Commentary on data tables that have changed

Wessex Water

August 2019

Wessex Water
YTL GROUP

Contents

1. Introduction

This document provides a commentary for all values that have been updated in the tables we have resubmitted as part of our representations to the draft determination.

It does not comment on values that have not changed.

2. App26: RoRE Scenarios

The draft determination states that we should complete this analysis in "the context that achieved cost and outcomes performance has been positively skewed at a sector level in previous price review periods".

As we discuss fully in representation R2, recently more than one-third of companies have underperformed on totex between 2015-6 to 2018-19 In 2018/19, 11 have underperformed, which is notably the first year that the full upper quartile challenge on ODIs has applied. We also note that the wholesale cost allowances are generally higher than the Ofwat PR14 view of efficient costs because Ofwat moved c.25% of the way towards the company estimates when setting these. In terms of our own performance we note that our PR14 outperformance on ODIs is driven almost entirely by a single ODI out of more than thirty. While in the first four years of the price review period we have outperformed on totex and ODIs the combination of sharpened efficiency challenges, step changes in performance required from companies, upper quartile challenges, RPEs and frontier shift all lead to an increased level of risk at PR19 compared to PR14 that means we are not making any changes to our RoRE other than those explained below.

Further, all the cuts Ofwat has made in its DD in our case are against statutory drivers or PCs with penalties. These one-sided rather than two-sided adjustments would create a negative skew against our totex RoRE because we retain the obligation but we have not adjusted for that at this stage subject to our representations on costs.

Importantly, we note that Ofwat has a resilience duty, which includes financial resilience and that the combination of factors mentioned above must be considered in the round in Ofwat's assessment at final determination.

We have made changes to the following areas:

1. The ODI position is incorporating the DD and assumes that Ofwat accepts the representations we are making. We have filled this in with an estimate of the range post a Monte Carlo analysis, not an additive case as previously. We have taken the approach as requested through the query process after the IAP and again re-iterate the risks with this approach. At an appointee level over the 5 years the figures are robust, inferring the splits as annual figures by price control will not be accurate.
2. We have accepted your intervention on the downside risk on financing costs. We have also reduced (in a symmetric manner) the potential upside, the cost of debt adjustment will limit the ability to outperform as well.
3. We have updated the D-MeX downside to reflect 12% of developer revenues as per the indication of the measure in the draft determination.
4. As discussed in the draft determination, we do not assume maximum downside on C-MeX.

We have also got a version of this table updated with our view of the RoRE ranges from the draft determination, if this would be useful we would be happy to provide this to you.

3. Bio1: Wholesale wastewater sludge (explanatory variables)

We have revised our sludge production forecast for PR19 due to the following reasons:

- As previously outlined in our original submission, Appendix 5.5, we are in the process of installing measurement to enable us to measure sludge production at the boundary of Network+/Bioresources.
- Once this measurement is fully in place, our method of calculation will therefore change from back-calculation (of sludge for recycling/disposal), to production figures from our Network+ sites
    - We will continue to calculate using the historical back-calculation method as a cross-check to provide confidence in the new method and instruments
- For 2018/19 our sludge import measurement was installed and calibrated but our indigenous measurement (for sludge from co-located sites) is still being completed.
- Therefore for APR19 we used the improved import measurements to calibrate our sludge production figures, but still maintained our historical approach overall.
- Using this new method of calibration for 18/19 showed our PR19 forecast figure was c.4% too high; the improved accuracy afforded by the new import loggers indicated our previous method has over-forecast our production.
- As we move to change our calculation to boundary measurement, we expect our production figures will be further refined and thus we have recast our PR19 forecast in light of the improved measurement accuracy.
- We have applied the changes made to our sludge production calculation for APR19 to our PR19 forecast (details in this document); we have then used this updated production forecast to update figures for related lines in Bio1.
- The modification to our import calibration methodology has resulted in a total reduction in our previous sludge production forecast for AMP7 of 4.35% (-16.5 tDS over 2020/21-2024/25).
- We have not adjusted any figures in the cost tables associated to the Bioresources control as our forecast of total costs have not altered.

