MEMORANDUM

DATE: December 7, 2015  Project No.: 418-02-14-36
TO: Jack Bond, City of Modesto
SENT VIA: EMAIL
CC: Glenn Prasad, City of Modesto
Miguel Alvarez, City of Modesto
FROM: Roberto Vera, RCE #83500
REVIEWED BY: Polly Boissevain, RCE #36164
SUBJECT: City of Modesto – Water Master Plan
Hydrant Testing for Hydraulic Model Calibration

This memorandum summarizes the proposed hydrant tests and testing procedures required to calibrate the hydraulic model of the City of Modesto’s (City) existing contiguous water system. This work is being conducted as part of the Water Master Plan project, and provides a plan for the collection of the necessary field data. West Yost Associates’ (West Yost) recommended program for hydrant testing is summarized below and provided for your review and comment.

HYDRANT TESTING PROGRAM

The hydrant testing program will be used to confirm and “spot-check” the roughness factors (C-factors) that are assigned to pipelines in the City’s hydraulic model. West Yost will use data collected directly through hydrant testing to verify if the current pipeline C-factors assigned in the City’s hydraulic model are appropriate. Depending on this field testing to determine representative C-factors by pipeline material type and pipeline age, pipeline C-factors may be adjusted in the hydraulic model to better reflect field conditions.

Details related to the hydrant testing program are divided into the following four separate categories and are discussed in more detail below:

• Personnel and System Data Requirements
• Hydrant Testing Schedule
• Testing Requirements and Procedure
• City Responsibilities
Personnel and System Data Requirements

West Yost would like to request the following City personnel, system data, and supporting documents to accomplish the recommended hydrant testing program under West Yost’s direction:

- A minimum of four City staff members (with vehicles and radio communications) that will be available during regular working hours to assist with, but not limited to, the following:
  - Closing and re-opening valves, as needed before and after hydrant testing,
  - Reading and recording hydrant pressure data,
  - De-chlorination at the flowing test hydrant,
  - Flowing the test hydrant,
  - Directing and controlling traffic, and hydrant flows, as necessary, to ensure safety during these hydrant flow tests, and direct this discharged water into the nearest drainage system during each test, and
  - Public outreach and interface, as necessary.

- System information before and during the hydrant testing period that includes the following:
  - City’s SCADA system information for:
    - Tank levels (water surface elevations),
    - Booster Pump Stations (pump operational status, speed settings, discharge pressures, and flows),
    - MID Turnout (pump operational status, speed settings, discharge pressures, and flows at Terminal Reservoir booster pump station), and
    - Well Status (discharge pressure, flow, and speed settings, where applicable).
  - If the City’s SCADA system does not provide for historical archiving of these data, or it is not possible to get this information in digital format, then manual readings at key zone facilities that affect zone supply will need to be taken before, during, and immediately after each hydrant test.

- One copy of the City’s Health and Safety Plan for testing hydrants.

It should also be noted that the City’s Fire Department conducts hydrant testing for their own use. City staff has indicated that in the event that City Operations (Ops) Staff are not available to assist with hydrant testing, it may be possible to reach out to the City Fire Department to help supplement City Ops Staff. The City will be responsible for determining whether there is sufficient City Ops Staff available to help conduct the hydrant testing or if additional staff from the City’s Fire Department will be required.
Hydrant Testing Schedule

West Yost requests that the hydrant testing be scheduled during regular working hours at the City’s earliest convenience. West Yost will meet with City staff at the beginning of each day to have a brief field coordination meeting to review hydrant testing procedures and protocol (i.e., where to go and what to do). West Yost will also use this coordination meeting to distribute pressure gauges (hydrant wrenches to be provided by the City) necessary to complete the hydrant testing program. **Hydrant testing should continue on subsequent days until completion of the proposed 20 hydrant tests, anticipated to take approximately 2 full days.**

