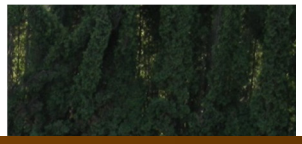
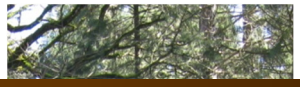
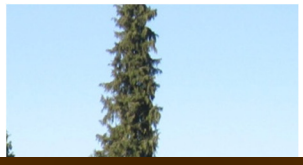
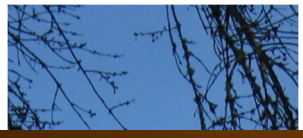
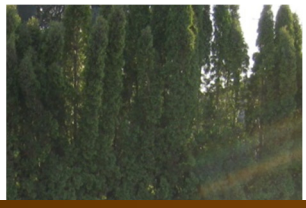
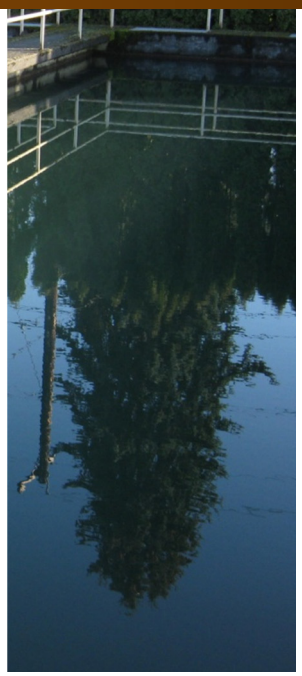






APPENDIX B– DISTRIBUTION FACILITIES EVALUATION





KELLER associates

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TECHNICAL MEMORANDUM

To: John Cramer, PE
Senior Engineer
City of Silverton, Public Works Department
From: James Bledsoe, PE
Keller Associates, Inc.
Date: November 2010
Re: Silverton Water Distribution System Inventory and Evaluation

The water system at Silverton, OR consists of two intakes and supply lines, a water treatment plant (WTP), three water tanks (two at the WTP site), three booster stations (one at the WTP site), multiple pressure reducing valve (PRV) stations, and an underground network of distribution pipelines serving multiple pressure zones. This technical memorandum summarizes the findings and recommendations for existing water facility including the high level tank, booster stations, and PRV stations. A separate evaluation of the water treatment plant and water distribution pipelines will be prepared later and are not included with this technical memorandum. Findings are based on observations and reported conditions collected from an on-site visit made to each of the facilities on February 17, 2010 and information gathered from available record drawings and Water Treatment Plant Operations & Maintenance (WTP O&M) Manual published in 2009. It should be noted that this evaluation does not consider the desired or needed capacities of the facilities which will be completed later as part of the master planning effort.

The paragraphs below describe the results of the evaluation for each of the individual facilities.

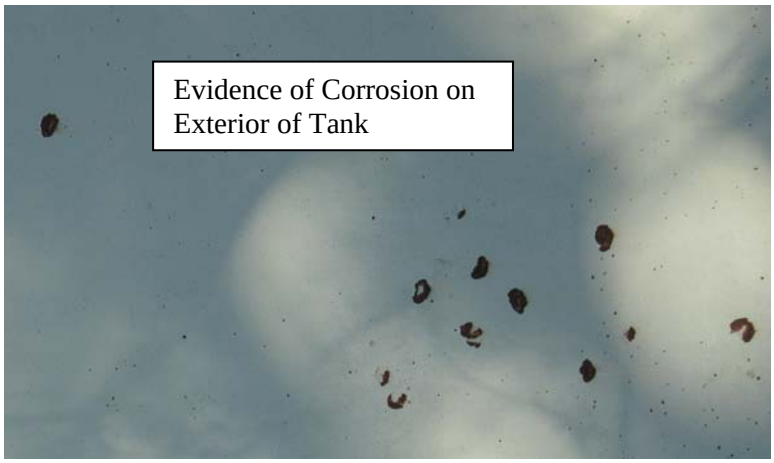
Storage Tanks

2 MG High Level Reservoir

The High Level Reservoir is on the top of a hill located in the southeast quadrant of Silverton. The 2MG welded steel reservoir was constructed in 1981. The tank is approximately 40 feet high and 95 feet in diameter. The tank serves the "high" pressure zone, and also provides backwash water from the newer treatment train at the WTP. It's location is hidden from large trees that surround the tank site.

