MANAGEMENT OF GOULBURN VALLEY WATER ASSETS DURING HIGH RAINFALL EVENTS AND FLOODS

Paper Presented by:

Rodd O'Donnell & Gino Russo

Authors:

Rodd O'Donnell, *Operations & Maintenance Employee,*
Gino Russo, *Operations and Maintenance Employee,*

Goulburn Valley Water

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Rodd O'Donnell, *Operations & Maintenance Employee,* Goulburn Valley Water
Gino Russo, *Operations and Maintenance Employee*, Goulburn Valley Water

ABSTRACT

Heavy rainfall and subsequent flooding in the Goulburn Valley Region has prompted Goulburn Valley Water (GVW) to take measures to protect numerous assets and improve services during such events.

The Central Operations and Maintenance (O&M) team at GVW has optimised the way in which the sewer pump stations in Shepparton operate during a heavy rainfall event. Three catchments that experience regular sewer spills during heavy rainfall were identified, and a control program put into place to manage sewer pump station run times. This has resulted in the elimination of sewer spills from these sites.

Flooding in the town of Numurkah threatened a number of GVW assets, in particular the sewer system. The Northern Operations team responded quickly and proactively to protect assets and minimise the impact of the floods on customers, resulting in no customer complaints relating to the sewer system for the duration of the flood.

1.0 INTRODUCTION

The recent summer saw significantly heavy rainfall for the Goulburn Valley region. As a result, many areas and residents within the valley suffered severe flooding, with GVW being no exception. Excessive rainfall and the subsequent floodwaters threatened many of GVW's assets, including water treatment plants (WTP), wastewater management facilities (WMF) and sewer systems. In particular, sewer assets in the towns of Shepparton and Numurkah were significantly affected by heavy rainfall or infiltration or floodwaters, prompting quick, novel responses from the operations and maintenance staff.

1.1 Shepparton

During heavy rainfall events, rainfall in excess of 40mm over two hours, the Shepparton sewer system fills to full capacity. This causes several sewer spills in the reticulation system if it is not well managed and controlled. The topography of the area is a contributing factor to these spills. Shepparton is in a very flat area, with approximately a one metre fall from one end of the town to the other. The sewers, therefore, are very deep, some in excess of 12 metres, meaning many of the sewer gravity catchments are pumped to one another. In some cases, this is repeated up to as many as six times before reaching the WMF at the far northern end of the township.

There are three large catchments that have had a history of repeat sewer spills, which causes customer and environmental concerns. These catchments are shown in Figure 1.