3.1 Line 1 Total sewage sludge produced, treated by incumbents

Increasing sludge production arises from increasing sewage load treated at STWs and from an increase in inorganic sludge production, the latter arising from increased Phosphorus removal at STWs.

The forecast for growth is based on analysis of reported data over the last 8 years to establish the underlying growth after allowance is made for inorganic sludge production as P consents have been introduced at our STWs.

Theoretical inorganic sludge production has been derived based on the timing and consent levels for future P Permits at our STWs.

The analysis uses a bottom up approach using data from individual STWs as a basis thereby enabling changes in sludge production from the introduction of new P consents to be more accurately forecast.

We described more fully our methodology for volume forecasting in Supporting document 5.5.

New import loggers were installed at our sludge treatment centres (STCs) in 2018 to improve our measurement of tDS of imports. At APR19 we modified our method of calculation, primarily with respect to calibration method of our sludge imported into sludge treatment centres. This resulted in a lower sludge production result than forecast in our original submission of Bio1 in September 2018.

We have also recently installed new loggers on our indigenous sludge at co-located STWs/STCs to enable us to calculate our sludge production at the boundary between Network+/Bioresources once fully commissioned and calibrated. Based on the improved accuracy and resulting lower results from the new import loggers, we deemed it was prudent to adjust our PR19 forecast to reflect the improving data.

For completeness we have copied and updated the forecasting methodology text from our business plan submission, Appendix 5.5, as Annex A to this commentary, which reflects the revised figures in Bio1.

3.2 Line 4 Total sewage sludge produced from non-appointed liquid waste treatment

The volume of sludge arising from the treatment of organic waste cannot be directly measured - it can only be calculated from measurement of volume and load discharged into the head of the STW.

To establish charges for organic waste we routinely measure settled chemical oxygen demand (COD) and total suspended solids and have comprehensive data for these parameters. To estimate sludge production requires further data on biochemical oxygen demand (BOD) and settleable solids for which we only have limited data. To derive secondary sludge production it is also necessary to assume a conversion factor (kg sludge produced from kg BOD) for the relevant process at each STW where organic waste is treated.

We have used the limited data we have available to derive an estimate for organic waste sludge production in 2016/17 and 2017/18 as 5% and 3.6% of total sludge production respectively. We have used an indicative figure of 4% for our forecast.

3.3 Line 5 Percentage of sludge produced and treated at a site of STW and STC co-location

The increase in Phosphorus removal will predominantly occur at STW sites which are not co-located and therefore the percentage of sludge produced and treated at a site of STW and STC co-location will marginally reduce.

Our sludge production forecast, which is built up from data from individual STWs, has been used to derive the forward forecast for this figure.

(*Please note that we queried this line as follows:-*

"We have one STC which receives sludge from a Network+ site by a rising main 3.5km length. As the work done is included in line 9 we have not previously included this site in line 5 – is this correct?".
Ofwat have confirmed this approach is correct – refer to Query 567 Final methodology queries and answers 25 June 2018)

3.4 Line 6 Total sewage sludge disposed by incumbents

The forecast allows for the increase in sludge production (based on our revised sludge production forecast) and for future changes in treatment process. The move to digest more sludge and reduce the volume that is limed will reduce disposal volumes.

The step change in disposal volume between 2019/20 and 2021/22 reflects the full commissioning of our Taunton STC development. It also arises from a reduction in liming of digested sludge cake which we have been undertaking to improve the stability of stockpiles on farms during the winter period, we are currently in the process of providing additional storage so that in future we can hold sludge cake on site during adverse weather conditions. On review of our forecast production figures we made a minor correction to our total disposal figures increasing post 2020 tDS by c.2.5% prior to the adjustment made for our reforecast production figures.

3.5 Line 9 Total measure of intersiting 'work' done by pipeline

Forecast figures are based on the average of last 4 years reported with an annual increase derived from the revised forecast sludge production figures.

3.6 Line 10 Total measure of intersiting 'work' done by tanker

Forecast figures are based on the average of last 4 years reported with an annual increase derived from the revised forecast sludge production figures.

