MEMORANDUM

To: P. N Guin

From: P. Olar Bear

Date: 04MAR2024

Subject: CE 3372 – Water Systems Design, Exercise Set 8.

Purpose

This memorandum presents the estimation of demand for a subdivision and a simple network analysis using EPANET for the network in ES7 (the prior exercise set). The results for each problem are presented in the narrative below.

Problem 1 Solution:

Figure 1 is the skeletonized layout for an EPANET model of the water distribution system for a proposed executive home subdivision. The figure depicts a supply reservoir, a pump, a check valve, pipes, and demand nodes. The system is a hybrid branch-loop system; the branches are relatively short.

Demand is estimated by counting the number of lots depicted on the map, then determining the type of structure on each lot, and finally determining the occupancy per structure (or lot). Once the total occupancy is estimated the product of that count and an average daily demand establishes the demand for the water distribution system.

The approximate count of lots depicted on Figure 1 is 409. Each lot is to house an executive home, with an average occupancy of 4 persons. A typical demand for a person is 100 gallons per day.[1], however because these are executive homes, there are likely pools, spas, and semi-exotic gardens so the demand is likely higher. As an estimate the demand range is 100 to 200 gpd per person.

Using these values, the total daily demand is 409 lots$\times$4 persons per lot$\times$100 gpd per person = 122,700 gpd for the low estimate and 245,400 gpd for the high estimate.

[1]Value from `http://water.usgs.gov/edu/qa-home-percapita.html` accessed 12 Oct 2016

