

Birmingham Water Work's EnviroLab

Water Quality Operations Division



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SYSTEM PROFILE

The Birmingham Water Works Board (BWWB), founded in 1871, produces on average 100 million gallons of potable water per day. The system has a maximum capacity of 189 million gallons per day. BWWB has four treatment plants (Carson, Putnam, Shades Mountain and Western) that receive water from the Cahaba River/Lake Purdy, Inland Lake and the Black Warrior River. The system has 51 storage tanks with a combined storage capacity of 75,776,000 gallons of water. BWWB serves a population of 600,000 people with a distribution network of 3,903 miles of pipe with 200,026 service connections. In addition, there are 13,185 fire hydrants in the system.

CONDITION

Due to the complex infrastructure of piping in the system, the BWWB's Water Quality Operations Division (WQD) has expended a lot of man hours, as well as, millions of gallons of water flushing the system to restore and improve the quality. State regulations requires the Board to maintain a chlorine residual of 0.20 ppm in the distribution system and even with routine flushing of certain sites it has been very difficult to maintain that residual. Thus, the department has had to have several flush points left running continuously (24/7). This resulted in a tremendous amount of water being expended and the lost of revenue. In addition to trying to maintain the required chlorine residual the Board issued water restrictions due to the drought which required WQD to conserve water by reducing routine flushing. This situation made maintaining the system a challenge.



We began to research and plan on ways to maintain the system and in doing so we learned about the Hydro Guard units with its automatic flushing features. This technology appeared to be the silver lining we were looking for to solve the Board's problem. A representative from the company came on site and demonstrated the unit to the staff and the department decided to purchase a couple of the units and put them to the test in the real world.

FLUSHING

While flushing procedures can vary, the Birmingham Water Works Board's Water Quality Operations Divisions considers flushing to be an integral component of an effective distribution system maintenance program. The benefit includes the control of bacterial re-growth and improved chlorine residuals. Maintaining water quality requires communication, cooperation, coordination and responsibility between several departments. To ensure coordination, communication and cooperation between those departments, you must have good Standard Operating Procedures (SOP). The Water Quality Department developed Water Quality Operations Standard Operating Procedures as means of providing standardized guidelines for flushing, sample collections, and documentation methods:

“Standard Operating Procedures are written documents that describe, in great detail, the routine procedures to be followed for a specific operation, analysis, or action. Consistent use of an approved Standard Operating Procedure ensures conformance with organizational practices, reduced work effort, reduction in error occurrences, and improved data comparability, credibility, and defensibility.”



CONVENTIONAL FLUSHING

Conventional system flushing consists of flushing fire hydrants, meters and blow-offs in response to customer complaints. When customer complaints are received for poor water quality those calls directed to the Water Quality Department and specific questions are asked to determine the severity and legitimacy of the issue.

Questions:

- Does the problem occur on the hot or the cold side of the water faucet?
- Are your neighbors experiencing the same problem?
- Have you noticed any construction work in the area?

If the problem cannot be resolve by phone with the customer answers the questions founded in the SOP then the information regarding the customer's complaint is sent to a field technician who further investigates the complaint at the customer's residence or place of business.

ROUTINE AND UNIDIRECTIONAL FLUSHING

Routine and Unidirectional flushing is used to remove sediment from distribution water mains throughout the system, as well as, in areas known for low chlorine residuals or frequent discoloration complaints. Both types of flushing are critical in preventing water quality degradation in the distributions system.



AUTOMATIC FLUSHING AND BENEFITS OF FLUSHING

Flushing improves the taste of the water and eliminates localized discolored and stagnant water. Automatic flushing is the newest method of flushing utilized by the Water Quality Department. In 2005, the Water Quality Department installed Hydro-Guard automatic flushing units at remote locations with the distribution system to improve chlorine residuals and prevent Biofilm growth in the distributions system. These units were effective in reducing travel time to flush in distant locations to improve water quality. The units were programmed to run after midnight for 2 hours per flushing sequence. This type of intermittent flushing allows the water to move continuously through the distribution system while keeping chlorine residuals in compliance with regulatory requirements.

Utilizing the automatic flushing devices has yielded significant results in maintaining chlorine residuals in the distribution system, particularly during the summer months when the water temperature increases. Chlorine residuals begin to decrease as the water moves through the distribution system. By strategically placing and programming the automatic flushing units, the chlorine residual levels are more likely to remain above the required limit and stagnant water can be removed from the system more efficiently.

The following table shows a comparison of chlorine residuals from 2004 and 2005 at a remote location within the distribution system.



Results of Hydro Guard Flushing/Chlorine Residuals at a Remote Location

| | 2004 | 2005 |
|----------|-----------------------------------|-----------------------------------|
| | Cl ₂ Residual (ppm) | Cl ₂ Residual (ppm) |
| January | 0.00 | *N/A |
| February | 0.10 | 0.66 |
| March | 0.20 | 0.56 |
| April | 0.30 | 0.87 |
| May | *N/A | 0.60 |
| June | 0.00 | 0.65 |
| July | 0.02 | 0.51 |

*N/A - No Cl₂ taken

Flushing a 2” blow-off running for 24 hours on a 6” main expends 17,877 gallon of water (2,390 cu ft.) over a 7 day period. Using a Hydro-Guard unit running 2 hours per day on a 6” main (12:05 a.m. to 2:05 a.m.) expended 1,414 gallon of water (189.00 cu ft) over a 7 day period. Thus the difference in water usage between the Hydro-Guard unit and the flush point is 16,464 gallons of water (2201 cu ft.) over a seven day period. Therefore, by using the Hydro – Guard units the company would save a total of \$ 120.41 per week which would accumulate to a total \$481.64 per month. There are 18 units (yearly saving of \$ 5,779.68 per unit) in BWWB’s distribution which gives the company a yearly saving of \$ 104,034.24. These calculations are based on commercial rates of \$ 2.28 per 100 cubic feet.



CONCLUSION

Using the Hydro Guard units the department has been able to reduce the amount of man hours per site, as well as, reduce the amount of water usage. The usage of the units has enabled us to maintain the required chlorine residuals in the system. All of the discharge is dechlorinated according to the Federal guidelines.

With the flexibility of being able to program the units, we can program the unit to flush for as long and as often as needed without any inconvenience our customers. We presently have 15 Hydro Guard units that are operational in our system. We plan to expand the number to 30 units over the next year. In conclusion, as stated in the chart and above paragraph the company has saved a tremendous amount of money, water and man-hours using the Hydro Guard units.