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Technical Memorandum

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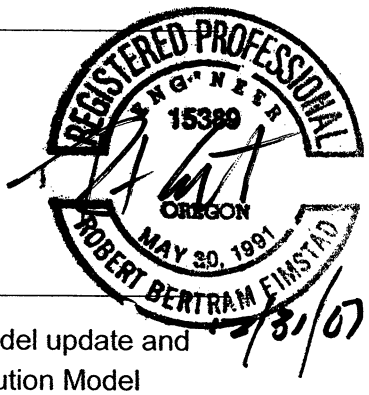
Subject: Technical Memorandum 1 - Model Update



The purpose of this technical memorandum is to summarize the hydraulic model update and calibration performed to fulfill the requirements of Task 1 of the Water Distribution Model Engineering Services Project.

Model Software Selection

The first step in updating the model was to select an appropriate software package. The City's existing model was developed in H2ONet. Three MWH Soft packages were considered; the three packages use the same hydraulic engine but run on different platforms. The three packages are as follows:

- *H2ONet*. This model runs on a CAD platform and the user must be familiar with the CAD environment. H20Net is the least user-friendly of the three models, especially when training new users or those users who are not familiar with CAD. MWH Soft is planning to discontinue upgrades to this package within the next 5 years.

- *H2OMap*. This model runs on a stand-alone platform, so additional programs, i.e., CAD or GIS, are not required on the modeling computer. The user can run the model without being familiar with CAD or GIS software. Transferring the modeling results and data in/out from this platform is very easy. Both H2OMap and InfoWater allow modeling results and contours to be exported as shape files for graphical display and/or map production. This allows access to the model (input / output / contours) from any City computer with a free GIS viewer program (available from ESRI). The stand-alone platform allows the model to be maintained by either engineering staff or by coordinating with GIS staff.

- *InfoWater*. This model runs within the GIS platform, so GIS software is required. The user should be familiar with the GIS program to fully integrate the model with the GIS. The modeling results can be displayed and/or printed directly from the model, since it is already within GIS. The GIS platform allows for GIS staff to easily maintain the water model (adding new facilities or modifying existing facilities) at the same time they are maintaining the GIS system, thus minimizing duplication of work.

Based on the above information, the City decided to move forward with the InfoWater package. The City's existing H2OMap was transferred into the InfoWater environment and all further work was conducted on the new InfoWater model.

Model Update and Calibration

The main purpose of this phase of the project was to update the model to reflect system improvements and operational changes that have been implemented since the model's last update in 2003. In addition, quality control procedures were used to check the existing data within the model and changes were made as needed. Specific changes to the model were as follows.

Reservoirs. The City has a total of 4 reservoirs with a total capacity of 6.9 million gallons (MG). The model includes settings for the base and overflow elevations, as well as usual minimum and maximum operating levels. The model settings for each of the reservoirs are summarized in Table 1.

Table 1 Summary of Reservoir Characteristics
Water Distribution Model Engineering Services
City of Ashland

Reservoir	Capacity (MG)	Base Elevation (ft)	Overflow Elevation (ft)	Operating Depths (ft)	
				Minimum	Maximum
Crowson	2.2	2,406	2,425	10	19
Alsing	2.0	2,530	2,558.5	19	22
Granite	2.1	2,166	2,194	22	24
Strawberry	0.5	2,560	2,585.5	15	18

Nodes. Node elevations in the model were set based on the 2-foot contours within the City's GIS. Selected nodes were spot checked to verify accuracy. In particular, the elevations of nodes located near pressure reducing valves (PRVs) were verified. Several nodes were added in the model to isolate closed valves, or for transitions between mains of different diameters.

