UNBLOCKING SEWERS – THE SMART WAY

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ABSTRACT

CAMS targeted sewer blockage reduction strategy saw blockage rates in Bendigo reduce from around 135 blockages per 100km to 84 blockages per 100km. After seeing a 19% drop in the first year, the blockage rate plateaued, falling short of modelled expectations. Following an analysis of completed maintenance schedules, it became apparent that to effectively implement the strategy, the sewer maintenance crews required assistance to help identify the locations of the targeted sites and to record details of their findings and actions. This led to CAMS developing and implementing a computer based work management system, designed specifically to meet the needs of the sewer maintenance crews. The system integrated the sewer blockage model, with job dispatch, data collection and GIS whilst utilizing the Next G telephone network allowing data to be exchanged on a daily basis. This solution along with training and development of staff and the commencement of Coliban Water's sewer relining program delivered the further 22% reduction seen to date.

1.0   INTRODUCTION

Since CAMS were awarded the contract in 2003 for the operations and maintenance of Coliban Water's assets a key focus has been the development and implementation of an effective sewer blockage reduction strategy. The sewer blockage rate for Bendigo was high at around 135 blockages per 100km. Annual blockage patterns followed seasonal cycles of high winter peaks, where winter rains promote tree root growth and lower summer rates where root growth appears to slow.

CAMS focus for this sewer blockage reduction strategy centred around developing and implementing a preventative maintenance program to reduce the number of blockages in Bendigo. Following an analysis of the sewer blockages history , each sewer length was rated in relation to its risk of blockage considering factors such as the number of past blockages and the risk to the environment and customer property. Preventative maintenance activities were then planned in line with the risk rating of each sewer length.

In conjunction with the detailed maintenance program, CAMS developed a sewer blockage model, designed to predict future blockage trends. The predictive model considers blockages at new sites, blockages where maintenance has failed and blockages at multiple blockage sites since 2001. A linear relationship was established between the Bendigo blockage rate and the number of active blockage sites. Where active blockage sites are defined as the number of sites where maintenance was not completed in the planned timeframe or where no maintenance was planned. In simple terms the more multiple blockage sites left unmaintained the higher the number of blockages.

During the first year of the programme the blockage rate for the Bendigo region dropped by 19% (see Figure 1). Although maintenance activity continued at a relatively consistent rate, the blockage rate plateaued and began to fall short of modelled expectations. It was essential that the reasons behind this effect were determined to ensure that operational targets were met.
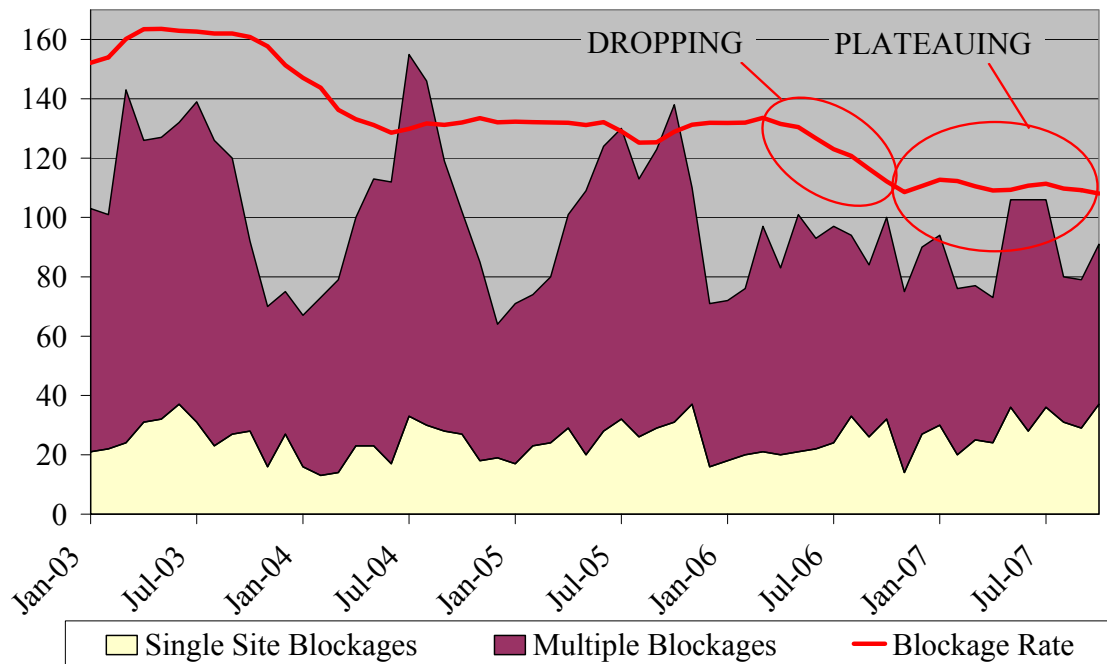
Figure 1: *The Blockage Profile for the Bendigo Region - Jan 2003 - Oct 2007 - The drop between Jan 2006 and Oct 2006 and the subsequent plateauing being clearly visible.*

