Discharges from the Ashlands waste-water treatment plant and their impact on the R. Wharfe: briefing notes for John Grogan MP

by

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These notes are intended to explain problems caused by the discharge of both untreated and treated effluents from the Ashlands waste-water treatment plant in Ilkley into the River Wharfe. They have been commented on by the Yorkshire Water and the Environment Agency. It is hoped therefore that notes relating to the performance of the treatment plant (YW) and to the ecological status of the river as monitored by the EA are factually correct. Neither organisation, however, necessarily endorses the opinions, conclusions or recommendations expressed.

Introduction

What are the problems?

1. There are two different but related issues: the problem of untreated storm discharges and nutrient phosphorus pollution by the treated effluent.

2. Standard waste-water treatment plants such as the one in Ilkley are designed to remove organic matter from the waste-water arriving at the plant before discharging the treated effluent to a water course.

3. Untreated organic matter from human waste causes both public health problems (from contamination of the water by faecal bacteria) and water pollution problems especially for fish (from the consumption of oxygen in the water as organic matter decomposes).

4. Untreated waste-water also has a high concentration of nutrients (phosphorus and nitrogen) that can cause excessive algal growth and undesirable alteration to freshwater ecosystems downstream.

5. Even treated effluent has a high concentration of nutrients and water companies are now being required to introduce nutrient removal processes into waste-water treatment plants to conform to the demands of the EU Water Framework Directive.

6. In all cases, it is assumed that receiving water is sufficiently clean and has sufficient flow adequately to dilute the effluent. This is by no means always the case.

7. Here we consider both issues: untreated discharges and nutrient pollution.

Discharge of untreated sewage

Why is untreated waste-water legally discharged to water courses?

8. In most treatment plants, such as Ashlands, waste-water derived from older parts of towns and villages includes surface water from rainfall entering the sewers through gutters from houses and road surfaces.

9. Such systems, called Combined Sewer systems are a problem for waste-water treatment plants as the flow of waste-water into the plant, especially after heavy rainfall events, can quickly exceed the capacity of the plant to treat the sewage. As a result, combined sewer overflows (CSOs) are placed in strategic points on the network to relieve pressure in the system and prevent internal and external flooding.

10. The amount of foul waste-water received by a treatment plant is predictable based on the number of people and households connected to the sewer. This is called the dry-weather flow. For Ashlands the dry weather flow limit in the consent is 62.7 litres/sec.

11. The amount of water derived from rainfall is unpredictable and depends on the amount, duration and intensity of rainfall.

12. During heavy rainfall events the combined flow can exceed the capacity of the plant to treat the waste-water, especially as rain falling on impermeable surfaces enters the sewer system almost immediately. In Ashlands the treatment capacity is set at 114.8 litres/sec.

13. When this treatment capacity is exceeded waste-water is diverted by pumping it into storm-water tanks where the untreated water is held before being released back for treatment once the excessive inflow has subsided. Ashlands has four tanks designed for this purpose with a total capacity of 826 cu m.

14. If the storm tanks fill to capacity before the flow has subsided the waste-water overflows untreated directly into the river.

15. A further problem arises in very high flow conditions when the capacity for the incoming waste-water to be pumped into the treatment plant is exceeded. In Ashlands the inflow capacity is 246 litres/sec. When this value is exceeded waste water is released untreated, but under permit, directly into the Wharfe.

16. So direct discharge of raw sewage into the river depends on the rate of flow into the plant whereas indirect discharge, i.e. via the storm overflow tanks, depends on the capacity of the storm tanks. When inflows exceed 246 litres/sec, therefore, discharge to the Wharfe begins before the storm tanks are full, as noted on more than one occasion during the summer of 2018.

17. Following prolonged rainfall raw sewage can be discharged simultaneously both directly into the river (when the inflow rate is exceeded) and indirectly (once the storm tanks are full).

18. Some of the most serious incidents occur in the summer following intense convective storms when the treatment plants are overwhelmed and untreated waste-water is discharged at a time of low, or very low, river-flow. Sewage is then neither adequately diluted nor adequately washed away.