Pipelines. Changes to piping fell into the three categories:

1. Reconfiguration of piping:
    a. Reconfigured mains from WTP into the distribution system, into Granite Reservoir, into Crowson Reservoir, and between Granite and Crowson Reservoirs.
    b. Tied 8" main along Skycrest/Sunnyview prior to closed valve.

c. Modified 6" West St. main so that it was not connected to 10" main along Grandview.

d. Changed closed valve configuration so that Hillview PS was servicing Pinecrest Terrace rather than the 6" main along Hiawatha Place.

e. Added pipes and nodes at Park & Crestview Dr. so that the 12" main was servicing Park and Tamarack Place, not the parallel 6" main.

f. Reconfigured main and node connections at Siskiyou Blvd & Walker Ave, so that the closed valve is to the east of Walker Ave. This connection allows Walker Ave (to the north) to be serviced by the 12" main on Siskiyou Blvd.

g. Reconfigured Ashland Street mains. Inserted nodes for transition between 20" & 16" mains, and 16" & 12" mains. Also interconnected the 6" and 20" mains at 542 Morton St, and at intersection of Ashland Street and Liberty Street.

h. Reconfigured piping downstream of Granite Reservoir and along Granite Street so that Ashland Creek Dr and Granite Street are serviced by the 24" main from WTP via 8" Granite main, not the 14" main from Granite Reservoir.

i. Added 8" main to loop from Jacquelyn Street south towards Siskiyou Blvd.

j. Added 8" and 12" mains to add loop along Clay St., Tolman Creek Rd. and Abbott Ave.

k. Reconfigured model near the intersection of Granite & Garfield, per City CAD drawing.

l. Reconfigure mains near Winburn Way, per City CAD drawing.

2. Correction of pipeline diameters throughout the system:

   a. Changed diameter along Holly Street between Terrace & Iowa from 4" to 10".

   b. Changed Granite diameter from 12" to 16".

   c. Changed diameters along Walker Road from 6" and 12" to 16". Also inserted junctions into the model for closed valve isolation in this area and added a parallel 6" main prior to the closed valve.

   d. Changed diameters along Normal Ave from a 4" to 8" main, just north of Siskiyou Blvd (after PRV-20).

   e. Changed diameters along Scenic Drive from 6" to 8" at intersection with Grandview Drive.

3. Addition of new mains that have been added to the system since 2003, as detailed in the City's CIP. These mains are detailed in Table 2.

Table 2 Water Mains Added Since 2003
Water Distribution Model Engineering Services
City of Ashland

Description / Location	Length (ft)	Diameter (in)	Comment
W7489 Alta Ave.	668' / 108'	8" / 6"	Changed diameters from 4" & 2" to 6" & 8"
W8844 Church St.	478' / 422'	6" / 4"	Installed junction to separate 6" & 4" mains at High Street
W8932 Crowson Rd	2,853	12"	Extended 12" main
W9090 Airport Road	468' / 753' / 567' / 1,211'	12" / 10" / 8" / 6"	Installed loop servicing Airport
W9501 Terrace St.	250'	8"	Added new main
W9565 Indiana St	1,133	12"	Added new main
W7737 Winburn Wy	Various	various	Reconfigured model and changed diameters per City CAD file

Valves. A quality control check of all PRVs in the system was conducted, including review of the location and setting, as summarized in Table 3. Upstream pressures are not set within the model, but values provided by the City were checked against model outputs. In addition, four PRVs that were not in the old model were added.

For the remaining valves in the system, quality control consisted mainly of checking if the valves are open or closed in the model. There are 34 valves in the model that are closed. These valves are primarily used to define pressure zones within the system. It is clear from the existing model and the data provided by the City that some of the City's pressure zones actually incorporate one or more sub-pressure zones. It is recommended that the boundaries of these sub-pressure zones be mapped and designated as separate zones to clarify operation of the system.

Table 3 PRV Settings
Water Distribution Model Engineering Services
City of Ashland

	Location	Size (in)	Upstream Pressure (psi)	Pressure Setting (psi)	Cla-Val Model	Elevation (ft)
1	Water & B Street	3	126	127	90-01	1866
2	Elizabeth & Otis	4 x 1 ½	155	76/83	90-01	1800
3	Laurel & Randy	4 x 2	150	80/87	90-01	1791
4	Helman & Orange	6	150	74	90-01	1824

Table 3 PRV Settings
Water Distribution Model Engineering Services
City of Ashland