Testing Requirements and Procedure

West Yost would like to conduct approximately twenty (20) hydrant flow tests, nineteen (19) within the City’s existing contiguous service area and one within the Del Rio outlying service area. In addition, two (2) alternative locations have been identified, if time permits, for a total of 22 proposed hydrant tests. Table 1 lists the 22 proposed hydrant test locations, which are also illustrated on Figure 1. As shown on Figure 1, the selected hydrants are distributed throughout the existing water service area and the Del Rio outlying service area; and were selected based on a specific pipeline diameter, age, and material type, as summarized in Table 1. Table 1 also includes additional details specific to each hydrant test related to the number of closed valves required to conduct the test, whether the test is located near drainage features (e.g. parks, storm drain basins, open lots, etc.), and if the test is a repeat test.

Each hydrant test will involve maintaining flow from a single hydrant, while monitoring the residual pressures at two to four observation hydrants located near the flowing hydrant. The field observed static and residual pressure readings would then be used to confirm or adjust pipeline C-factors to calibrate the hydraulic model to observed conditions. Hydrant test locations have been selected to isolate pipelines of a particular material type, diameter, and age and some tests will require that City personnel close one or more isolation valves prior to the test and re-open these isolation valves following the test.

The general testing procedure at each of the hydrant test locations is outlined below and illustrated on Figure 2. In addition, if GPS equipment is available, provided either by the City or by West Yost, record the spatial location (XY coordinates and elevation) at the base (i.e. ground elevation) of the flowing hydrant. Spatial location is important during the calibration effort because it confirms the location and elevation at the flowing hydrant.

**Step 1.** Before the test, flush the test (flowing) hydrant and each observation hydrant before attaching the pressure gage. (This allows sediments, which might damage the gage or cause faulty readings, to be flushed out from the hydrant.)

**Step 2.** Attach the pressure gage to the hydrant with the gage’s test cock valve open. Slowly open the hydrant and bleed off the gage with the gage’s test cock until the hydrant is fully pressurized.

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1 Tests identified as a “Repeat Hydrant Test” are repeat tests from the Hydraulic Model Calibration effort conducted by West Yost in 2003. The purpose of repeating the hydrant test is to confirm or compare the assigned C-Factor determined in the 2003 calibration effort.
Step 3. Close the gage test cock valve, and then measure the static pressures at the designated test hydrant and each observation hydrant.

Step 4. Flow the designated test hydrant and measure the discharge flow and pressure.

Step 5. Measure the residual pressures at the designated test hydrant and at each observation hydrant while the test hydrant is flowing.

Step 6. Continue monitoring pressure until the “all clear” is given by a West Yost employee. Record the static pressure and then detach the pressure gage.

**IMPORTANT:** Before closing the hydrant, be sure the gage’s test cock valve is open and bleeding while the hydrant is being closed.

At least one City staff member will be required at the flowing test hydrant and up to three (3) additional City personnel will be required in the field to measure static and residual pressures at the adjacent observation hydrants (refer to Attachment A). West Yost will provide two staff members to direct, oversee, and assist in the field data collection work effort.

It is anticipated that each hydrant test will take no more than one half hour and that each hydrant will be flowing for no more than 10 minutes during a test.

**Testing Equipment**

West Yost will provide 2.5-inch and 4.5-inch diameter Swivel Piezo Diffusers and pressure gages during the hydrant testing program. It is our recommendation that the 4.5-inch diameter Swivel Piezo Diffuser be used for all proposed hydrant tests. For any hydrant test where it is not possible to use this type of diffuser due to drainage or traffic control issues, an alternative method will need to be further evaluated and confirmed before the day of field testing.

**City Responsibilities**

The City will be responsible for providing the following hydrant testing equipment:

1. Hydrant wrenches, and
2. Two-way portable communication for each of the testing personnel.

*The City is also responsible for notifying other City staff and residents about the scheduled hydrant testing, obtaining any approvals that may be required, providing proper drainage of the hydrant flow, and providing equipment for de-chlorinating* test water and personnel for traffic control, if required.

