Barkley Lake Water District
Leak Detection Plan

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Leak detection and repair is a vital part of any water systems operation. Because of aging lines and variable elevations, the water district is prone to breaks and leaks. Due to the volume of system storage, the overall production capacity of the water treatment plant, and the rocky soil of the area some of these leaks can be hard to locate. In this manual we will look at the various options available to our water system to find and repair leaks.

With the factors mentioned above in mind, the water system approaches leak detection though several different methods.

1. Master Meters
2. Tank Patterning & Tank Draw Downs
3. Pressure Readings
4. Night Checks
5. Customer Communication

I. Master Meters

Master meters play an important role in the narrowing the scope of leak detection. Currently the District has several meters that can be used in this fashion.

1. **Raw Water Meter – 16" meters the water coming into the treatment plant
2. **High Service Meter – 16" meters the water leaving the clear well.
3. *Hobson Meter – 8" meters water going to Cumberland Shores/Canton area
4. *Blue Springs Meter – 4" meters water going into Blue Springs area
5. Pete Light Meter – 4" by-pass meters water leaving Pete Light Tank
6. *272 Meter – 6" meters water from 4 Way Stop down Hwy 272
7. **S. Road Pump Station Meter – 6" meters water going down 139 South
8. *Linton Meter – 6" meter that monitors the Linton area
9. *Military Road Meter – 4" compound meters water sold to Christian County
10. S. Road Tank – 1" by-pass used to measure water leaving S. Road Tank
11. North Stuart – 4" meters water sold to North Stuart Tennessee
12. **Rogers Pump Station – 6" meters water going to Rogers Tank
13. Rogers Tank – 1" by-pass meters water leaving Rogers Tank
14. **McUpton Pump Station – 4" mag meter
15. *McUpton Siloam – 8" meters water going towards Siloam Tank
16. *Avalon – 4" meters water going up 139N/toward Cerulean Pump Station
17. *Siloam Tank – 6" meters water leaving Siloam Tank
18. 778 Meter – 4" meters water sold to Lyon County, located off Hwy 778
19. *Blackhawk Meter – 2" meter located on 93 South meters water sold to Lyon County
20. **Cerulean Pump Station – 6" meters water entering pump station
21. *Gracey Meter – 4" meters water sold to Christian County

Asterisk (*) denotes meters monitored daily through Beacon System.
Asterisk (**) denotes meters monitored daily through SCADA

Each meter listed above is used in a specific manner to find and isolate leaks. Some meters are monitored daily to pattern the flow to specific zones. Some are used to narrow searches down once a leak has been determined in an area. The District's main method of utilizing the meters listed is to isolate lines and see how much water is flowing through the meters.

Example: 4" by-pass Pete Light

During a night check, first turn off the valve at the gun shop on Canton Road outside of Cadiz. Then shut off main valve at Pete Light tank and open the by-pass line. This will allow pressure to be maintained while limiting flow. Next shut off flow at Rogers station by turning off main valve. Next turn off the pumps at S. Road pump station. Now the Pete Light pressure zone is isolated from the rest of the system. Now crews can begin shutting off valves at the furthest edges of the zone and working their way back to the tank. This allows the crew to estimate the amount of water that should be flowing to an area and helps to begin narrowing the leak to a specific line or section of line.

II. Tank Patterning & Tank Draw Downs

Tank patterns are utilized by the plant staff to assist the distribution crew to help find potential leaks. The current SCADA system utilized by the District allows for the graphical representation of the flows into and out of the tanks within the system. This method is utilized daily by the distribution manager and system manager to locate trouble areas. This is usually one of the first steps in the leak detection process.

Example: Cerulean Tank

With the inclusion of an isolation valve (2021) at Cerulean Pump Station the Cerulean draw down has changed. Now operators watch the duration of the tank fall over night. If the tank is taking a long time to fill during the day and increases only at night with a quick fall in the off hours indicates a leak in the pressure zone. Tank should take roughly the same amount of time to fill as it does to fall. This does not rule out customer leaks or increased flow to the Gracey meter. The tank patterns are a good starting point to begin investigating the increase in flow to a specific area.

Tank drawdowns are done by the plant staff on a regular basis to give a baseline for the water that is leaving a tank. These are done by isolating the tank (turning off the pumps or valves feeding the tank), waiting a minimum of one hour while the tank falls (longer times give a better overall picture) and calculating the amount of water that left the tank. These calculations are then compared to historic averages to detect leaks.

Calculation:

volume of tank reservoir/height of tank reservoir = gallons per foot

Multiply by

Amount of fall (in feet)

Divide by

Time in minutes = gallons per minute lost

Example:

Pete Light Tank

1,000,000 / 51 feet = 19,607 gallons per foot

19,607 x 3 = 58,821 gallons

58,821 / 120 = 490 gpm

III. Pressure Readings

Pressure readings are another tool in the bag to help locate and pinpoint leaks. The district uses pressure reading in a broad fashion utilizing our SCADA system. Each pump station has a suction pressure reading and a discharge reading. These can be used to tell if there is a leak upstream or downstream from the station. If your suction pressure and flow rate decreases this can indicate a leak upstream from the station. If your discharge pressure drops and your flow rate increases this can indicate a leak downstream from the pumps.

Another method using pressure ratings is to catalog the pressure readings at your flush plugs and the elevation of the individual plugs. With this data the system can test the lines between the individual plugs for pressure loss which can indicate small leaks.

Example:

Flush plug one has a pressure reading of 100 psi. It is set and an elevation of 550. The next flush plug in the system is located at an elevation of 570. The pressure reading on this hydrant should read roughly 91 psi. If the reading is lower than this number, there is leak in between the two locations.

10 feet of elevation = 4.33 psi

The higher the target location is from the beginning location the lower the pressure. The lower the target location is from the starting location the higher the pressure. Currently the District does not utilize this method. A comprehensive logging of pressure and elevation has not been done at this time.

IV. Night Checks

Night checks are the one of the main tools the district uses to find unreported or unknown leaks. Periodically throughout the month the district will work on each of the pressure zones to check the overall flow rate of the master meters during off hours. These checks are done from 11 pm to 3 am. If any high flow is detected the district will begin turning valves to isolate the leak. This is done after hours to limit the impact on the customer base.

Example:

Using the 272-master meter, one employee stays at the meter while the rest of the crew begins working the valves from the end of the line back towards the master meter. As each valve is cut off the flow rate is written down and the crew moves to the next valve. When the high flow is reduced to normal, we know the leak is located between the two valves.

V. Customer Communication

One of the most important aspects of leak detection is customer communication. This ranges from customer complaints to tips. The district only has so many employees, but and engaged customer base can help lower the system's water loss. Using the information provided by the customer base the system can narrow search parameters and pin-point leaks.