Sanitary Sewer System Inflow & Infiltration Study

West Norriton Township

Background

RETTEW
We answer to you.

- On October 9, 2012, the Board of Commissioners approved Rettew Project No. 057702004 to develop a comprehensive sanitary sewer plan to include the following:
  - Inflow and infiltration (I&I) abatement program based on an eight (8) year schedule for the remediation of I&I into the sanitary sewer system;
  - Upgrading and rehabilitation of the sanitary sewer system to handle all current and future flows;
  - Upgrading and rehabilitation to the existing pumping stations.
- Rettew has prepared the rehabilitation plans utilizing current Chapter 94 flow data and flow data from the flow meters installed within the sanitary sewer system.

Computer Modeling

- This Inflow & Infiltration Study consists of two components:
  - Metering of the sewage flows throughout the system
  - Development of a computer model of the entire West Norriton Township sewer system.
    - Prior to the development of the model, GIS mapping of the sewer system was completed using sewer system drawings, digital aerial photography and parcel mapping

Computer Model (cont.)

- Developed using Bentley SewerCAD Version 8i modeling software
  - Gravity sanitary sewer lines, force mains and manholes were developed for the model by linking and integrating the GIS database with the SewerCAD
  - The Township's 6 pump stations were created using the record drawings and pump flow curves.
    - Each station consists of a wet well, lead and lag pumps.

