Chapter 11a
Non financial measures
Water service
serviceability indicators

Covering:
Water treatment works – turbidity

Non financial measures
Chapter 11a
Water service serviceability indicators

This table has one block, block A and 4 lines.

This information is required to enable NIAUR to identify trends, which may indicate declining asset condition at treatment works. This adds to the basket of indicators that will together inform an assessment of serviceability to customers.

Guidance

Water treatment works turbidity

Three tables have been provided. One for NI Water data only, a second for PPP data only and a third which will be the sum of the first two.

Block A in this table covers:

Water treatment works – turbidity

Reporting is for the calendar year to align with DWI reporting. The company is required to analyse turbidity results for each operational water treatment works that produced water for drinking purposes in the calendar year and determine 95 percentile values. The company should identify and report number of works and their aggregated output (Ml/d) over the calendar year where the 95 percentile is greater than or equal to 0.5 Nephelometric Turbidity Unit (NTU) in line 1 and less than 0.5 NTU in line 2. This requires an off-line calculation and the procedure is set out in Appendix A to this chapter (methodology and calculations). It is expected that turbidity will be monitored at least weekly.

We have a line for reporting where there are works with insufficient sampling for turbidity to determine 95 percentile values. Changes in water regulations require from 2004 that turbidity in the final water at works will be reported to the DWI. We expect that the company is better able to report on this measure for an increasing number of works. The expectation is that for those works that are sampled for turbidity, data is available on at least one sample per week.

If continuous monitoring of turbidity has been introduced and is not producing results consistent with regular sampling, and vice versa, the company should work to resolve this issue. For the time being, NIAUR will keep to using results of routine regular sampling.

The company is required to note that the methodology requires the exclusion of works where there are long gaps in the data, the removal of 'non-routine' samples and samples extra to the regular sampling interval. For some works, this may mean that there is insufficient data to calculate a 95 percentile figure (refer Appendix A). We recognise that some works may be fully operational but not in supply for part of the year, creating long gaps in turbidity data. To avoid excluding these works, data gaps due to a works not being in supply should be ignored.

Report in line 3 works where turbidity is not recorded or cannot be reported, and their aggregate output.

The 0.5 NTU threshold is not a surrogate for a Prescribed Concentration or Value (PCV). Companies are to provide an assessment of the results and their expectations, above and below 0.5NTU based on the type and quality of source waters, treatment processes and recording procedures.

Company commentary

Water treatment works turbidity

The company should:

- explain the reasons for the figure in line 3; in particular where works are operated for less than the whole year and whether this has affected the figures in lines 1 or 2 significantly;
- when appropriate, comment on performance on the calendar year to date, to further inform trend assessment; and,
- report PPP data where indicated.

The company is encouraged to make similar analyses of performance in relation to other key determinants to aid demonstration of performance of works in this group and describe any such progress in their commentary.

Guidance to Reporters

Water treatment works turbidity

The reporter is asked to review the calculations undertaken by the company. The review should include adherence to the methodology, assumptions made and calculations produced. The reporter is asked to confirm or otherwise whether the results produced are realistic and justifiable.

The reporter should:

- identify which works did not produce water throughout the year and check that these results are appropriately included;
- check the company's exclusion of non-routine samples and review the exclusion of works on the basis of insufficient data or gaps in the data, to ensure that the criteria have been correctly applied;
- confirm the correct reporting of PPP data;
- challenge data that is included or excluded, and comment on whether the procedure for exclusion of samples has had a material effect on the results; and
- comment on company proposals regarding any other performance indicators for this group of assets.

Water service non-infrastructure

Ofwat introduced reporting on water service non-infrastructure maintenance in 2008/09 after a two year trial period. This additional reporting requirement was introduced in order to address a gap identified in a review of serviceability indicators by UKWIR and is designed to provide a better picture on the future service capability of the asset systems. It is intended to provide information on the underlying performance of the non-infrastructure assets that deliver service, particularly treatment, and on the underlying performance of the assets that convey water.

The UKWIR review recommended that an indicator based on the concept of unplanned maintenance be developed. Discussion with companies in England and Wales revealed that whilst this would be useful, maintenance data is structured in different ways that reflect the maintenance planning and recording procedures of each company. It is therefore impossible to standardise on a definition without requiring companies to change the way data is captured and used. Therefore the measure would only be useful to the companies if the method of measurement fits with each company's own internal recording procedures and governance.