19. Some mitigation has been introduced at Ashlands following highly visible discharges that occurred in the summer of 2018. Screens and pumps not required by the permit have been

upgraded. The new pump lifts additional flows into the storm tanks and the new screen will replace the current screen on the overflow to retain more debris.

Will the problem become more serious?

20. As flows into the plant cannot be easily reduced and the capacity of the plant cannot be easily increased the frequency and severity of untreated effluent discharges is unlikely to decrease. To increase the capacity on site, the permit would need to be reviewed and changed.

21. Without increased capacity the situation is likely to deteriorate. A significant number of new homes are being built or are planned for Ilkley and Addingham. Although new development should not add to surface water flows as developers are no longer allowed to route rainfall into the sewers, dry weather flows will be increased in proportion to the number of households connected to the sewer network.

22. For Ilkley and Addingham combined, a population increase of approximately 3000 is expected over the next decade leading to a dry-weather flow increase of up to 15%.

23. Climate change is also a concern. Under projected climate change winter rainfall for the north of England might increase by between 10 and 20% over coming decades and there might be further increase in the frequency and intensity of high rainfall events (https://www.metoffice.gov.uk/research/collaboration/ukcp) .

24. As noted above summer storms have the most damaging consequences as raw sewage discharges will occur at a time of year when there is minimal river water dilution.

Are there any solutions?

25. It might be argued that the Ashlands site is now unfit for purpose and the only long-term viable solution is to close the works and pump the waste-water further down the valley to a site with the capacity to treat all waste in all conditions.

26. However, sites downstream at Ben Rhydding, Burley and Otley all have CSOs and are likely to be overloaded in storm conditions.

27. Failing that, a major upgrade is called for. Ashlands has a scheme to increase permitted storm tank capacity from 826 m^3 to 945 m^3 which meets 2 hours at maximum flow through the storm tanks. The scheme is due for delivery by 31 March 2024. Ilkley is one of 63 sewage treatment works in Yorkshire and 392 in England where an increase in storm storage is required under the Water Industry Natural Environment Programme (https://www.gov.uk/government/news/5-billion-investment-by-water-companies-to-benefit-the-natural-environment).

28. In the meantime measures to reduce flow into the plant should be examined. These include:

    - ensuring that surface water from new building does not enter the sewer system. This requires careful scrutiny of planning applications by local parish councils;

- encouraging property owners in the catchment to install SuDS, especially by making hard surfaces permeable, intercepting roof water, creating rain gardens and building soakaways. YW have plans to install SuDS at Addingham Primary School and Sacred Heart Primary School;

- examining the possibility of increasing storm tank capacity at the Addingham pumping station both to minimise discharges into the Wharfe at Addingham and decrease inflow rates at Ashlands.

What are the problems of discharging untreated waste-water directly into the river?

29. Any raw sewage discharge is potentially damaging both to human health and to the health of the river. The threat to human health comes from contamination of the water by faecal bacteria.

30. The threat to the ecology of the river comes from the decomposition of the organic matter (i.e. raw sewage) in the water, a process that consumes oxygen dissolved in the water, stressing both invertebrate and fish populations. This is measured as BOD (or Biochemical Oxygen Demand).

31. The impact of these discharges on the Wharfe seem to be entirely unknown, as there appear to be no data for either faecal bacteria or BOD immediately downstream of the outfalls in Ilkley.

32. Data are absent because there is no statutory requirement for microbiological monitoring in the river itself as the river is not designated for bathing. The EA are only concerned with water quality issues under WFD (see below), Public Health England only engage with contaminated water monitoring if permitted discharges are exceeded or a serious health risk has been reported, and YW are only concerned with the quality of the treated effluent leaving the works.

33. However, even in the absence of data there can be little doubt that faecal bacteria concentrations in the river are high during periods of untreated discharges (cf. Kay et al. 2008, *Water Research*).

What new information is needed?