The tank is typically operated between 34 feet and 39 feet, with an overflow at elevation 40 feet. Water levels are measured with an ultrasonic sensor (installed 2008) and relayed to the WTP SCADA system via a radio antennae mounted on top of the tank. The tank is filled by the High Level Pumphouse located at the WTP. A single inlet/outlet pipe allows flow to enter and leave the tank. According to City staff, there have been no issues with poor water quality or loss of chlorine residual from the tank.

According to the WTP O&M Manual, the reservoir has been inspected periodically both by divers and visual inspection when empty and that the interior was recoated in November 2005. The cathodic protection system reportably functions well, with electrical and control upgrades in 2001 and a replacement of the original platinum anodes in 2006. The City has an annual contract for inspection and service to the cathodic protection system.


Evidence of Corrosion on Exterior of Tank

According to City staff, the exterior coating of the tank is original. Evidence of rust can be observed at many locations on the exterior of the tank.

Based on Keller Associates visual inspection of the site, we offer the following recommended improvements:

- Recoating of the exterior of the tank.
- Replace the ladder system with a more secure system.
- Provide increased security (cameras, intrusion alarm system)
- Replace the old bolted manway covers with Chase type manways. They are safer to use and are more secure; they can't be opened with water in the reservoir. This reduces the potential for unauthorized opening and release of water and damage due to the release.
- Replace the top vent with a security vent. The security vent prevents contaminates from entering the reservoir much more effectively than conventional vents.

Booster Stations

<u>High Level Pumpstation</u>

The High Level Pumpstation is located at the WTP site and delivers flow to the High Level Reservoir. Record drawings for the pump station are dated 1981. The system consists of a duplex pump arrangement, with 150 hp, 12-inch Byron-Jackson, 4 stage vertical turbine pumps that reportably deliver approximately 1450 gpm at the normal operating head. Six inch and three inch pressure reducing valves located in the pump house also allows flow from the high pressure zone to the medium pressure zone. All flow to the medium pressure zone is first pumped to the high pressure zone. Pressure relief valves will bleed off high pressures from either the high pressure zone or the medium pressure zone back to the tanks located at the WTP site that serve the low pressure zone.

The facility is 30 years old and is approaching the end of its life from a mechanical and electrical standpoint. The mechanical and electrical equipment maintenance

will become a problem in the near future due to difficulty in obtaining service parts.

According to City staff, the City is currently planning on replacing one of the 150 hp pumps with a 75 hp pump equipped with a VFD.

The pumps are called "off" based on the "high" level in the High Level Reservoir. Pumps are called on either via a timer (set for morning or afternoon) or a "low" level in the High Level Reservoir.

Recommendations:

- The booster station should be replaced or substantially upgraded. The new pump and motor could be integrated into the new pumping facility. The new booster facility should be capable of meeting existing and system demands with the largest pump off-line.
- Provide standby power capable of delivering future peak day demands.
- Consider adding another pump that pumps directly to the medium pressure zone. Newer technology allows this to be more easily accomplished than when the facility was originally completed. Pumping directly to the medium pressure zone will result in energy savings. This modification would also allow some simplification in the existing piping and pressure/flow control valves. The pump control valves can be replaced with a simple check valve when the electronic controlled pumping is installed.
- The electrical equipment should be completely replaced. New motors should be premium efficiency to reduce the energy consumption.
- Pump controls should be adjusted as required to ensure proper tank circulation. If VFDs are provided, tank levels should be closely monitored to ensure that adequate rise and fall of tank levels occurs.
- If the existing building is to be incorporated into the booster station upgrades, modifications to the pumphouse will be required to make the mechanical and electrical changes. The door should be replaced with a more secure door. Ventilation system changes to accommodate the new mechanical and electrical systems will also be required.
- Eventually add security systems including intrusion alarms.

Edison Road Booster Pumpstation

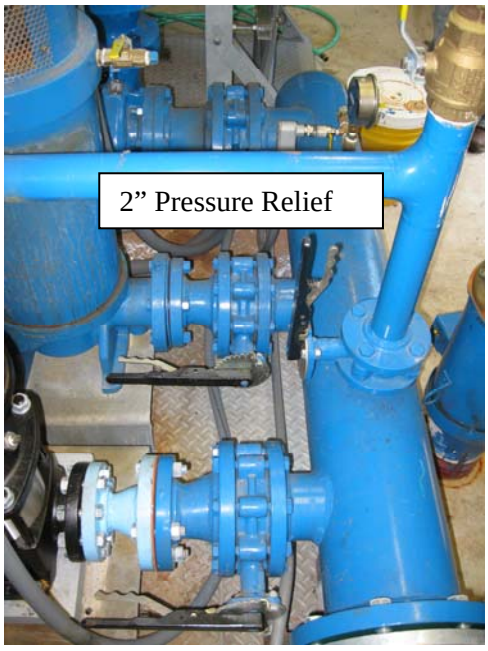
The Edison Road Booster Pumpstation is located in the southwest quadrant near the intersection of Eureka Avenue and Edison Road. The booster facility was completed in 2004 and serves only a small area. It pulls water from the high pressure zone (HGL maintained by the High Level Reservoir) to a High-High pressure zone, or the Edison Booster Station pressure zone.