Daily Flow

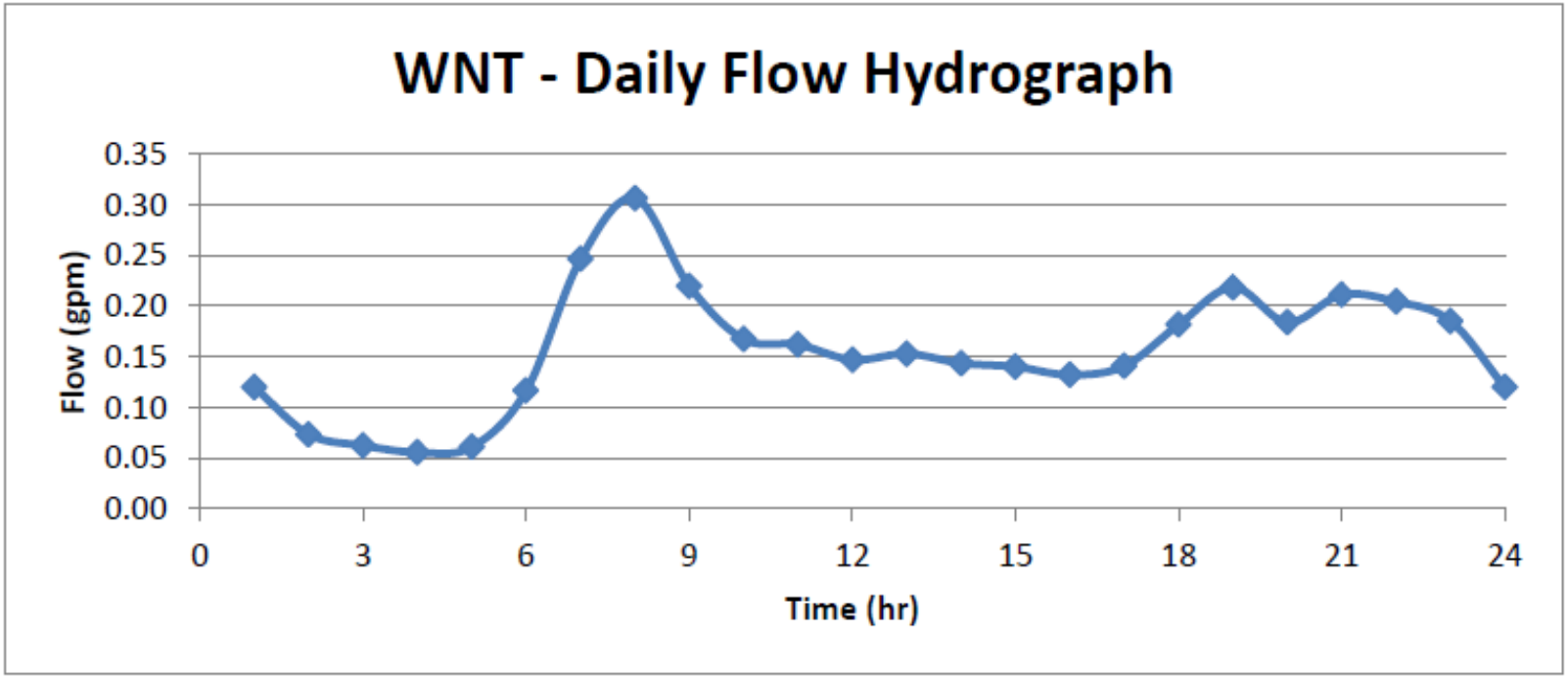