34. It is in the interests of those who use the water for paddling, swimming and fishing (e.g. local residents, angling clubs) to know the level of health risk they are taking when entering the river close to, or downstream of, the treatment plant.

35. It is also in the interests of charities concerned with restoring the health of the river (e.g. the Yorkshire Dales Rivers Trust, Wharfedale Naturalists, the Wild Trout Trust), to know what impact raw sewage discharges may be having on river ecology, especially as such discharges impair attempts to restore native salmonid fish populations to the upper reaches of the river.

36. It is also in the interests of the Environment Agency seeking to restore this section of the river to “good” ecological status by reducing nutrient pollution under the Water Framework Directive (see below). As the phosphorus concentration in raw sewage is higher than in

treated effluent, storm-flow discharges are likely to contribute disproportionately to the relatively high concentrations of orthophosphate recorded by the EA at Burley Weir.

37. High quality monitoring for faecal bacteria and BOD is expensive and, as noted above, no agency (YW, EA, Public Health England) in the absence of a permit breach has shown any willingness to conduct such monitoring, although there are standard sampling and measurement protocols available.

38. Such monitoring cannot be taken on by concerned local citizens or charities, due to its specialised nature and expense, although local organisations through their volunteer networks could help, e.g. by sample collection and delivery to central laboratories, if funding for laboratory analysis could be found.

39. It would be helpful if all parties could collaborate and raise funding to commission an independent study of the impact of untreated waste-water on the microbiological condition of the river using agreed standard protocols. The aim would be to establish the health risks to the general public of raw sewage discharges of differing magnitude and duration under different river flow conditions during the year.

40. The results of such a study could then be used to: (i) provide advice on health risks to the general public akin to those used for bathing beaches; and (ii) establish an agreed protocol for routine long-term monitoring.

Nutrients (especially phosphorus) in treated effluent

What is nutrient phosphorus pollution?

1. As noted above standard waste-water treatment plants are designed to remove organic matter from waste water before discharging the treated effluent to a water course, usually to a river, lake or to the sea.

2. Although serious untreated discharges of raw sewage continue, as described above, the failure of our rivers now to meet good ecological standards is not due to organic matter contamination but to the high concentrations of nutrients in treated effluent from waste-water treatment plants and to the input of nutrients into watercourses from agricultural land, especially arable land.

3. Phosphorus pollution is the main problem nutrient. It is an essential plant nutrient found in very low concentrations in natural waters, sufficiently low to limit the growth of algae in water. Increasing the P concentration therefore can lead to excessive growths of algae as well as cause major changes in aquatic plant and animal communities, especially in lakes. This process is called eutrophication.

4. Eutrophication as a major global problem came to light in the 1960s when lakes around the world turned green from excessive algal growth as discharges of nutrient-rich sewage effluent enriched by newly formulated P-rich washing powders increased. In many cases the decomposition of the algal material in the lake consumed all the dissolved oxygen in the water and fish died.

5. Consequently it is now mandatory under the EU Wastewater Treatment Directive for all sewage works serving populations of more than 10,000 upstream of standing waters to strip P from the treated effluent. This is often referred to as ”tertiary treatment”. A classic

example is the Windermere Tower Wood treatment works that installed P removal technology in 1992.

6. Sewage works on rivers, such as the Ashlands plant, are currently exempt from this legislation. The legislation was mainly directed at standing waters where eutrophication is a more serious problem as oxygen consumed by decomposition processes in deep lakes cannot be easily replenished during the summer period.

7. However, partly because of the loss of P from agricultural soils but also because of the lack of controls on P discharge from waste-water treatment plants, P concentrations in lowland rivers are high causing increased algal growth in river ecosystems and, perhaps most importantly, creating severe problems of eutrophication in downstream estuaries and in the North Sea.

8. High P concentration with its associated biological consequences is now one of the main reasons why so many watercourses in the UK fail to be classed as "good status" under the EU Water Framework Directive (WFD) and why the EA are requiring water companies including YW to invest in expensive P-removal technologies in many of its waste-water treatment plants.