3.7 Line 11 Total measure of intersiting 'work' done by truck

Wessex do not currently transport any sludge by truck. Following full development of Taunton STC (circa December 2019) Minehead, West Huntspill and a proportion of Yeovil sludge will not be limed but will be transported by truck to Taunton for digestion.

The forecast for truck movements assumes the following:-

- Activity starts April 2020 (any prior activity will be part of commissioning work)
- Average of last 4 years disposal data, with adjustment for no lime mass, used to determine tDS to be transported
- Total number of movements at 2020 derived by converting tDS to volumes with estimated %DS figures for each STC operating without lime and assuming 15 wet tonnes per movement.
- Total number of movements and mileage used to derive intersiting ‘work’ done by truck.

3.8 Line 13 Total measure of intersiting 'work' done by tanker (by volume transported)

Forecast figures are based on the average of last 4 years reported with an annual increase derived from the revised forecasted sludge production.

3.9 Line 16 Total measure of 'work' done in sludge disposal operations by truck

Forecast figures are based on the average of last 4 years reported with an annual increase derived from the revised sludge disposal forecast.

3.10 Line 18 Total measure of 'work' done by tanker in sludge disposal operations (by volume transported)

We previously have quoted the volume moved by truck rather than tanker as we believed the reference to tanker to be incorrect. On review of figures submitted by other WaSCs for APR19 we submitted a query to Ofwat (as part of the post-DD queries, ref. 8) to clarify the definition of the value. Following Ofwat's response ["*Bio1 line 18 is only intended to capture all work done for sludge disposal by tanker only (by volume transported). Since you only transport by truck, line 18 is not applicable to you and therefore should contain a zero value.*"], we have changed all forecast values in this line to zero. For consistency with previous APR submissions, we have left in the values submitted for APR18 and APR19.

3.11 Line 19 Chemical P sludge as percentage of sludge produced at STWs

Ofwat responses to query 43 on the methodology for PR19 have resulted in a change to the way we have calculated this number. We have previously reported our estimate of the proportion of sludge produced at each STW that arises from chemical dosing and then summated this for all STWs. The figure we reported in 2016/17 was 5.0%. Based on Ofwat's response to Query 43 we understand that if a STW has chemical dosing then the total sludge produced from that STW should be included. Using this method our 2016/17 figure would be 26.4%.

We confirm our 2017/18, 2018/19 figures and our forecast for this line is in accordance with the response to Query 43.

However, this prompted us to raise a further query with Ofwat (568) as follows:- "At one of our Network+ STW (where chemical dosing is undertaken) sludge is transferred to another Network+ site by sewer. At the second STW no chemical dosing is undertaken. To complicate matters further at the first STW sludge imports are also accepted (of which some but not all are from chemically dosed STWs and all are less than 10% DS) and transferred along with the indigenous sludge by sewer to the second STW. Guidance notes advise that we should be reporting sludge produced at the boundary between Network+ and Bioresources which in this case is as sludge is discharged from the primary tanks at the second STW. To report chemically dosed sludge should we therefore

a) Include all the sludge produced at the second STW (i.e. report based on the Network+/Bioresources boundary) noting that this site produces 50% of our total sludge production of which only around 12% is from chemically dosed sites; or

b) Report based on figures as the sludge leaves each Network+ site (i.e. only include the total indigenous volume from the first STW and the total sludge imports from chemically dosed STWs)."

We have reported in accordance with option b) above.

Ofwat have confirmed this approach is correct – refer to Query 568 Final methodology queries and answers 25 June 2018.

4. R1: Residential Retail

4.1 Line 16 Household connected

Following agreement and publication of our final water resource management plan (WRMP) we have updated the split of measured and unmeasured customers to reflect the published data.

No other figures in this table have been updated.

5. WS1: Wholesale water operating and capital expenditure by business unit

5.1 Line 15 Other Capital expenditure – non infra

A total of £4.23m capex has been added to this line in the Water Resources price control, phased through each year of AMP7. This relates to the expenditure for Strategic Regional Water Resource Solutions.

