CHAPTER 4
Hydraulic Model Management and Documentation Protocols

It is important for the City's hydraulic model to be updated regularly to reflect newly installed/modified water system pipelines and facility conditions, so it can be used confidently to evaluate the City's water system. The purpose of this chapter is to develop protocols for updating the City's hydraulic model so that these model updates can be performed efficiently and on a regular updating schedule. West Yost developed the following recommended hydraulic model management and documentation protocols, with input from City staff, to ensure that the recommended protocols are mutually agreeable.

The last major update and calibration of the City's water system hydraulic model was completed in 2008 by West Yost.[1] City staff has requested subsequent localized hydraulic evaluations using the hydraulic model and minor updates to the City's hydraulic model have been performed by West Yost since 2008. As a part of this Water Master Plan Update project, a comprehensive hydraulic model update was completed to create a one-to-one relationship with the City's water system AutoCAD/GIS pipeline data, which is described in more detail below.

The following sections first present the existing procedures for updating the hydraulic model including a summary of key work tasks and findings from the most recent hydraulic model update performed for this Water Master Plan Update and then follows with the recommended hydraulic model management and documentation protocols that should be used for all subsequent hydraulic model updates.

4.1 EXISTING PROCEDURES FOR HYDRAULIC MODEL UPDATES

The City does not currently have a regular schedule for updating their water system hydraulic model. As discussed above, localized updates to the City's hydraulic model have been performed on an "as-needed basis" when various hydraulic evaluations are requested by City staff. These updates include facility (*e.g.*, pipelines, pumps, storage reservoirs, and pressure regulating valves) and/or operational data (*e.g.*, pressure control settings, *etc.*) when provided. A more comprehensive hydraulic model update was completed in December 2013 as a part of this Water Master Plan Update project and a summary of key work tasks and findings is provided below.

4.1.1 Summary of Recent Hydraulic Model Update Performed for the Water Master Plan Update

The City's existing hydraulic model was developed prior to the availability of detailed AutoCAD/GIS pipeline data files and only represents a skeletonized pipeline network of the City's water system. As a part of this Water Master Plan Update effort, the City's hydraulic model was first updated to maintain a one-to-one relationship with the City's water system AutoCAD/GIS pipeline data. This updated hydraulic model would provide the City with an "all-pipes" model consistent with the City's AutoCAD and GIS mapping, and will also help automate future pipeline updates for the hydraulic model.

[1] *City of Santa Rosa Hydraulic Water System Model Update and Calibration Memorandum*, West Yost Associates, October 27, 2008.

West Yost worked with City staff to identify the appropriate pipeline attribute data fields to include in the updated hydraulic model. Additional data fields were also added in the hydraulic model to help maintain the one-to-one relationship with the City's water system AutoCAD/GIS pipeline data. Table 4-1 summarizes the pipeline attribute data fields that have been incorporated into the hydraulic model.

Table 4-1. Summary of Pipeline Attribute Data Added to the Hydraulic Model

Attribute Data Field in AutoCAD/GIS	Corresponding Data Field in Hydraulic Model	Description
Data Fields from City's AutoCAD/GIS		
PIPE_ID	GISPIPE_ID	Unique pipeline ID field used to maintain a one-to-one relationship with the City's AutoCAD/GIS pipeline data
DIAM	Diameter	Pipeline diameter in inches
PIPETYPE	Material	Pipeline material type (*e.g.,* AC, CI, DI, PVC, *etc.*)
DATE_	INS_DATE	Installation date
OWNERSHIP	OWNERSHIP	Identifies if pipeline is owned by the City or SCWA[(a)]
Data Fields added by West Yost		
--[(b)]	GIS_DUP	Indicates pipeline was split by West Yost and has a duplicate PIPE_ID[(c)]
--[(b)]	MOD_WYA	Indicates pipeline was modified by West Yost and is different from the City's AutoCAD/GIS data
--[(b)]	UPDATE	Provides date pipeline was last updated in the hydraulic model

(a) SCWA (Sonoma County Water Agency) pipelines do not have a unique pipeline ID. Updates will need to be reviewed and confirmed manually.
(b) Not applicable to the City's AutoCAD/GIS data.
(c) Indicates that a unique PIPE_ID is duplicated when this pipe is split to accommodate a connection to another intersecting pipe. This operation was performed only when necessary as it will cause a loss in the one-to-one relationship with the City's AutoCAD/GIS data.

Additional tasks were also performed to update the City's hydraulic model, which are summarized in Table 4-2.

Table 4-2. Summary of Hydraulic Model Update Performed for the Water Master Plan Update

Task	Description of Task
Pipeline Selection[(a)]	Removed pipelines for: • Private water systems (OWNERSHIP = PRIV) • Hydrant laterals (CADLAYER = UFHLAT) • Urban reuse (CADLAYER = URBAN-REUSE-MAIN)
Append Nodes	Nodes were assigned to the beginning and end-points for the imported pipelines (from and to nodes)
Review Pipeline Network Connectivity	Imported pipeline network was reviewed to identify and fix any connectivity issues (*e.g.,* parallel pipes, orphan pipes, intersecting pipes, *etc.*)
Assign Pipeline C-factors	Roughness factors (C-factors) were assigned based on pipeline age and material type[(b)]
Incorporate Facilities	Facilities data were extracted from the existing hydraulic model and incorporated into the updated hydraulic model
Allocate Elevations	Elevations were allocated based on updated digital topology information (2005 Digital Elevation Model) provided by City staff[(c,d)]
Assign Facility Controls	Facility settings and controls were initially assigned based on data in the existing hydraulic model and were subsequently updated based on additional operational data received
Allocate Water Demands	Metered water demands (2012) from the City's spatially located water meter records were used to allocate water demands to the closest pipeline/junction

(a) *COMPHWMN_WaterMain.shp* was received from City staff on October 8, 2013 and was used to develop the City's updated hydraulic model.