2.0   INVESTIGATION

With a preventative maintenance strategy and predictive model developed, investigations commenced into possible reasons behind the plateauing of the blockage rate. Initial investigations considered the number of preventative maintenance jobs being carried out. This was found to be in line with expectations. Consideration was given to the focus of this activity. It was determined that during some periods, approximately 50% of the activity was carried out on sites classified as single blockage sites, where the risk of blockage was low (see Figure 2).

Interviews with the operators established that historically, maintenance was performed on an entire length of sewer rather than on individual sections. It also became apparent that the provision of paper based work schedules was hindering work progress by making the identification of blockage addresses cumbersome. Once a job was selected, the sewer length would be identified on Arc Explorer, the GIS interface installed on the operator's laptop computer, the work would then be carried out and a paper based work order would then be completed. The selection of the next job would ideally be done with a view to minimizing travel time, but would generally be taken from the next job on the alphabetical list. Work efficiency was largely dependent on the operator's knowledge of both the local area and the location of the 200 jobs identified in each work schedule. It was decided that if the preventative maintenance strategy was to be effectively delivered these processes would have to be changed.
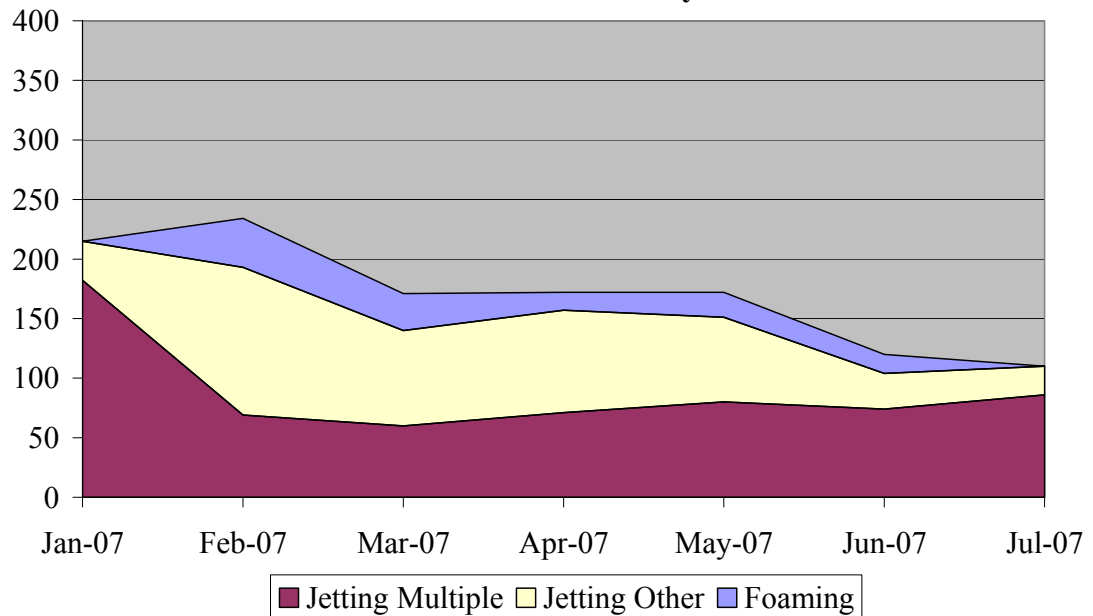
Jet Trucks Activity