How serious is nutrient pollution in the River Wharfe downstream of Ashlands?

9. The Ashlands site is within the WFD waterbody from the River Dibb to upstream of Burley in Wharfedale. The ecological status of this waterbody is classed as "moderate" on the basis of fish, "high" for invertebrates, "good" for phytobenthos and "high" for phosphate. The overall classification is therefore "moderate" (= fail), reflecting the score for fish (see EA 2018/84880) as the poorest performing metric.

10. It should, however, be noted that the "high" status for phosphate is based on the sampling point at Bolton Bridge, and therefore reflects the status of the river above the Ashlands STW.

11. The reason why the fish metric is classed as moderate for this waterbody is related to hydromorphological conditions (i.e. the presence of physical barriers to fish movement) rather than nutrient pollution.

12. The WFD waterbody downstream from Ashland is from Burley in Wharfedale to the River Washburn. Here the WFD classification is also "moderate", but on the basis of macrophytes and phytobenthos combined. For invertebrates the WFD is classed as high and for phosphate the WFD is classed as good (63 µg/l) (see EA 2018/84880). The overall classification is therefore "moderate" (=fail).

13. The chemistry monitoring point for this waterbody is located on the River Wharfe at Burley Weir. Although the three-year mean value of 63 µg/l places the waterbody in the "good" category, this is a relatively high value, probably close to the good-moderate boundary. The value of orthophosphate-P used by the EA to define the boundary is needed in order to verify this assumption.

14. Although these metrics appear to be in conflict, the difference between them is understandable as they reflect different water quality attributes. The composition of the

phytobenthos responds primarily to nutrient concentration (especially P) whilst invertebrate communities respond primarily to oxygen conditions. In a fast flowing relatively turbulent river such as the Wharfe where oxygen used in organic matter decomposition can be quickly replenished by entrainment from the atmosphere, inverts may not be so strongly affected as the phytobenthos.

15. The relatively high phosphate levels downstream of Ilkley and the "moderate" performance of the phytobenthos at Burley suggests that the Wharfe downstream of Ashlands is indeed suffering from nutrient pollution.

16. There is consequently a need reduce P concentrations in the river to protect downstream habitats not just locally but also, as noted above, in the Humber estuary and the North Sea where eutrophication is a major problem.

17. The problem of eutrophication is being aggravated under climate change as P loading from sewage treatment plants and from agriculture is increasing principally due to increased rainfall causing more frequent storm water discharges from sewage treatment plants (as above) and increased soil erosion from agricultural land.

18. Higher temperatures also lead to a reduction in oxygen concentrations in water and encourage growth of undesirable algal species both in fresh and marine waters.

What additional information is needed?

19. Monitoring of nutrient (especially orthophosphate) concentrations and the different biological elements by the EA remains paramount. The impact of the Ashlands STW on the Wharfe is best assessed by comparing data upstream and downstream. Upstream the official monitoring points for chemistry are Bolton Bridge and downstream the monitoring point is Burley Weir. An intermediate site at Denton Bridge is also monitored but only for chemistry. However the EA have indicated they might increase the range of elements they will monitor at Denton Bridge and this should be welcomed.

20. Concentrations are flow dependent. No data are yet available for the summer of 2018, but given the very low flows of receiving water in the Wharfe during the summer, concentrations downstream are likely to be abnormally high for that period as the treated effluent rich in P will have received minimal dilution. It would be useful to have these more recent data.

21. One problem in interpreting the chemical data is that, due to the Government's austerity programme, there has been a major reduction in the frequency of monitoring by the EA, from 12 samples per year (monthly) to 4 samples (quarterly) per year at present. The calculated mean now is therefore much less statistically secure then before; the present day programme of quarterly measurements cannot fully capture the range of conditions occurring in such a dynamic river system.

22. Installation of a P-stripping process at Ashlands could reduce nutrient pollution significantly and lead to an improvement in the ecological status of the river under WFD.

23. But failure to resolve the storm-water discharge problem will continue to give rise to public health concerns and cause episodic organic matter and nutrient pollution.

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