Two forms of indicator were suggested:

- a count of unplanned jobs; and
- a percentage availability of (critical) plant.

But it was acknowledge that there may be others.

Each company was therefore asked to draw up its own specification of a suitable indicator or indicators and reporting procedures based around the generic definition. The aim being to inform potential change in the likelihood of service failure. The company had to explain its rationale for the indicator(s) and the data used within the context of its maintenance strategy. The indicator(s) was supposed to closely align with the presentation of metrics used to inform the company's Board of the ongoing state of its mechanical, electrical and instrumentation and control equipment.

The counting procedures were to focus on capturing relevant data from the company's maintenance systems at a level of granularity and materiality for this purpose. A rising trend in the indicator would indicate deterioration, a reducing trend would indicate improvement, and a stable trend will indicate stability, for an unchanging size in asset base. The data was to be held at one or more levels of aggregation, to inform (at least in the commentary) the distribution of numbers among different asset types e.g. pumping and treatment. The companies had to include specification for what is captured in the annual time frame to ensure consistent reporting year on year, e.g. jobs raised or jobs closed. Ofwat recommended 'jobs completed in the year', consistent with other annual information return activity reporting.

NIAUR are considering the introduction of a similar indicator in future annual information returns and would ask the company to draw up its own specification of a suitable indicator or indicators during 2009/10 to allow trial reporting to commence in AIR10 if required. The rationale for the choice of indicator(s) and the data used within the context of its maintenance strategy will need to be explained.

Utility Regulator
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TABLE 11a
APPENDIX A
Methodology and calculations

Water treatment works – turbidity

Introduction

The company is required to report the number of treatment works whose 95 percentile turbidity values exceed a 0.5 NTU threshold in the reporting year. This information is required to enable us to identify trends which may indicate declining asset condition at treatment works. For consistency, companies should adopt the following procedures for selecting data and calculating the 95 percentile for each works.

1. Select data

The company must analyse turbidity results for the reporting year for each operational works. It is expected that turbidity will be monitored at least weekly and, in most cases, at least twice a week.

### 2. Calculate 95 percentile values for each treatment works

Methodology:

1) Assemble data for the relevant treatment works and calendar year being reported.

2) Order by date and time.
   - Recording of time is not mandatory but, if available, times should be included.
   - If date and time are not available continue at step 6.

3) Calculate the time interval between one sample and the previous one to the nearest day.
   - For the first sample, the time interval should be the time elapsed since the year start.
   - For the last sample, the time interval should be the time to the year end.

4) Check for long gaps in the data.
   - Identify periods when the works was not in supply, and the time (weeks) not in supply.
   - If the maximum time interval is less than or equal to 28 days, proceed.
   - If the maximum time interval exceeds 28 days, check whether this corresponds to a period when the works was not in supply. If it does not so correspond, stop. Report "Gap in data too long".
   - If the works was in supply for eleven months or less, check whether the maximum time interval is less than or equal to 28 days less one per four weeks not in supply. If it does exceed this adjustment to the maximum interval, stop. Report "Gap in data too long".
   - Exclude works where the maximum time interval exceeds 28 days, except where this corresponds to when the works was not in supply and the adjusted maximum time interval is not exceeded.

5) Remove 'non-routine' samples
   - 'Non-routine' samples are those carried out as part of special investigations.
   - If 'non-routine' samples are not known they must be removed from the data in the following way:
   - Define the frequency of sampling (weekly, twice weekly periods etc). This may be known or estimated by dividing the total number of samples by 52 and rounding to the nearest integer greater or equal to 1.

- Define 'weeks' (periods) from the start of the year in appropriate blocks (seven days for period = week) as shown below, with the 31st December being included in the preceding week. (The 'week' referred to here is the average interval between samples. This period may be a week, a half-week, a day, etc., depending on the sampling frequency).

Week number	Dates (inclusive)
1	1st to 7th January
2	8th to 14th January
…	…
9	26th February to 4th March (Inc. 29th February if appropriate)
…	…
21	21st to 27th May
…	…
52	24th to 31st December

- Assign the appropriate week (period) number to each sample
- Discard the samples extra to the regular sampling interval (in this case a week) from each week (period), latest first, so that the maximum number of samples in any week (period) is the sampling frequency.

6) Check for an adequate number of data points.
- If the number of samples is less than 29, stop and report: "Not enough samples at works".