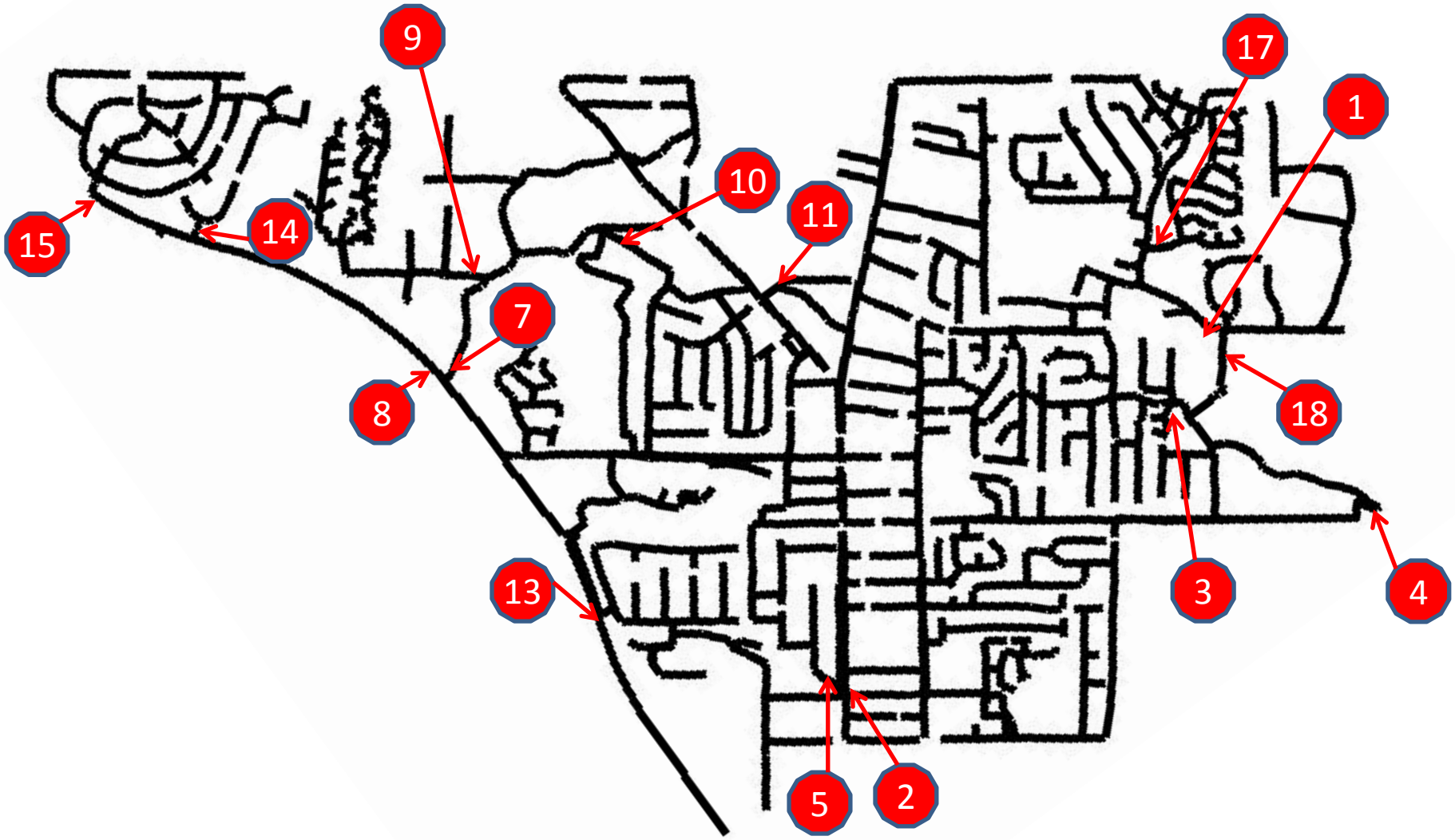