6. WS2: Wholesale water operating and capital expenditure by business unit

6.1 Line 14 Resilience

We have recategorised £0.528m total capex in the Water Resources price control for improving SSSI landholdings to line 31 Partnership Working. This work is phased annually through the next control period. In the deep dive on resilience, Ofwat comment that these activities may be better considered under raw water deterioration. Instead we have reallocated them to a freeform line for Partnership working. We have submitted a separate representation, C9, specifically on partnership working.

6.2 Line 32 Strategic Regional Water Resource Solutions

A total of £4.23m capex has been added to this line in the Water Resources price control, phased through each year of AMP7. This relates to the expenditure for Strategic Regional Water Resource Solutions.

7. WS2a: Wholesale water cumulative capital enhancement expenditure by purpose

See commentary for WS2: Wholesale water operating and capital expenditure by business unit

8. WS3: Wholesale water properties and population

Following agreement and publication of our final water resource management plan (WRMP) we have updated the split of measured and unmeasured customers to reflect the published data.

We have also updated the number of meters installed, to be consistent with the published data.

No other figures in this table have been updated.

9. WWn4: Wholesale wastewater sewage treatment (potential explanatory variables)

Line 18 Current population equivalent served by filter bed STWs with tightened/new P consents and Line 23 Current population equivalent served by STWs with tightened/new sanitary parameter consents

We have identified discrepancies with our population reporting. Where sites had more than one scheme/driver we had apportioned the costs to the relevant capital/operating expenditure lines in Data Tables WWS2 and WWS2a. However we had, incorrectly, only placed the population equivalent against the primary cost driver in Data Table WWn4. This has resulted in an understatement of population equivalent against Lines 18 and 23.

Furthermore, Ofwat changed its modelling from a capex approach at IAP to totex approach at DD. The current line definition for Line 18 is:

> *Population equivalent served by biological filter STWs at which there are new or tightened consent conditions for phosphorus, delivered in the report year and for which capital costs are reported in WWS2 line 19. Exclude population equivalent served where the output has primarily been met through opex rather than capex solutions.*

Given the change in modelling approach, we assume that Ofwat intended to update the line definition to include population equivalent served through opex solutions. As such, we have updated the population equivalents for Line 18 to include opex solutions.

Table – Updated lines in WWn4

	Line Description	WWn4 April 2019 (2020-2025)	Amendment	Revised WWn4 August 2019 (2020-2025)
18	Current population equivalent served by filter bed STWs with tightened/new P consents	360,350	+ 1,646* + 38,511***	400,507
19	Current population equivalent served by activated sludge STWs with tightened/new P consents	508,104	-	508,104
23	Current population equivalent served by STWs with tightened/new sanitary parameter consents	89,027	+86,430**	175,457
24	Current population equivalent served by STWs with tightened/new UV consents	50,851	-	50,851

* Corfe Castle p.e. originally only assigned against Line 24 (Current population equivalent served by STWs with tightened/new UV consents). Now included against Line 18 for 2020-21.

** Castle Cary, Radstock and Yeovil p.e. originally only assigned against Line 18 (Current population equivalent served by filter bed STWs with tightened/new P consents)

*** Evercreech. Wells and Wellington are opex solutions (with a bit of enabling capex), so p.e. not previously included

The operational enhancement sites for phosphorus removal are shown below:

Table 1-1 – Population equivalent for phosphorus removal opex solutions at filter bed STWs

Site	P.E.	Year
Wells STW	15,076	2020-21
Wellington STW	15,747	2020-21
Evercreech STW	7,688	2022-23

The full list of sites related to Line 23 (sanitary parameter consents) are shown below:

Table 1-2 – Population equivalent for sanitary parameter removal schemes

Site	P.E.	Year
Shepton Mallet	39,107	2020-21
Radstock	25,523	2021-22
Castle Cary	4,099	2023-24
Wells	15,105	2023-24
Yeovil	56,807	2023-24
Gillingham	14,505	2024-25
Keynsham	20,310	2024-25

The associated lines in table WWn4 have been updated to reflect the above changes.

