Pumping stations – A better way to manage risk

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Introduction

Pumping stations are an integral part of any sewerage network, but are perhaps that part of the system that has received less attention than other elements. Yet we ignore the importance of these assets at our cost. In 2007, of the category 1 and 2 pollution incidents recorded against Water Company assets, around 20% were down to pumping station malfunction, and the associated operation of pumping station emergency overflows. The impact these discharges have on the environment should hardly come as a surprise, as such emergency discharges are invariably comprised of neat foul sewage, rather than dilute storm sewage. And yet the current AMP guidance and associated consenting is unclear on what problem needs to be solved, and by what means.

This paper explores a radically different approach to this issue that is now being trialled within Yorkshire Water, and how this is progressing.

Background

Emergency overflows exist at sewage pumping stations, to safeguard those installations and associated properties from flooding or damage in the event of a mechanical or electrical failure.

In consenting guidance provided by the fore-runner of the Environment Agency as long ago as 1993, an emphasis was placed on *“ensuring that there was an adequate response to failure, so as to minimise discharges from emergency overflows”*. Moreover, the guidance advocated *“providing adequate arrangements to reduce the risk of discharge as far as reasonably practicable”*. The guidance also detailed the types of facilities that could be provided at sites, including telemetry, standby pumps, standby generation, access for tankers and storage, but did not seek to place these in a risk based context.

In addition, the consents that were issued by the Environment Agency and its predecessor focussed on defining what constituted a failure, the type(s) of equipment that should be provided at the site, and a requirement to *“take all reasonable measures to return the pumping station to normal operation, as soon as practicable after receipt of warning of failure or breakdown of the pumping station”.*

It was on this basis that Yorkshire Water entered AMP3, when it was required to embark on a programme of improvements to emergency overflows at over 400 sites, as part of its AMP3 quality obligations. Whilst the Company had a shared view with the Agency regionally on the majority of emergency provisions, this was not the case when it came to providing additional new storage at over 150 sites and, as a result, the requirement to provide 4 hours storage at DWF was appealed accordingly.

In looking at how to resolve those appeals, it quickly became apparent that not only were some of the emergency overflow storage volumes larger than those being constructed for the Company’s AMP3 UPM programme, but that, more fundamentally, such provision was only addressing some of the symptoms of overflow failure, it was not addressing the root cause.

It was therefore time to look at this problem in a different way.

A new approach

Core to the new approach was the need to focus on preventing the underlying causes of failure, being able to recover from any failure swiftly, and having an approach that was tailored to the environmental sensitivity of each pumping station in relation to its receiving watercourse.

Visible routine maintenance

The first element in preventing emergency discharges is to make the pumping stations themselves more reliable, and in doing so, make this improved reliability transparent to the Agency.

To meet this requirement, the approach developed reinforced existing good practice, focussing on assets and issues, and aligned with the company vision for asset maintenance. It relies on routine planned maintenance, underpinned by a QMS system, to ensure that each site continues to receive the correct level of servicing, to minimise the risk of failure. This information is made available to operational staff through company standard maintenance systems, which can be accessed by mobile computer "tough-books". At the same time, as part of the QMS system is about continual improvement, opportunities are taken to build up knowledge about equipment and maintenance routines that either improve or reduce the risk of failure. For example, understanding that some pump types are less liable to block in some situations than others, or appreciating the lack of reliability of some rural power supplies.

Target Maximum Discharge Duration

The second stage in minimising the impact of emergency overflows is the development of recovery plans, so that if a site failed, it could be brought back into operation within an acceptable time. In turn, it is the definition of this acceptable time, or Target Maximum Discharge Duration, that is perhaps the key stage in the whole of the appraisal of the pumping station, as it is this information that relates the potential impact of the pumping station to the environmental sensitivity of the watercourse.

To do this, firstly, the environmental sensitivity of the site is scored on a low-medium-high scale, depending on a number of factors, including ecological and amenity considerations. The potential impact on the receiving water is then scored on a similar low-medium-high scale, based on the relative dilution between the pumping station flow and receiving watercourse flow. The table below is then used to evaluate the Target Maximum Discharge Duration, which is the duration beyond which the discharge is likely to cause an unacceptable environmental impact. The aim is for the recovery plan to allow the discharge to be ceased within the target duration.

Target Maximum Discharge Duration (Hours)

	Watercourse sensitivity		
Potential Impact	High	Medium	Low
High	0	1	3
Medium	1	2	4
Low	3	4	6

Recovery plan

Having identified the environmental sensitivity of the site, attention could then be focussed on developing recovery plans for each site, should failure occur. These also build on existing good practice, and are underpinned by a QMS system. Quite often, they capture information or actions that are vital for a swift reaction, but had often not been to hand, such as the site electricity meter number, over-pumping provisions and the type of emergency vehicle access available. Quite often in the past, precious time has been wasted, by not having this information. Similarly, information is also held on the type and availability of spare equipment, including via third parties.

Rolling out the plans

To ensure that the maintenance and recovery plans are understood and acted on by the operational teams, there have been a number of awareness and training sessions, to address this issue. At the same time, these sessions have also proved invaluable in finalising the maintenance and recovery plans, based on the local knowledge of individual operators. Similarly, time has also been put in with control room staff, so that they also understand what actions they need to take, should a site fail.

Alongside this, capital works are underway to improve the reliability of a number of sites. In many circumstances these are small scale improvements, such as the fitting of generator and over-pumping couplings, and even “cat-flaps” that allow these connections to be made without losing site security. It has only been at a relatively small number of sites that additional storage has found to be necessary, and even then, the size of storage required has generally been small.

A new consenting regime

To mirror the changes in approach, the existing form of discharge consent has been completely overhauled. Gone are the pages of prescriptive clauses, to be replaced by a few simple clauses that put the onus on the Company to have a maintenance and recovery plan, and to operate to it. Such an approach is not without risk to both parties, but it challenges and allows both the Company and the regulator to act as mature organisations, which can then both play to their strengths.

Conclusions

Pumping stations and their associated emergency overflows pose a significant risk of pollution incidents, should they suffer from mechanical or electrical failure. The traditional approach to this problem has been to install large amounts of equipment, and to construct storage to catch spills, in the event of failure. Such an approach did not address the true causes of those failures, and additionally made poor use of available capital and operational resources to improve reliability.

By approaching this question from the point of view of preventing failure in the first place, and then additionally having a robust recovery plan should failure occur, has transformed both the capital and operational approach to this long standing issue. In doing so, it has also modernised the regulatory approach to this question, and has led to a satisfactory outcome for all involved.