The pump station has 2 variable speed domestic pumps and 1 constant speed high demand pump. The smallest pump is a variable speed Grundfos CR(E)15-3 rated at 5 hp and delivers 90 gpm @ 150 feet of head. The next larger pump is a 10 hp pump and has a reported capacity of 150 gpm. The 30 hp pump (design point of 800 gpm @ 164' TDH) is a constant speed pump intended for emergency/fire conditions. When the pumps were tested in August 2010, there were a number of issues discovered:

- The power feed was experiencing problems. This was later repaired by PGE.
- The cla-valve downstream of the largest pump was not operational, preventing the pump from running.
- Pump 1 delivered 122 gpm at only 70 feet of head (compared to the pump curve which shows 130 feet of head at this flow).
- Pump 2 delivered 180 gpm at only 53 feet of head (compared to the pump curve which shows 160 feet of head at this flow).

The existing pump operating sequence is as follows:

1. pump 1 comes on.
2. if psi indicates pump 1 is insufficient, pump 2 comes on and pump 1 turns off.
3. if psi and flow indicate pump 2 is insufficient, pump 1 will come on.
4. if psi and flow indicate pump 1 and 2 are insufficient, pump 3 will come on and pump 1 and pump 2 will turn off.



A small pressure tank also helps regulate pressures during low demand periods. Additionally, a 2-inch pressure sustaining valve (PSV) will provide relief (for pressures above 95 psi) in the event that one of the smaller pumps fails to ramp down to sufficiently low levels during low demand periods. This valve is too small to adequately relieve pressure if the largest pump were to run at full speed.

A standby generator operates on propane fuel and is capable of running all three pumps. The fuel tank is 120 gallons with a target minimum level of 70 gallons (which is reportably adequate to supply enough fuel to operate the domestic pumps for 8 hours and supply the emergency pump for 2 hours). According to the local

fire authority, this area is subject to extended power outages, lasting up to a week.

Information is relayed to the City's SCADA system. Alarms include fire, intrusion, and equipment malfunction.

In the event that the booster pump station were to be taken off-line, the City has adjacent fire hydrants in the high zone and high-high zone and a temporary pumping system could be used to pressurize the high-high zone. However, the fire department is not equipped with potable equipment and hoses.

Recommendations:

- As part of the planned improvements at the new tank and booster site located nearby, there should be a pressure relief valve installed that would allow any over pressurization in the Edison booster zone to bleed back into the lower pressure. Additionally, backup pumping capacity should be provided so that peak fire demands of this pressure zone could be met in the event that the existing largest pump is off-line.
- Modify the pump controls to allow all three pumps to run concurrently during fire events.
- Follow up with the two smaller pumps to see why they are not operating on their pump curves.
- Either connect the existing generator to a natural gas pipeline in the vicinity, or provide a larger tank. If the larger tank option is pursued, it should either be buried, or placed behind a wall for security purposes.

West Main Pump Station

West Main Pump Station was originally intended to provide a backup supply to the medium pressure zone located west of Silver Creek. No record drawings or O&M data were available for this site. The pump station appears to be 25+ years old. The pump facility is located in a vault and is equipped with a single 20-hp pump. No SCADA is provided. Controls are manual, and a transfer switch is provided to run the pump via a portable standby power unit. At the time of the visit, the vault was not locked. Staff indicate that they visit the site about 1 time per year. A pressure sustaining valve will dump water to the lower pressure zone if upstream pressure exceed 93 psi.

Recommendation:

- Abandon the pumping facilities. A backup supply source to this pressure service area is proposed to be addressed via Priority 1 master plan improvements.
- Maintain the PRV capabilities.