Figure 2: *Bendigo Preventative Maintenance Profile Jan 2007 to Jul 2007*

Direction was given to the crews for them to focus purely on those sewer lengths listed on the work schedule and not to complete adjacent lengths whilst work commenced on the development of a series of tools to assist the operators in their work. With the assistance of the CAMS IT department it was determined that these tools should consist of a database facility to advise of and to record details of the current work schedule and a mapping interface to highlight the sewer lengths where maintenance was required. The purpose of the map interface is to optimise the travel time by making all nearby jobs immediately and simply accessible to the operator. Arc Explorer was selected as the mapping tool as it was already utilised by the operations staff.

A number of key requirements for the database were identified.

- An import facility from the existing sewer blockage reduction database
- An interface allowing numerous searches to be performed across a number of key fields e.g. to allow sewers to be identified by district or by street
- The ability to record data for work order form completion and for this data to be exported into Mainpac, Coliban Water's Asset Maintenance management database.
- The ability to record additional data e.g. the identification of heavy sewer lids due for replacement as part of Operational Health and Safety initiatives
- The ability to update the master copy of the database in the control centre and to simultaneously update the laptop with new jobs added by the control centre.
- An export facility to allow work schedule data to be utilized in Arc Explorer

As the main sewer blockage database was developed on a Microsoft Access platform it was decided that the initial version should be developed on the same platform. The system would utilize the application's replication facility for data exchange via a NextG data card installed in the laptop computer. All data would then be mastered in Coliban Water's corporate system Mainpac.
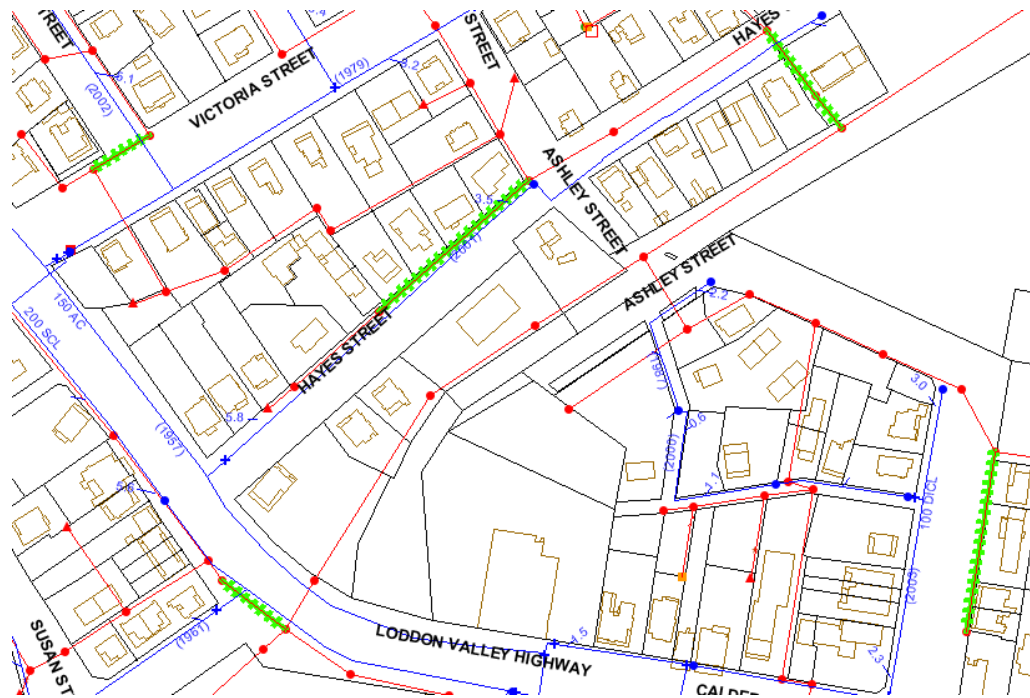
Figure 3: *Arc Explorer Screen Display - Sewers Requiring Maintenance Displayed as Hatched Lines*