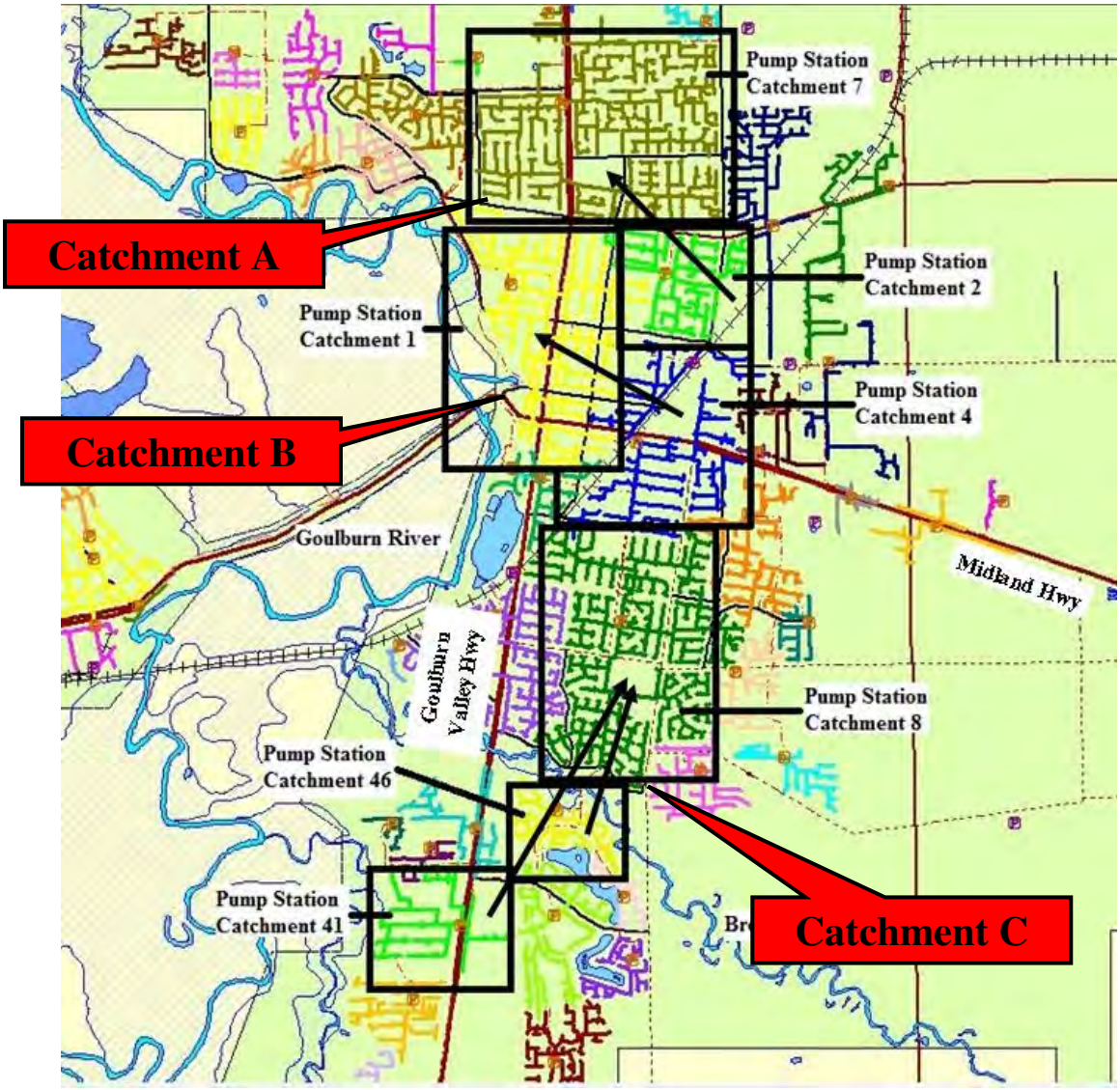

Figure 1: ***Location of Shepparton pump station catchments and the direction of pumping from one catchment to another***

Catchment A

Shepparton Pump Station No. 2 (SHPS02) discharges into the top end of the Shepparton Pump Station No. 7 (SHPS07) catchment. Sewer spills occur when SHPS07 fills to capacity during high rainfall events and SHP202 continues to discharge into it. Wastewater spills into the backyards of several residential properties and causes issues with flooding garages, sheds, lawns and gardens of the properties. This has been an ongoing issue for a number of years, and accounts for a number of customer complaints.

Catchment B

Shepparton Pump Station No. 4 (SHPS04) discharges into the top end of the Shepparton Pump Station No. 1 (SHPS01) catchment. Sewer spills occur when SHPS04 continues to discharge into the SHPS01 catchment, even when this catchment is full, resulting in significant volumes of wastewater spilling from the grease trap of a local restaurant.

Catchment C

Shepparton Pump Station No. 46 (SHPS46) and Shepparton Pump Station No. 41 (SHPS41) are both newer systems, which pump under the Broken River and into the top end of the Shepparton Pump Station No. 8 (SHPS08) catchment.

When full, wastewater flows into the stormwater system, then into the Broken River, which is immediately upstream of the Goulburn River off take for the town's water supply.

The heavy rainfall experienced over the 2011/12 summer prompted the investigation into a new way of managing these catchments to reduce or eliminate the likelihood of sewer spills in these areas.

1.2 Numurkah

Severe flooding in the town of Numurkah threatened a number of GVW assets. Flooding was caused by substantially higher flows down the Broken Creek, which runs through the centre of the town.

While the SES and local council were predicting the flood peak to hit around noon on the 5th March 2012, GVW northern district operators noticed significant volumes of water flowing from the Muckatah Depression towards the Broken Creek at Numurkah. This brought them to the conclusion that the peak would occur much sooner than predicted. This prompted them to take action to protect GVW assets earlier than anticipated.