West Yost requests that City Ops staff review and inspect each of the proposed test locations before the testing date to identify any potential problems or hazards with the selected locations. Of particular concern will be the potential for flooding landscaping, building basements, or creating hazardous traffic conditions. West Yost recommends that all drainage inlets/manholes be inspected near the testing sites to confirm proper drainage. Additionally, location and status of valves that will be closed during the hydrant testing should be checked. Detailed figures, which illustrate the

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2 Handling of water released from each hydrant test will need to comply with the City Operations procedures and be consistent with the City’s NPDES permit for planned releases from hydrant tests.
flowing hydrant, observation hydrants, valves to be closed, and adjacent drainage features are provided in Attachment A.

SUMMARY OF HYDRANT TESTING PROGRAM

Hydrant testing will be performed as described above during regular operations staff working hours. The City is responsible for notifying other City staff including local residents/businesses about the hydrant testing program and coordinating with the City’s Fire Department, as needed.

West Yost requests a conference call or meeting with City staff approximately two weeks before the scheduled testing day to review and identify any potential issues that may occur during hydrant testing such as unavailable SCADA system data. An Outlook meeting request will be sent to City staff to schedule a suitable meeting date and time. In the meantime, please feel free to contact Bobby Vera at 925-425-5624 if you have any questions or comments.
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Pipeline Material</th>
<th>Installation Year</th>
<th>Pipeline Diameter, inches</th>
<th>Location</th>
<th>No. of Closed Valves</th>
<th>Comments[^a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AC</td>
<td>1973</td>
<td>6</td>
<td>Near the intersection of Ortega Rd. and Galvez Ave.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>CI</td>
<td>1966</td>
<td>6</td>
<td>Along Kientiz Ave. near Steuden Wy.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>AC</td>
<td>1992</td>
<td>8</td>
<td>Along Norik Dr. near Manor Oak Dr.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>AC</td>
<td>1986</td>
<td>6</td>
<td>Along Pantaleo Dr. near Carmella Wy.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>AC</td>
<td>1959/1965</td>
<td>6</td>
<td>Along Wycliffe Dr. near Scenic Dr.</td>
<td>2</td>
<td>Repeat Hydrant Test</td>
</tr>
<tr>
<td>6</td>
<td>AC</td>
<td>1989</td>
<td>6</td>
<td>Along Larned Ln. near Goodland Ct.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>AC</td>
<td>1970</td>
<td>6</td>
<td>Along El Goya Dr. near N. Riverside Dr.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>STL</td>
<td>1962</td>
<td>6</td>
<td>Along Moran Ave. near Phoenix Ave.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>9</td>
<td>AC</td>
<td>1986</td>
<td>6</td>
<td>Along Albion Way near July Dr.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>AC</td>
<td>1980</td>
<td>10</td>
<td>Along Jim Wy. Near Olivero Rd.</td>
<td>1</td>
<td>Repeat Hydrant Test, Near Drainage Feature</td>
</tr>
<tr>
<td>11</td>
<td>AC</td>
<td>1981</td>
<td>8</td>
<td>Along Hanh Dr. near English Oaks Dr.</td>
<td>2</td>
<td>Near Drainage Feature</td>
</tr>
<tr>
<td>12</td>
<td>CI</td>
<td>1939</td>
<td>6</td>
<td>Along Hilton St. near Enslen Ave.</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>13</td>
<td>CI</td>
<td>1959</td>
<td>6</td>
<td>Along Lauralee Ct. near Carver Rd.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>14</td>
<td>CI</td>
<td>1977</td>
<td>6</td>
<td>Along Wellington Dr. near York Wy.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>15</td>
<td>AC</td>
<td>1976</td>
<td>6</td>
<td>Along Rugby Ln. near Rexford Dr.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>AC</td>
<td>1981</td>
<td>8</td>
<td>Along Elmo Loop near Snyder Ave.</td>
<td>1</td>
<td>Well 63 will need to be offline</td>
</tr>
<tr>
<td>17</td>
<td>STL</td>
<td>Unk[^b]</td>
<td>8</td>
<td>Along River Rd. near Herndon Rd.</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>PVC</td>
<td>Unk[^b]</td>
<td>8</td>
<td>Along Country View Dr. near Stonegate Dr.</td>
<td>2</td>
<td>Del Rio</td>
</tr>
<tr>
<td>19</td>
<td>STL</td>
<td>1945/2000</td>
<td>6</td>
<td>Along Paradise Rd. near Pauline Ave.</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>20</td>
<td>AC</td>
<td>1978/1986</td>
<td>10</td>
<td>Along Semallon Dr. near Virginia Corridor</td>
<td>3</td>
<td>Near Drainage Feature</td>
</tr>
<tr>
<td>21</td>
<td>AC</td>
<td>1980</td>
<td>6</td>
<td>Along Melgren Ave. near Gagos Dr.</td>
<td>1</td>
<td>Alternate location to be tested, time permitting</td>
</tr>
<tr>
<td>22</td>
<td>PVC</td>
<td>Unk[^b]</td>
<td>8</td>
<td>Along Anada Ct. near Greco Ln.</td>
<td>1</td>
<td>Alternate location to be testing, time permitting</td>
</tr>
</tbody>
</table>

