Sewer Main Cleaning Frequency optimization

Workshop #2

# Problem

Sewer Main cleaning frequencies haven’t been optimized.

# Solution

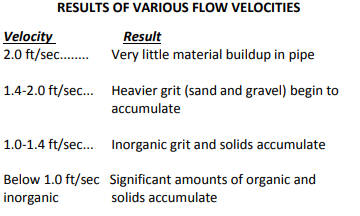
Calculate actual peak velocities

# Process

Apply Manning’s Partially Full Pipe Velocity Formula to determine sediment accumulation potential and flushing frequency need.



Group mains into categories based on velocity and estimated sediment accumulation potential.



# Variable Descriptions

## **Peak Flow Rate (Q, cfs)**

Calculated using 270 Gallon per ERU, peak factor of 3, 4 hour flow duration, ERU count, and infiltration.

ERU count calculated equivalent residential units using ArcGIS ‘Trace Upstream’ analysis, which counted all upstream sewer lateral points.

Infiltration calculated for STM mains East of S. Virginia at a rate of 0.0044 gal/min/ft. Calculated based on 600 gal/min infiltrating into STM and 137,582 feet of main.

## **Diameter**

Attribute of main in GIS

## **Roughness**

Manning’s Formula is to be used in computing depth of flow and velocities of all sanitary sewer conduits, with the roughness coefficient "n" value equal to:

0.012 for PVC pipe

0.012 for Reinforced Concrete pipe

0.012 for Ductile Iron pipe

0.011 for High Density Polyethylene (HDPE) pipe.

0.011 for ACP

0.014 for Clay pipe

0.012 for Blank or Unknown

## **Slope**

Rise was calculated based on the difference between main’s upstream manhole [INVERT\_OUT] elevation and downstream manhole [INVERT\_IN] elevation. When downstream manhole had multiple [INVERT\_IN] the [INVERT\_ANGLE] and [PIPE\_ANGLE] was used to determine correct invert.

Slope was calculated by dividing Rise by [LENGTH\_FT]

## Depth

Manning’s formula was rearranged to calculate depth based on known peak flow, diameter, roughness, and slope.



The left side, manning’s constant, is calculated for each main and is used as a lookup value in a lookup table containing. The lookup table contains calculated lookup values for each variation of diameter, roughness, and height (in 5% diameter increments). The calculation accounted for whether the pipe was greater or less than half full.

# Limitations

1. Does not account for commercial properties
   1. Possible TMWA source for ERU
2. Does not account for City of Reno customers in STMWRF
3. Force mains excluded
   1. Calculated Q as 9,999

# Long Term Improvements

1. Calculate the frequency of flushing based on calculated sediment accumulation
   1. Calculate rate of accumulated based on velocity and flow using Hjulström curve
2. Improve Invert and Slope data
3. Populate Q on lateral point
4. Improve material attributes