The sewer truck database and Arc Explorer layer interface was developed over a two month period and a copy was issued to the operators for testing. During this period a number of improvements were recommended by the sewer truck operators who had embraced the use of the system. The automation of a number of key tasks – such as the automatic recording of start and stop times for each job, and the pre-completion of upstream and downstream manhole details and address details meant that record keeping time reduced considerably. The search facility also proved effective allowing ease of access to all outstanding jobs. The Arc Explorer (see Figure 3) interface clearly displayed all of the outstanding jobs allowing the sewer truck operators to quickly determine nearby jobs by simply panning around the maps.

The month following full implementation saw a significant rise in the proportion of priority sewer lengths where maintenance was performed. Transition times between jobs was reduced leading to an increase in the overall number of jobs completed. Feedback from the sewer truck operators was very positive. The facility encouraged them to pass on information which ordinarily may have previously been overlooked. Issues allowed a number of known problem areas to be reclassified as having manhole issues requiring consideration under alternative maintenance programs.

A series of training sessions were conducted to introduce the new facilities to operators, and for operators to be consulted on further developments which could be introduced into the system.

Productivity increases were maintained over subsequent months leading to a reduction in the blockage rate from October 2007 onwards. Activity levels through 2008 (see Figure 4) have fluctuated in line with network demands as operator focus switches between water issues in summer time and sewer maintenance in winter.
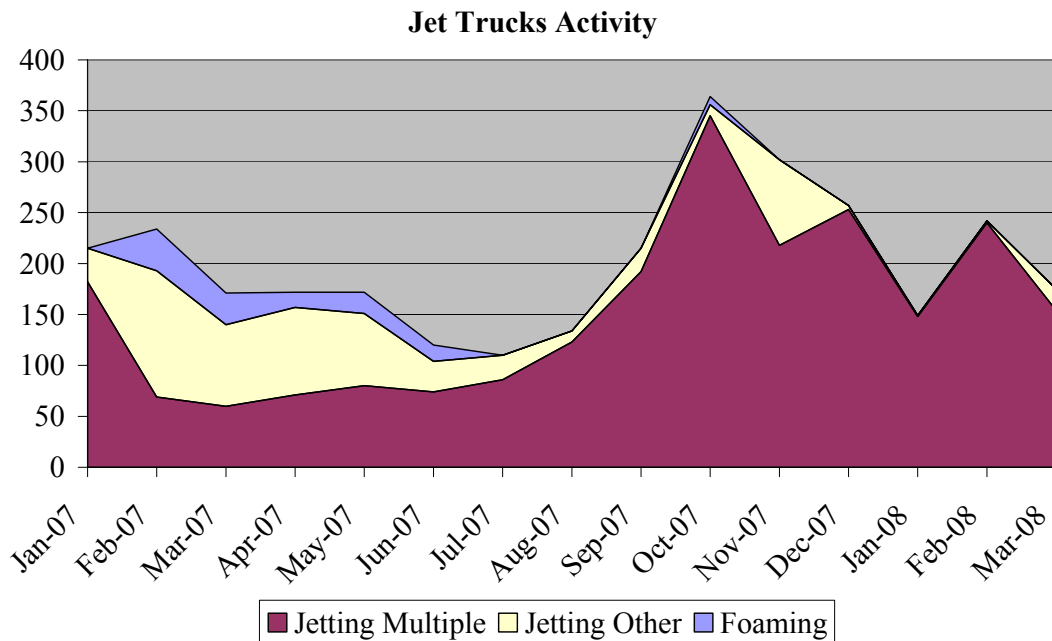
Jet Trucks Activity

Figure 4: *Preventative Maintenance Activity Between Nov 2006 - Mar 2007. The proportion of lower priority (the lighter area) being significantly reduced.*

In late 2007, Coliban Water commenced a sewer relining program which has complimented the preventative maintenance work. During this initial period 120 sewer lengths were relined. A phased program of works will continue through the period of the 2008-2013 water plan, with approximately 90 lengths being relined each year.