[^a] 20 Test Locations and 2 Alternate Test Locations.
[^b] Hydrant test will be used to confirm the C-Factor in this area, since age is not known.
Figure 1
Proposed Hydrant Test Location Map

City of Modesto
Water Master Plan
Hydrant Test Plan
**STEPS 1, 2 & 3:** REMOVE HYDRANT CAP, FLUSH OUT HYDRANT AND MEASURE THE STATIC PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.

**STEP 4:** FLOW THE DESIGNATED TEST HYDRANT AND MEASURE THE DISCHARGE FLOW AND PRESSURE.

**STEP 5:** MEASURE THE RESIDUAL PRESSURES AT THE TEST HYDRANT AND AT EACH OBSERVATION HYDRANT.
Figure A-1
Test 1
(6" AC - 1973)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-2
Test 2
(6" CI - 1966)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-3
Test 3
(8" AC - 1992)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-4
Test 4
(6" AC - 1986)
Figure A-6
Test 6
(6" AC - 1989)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-7
Test 7
(6" AC - 1970)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-9
Test 9
(6" AC - 1986)
City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-11
Test 11
(8" AC - 1981)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-12
Test 12
(6" CI - 1939)
City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-13
Test 13
(6" CI - 1959)
City of Modesto
Water Master Plan
Hydrant Test Plan

Symbology
- Flow Hydrant
- Observed Hydrant
- Hydrant
- Closed Valve
- Valve
- Test Pipeline
- Pipeline
- Storm Drain Inlet

Scale in Feet
0 100 200
Figure A-14
Test 14
(6" CI - 1977)
City of Modesto
Water Master Plan
Hydrant Test Plan
Well 63 will need to be manually shut down during hydrant testing.
Figure A-17
Test 17
(8" STL - UNK)

City of Modesto
Water Master Plan
Hydrant Test Plan
Note:
1. It is recommended that Well 282 remain online during the test. However, during the hydrant test, water will need to be flushed for a slightly longer period of time until Well 282 has stabilized, since it is pressure controlled.
2. Well 282 will also need to be isolated from Stonegate Dr., as shown on the closed valve details on this figure.
Symbology

- **Flow Hydrant**
- **Observed Hydrant**
- **Hydrant**
- **Closed Valve**
- **Valve**
- **Test Pipeline**
- **Pipeline**

**Figure A-19**

*Test 19 (6" St - 2000/1945)*

City of Modesto
Water Master Plan
Hydrant Test Plan

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Figure A-20
Test 20
(10" AC - 1978/1986)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-21
Test 21
(6" AC - 1980)

City of Modesto
Water Master Plan
Hydrant Test Plan
Figure A-22
Test 22
(8" PVC - Unknown)

City of Modesto
Water Master Plan
Hydrant Test Plan