10. WWn8: Wholesale wastewater network plus special cost factors

10.1 Line 7 Total expenditure for special cost claim 2

£2.307 totex in line for the sewage treatment works capacity programme from 2021-22 to 2024-25 has been recategorized to line 19, which relates to the Bristol (Avonmouth) STW FFT & Growth cost adjustment claim.

10.2 Line 19 Total expenditure for special cost claim 5

We have added a new cost adjustment claim relating to the works that are planned at Bristol (Avonmouth) STW to provide an increase in flow to full treatment (FFT) and also some treatment capacity for development growth. This is the cost adjustment claim 5, “Bristol (Avonmouth) STW”.

The cost claim is for the funding of the costs associated with the required works at Bristol (Avonmouth) STW which are not adequately accounted for in the cost assessment feeder model for flow to full treatment or the base cost allowance for STW growth. Our representation document C1 – Cost adjustment claim for Bristol (Avonmouth) STW, provides further details.

We have included the total expenditure included in our business plan in row 19 of the table. Ofwat has allowed an implicit modelled allowance for both the increase in FFT at Bristol (Avonmouth) STW and the provision of capacity for STW growth. Our cost claim is for the difference between our total planned expenditure[1] (£44.149m – as shown in row 19) and the combined total implicit allowances from Ofwat’s cost models. We do not have full visibility of Ofwat’s calculation of implicit allowances but estimate their combined value for flow to full treatment and growth at Bristol STW, at approximately £23.6m.

This investment is also shown in table WWS2 as freeform lines 36 (capex) and 83 (opex).

[1] We explain in the representation document that, following an independent review of the technical scope of the planned solution at Bristol STW, we have accepted the challenge that a reduced number of new primary settlement tanks is required (3 No. rather than 4 No.), and have subsequently reduced the planned investment shown in our final business plan (September 2018) by £2.0m.

11. WWS1: Wholesale wastewater operating and capital expenditure by business unit

11.1 Line 15 Other Capital expenditure – non infra

£3.282m capex in total in the Sewage Treatment price control, phased from years 2 to 5 of AMP7, has been removed from this line. This is for the reduction in expenditure for WINEP / NEP ~ Event Duration Monitoring at intermittent discharges and WINEP / NEP ~ Schemes to increase flow to full treatment.

£0.949m capex in total in the Sewage Collection price control, phased through years 1 to 3 in AMP7 has been removed from this line. This is for the reduction in expenditure for WINEP / NEP ~ Event Duration Monitoring at intermittent discharges.

Refer to commentary for table WWS2.

12. WWS2: Wholesale wastewater capital and operating expenditure by purpose

12.1 Line 6 WINEP / NEP ~ Event Duration Monitoring at intermittent discharges

Total capital expenditure on this line in the Sewage Treatment price control has been reduced by a total of £1.282m, phased through years 3 to 5 in AMP7.

A reduction of £0.949m total capex has been made in the Sewage Collection price control and this expenditure is phased through years 1 to 3 in AMP7.

12.2 Line 9 and Line 56 WINEP / NEP ~ Schemes to increase flow to full treatment

We have reduced the total capex relating to the scheme at Avonmouth, Bristol, STW to increase flow to full treatment from £43.721m to £41.721. We have also recategorized this expenditure to line 36 Bristol (Avonmouth) STW FFT & Growth. This expenditure is phased over years 2 to 5 of PR19. The associated enhancement opex of £0.121m in year 5 of PR19 has been categorised to line 83. We have revised the opex in Line 56 to £0.707m in year 5.

12.3 Line 11 WINEP / NEP ~ Storage schemes in the network to reduce spill frequency at CSOs, etc.

£3.167m total capex in the Sewage Collection price control relating to FSO Investigations has been recategorised to line 16 WINEP / NEP ~ Investigations, in line with the reallocation by Ofwat in the draft determination deep dive. This is due to complete in 2022/23 and has expenditure phased through the first three years of the control period.

12.4 Line 26 and Line 73 Growth at sewage treatment works (excluding sludge treatment)

£2.301 total capex in the Sewage Treatment price control phased from Years 2 to 5 of PR19 has been recategorized to line 36 Bristol (Avonmouth) STW FFT & Growth. The associated enhancement opex of £0.006m in year 5 AMP7 has been recategorised to line 83. We have revised the opex in Line 56 to £0.502m in year 5.