Pressure Reducing Stations

General: The City of Silverton inspects each pressure reducing valve (PRV) on an annual basis and rebuilds their PRVs every other year. This results in the valves being in relatively good shape and operating at their intended design points. This section does not discuss PRV settings, but rather focuses on the condition of the facilities. Pressure reducing valves at the booster pumping facilities were discussed previously.

The operation of the PRVs is not monitored via SCADA. Keller Associates **recommends** that these valves eventually be added to the SCADA system to monitor open/closed status and upstream and downstream system pressures.

Anderson PRV

Record drawings show the facility was completed in 1981 with two PRVs (3" and 6") installed in parallel. Since the original construction, a third 1.5" PRV has been installed on a PVC line. This line was reportably added because the demands were too low for the 3" PRV to properly operate. The PRVs are located below ground in a concrete vault with a manhole access. At the time of the visit, the bottom of the vault was wet. High moisture levels in the vault is evident by the amount of rust seen on the ductile iron pipe in the vault. As evidenced in the photos, valve vaults are very corrosive environments due to the constant moisture and air. Some measures should be used to reduce

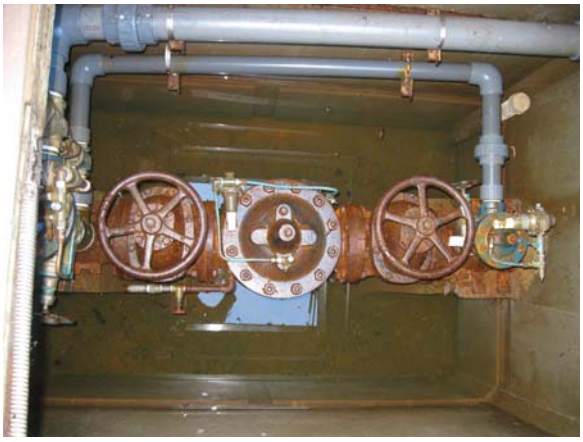
the corrosive environment inside the vault.

Recommendations:

- Keller Associates recommends that this vault and associated mechanical piping and valves be replaced in the near future. Ideally, the new vault would have the following features: located such that surface drainage protection is provided (alternatively a dewatering pump is provided); constructed with water proof concrete in the wall and floor to reduce water intrusion; power is available at the vault to run ventilation, dehumidification, possible dewatering equipment, and SCADA equipment in the future; security provisions such as a lock down lid, high and low pressure alarms and possibly an intrusion alarm.

South Water PRV

The South Water PRV station serves a small area near Water Street. A 2" and 6" PRV deliver water to the pressure zone. Pressure relief valve also dumps water to the low pressure side in the event that pressures in this zone become too high. At the time of the visit in February 2010, we could hear a significant amount of flow passing through the 2" PRV. Additionally, standing water could be seen in the vault.



Recommendations:

- This PRV vault is located where a modification to the top of the vault to raise it above grade is possible and there is adequate space for an electric service to provide power to the vault for humidity control equipment and future SCADA equipment.
- SCADA – eventually look at adding SCADA and upstream and downstream pressure transducers for monitoring system pressures.

- Security – add lock down lid to vault; add high pressure alarm and potentially intrusion alarm once SCADA is at site.
- In addition to making the top water resistant, add ventilation and dehumidifier to the vault to reduce the corrosion damage to the equipment and make maintenance easier.
- Water proof the vault walls and floor to help reduce the moisture intrusion from the surrounding soil.

Mooney / Water Street PRV

The valve located at Mooney & Water Street had been taken out of service and is currently not being used. The valves and vault appear to be newer than the Anderson and Water street PRV stations. Similar to other vaults, this vault floods. The valve station is equipped with 2" and 6" PRVs, with no relief. Since this PRV is no longer used and the vault is subject to flooding, the City should consider removing the valve and vault. The flooding presents a potential health hazard since any pipe or valve failure inside the vault could allow contaminated water to enter the distribution system.

Ike Mooney Road PRV

The Ike Mooney Road PRV station is a newer PRV station. The valves are located in a vault and include a 3" PRV and an 8" PRV. A 3" relief valve also allows water to be discharged outside the vault in the event that there is a high pressure event.

Recommendations:

- Redo the top of the vault to make it water resistant. Alternatively, regrade so that water drains away from the vault.
- Water proof the inside walls and floor.
- Add an electric service to the vault and add ventilation and dehumidifying equipment to the vault.
- SCADA – eventually look at adding SCADA and upstream and downstream pressure transducers for monitoring system pressures.
- Security – add lock down lid to vault; add high pressure alarm and potentially intrusion alarm once SCADA is at site.