(b) Source: Table 1, *City of Santa Rosa Hydraulic Water System Model Update and Calibration Memorandum*, West Yost Associates, October 27, 2008.

(c) If available, elevations for water system facilities were assigned based on as-built drawings or other available data provided by City staff.

(d) Model elevations are based on the National American Vertical Datum of 1988 (NAVD 88).

The completion of the above tasks provides the City with an updated hydraulic model that more accurately represents the City's water system as it now includes all applicable water system pipelines and also incorporates updated facility controls and specifically correlates with actual metered water demand locations. The following section presents the recommended hydraulic model management and documentation protocols for all future updates of the City's hydraulic model. The recommended protocols also incorporate the lessons learned during the most recent hydraulic model update.

4.2 RECOMMENDED HYDRAULIC MODEL MANAGEMENT AND DOCUMENTATION PROTOCOLS

Effective and successful hydraulic model management requires (1) updates that are scheduled to be performed regularly, (2) clear communication between City staff from different departments/divisions and between City staff and the consultant updating the hydraulic model, and (3) efficient data management. The following sections present the recommended protocols for management of the City's hydraulic model.

4.2.1 Update Schedule

The City's hydraulic model should be updated regularly so that it will not become outdated when compared to the City's AutoCAD/GIS pipeline data and current operational controls. A realistic, routine update schedule should be selected, so that these updates do not create undue burden on City staff, but still support the hydraulic model's applications. Based on further discussions with City staff, it was agreed that routine hydraulic model updates would generally be performed on a quarterly basis (in March, June, September and December) and can be adjusted in the future to better meet the City's needs. The first quarterly hydraulic model update is scheduled for September 2014.

4.2.2 Internal Communication and Data Management

Changes to the City's water system facilities and operational controls should be documented regularly and documentation should be accessible to both Public Works and Utilities Department staff. Clear communication is required between the Public Works and Utilities Departments and within different divisions for each Department in order to effectively and efficiently transfer the data necessary for updating the City's water system hydraulic model. Table 4-3 summarizes the recommended internal communication and data management protocols for the City's routine hydraulic model updates.

4.2.3 External Communication with West Yost

City staff will need to provide updated water system information to West Yost prior to the scheduled hydraulic model update. The following information will be required to perform each routine update to the hydraulic model:

- Up-to-date GIS pipeline shapefile with unique PIPE_ID;
- Up-to-date water system facility data (pumps, storage reservoirs, and pressure regulating valves); and
- Up-to-date operational control data.

The required data should be easily available from the City's various information systems and should be provided to West Yost in the preferred data format as presented previously in Table 4-3. West Yost will proceed with updating the City's hydraulic model once all the requested information is received. The pipelines in the City's hydraulic model will be updated in a manner to maintain a one-to-one relationship with the City's AutoCAD/GIS pipeline mapping.

Table 4-3. Recommended Internal Communication and Data Management Protocols for the City's Routine Hydraulic Model Updates

Data Type	Example of Relevant Data	Responsible City Department – Division	Communication and Data Management Protocol(s)	Frequency	Preferred Data Format for Submittal to West Yost
Pipelines	Diameter, Material Type, and Installation Date	Public Works – Engineering Division	Provide as-built drawings of new and replacement pipelines to Utilities – Engineering Services staff	As-needed for changes	GIS shapefile (with unique pipe IDs)
		Utilities – Operations & Maintenance	Provide any pipeline discrepancies found during field work to Utilities – Engineering Services staff	As-needed for changes	
		Utilities – Engineering Services	Update pipeline changes in AutoCAD/GIS pipeline mapping and track edits in separate MODEL field to provide to West Yost for routine hydraulic model update	As-needed for changes	
Other Water System Facilities	Elevation, Diameter, Pump Curve or Maximum Reservoir Level	Public Works – Engineering Division	Update changes to facilities in Hansen Asset Management System	As-needed for changes	Excel spreadsheet
		Utilities – Engineering Services	Provide summary of facilities data to West Yost for routine hydraulic model update	--	
Operational Controls	Pressure or Reservoir Level Setting	Utilities – Operations & Maintenance	Update changes to facility operational controls in the SCADA System	As-needed for changes	Excel spreadsheet
		Utilities – Engineering Services	Provide summary of operational controls to West Yost for routine hydraulic model update	--	

4.2.4 Summary of Recommended Hydraulic Model Management and Documentation Protocols

Performing regular updates of pipelines and other system facilities including operational controls in the hydraulic model will help keep this tool up-to-date and representative of the City's current water system conditions. This is a critical component in maintaining the hydraulic model and providing accurate and reliable hydraulic evaluation results for the City's water system. Figure 4-1 illustrates the recommended hydraulic model management and documentation protocols for regular updates to the City's hydraulic model. The protocols are set-up so that the City can assign a staff member as a Task Leader for each task to clearly identify staff responsibilities. This will provide a single point of contact/responsibility if questions arise, and will also help provide more efficient and successful hydraulic model updates.

Figure 4-1. Recommended Hydraulic Model Management and Documentation Protocols