average of the MZC % figures for 39 different parameters that are tested to establish the quality of water. Performance over the past four years is shown in Table 1.

Measure	2017	2016	2015	2014
SEW MZC	99.95%	99.95%	99.96%	99.96%
Performance commitment	100%, adjustment to revenue penalty at 99.94% or lower			
Total No. of failures at Customer tap	24	44	51	49
No. of failures contributing to MZC	18	29	29	27

Table 1: South East Water mean zonal compliance performance 2014-17

There were 24 samples taken from customer's taps in 2017 in which a parameter failed to meet standards, which represents a significant improvement on the previous three years which saw an annual average of 48 sample failures. The greatest improvement has been seen for total coliforms which dropped from an average of 20 per year to 6 in 2017 as a result of improvements at WTW, in the network and disinfection techniques at the customer property. Iron has reduced from an average of 11 failures per year to 7 in 2017 as a result of the sequential flushing and SeaQuest installations which form part of the Company's discolouration strategy. Despite the reduction in the number of failures, the MZC remains at 99.95 % as a result of the low sampling frequency of eight for 8/24 of the failures, which increases the relative impact of each failure.

#### 3.2 Discolouration contacts

As outlined in section 2.6, the company identified areas where an elevated number of customer contacts were received, particularly with respect to discolouration and has had a discolouration strategy in place since 2012 to address these identified issues.

In line with the DWSP approach, this strategy considers all aspects from source to tap and the work to date has focussed on improvement of performance at treatment works, increased cleaning frequency of key service reservoirs, installation of SeaQuest dosing to minimise deposition within the distribution network and a programme of sequential flushing.

The discolouration strategy was aimed to reduce the number of water supply zones (WSZ) which experienced a contact rate above 2/1000 population. The strategy was amended following the introduction of the OFWAT outcome delivery incentive (ODI) target of an overall company rate of 0.58 contacts per 1000 population. Figure 2 shows the ongoing improvement in performance with regard to discolouration contacts. Six WSZ had a contact rate above 2/1000 compared with 9 in 2016. For the first time on record, no WSZ had a contact rate over 4/1000.

The current projection is that the ODI target of 0.58/1000 will be met by the end of the current business plan period and all WSZ should have a contact rate below 2 contacts /1000 population.