	Location	Size (in)	Upstream Pressure (psi)	Pressure Setting (psi)	Cla-Val Model	Elevation (ft)
5	Oak & Hersey	4 x 1 ½	130	60/67	90-01	1845
6	Crispin & Oak	6" x 1 ½	140	55/60	90-01	1834
8	Grandview & Scenic	8 x 3	142	40/45	90-01	2093
9	Walnut & Wimer	6 x 2	135	45	90-01	2095
10	Strawberry Pump Station	6	146	Off	90-01	2236
11	Westwood	8 & 4	115	70/75	90-01	2306
12	Morton & (Ditch) Waterline Rd.	4 & 2	135	83/90	90-01	2377
13	Iowa & Terrace	8 x 2	110	45/54	90-01	2168
14	Gresham & Allison	6	150 (1)	65	90-01	1988
15	Union & Allison	8	130	85	90-01	1978
16	Morton & Iowa	6	185	90	90-01	1975
17	1067 Ashland	10 x 6	160	90/98	90-01	2059
18	Walker & Siskiyou	6 x 2	120	56/63	90-01	2017
19	Harmony at Siskiyou	2	150	93	90-01	2057
20	Normal & Siskiyou	6 x 2	158	55/60	100-01	2060
21	Bellview & Morada	6	135	77	90-01	2238
22	Tolman & Morada	8	150	95	90-01	2208
23	842 Clay Street	6 & 2	150	93/100	90-01	2072
24	Crowson Road	10 & 4	125	30/35	90-01	2137
25	Washington Street	6 & 2	185 (2)	85/90	90-01	1998
26	Mistletoe Road	10 & 4	145	90/97	90-01	2086
27	Faith & Siskiyou	4 & 1 ½	150	93/100	90-01	2078
28	Meade & Iowa	8 & 4	126	70/80	90-01	2110
29	Hersey Street	10 x 3	144	90/105	100-01	1841
30	Mountain Avenue	6 x 2	162	120/135	100-01	1789
31	Fair Oaks @ Mt. Meadows	6 x 2	120	82/87	100-01	1809
32	Nevada St. @ Mt. Meadows	6 x 2	126	72/77	100-01	1793

Notes:
(1) Static Fire Hydrant reading nearby at 125 psi.
(2) Static Fire Hydrant reading nearby at 130 psi.

Pump Stations. The City's system includes four pump stations, as summarized in Table 4. The pumps are simulated in the model by inputting either three data points (shut-off head, design point, and high point) from their pump curve, or by the design operating point (total dynamic head and flow). Table 4 also summarizes the control strategy for each pump station.

Table 4 Pump Stations
Water Distribution Model Engineering Services
City of Ashland

Description /Location	Elevation (ft)	No. Pumps	Manufacturer/ Model	Control Strategy	Model Settings
Hillview	2,154	2	Peerless HE Vertical	Controls water level in Alsing reservoir	Shut-off Head = 350 Design Point = 300 TDH / 350 gpm High Point = 200 TDH / 650 gpm
Park Estates	2,394	3	PACO L-1596-1 L-1596-3 L-3096-5	Services small development in higher elevations	50, 100, 500 gpm @ 240 TDH
S. Mountain	2,378	2	Berkeley & Cornell / B1 ½ ZPH & 2 ½ YHB-40-2	Services small development in higher elevations	Shut-off Head = 300/265 Design Point = 260/230 TDH & 400/100 gpm High Point = 200/120 TDH & 600/145 gpm
Strawberry	2,240	2	PACO KP-3014-5/6	Controls water level in Strawberry reservoir	200 gpm 192 TDH

Model Calibration. In addition to the above model updates, three procedures were used to further calibrate and verify the accuracy of the City's model, as follows:

- Comparison of static pressures in model to static fire hydrant pressures. This check verified that the model pressures are representative of the City's system. The model pressures are slightly higher (5-15 psi) than those observed in the actual system, but this difference will not significantly affect the distribution system evaluation.
- Evaluation of low pressure areas.

- Evaluation of mains with high velocities.

Recommendations

The model has been updated and calibrated sufficiently to move forward with the next phase of this project. As noted above, we recommend that the City map out all sub-pressure zones to clarify the system operation.