Summary

i  Background

In a number of papers, concern had been raised that low pressures may occur in water distribution systems such that dirty water could be drawn into the pipe with a consequent risk to health. It was suggested that this could be the result of exceptional demands or unusual operational events. A review was carried out for Defra by WRc. The review concluded that the most valuable next step would be to carry out long-term pressure monitoring in distribution systems. This project was the result of following up this conclusion.

ii  Objectives

1. Identify three distribution systems that are likely to be subject to surge effects.
2. Identify three distribution systems that are likely to be subject to longer term depressurisation caused by exceptional demand including bursts.
3. Within each distribution system identify appropriate vulnerable points for pressure monitoring.
4. Install appropriate high speed pressure monitoring equipment and recording instrumentation at the locations identified.
5. Maintain the pressure monitors throughout the study.
6. Download and review data from the pressure monitors at regular periods, gathering other relevant data to help interpret the results.
7. Carry out final analysis and investigation, draw conclusions and report the findings.

iii  Approach

Detailed pressure monitoring was carried out in 6 separate distribution networks for a combined period of 56 months. The data was reviewed regularly and low pressure events were investigated. The investigation included reference to the knowledge of water company staff. Hydraulics theory, low pressure statistics from the fieldwork and detail from example events were used to draw conclusions.

iv  Conclusions

1. Some low and negative pressures were observed during the study.
2. The probability of very low (surge) pressures as a result of a sudden demand is very low.
3. The probability of very low pressures as a result of exceptional high demands is very low.

4. A system is most at risk from low surge pressures if:
   a. Pipe junctions are widely spaced
   b. Property density is low (low number of service pipe connections)
   c. There are very rapid increases in demand.

5. A system is most at risk from exceptional demands if:
   a. There is a fall in ground level from the source followed by a substantial rise
   b. There is a significant area at low level
   c. There is a significant area at high level
   d. Normal pressures in the high level area are low.

6. Pressures low enough to cause ingress are more likely as a result of the following than they are from a demand-driven event:
   a. Isolating mains for repair
   b. Mains draining down during valving operations
   c. Pump failure or rapid pump switching
   d. PRV failure or maintenance.

7. To pose a health risk a source of contaminant around the low pressure point and a pathway to the pipe flow are also necessary.

8. Thorough planning is required to ensure the successful completion of such an extensive monitoring exercise.

v Recommendations

1. Additional proactive measures are not required to minimise an already low probability of very low pressures occurring.

2. The practice of designing distribution systems with alternative routes to most customers (i.e. with loops) should continue.

3. Good practice should be followed with respect to:
   a. Opening and closing valves and hydrants slowly
   b. Running hydrants at the lowest necessary flow
   c. Returning mains to service (disinfection)
   d. Disinfecting local mains which have drained as a consequence of work on other mains
   e. Implementing soft start and stop for pumps
   f. Maintaining PRVs and maintaining pressures during maintenance.
4. When carrying out research of this nature:
   a. A thorough survey should be carried out of all potential locations for any monitoring equipment
   b. Sufficient alternative locations should be identified.

vi Résumé of Contents

The report gives underlying theory, describes the choice of sites and logging equipment, gives a summary of all low pressure events and includes example events from each site.