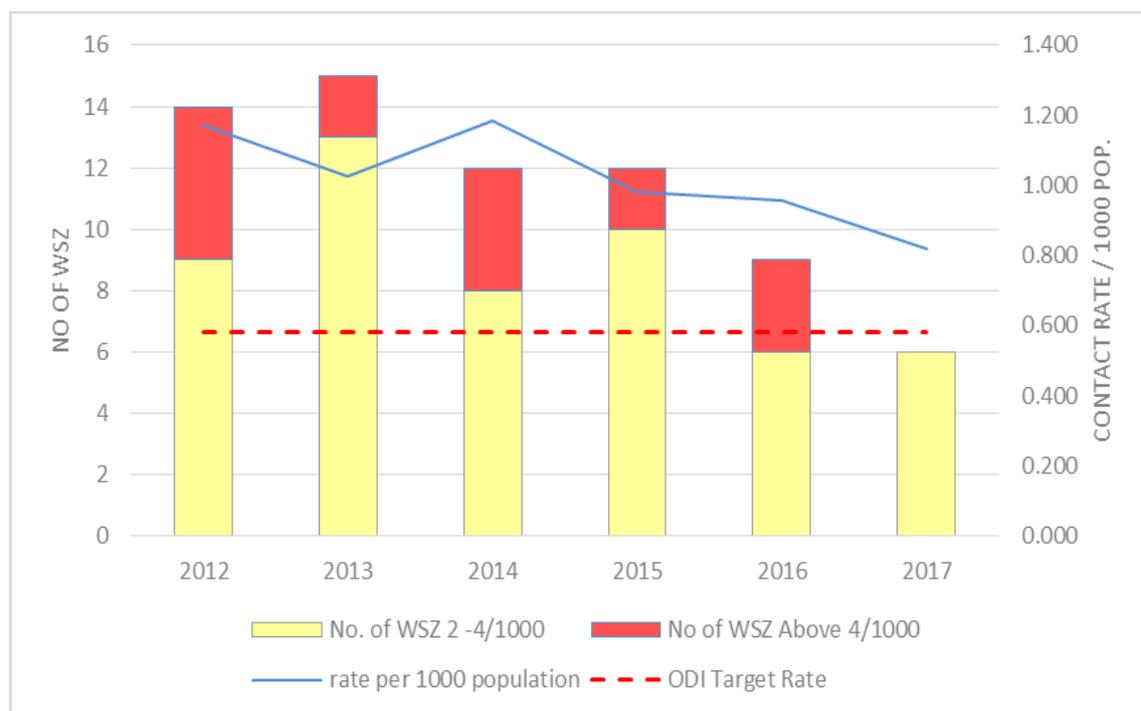


Figure 2 Discolouration performance WSZ and overall rate

### 3.3 Above ground asset performance

Above ground asset performance comprises of four serviceability indicator outlined below, performance is assessed as stable or marginal.

**WTW Coliforms:** *The number of water treatment works with determinations containing coliforms as a percentage of the number of determinations of water leaving treatment works taken at frequencies required by regulation 13 (Schedule 3, table 3, item 2 – see page 39), as specified in regulation 4 (schedule 1, table A, part II, item 1 – see page 34) of the ‘Water Supply (Water Quality) Regulations 2000’ (and its equivalent in Wales).*

**Service reservoir coliform non-compliance:** The number of service reservoirs where more than 5% of the samples taken exceeded the maximum concentration required for coliform bacteria as a percentage of the number of service reservoirs tested for microbiological parameters. As stated for Item 1 of Part II in Table A of Schedule 1 of the Water Supply (Water Quality) Regulations 2000. This is the same measure reported in the Chief Inspector's Report on Drinking Water on a calendar year basis.

**Turbidity at WTW:** The number of operational potable water treatment works and sources (where measured) whose turbidity 95 percentile equals or exceeds a 0.5 NTU threshold. Calculate 95 percentile value using all data from regular routine sampling of final water from sources for the calendar year

**Enforcement incidents:** The number of enforcement actions considered by the DWI for a breach of microbiological standards during the calendar year

Above Ground Asset performance Assessment – Overall assessment based on results of all individual measures within Lines1-4. Targets and performance to date are shown in Table 2.

Composite index				2015-16	2016-17	2017-18	2018-19	2019-20
<b>Indicator</b>	<b>Unit</b>	<b>Performance bands</b>		Stable	Stable	Stable		
<b>WTW coliforms non-compliance</b>	%	High	0.08	0.04	0.08	0.04		
		Ref	0.05					
<b>Service reservoir coliforms non-compliance</b>	%	High	0.84	0.00	0.00	0.00		
		Ref	0.21					
<b>Turbidity non-compliance</b>	Nr	High	11	0	0	0		
		Ref	4					
<b>Enforcement</b>	Nr	High	1	0	0	0		
		Ref	0					

Table 2 Above ground asset performance

Performance in this metric has been assessed as stable for each of the three years of the current business plan reporting period 2015-20.

## 4 Water quality performance 2020-25

### 4.1 Compliance risk index

A new drinking water quality measure was required to replace the current Mean Zonal Compliance Index for a number of reasons, including those provisions in the proposed Water Supply (Water Quality) Regulations amendments 2017 that will allow companies to move away from the current monitoring programme (based on sample numbers) to a risk based monitoring methodology to assess compliance.

The compliance risk index is a new measure devised by the DWI to replace MZC as the headline water quality measure. Unlike MZC which used only data from samples taken at customer properties, CRI assesses all compliance final water data submitted as required under the water supply (water quality) regulations at treatment works, service reservoirs, supply points and customer properties – as such this measurement provides a truer reflection of water quality performance.

The metric is made up of three components:

- A parameter score, with a focus on health based impact
- The DWI assessment of the failure / response
- The volume / population affected

This measure replaces the mean zonal compliance performance commitment and also the above ground asset performance assessment in the current business plan period for South East Water.