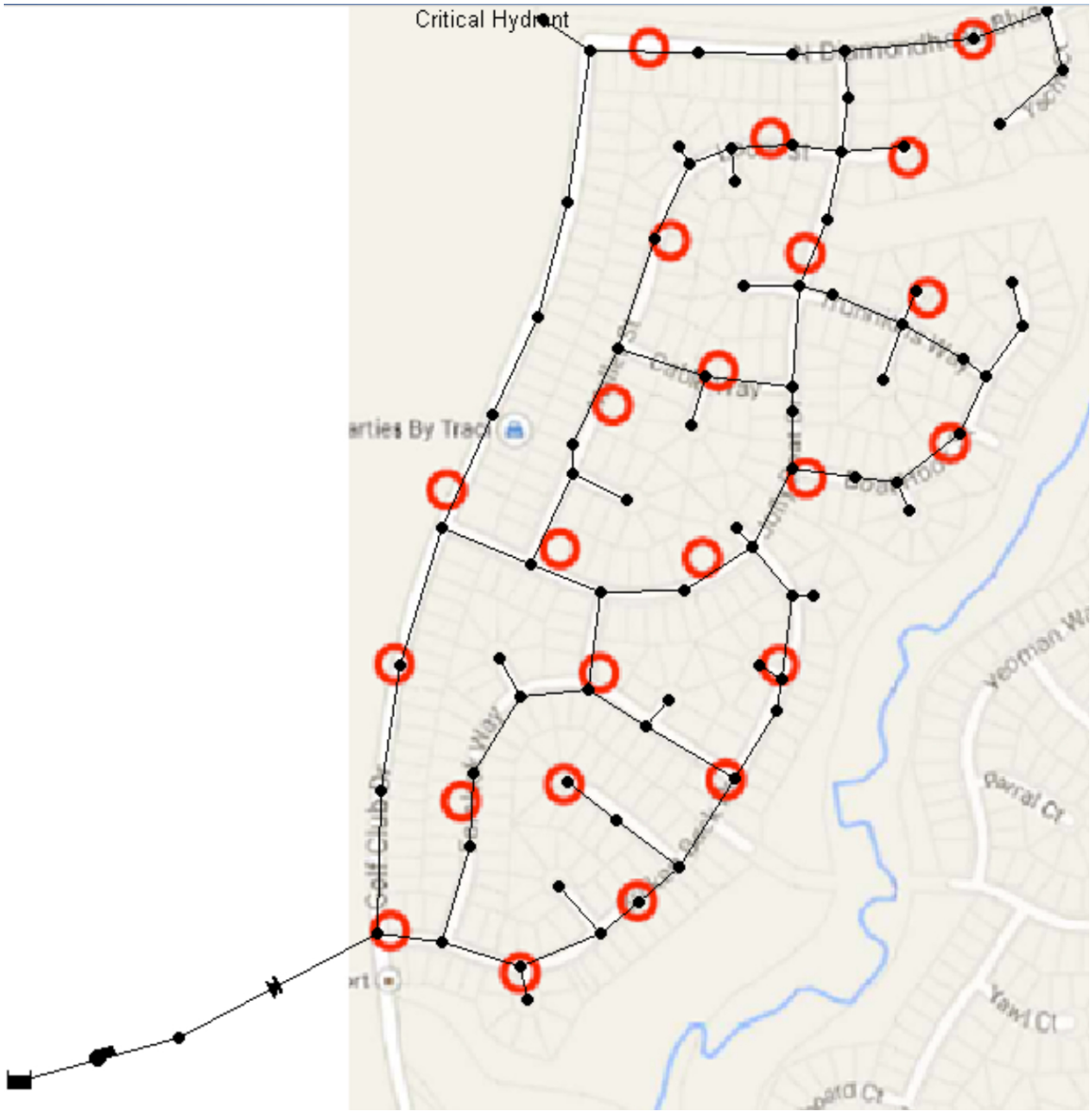

Figure 1: Newport Subdivision EPANET Model Pipe Layout

Problem 2 Solution:

Figure 2 is a screen capture of an EPANET model of a five-pipe network with a water supply source (a reservoir) connected at Node 1, and demands at Nodes 1-5.