7) Calculate 95 percentiles for works with sufficient numbers of samples and no long data gaps.

- Put the data in descending order: V_1 (max), V_2, V_3 etc.
- Calculate $m = 0.05 *$ (number of samples + 1)
- Split m: $m = i + j$ where i is an integer and $0 <= j < 1$

$95\%ile = \{(1-j) * V_i\} + \{j * V_{i+1}\}$

$m = 1.95$

$i = 1$

$j = 0.95$
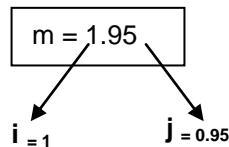
3. Worked example

Consider the data for a works outlined in table A.1. The works was in supply for the whole year. Applying the methodology shows that the maximum time difference between samples is 27 days, which is just acceptable. The total number of samples is 53, which suggests a weekly sampling regime. To get one sample per week remove the samples in bold in table A.1 from the data set. Assigning weeks to each of the samples does this.

Table A.1   Example works turbidity data

Date	Values (NTU)	Time interval between samples	Week number
02/01/99	0.3	2	1
03/01/99	<0.2	1	1
05/01/99	<0.2	2	1
10/01/99	<0.2	5	2
18/01/99	0.4	8	3
25/01/99	0.4	7	4
08/02/99	0.2	14	6
15/02/99	<0.2	7	7
22/02/99	0.2	7	8
15/03/99	<0.2	21	11
22/03/99	<0.2	7	12
29/03/99	0.3	7	13
01/04/99	0.3	3	13
04/04/99	<0.2	3	14
08/04/99	0.3	4	14
19/04/99	<0.2	11	16
26/04/99	<0.2	7	17
07/05/99	0.3	11	19
17/05/99	0.2	10	20
24/05/99	<0.2	7	21
27/05/99	<0.2	3	21
29/05/99	<0.2	2	22
09/06/99	0.3	11	23
14/06/99	0.3	5	24
21/06/99	0.3	7	25
28/06/99	0.3	7	26
30/06/99	0.3	2	26
06/07/99	<0.2	6	27
09/07/99	0.3	3	28
13/07/99	0.4	4	28
19/07/99	0.3	6	29
20/07/99	0.4	1	29
26/07/99	0.4	6	30
27/07/99	0.3	1	30
02/08/99	<0.2	6	31
03/08/99	<0.2	1	31
07/08/99	0.2	4	32
16/08/99	0.3	9	33
17/08/99	0.4	1	33

Date	Values (NTU)	Time interval between samples	Week number
23/08/99	<0.2	6	34
25/08/99	0.2	2	34
29/08/99	0.4	4	35
08/09/99	0.3	10	36
13/09/99	0.3	5	37
17/09/99	0.3	4	38
21/09/99	0.2	4	38
22/09/99	0.3	1	38
27/09/99	0.2	5	39
05/10/99	<0.2	8	40
01/11/99	0.4	27	44
08/11/99	0.2	7	45
04/12/99	<0.2	26	49
07/12/99	0.4	24	49

The remaining 38 data points are shown in descending order in table A.2. Since there are more than 29 samples the percentile can be calculated:
- Data in descending order and labelled V_1 (max), V_2, V_3 etc is shown in table A.2
- m = 0.05 * (number of samples + 1) = 0.05 * (38 + 1) = 1.95
- Splitting m: m = i + j where i is an integer and 0 <= j <1
  is achieved by setting i = 1 and j = 0.95
- So the 95%ile is $\{(1 - j) * V_1\} + \{j * V_{i+1}\}$ = {(1 - 0.95) * 0.4)+(0.95 * 0.4)} = 0.4

Table A.2   Example turbidity data, after processing and sorted in descending order

Date	Value (NTU)	V_I	
18/01/99	0.4	V_1	$V_i = V_1$
25/01/99	0.4	V_2	$V_i + 1 = V_2$
26/07/99	0.4	V_3	
29/08/99	0.4	V_4	
01/11/99	0.4	V_5	
02/01/99	0.3	V_6	
29/03/99	0.3	V_7	
07/05/99	0.3	V_8	
09/06/99	0.3	V_9	
14/06/99	0.3	V_{10}	
21/06/99	0.3	V_{11}	
28/06/99	0.3	V_{12}	
09/07/99	0.3	V_{13}	
19/07/99	0.3	V_{14}	
16/08/99	0.3	V_{15}	