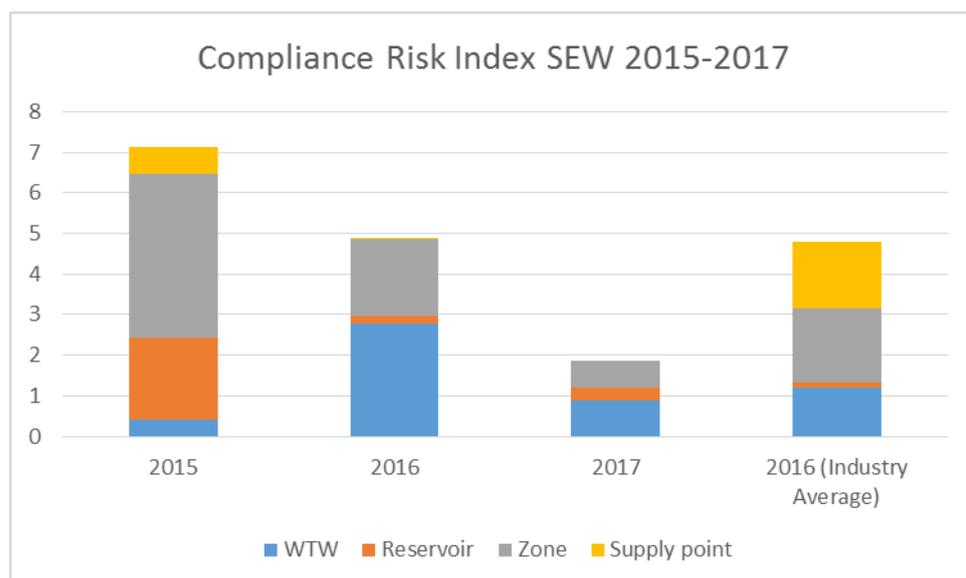


Figure 3 Compliance Risk Index 2015-2017

Figure 3 shows the published CRI information for 2015 and 2016, the industry average for 2016 and the calculated CRI for South East Water for 2017. The company show a year on year improvement for this metric.

CRI has been included within OFWAT's common performance commitments for PR19. Performance criteria for this metric have yet to be finalised, however DWI proposed a penalty only ODI. As every compliance failure represents a failure of the company to meet their statutory obligations it is not appropriate to offer rewards. As such, in terms of a target, companies should aim for CRI scores of zero and thus aspire to continuous improvement and results of at least at a level that is equal to or below the national average.

#### **4.2 Discover water appearance contacts**

During the current business plan period there are a number of different metrics in use across the industry with regard to the quality of the water supplied, ranging from contact rate for discolouration (black, brown and orange) to all contacts received reporting appearance, taste and odour and illness. For the period 2020-25, it has been proposed to standardise the approach to reporting in line with the Discover Water performance measure - Number of times companies were contacted by customers about the appearance of their tap water (per 10,000 people supplied)

Performance for the industry for the calendar year 2016 is shown in Figure 4.

The largest constituent of this measure for South East Water is discolouration rate (black, brown, orange). Key activities identified to drive improvements in this measure are outlined in section 2.6 water distribution.

This measure is included within the long list of asset health performance commitments and replaces the discolouration contacts performance commitment in the current business plan period for South East Water.

#### **4.3 Event risk index (ERI)**

The DWI proposed Event Risk index (ERI) to complement the Compliance Risk Index (CRI) on water quality, which is already included in OFWAT's common performance commitments for PR19. The ERI looks at: the seriousness of water quality events, how the company managed the event and the impact of the event. OFWAT noted in their final methodology that ERI is currently behind CRI in its development. Based on the information available, they considered that ERI could be an excellent metric of water quality events and their impacts on customers. As such, they proposing to include ERI in the asset health long list of optional metrics (with common definitions), to supplement the common asset health performance commitments. South East Water intend to adopt this measure on a reputational basis only for the business plan period 2020-25 as there is insufficient data available at the current time.