2.0 DISCUSSION

2.1 Shepparton: Installing Shut Off Switches in the Upstream Sewer Pump Stations

Following discussions between the Central O&M team and the IT staff of GVW, it was decided the best way to manage the sewer spills in Shepparton was by installing shut off switches in the upstream sewer pump stations.

The high level alarm in the telemetry system for the downstream sewer pump station was used as a trigger point to shutdown the upstream sewer pump station. This stops the upstream pumps from discharging into the near full gravity catchment and therefore avoids a spill.

2.2 Shepparton: Installing Timers in the Upstream Sewer Pump Stations

In addition to installing shutoff switches, it was decided to install timers to better manage the pumps in the affected catchments. Timers were installed on the upstream pumps and are set up such that this is the only way the pumps can be operated when the downstream wet well is on high water alarm.

The upstream pumps can be started remotely (using SCADA) as per the setting (by default, the settings are 10 minutes on, 10 minutes off). It is common practice to start the pumps only after an operator has attended the site and by conducting a visual inspection, the timers can be adjusted to suit the flows.

The timers will stay in the timer mode until the downstream wet well high water alarm clears. Only then can the upstream pumps be placed on normal operation.

These items have been installed at each of the sites, and while the timers and monitoring systems are site specific, the basic principles have been used very successfully at each site over two large heavy rainfall events without any spills or issues.

2.3 Numurkah: Treatment Plant Responses

Both the WTP and WMF in Numurkah were affected by floodwaters, with the WTP being threatened by inundation and the WMF experiencing significantly increased inflows.

All of the northern operations staff, including the District Manager, were required to sandbag the WTP, which took the whole day. Particular attention was paid to sandbagging the main building, pumps, stormwater pits. Additionally, electrical junction boxes were raised, generators were fuelled and the WTP was operated to ensure storages remained full.

In addition to this, backwashing only occurred when absolutely necessary and the backwash tank was isolated, in order to store as much backwash water as possible and reduce the amount of water sent to the already inundated sewer system.

At the WMF, both inlets into the primary lagoons were opened (as opposed the usual one inlet) to cater for increased flows, as well as the valves in-between the lagoons. The pump that transfers wastewater to the main winter storage lagoon was started to compensate for the larger volumes of water in the lagoons.

2.4 Numurkah: Sewer Asset Responses

Infiltration into the sewer network meant that pump stations had to be tightly controlled and the sewer system constantly monitored. Visual inspections of manholes and pump stations were carried out every few hours to determine the degree of inundation in each pump station catchment, and pump stations were turned on or off accordingly. The location of each pump station is shown in Figure 2.