Figure 1: West Norriton Township daily flow hydrograph used for each sewer connection in the hydraulic model.

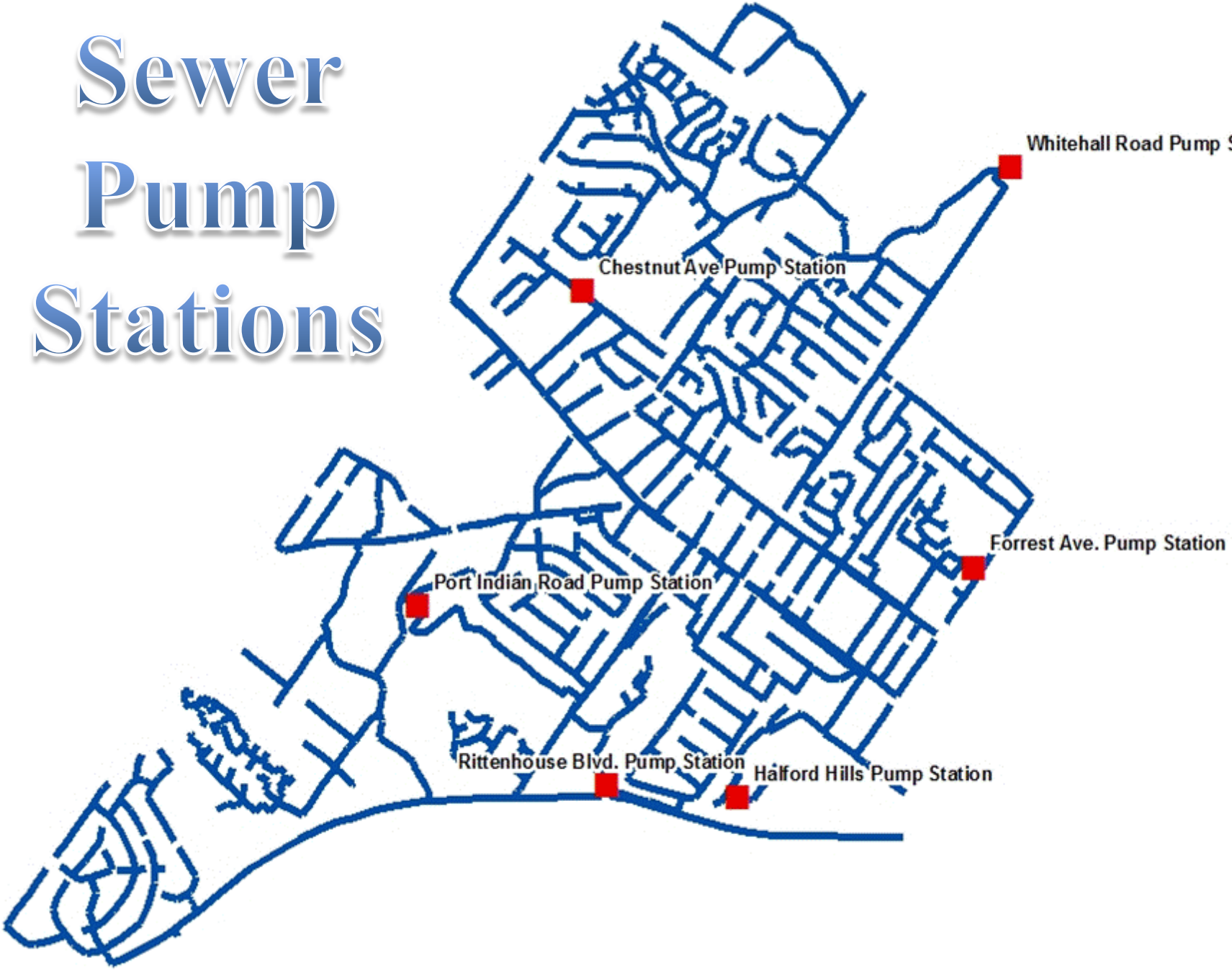
Meter Locations

Meter Number	Meter Name	Location
1	360 Burnside	Manhole 1299 at 360 Burnside Ave.
2	7-11	Manhole 98 in front of 7-11 on Main St.
3	Wayne Drive	Manhole 1153 behind 1909 and 1911 Wayne Drive
4	Whitehall	Manhole 1218 behind Whitehall P.S.
5	Sheridan/Hartranft	Manhole 209 at the intersection of Sheridan Ln. and Hartranft Dr.
7	498 Port Indian	Manhole 498 on Port Indian Road
8	367 Port Indian	Manhole 367 on W. Indian Lane
9	General Armistead	Manhole 505 near the intersection of Blvd. of the Generals and General Armistead Ave.
10	Port Indian Detention	Manhole 676 near Port Indian P.S.
11-1	School at Driveway	Manhole 701 on School Lane
11-2	Off School	Manhole 708 just off of School Lane
13	Beaver Hollow	Manhole 336 behind 1710 Beaver Hollow Rd.
14	West Indian Woods	Manhole 480 behind 922 Mystic Lane
15	Riverview	Manhole 390 on Riverview Blvd.
17	Paddock	Manhole 1254 near Paddock Circle
18	Burnside Ave	Manhole 1349 behind 380 Burnside Ave.

METER LOCATIONS



Sewer Pump Stations



Pump Station/System Comparisons

Model Results – Pump Station/System Comparisons

Pump Station Name	Average Daily Flow (gpm)	
	2012 Chapter 94 Report	Model Dry Weather
Rittenhouse Blvd	985.1	852.3
Whitehall Road	307.7	312.1
Port Indian Road	226.5	184.7
Forest Avenue	124.3	150.4
Chestnut Avenue	40.9	34.2
Halford Hills	1.7	2.0
Jackson Street	651.6	577.7
Flow to Norristown	1,636.7	1,430.0

gpm = gallons per minute

Flow Meter Comparisons

Model Results – Flow Meter Comparisons

Meter #	Meter Name	Average Daily Flow (gpm)	
		Metered Dry Weather	Model Dry Weather
1	360 Burnside	70.0	133.9
2	7-11	300.0	571.6
3	Wayne Drive	75.0	62.0
4	Whitehall	200.0	308.7
5	Sheridan/Hartranft	60.0	231.3
7	498 Port Indian	0	166.4
8	367 Port Indian	60.0	39.0
9	General Armistead	75.0	71.7
10	Port Indian Detention	50.0	184.7
11(1)	School at Driveway	4.0	2.8
11(2)	Off School	100.0	130.4
13	Beaver Hollow	1.0	22.9
14	W Indian Woods	40.0	3.6
15	Riverview	2.0	14.2
17	Paddock	0.2	49.7
18	Burnside Avenue	120.0	155.4