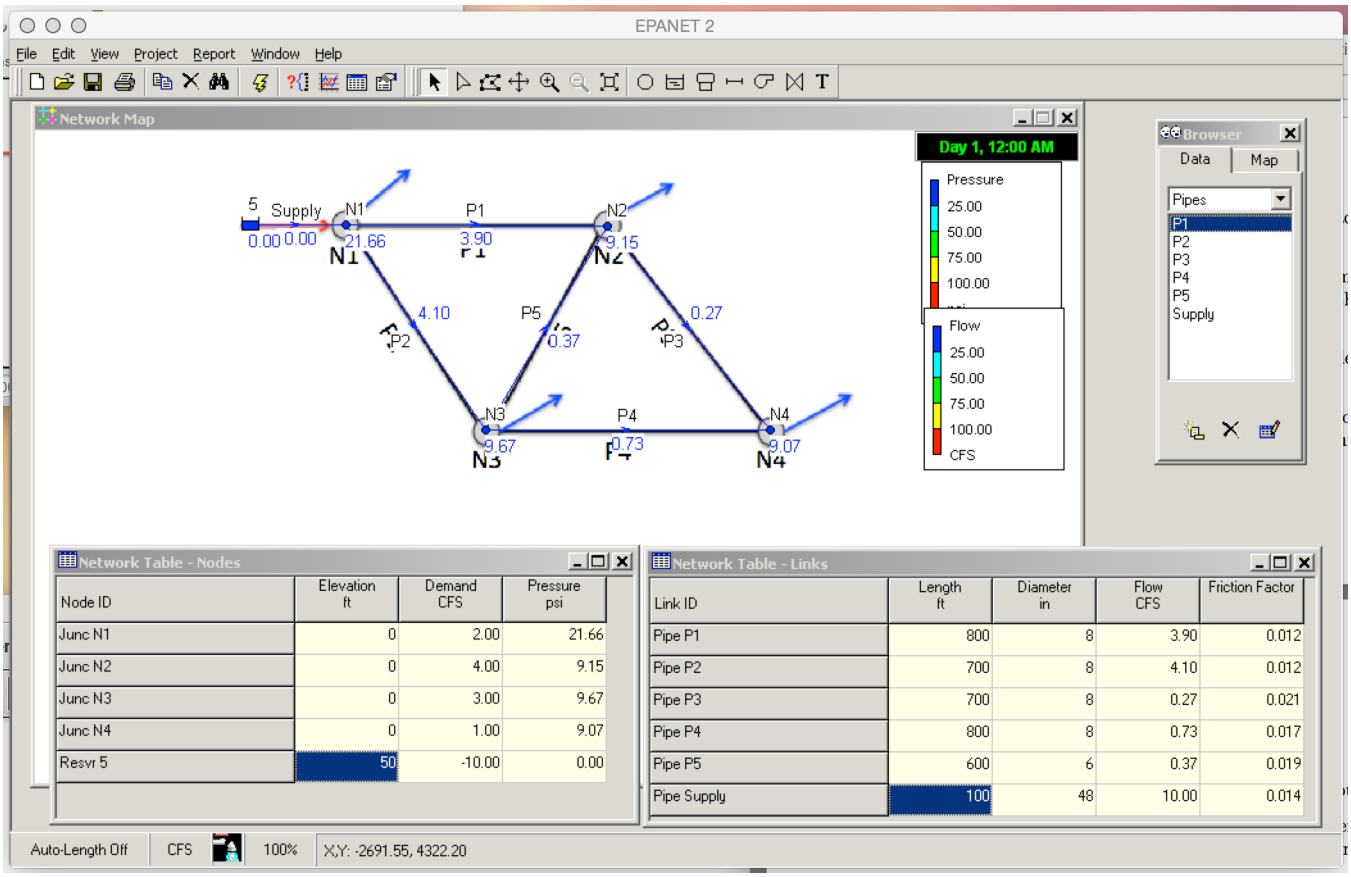

Figure 2: Layout of Simple Network

The screen capture shows the network map, with the Node ID and Node Pressures (in psi) displayed on the map, and with the Pipe ID and Pipe Flow Rates on the map.

The screen capture displays a table (lower left of the image) that lists each node name, node elevation, and the resultant pressure in U.S. Customary units. The screen capture displays another table (lower right of the image) that lists each pipe name, length, diameter, computed friction factor, and the resultant flow rate in U.S. Customary units.

The node with the lowest pressure (excluding the reservoir) is node N4 with a reported pressure of 9.07 psi.

The EPANET output report appears as the remainder of this memorandum.

```
Page 1                                                  10/12/2016 3:29:15 AM
*************************************************************************
*                            E P A N E T                                *
*                     Hydraulic and Water Quality                       *
*                     Analysis for Pipe Networks                        *
*                          Version 2.0                                  *
*************************************************************************
Input File:
Link - Node Table:
-------------------------------------------------------------------------
Link            Start           End                 Length  Diameter
ID              Node            Node                    ft        in
-------------------------------------------------------------------------
P1              N1              N2                     800         8
P2              N1              N3                     700         8
P3              N2              N4                     700         8
P4              N3              N4                     800         8
P5              N3              N2                     600         6
Supply          5               N1                     100        48
Node Results:
-------------------------------------------------------------------------
Node                Demand      Head  Pressure   Quality
ID                     CFS        ft       psi
-------------------------------------------------------------------------
N1                    2.00     50.00     21.66      0.00
N2                    4.00     21.13      9.15      0.00
N3                    3.00     22.32      9.67      0.00
N4                    1.00     20.93      9.07      0.00
5                   -10.00     50.00      0.00      0.00 Reservoir
Link Results:
-------------------------------------------------------------------------
Link                  Flow  VelocityUnit Headloss    Status
ID                     CFS       fps    ft/Kft
-------------------------------------------------------------------------
P1                    3.90     11.17     36.09      Open
P2                    4.10     11.74     39.53      Open
P3                    0.27      0.76      0.29      Open
P4                    0.73      2.10      1.75      Open
P5                    0.37      1.86      2.00      Open
Supply               10.00      0.80      0.04      Open
```