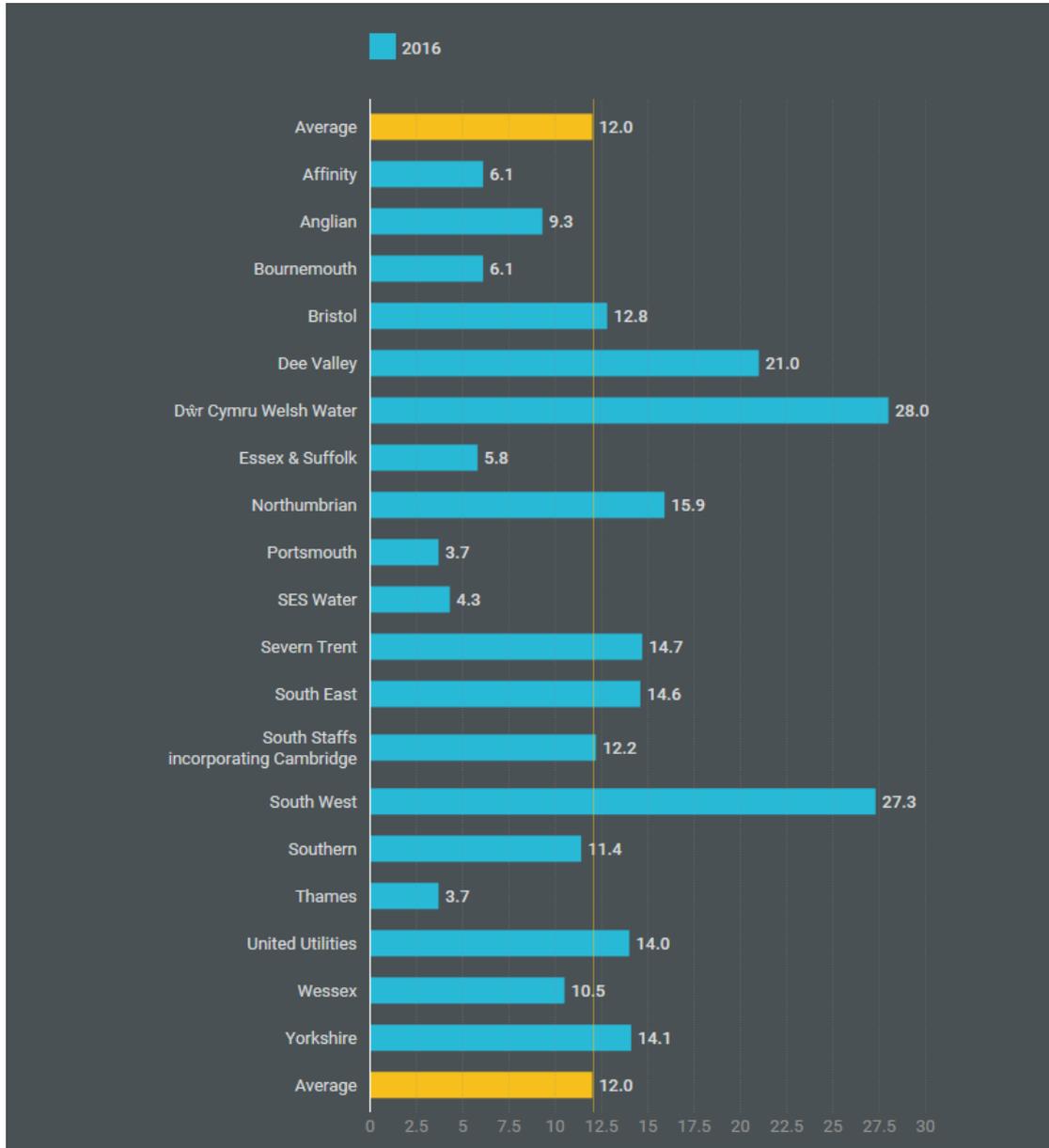


Figure 4 Number of times companies were contacted by customers about the appearance of their tap water (per 10,000 people supplied)