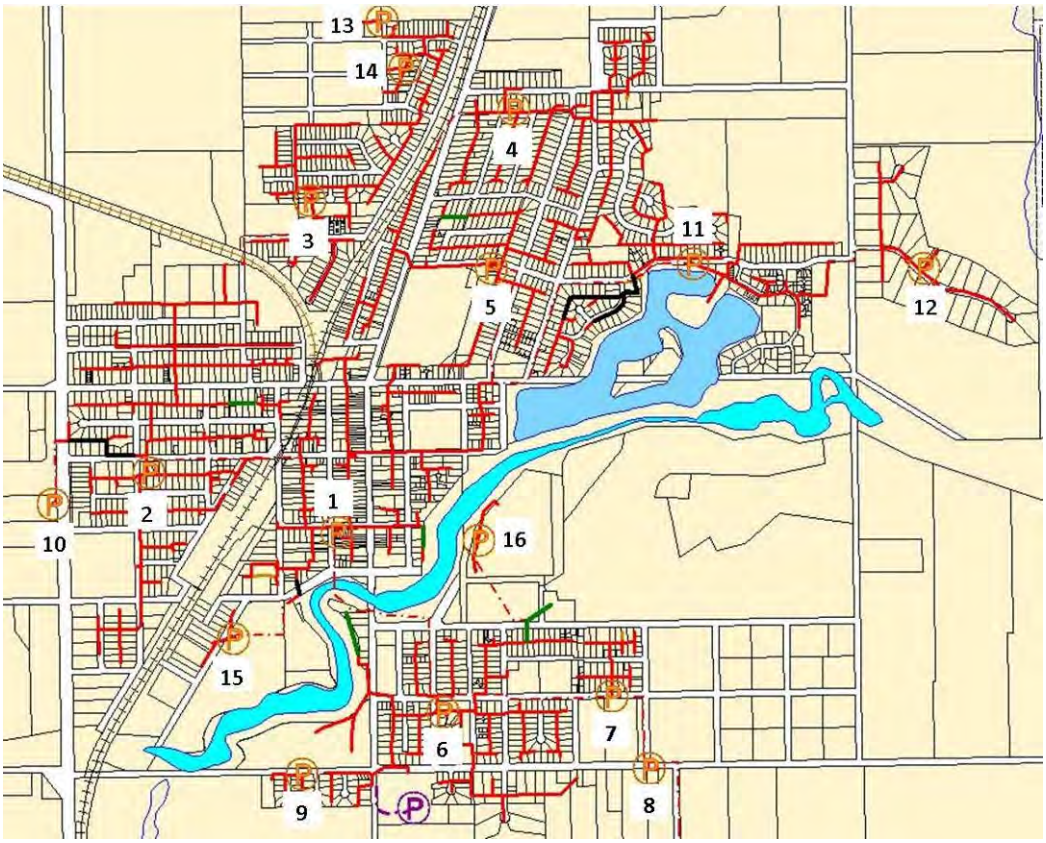

Figure 2: ***Location of Numurkah pump stations***

It was discovered that pump station catchments 9, 10, 12 and 16 were completely inundated, with an average water depth of 800mm, and therefore the pump stations were to remain offline until the floodwaters receded.

Pump stations 1, 6, 7 and 8 were left to continually run as they pumped directly into the rising main running to the wastewater treatment plant, keeping these catchments under negative pressure. Pump station 1's catchment received flow from Pump stations 2, 5 and 11 and therefore to balance flows, these pump stations could not be run at the same time unless there was over 1.2m freeboard in the pump station 1 wet well, in which case two out of the three pumps could be run. Pump stations 2 and 5 were also restricted to a flow rate of no more than 15 L/s, as any greater would overflow the manhole receiving sewer from the rising main.

The high level floats were raised to allow the catchments to hold more wastewater than normal, and the high level alarms were also raised on the SCADA system.

At the same time as carrying out visual inspections, O&M staff sandbagged overflow relief gullies, manhole lids taking in water and other infiltration points. This had a noticeable effect on lowering water levels in the pump stations. Detailed plans of the town that mapped out inundated areas were also used to target branches of catchments that were inundated.

After 72 hours the floodwaters had receded enough to allow GVW operations staff to access areas that had been heavily inundated, allowing them to locate and block off areas where infiltration was occurring.

3.0 CONCLUSION AND LESSONS LEARNT

3.1 Shepparton

By altering the way sewer pump station run times are managed, GVW's Central O&M Team have successfully eliminated sewer spills from three sites which have in the past experienced regular spills during heavy rainfall events. It was found that the height of the upstream wet wells should be considered, as the higher the head in the well, the more the pumps will discharge, leading to a spill.

The installation of an isolation valve on the upstream rising main, which allows for the throttling of the main, was found to assist with the discharge capacity of the system during a high wet well event.

Finally, visual monitoring of the flows on site, rather than assuming the system is running satisfactorily, is required before leaving the site.

3.2 Numurkah

It took six days for the floodwaters to completely recede in Numurkah. Due to the proactive thinking and quick responses of the O&M staff, the impact of these floodwaters on the Numurkah sewer system was minimal. Ongoing efforts by the Northern GVW staff saw 75% of the sewer reticulation system working within 48 hours of flooding, 95% of the system working four days after flooding, and 100% of the system back online six days after the flooding.

There were no customer complaints concerning toilets not working, sewer spillages or any sewer related issues throughout the duration of the flood.

The Numurkah WMF received ten times the normal amount of daily wastewater intake, which was all satisfactorily contained within the lagoons and the preventive measures put in place at the WTP ensured that the floodwaters had no significant effect on the WTP assets.

Finally, detailed flood plans have been assembled, allowing staff to have a clear understanding of which areas are prone to flooding and how to manage the sewer system for future flood events.

4.0 ACKNOWLEDGEMENTS

Thanks to the Central O&M team, the Northern Operations team, the IT staff of GVW, Senior Management of GVW and the newly appointed Manager of Operations, Steven Nash.