12.5 Line 27 Resilience

£2.323m total capex in the Sewage Treatment price control relating to partnership initiatives [Bathing Water Partners Programme (£1.056m), Catchment Partnerships (£0.950m), both phased annually through the next control period, and Brinkworth Brook (£0.317m spread over the first two years of AMP7), completing in 2021/22] has been recategorised to line 33 Partnership Working.

In the deep dive on resilience Ofwat comment about whether these activities contribute to mitigating low probability high consequence events. We have submitted a separate representation, C9, on partnership working.

13. WWS2a: Wholesale wastewater cumulative capital enhancement expenditure by purpose

See commentary for WWS2: Wholesale wastewater operating and capital expenditure by purpose.

14. WWS3: Wholesale wastewater properties and population

Following agreement and publication of our final water resource management plan (WRMP) we have updated the split of measured and unmeasured customers to reflect the published data.

No other figures in this table have been updated.

Annex A. Sludge forecast

A.1 Background

For provision of sludge figures within our Annual Performance Review we have determined a sludge production figure from the records of cake recycled to land. This approach has been adopted as the data available is the most reliable. Volumes exported are measured either by weighbridge or by load cells on vehicles and routine sampling is undertaken to obtain sludge cake density. To arrive at a sludge production figure allowance is then made for either the lime added or losses through digestion, depending on the process used for treatment. Lime addition is obtained from purchase records. Sludge is routinely sampled pre- and post-digestion for dry solids content which provides the data for an average destruction rate to be calculated.

In line with the RAG4 Guidelines, we have recently installed measurement at the boundaries of the Network+ and Bioresources business units.

As the real time accurate measurement of sludge density is technically difficult and to ensure a high level of accuracy is achieved, calibration against results from laboratory analysis of samples has been undertaken for imports and is ongoing and will be undertaken for indigenous sludge when indigenous measurement is available. Results of this exercise, which will provide data on both indigenous and imported sludge, will enable comparison with the current method of determining sludge volumes. However, as per the time of submitting the plan this data is not yet available for indigenous sludge, however the data is now available for imported sludge, hence the change to our production forecast.

Forecasting also needs to reflect the impact that increased Phosphorus (P) removal has on sludge production. The Phosphorus removal programme is described in supporting document 5.1.

Undertaken by chemical dosing, P removal produces a significant quantity of inorganic sludge. To develop a robust forecast for future sludge production a spreadsheet model has been developed that enables:

- an annual growth factor to be determined
- allowances to be made for increase in sludge from P removal.

This method is compliant with the definition in the Ofwat PR19 methodology (Appendix 6: Bioresources control, Box 1) for determining the sludge production in tonnes of dry solids.

A.2 Sludge production forecast model

To produce our production forecast, taking into account the constraints outlined above, we have adopted the following approach:

- Production back-calculated from exported sludge has been compared with a figure derived from the sum of indigenous, calculated from p.e. and a theoretical production rate of 0.065g/hd/day[2], and the total of all logger imports.

Sept 18 calibration methodology:

- In our original business plan submission (Sept 18) this exercise was undertaken with data for three financial years (2014/15, 2015/16 and 2016/17).
- This showed that the sludge loggers at some treatment centres appeared to overstate the volume (tds).
- A calibration factor for imports, specific for each logger, was determined such that

  Produced (from exports) ≈ Indigenous (from p.e.) + Logged Imports x Calibration Factor

Revised (August 19) calibration methodology:

- For APR 2018/19 this calibration exercise was undertaken using import data with individually calibrated data for origin production sites (STWs) to produce a new indigenous value for each STC.
- The calibration factors for imports, specific to origin sites, were determined using sample results.
- This provided greater accuracy by allowing calibrations to be applied to individual sludge types (by origin).
- These origin site calibration factors were applied retrospectively to the historic raw import data.
- To adjust for changes in sludge from P removal a theoretical percentage increase, dependant on treatment type (activated sludge, biological filters, tertiary etc.) and the consent limit has been used.[3]
- A theoretical sludge volume for each year in the period from 2012/13 to 2018/19 has then been derived as follows:-