Date	Value (NTU)	V_I
08/09/99	0.3	V_{16}
13/09/99	0.3	V_{17}
17/09/99	0.3	V_{18}
08/02/99	0.2	V_{19}
22/02/99	0.2	V_{20}
17/05/99	0.2	V_{21}
07/08/99	0.2	V_{22}
27/09/99	0.2	V_{23}
08/11/99	0.2	V_{24}
10/01/99	<0.2	V_{25}
15/02/99	<0.2	V_{26}
15/03/99	<0.2	V_{27}
22/03/99	<0.2	V_{28}
04/04/99	<0.2	V_{29}
19/04/99	<0.2	V_{30}
26/04/99	<0.2	V_{31}
24/05/99	<0.2	V_{32}
29/05/99	<0.2	V_{33}
06/07/99	<0.2	V_{34}
02/08/99	<0.2	V_{35}
23/08/99	<0.2	V_{36}
05/10/99	<0.2	V_{37}
04/12/99	<0.2	V_{38}

4. Aggregate results at company level
Allocate works into the relevant category for lines 1 to 3. Report numbers of works and their aggregated output for each of lines 1 to 3. Line 4 is the summation of lines 1 to 3.

Table 11a line definitions

A   WATER TREATMENT WORKS - TURBIDITY

1	95%ile greater than or equal to 0.5NTU [column 1 – number of water treatment works]	nr	0dp
Definition	The number of operational potable water treatment works and sources 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. Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply. The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Input		
Responsibility	Network Regulation Team		

1	95%ile greater than or equal to 0.5NTU [column 2 – output volume]	Ml/d	2dp
Definition	The sum of the output volume for the calendar year for operational potable water treatment works and sources 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. Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply. The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Input		
Responsibility	Network Regulation Team		

2	95%ile less than 0.5NTU [column 1 – number of water treatment works]	nr	0dp
Definition	The number of operational potable water treatment works and sources whose turbidity 95 percentile is less than a 0.5 NTU threshold. Calculate percentile value using all data from regular routine sampling of final water at water treatment works for the calendar year. Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply. The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Input		
Responsibility	Network Regulation Team		

2	95%ile less than 0.5NTU [column 2 – output volume]	Ml/d	2dp
Definition	The sum of the output volume for the calendar year for operational potable water treatment works and sources whose turbidity 95 percentile is less than a 0.5 NTU threshold. Calculate percentile value using all data from routine regular sampling of final water at water treatment works for the calendar year Minimum of 30 water samples where the works is in production for more than 11 months of the year. Otherwise, a minimum of 30 samples, less one sample per unit of four weeks that the works is not in supply. The maximum time interval between data samples is 28 days where works is in production for more than 11 months of the year, otherwise 28 days less one per unit of four weeks not in supply.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Input		
Responsibility	Network Regulation Team		

3	Turbidity not recorded [column 1 – number of water treatment works]	nr	0dp
Definition	Number of operational water treatment works or sources for which turbidity is not recorded or where there are insufficient samples or where the time interval between samples is longer than the required minimum (see line 1 and 2 definitions).		
Primary Purpose	Confirming delivery of key outputs and service.		
Processing rules	Input		
Responsibility	Network Regulation Team		

3	Turbidity not recorded [column 2 – output volume]	Ml/d	2dp
Definition	The sum of output volume for the calendar year for operational works in this category, expressed in megalitres per day.		
Primary purpose	Confirming delivery of key outputs and service.		
Processing rules	Input		
Responsibility	Network Regulation Team		

4	Total [column 1 – number of water treatment works]	nr	0dp
Definition	The total number of operational water treatment works.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Calculated: sum of lines 1, 2, and 3		
Responsibility	Network Regulation Team		

4	Total [column 2 – output from water treatment works]	Ml/d	2dp
Definition	The total output from operational water treatment works for the calendar year.		
Primary Purpose	Confirming delivery of key outputs and service		
Processing rule	Calculated: sum of lines 1, 2 and 3		
Responsibility	Network Regulation Team		

**CHANGE CONTROL SHEET
CHAPTER 11a**

2008/1.0	First issue of chapter for the SBP period
2009/1.0	Second issue of chapter for the SBP period - Notification of potential future reporting on water service non-infrastructure added - Tables amended to provide PPP only and NIW+PPP reporting