By the end of June 2008 the blockage rate for Bendigo had fallen to 84 blockages per 100km of sewer main. It is anticipated that by August 2008 this blockage rate will have fallen below 80 blockages per 100km of sewer mains – a significant milestone in the management of Bendigo sewer reticulation system.

3.0   CONCLUSIONS

Having developed a sewer blockage reduction strategy CAMS, sought an effective method of delivery for the maintenance program. The system developed has ensured that the focus of maintaining priority sewer mains has been achieved. This has in turn led to a significant reduction in the sewer blockage rate for Bendigo, impacting directly on the overall blockage rate for the whole Coliban system.

Ongoing improvements to the system continue, with additional Arc Explorer layers being added highlighting newly relined sewer mains and properties where intrusions have resulted from previous preventative maintenance. The sewer maintenance history of each sewer line has also been made available to the operators, enabling them to anticipate problems at known difficult site. The ownership of the system has been proudly taken by the operators who have suggested the majority of improvements made.

The project has proved that a targeted approach to sewer blockage management can be effective, but it is essential that sufficient support is provided to allow the operators to deliver the project.
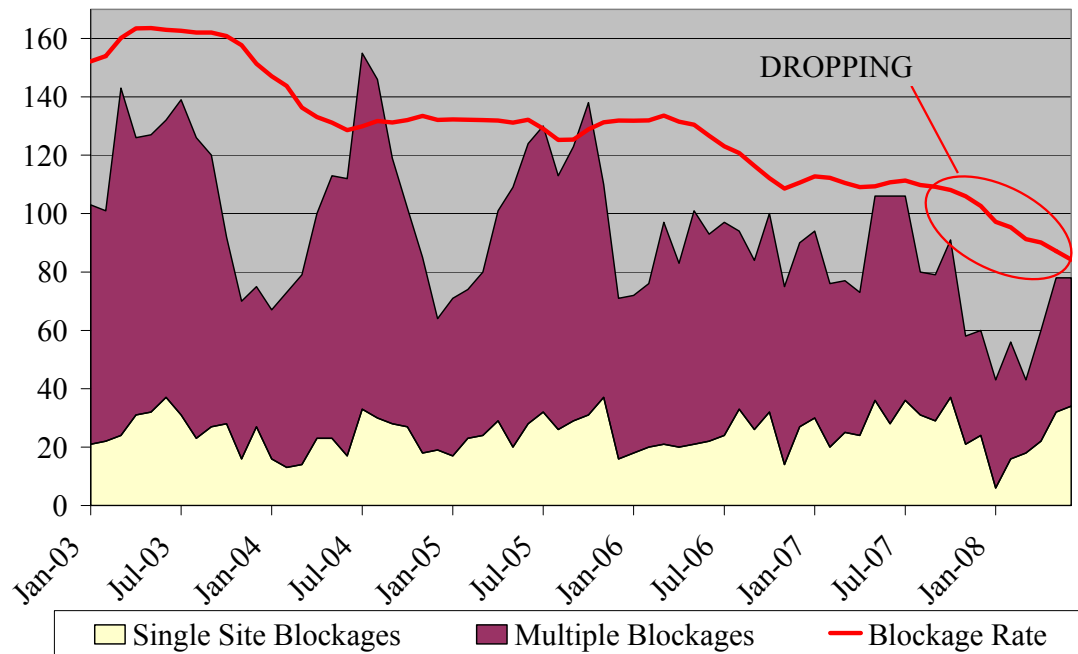
Figure 5: *The Blockage Profile of the Bendigo District - Jan 2003 - Jun 2008. The reduction in the blockage rate from October 2007 highlighted.*

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