  Theoretical production = { Indigenous (2018/19[4])} x Annual Growth Factor + Origin site calibrated logger imports)

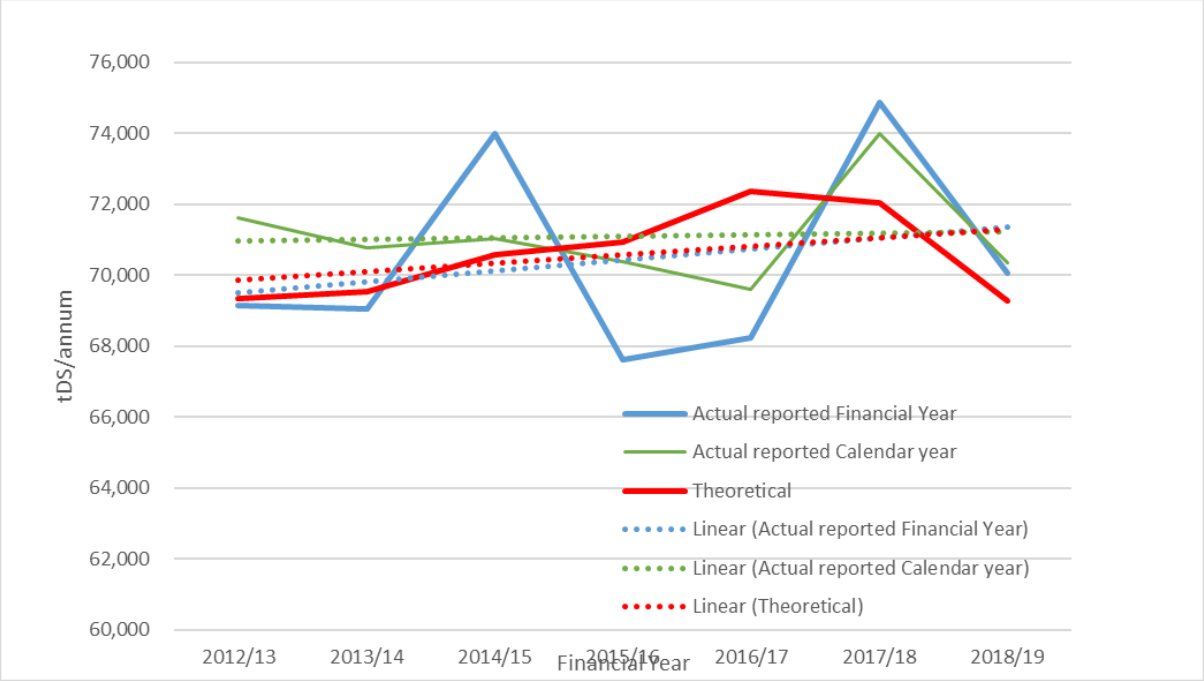
- The growth factor has been adjusted to derive a fit with reported sludge production over the period 2012/13 to 2018/19; a reasonable correlation is achieved when a growth factor of 0.4% per annum is assumed. This is illustrated in the following figure.

[2] Based on Wessex Water design standards and assuming a primary sludge production of 0.04 kg/hd/day and a secondary sludge production of 0.025 kg/hd/day. The former is appropriate for

[3] Based on Wessex Water design standards and assuming a primary sludge production of 0.04 kg/hd/day and a secondary sludge production of 0.025 kg/hd/day. The former is appropriate for STWs without chemical dosing, as is the case for most of our co-located sites and the latter is typical for either a filter works or an activated sludge plant with a long sludge age.

[4] This is for all STCs with the exception of Minehead as there is no logger installed due to the small volumes received. The indigenous value used for this site was as previously (average of 2014/15, 2015/16, 2016/17).

Figure 1-2: Calibration to derive growth factor

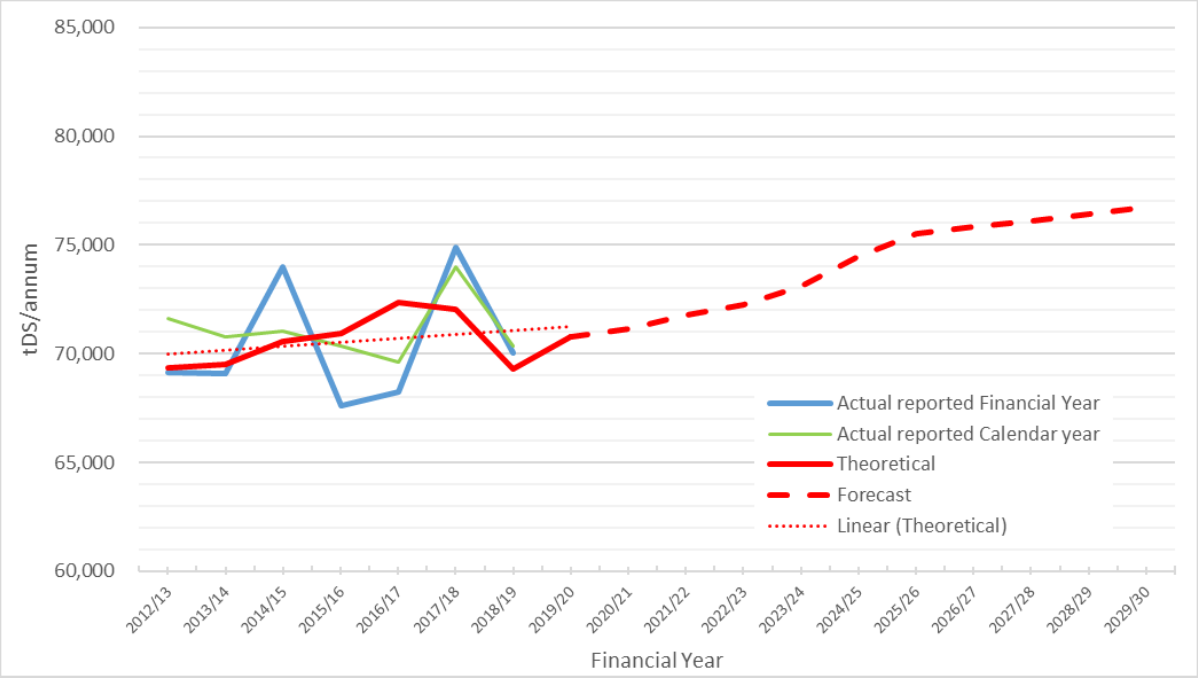


A.3 Forecasted volume increase 2019/20 to 2029/30

Future sludge production figures are forecasted using a similar approach. An underlying growth factor of 0.4% per annum has been assumed, based on the analysis of historical data described above, with increases in sludge production from additional inorganic sludge calculated when a new or tighter P consent is introduced at a treatment works.

The following figure shows the resultant forecast.

Figure 1-3: Sludge production forecast



The step change from 2023/24 to 2024/25 arises from the increased inorganic sludge as a large number of new P consents come into force at our sewage works.

Our forecast for the period 2020/21 to 2024/25 is also detailed in the table below. This includes a comparison with historical data and a breakdown to illustrate the impact of additional inorganic sludge.

Table 14-1: Production forecast (ttds)

	2015/16 to 2019/20 (1)	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26 to 2029/30
Total sludge	351.5	71.2	71.8	72.3	73.1	74.4	380.6
		362.7					
Inorganic sludge (2)	17.7	4.2	4.6	4.8	5.3	6.4	35.6
		27.3					

Notes

(1) Total includes actual data for 2015/16, 2016/17, 2017/18 and 2018/19 and forecasted figures for 2019/20

(2) This is the estimated inorganic sludge quantity i.e. the additional sludge arising for chemical dosing for P removal. This is different to the figures used to evaluate the percentage quoted in Table Bio1 Line 19, where the total sludge i.e. both organic and inorganic at sites where chemical dosing is undertaken for P removal is used to determine chemical P sludge.