gpm = gallons per minute

Meter Area Priority

Meter Chart.pdf - Adobe Reader

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Priority Number	Meter #	Meter Name	Contributing MHs	Estimated June 7 I & I (GPM)	June 7 I & I per Manhole (GPM)	Estimated July 23 I & I (GPM)	July 23 I & I per Manhole (GPM)
1	14	West Indian Woods	14	200	14.3	50	3.6
2	11(1)	School at Driveway	7	70	10	17	2.1
3	1	360 Burnside	141	800	5.7	300	3
4	4	Whitehall	42	1000(4)	4.2(5)	650(6)	7.1(7)
5	18(1)	Burnside Avenue	50	(2)	(2)	NF(3)	NF
6	11(2)	Off School	124	NF	NF	500	4
7	7	498 Port Indian	84	700(8)	3.9(9)	NF	NF
8	8	367 Port Indian	23	400(10)	3.14(11)	0	0
9	17	Paddock	38	80	2.1	0	0
10	10	Port Indian Detention	108	450(12)	1.9(13)	NF	NF
11	3	Wayne Drive	106	NF	NF	220	2.1
12	9	General Armistead	96	NF	NF	200	2.1
13	5	Sheridan/Hartranft	86	NF	NF	NF	NF
14	15	Riverview	90	NF	NF	0	0
15	2	711	153	0	0	0	0
16	13	Beaver Hollow	55	0	0	0	0

(1) Prioritized based on July 23 Flow Analysis of Meter 4
(2) Calculated with Meter 4
(3) Non-Functioning
(4) Assumed to come from Meter 18, Meter 3, Meter 17 and Meter 4
(5) Based on a total of 236 manholes in the total contributing sewershed
(6) Assumed to come from Meter 18 and Meter 4
(7) Based on a total of 92 manholes in the total contributing sewershed
(8) Assumed to come from Meter 7 and from Meter 9
(9) Based on a total of 180 manholes in the total contributing sewershed
(10) Assumed to come from Meter 14, Meter 15, and from Meter 8
(11) Based on a total of 127 manholes in the total contributing sewershed
(12) Assumed to come from Meter 11(2) and from Meter 10
(13) Based on a total of 232 manholes in the total contributing sewershed

WEST NORRITON TOWNSHIP

Meter Area Possible I & I Sources

Priority Number	Meter #	Meter Name	Possible I & I Sources								
			Sump Pump Connections	Manholes in low points of paved areas	Manholes adjacent to drainage paths	Exterior surface drains connected to sewer lateral	Sewer vents at ground level and in drainage path	Low sewer vent adjacent to drainage path	Downspout connections to sewer lateral	Manhole inflow from road stone subbase	Infiltration from groundwater
1	14	West Indian Woods	N	N	Y	N	Y	Y	N	Y	N
2	11(1)	School at Driveway	Y	Y	Y	Y	Y	Y	N	Y	Y
3	1	360 Burnside	Y	Y	N	Y	Y	N	Y	Y	N
4	18[(1)]	Burnside Avenue	Y	N	Y	N	Y	Y	N	Y	Y
5	4	Whitehall	Y	N	Y	N	Y	Y	N	Y	Y
6	11(2)	Off School	Y	Y	Y	Y	Y	Y	Y	Y	Y
7	7	498 Port Indian	Y	N	Y	N	N	Y	N	Y	Y
8	8	367 Port Indian	N	N	Y	N	N	Y	N	N	N
9	17	Paddock	N	N	Y	N	N	Y	N	N	N
10	10	Port Indian Detention	U	U	U	U	U	U	U	U	U
11	3	Wayne Drive	N	Y	N	Y	N	N	Y	Y	N
12	9	General Armistead	N	N	Y	N	Y	Y	N	N	N
13	5	Sheridan/Hartranft	U	U	U	U	U	U	U	U	U
14	15	Riverview	N	Y	Y	Y	Y	Y	Y	Y	N
15	2	711	N	N	N	N	N	N	N	N	N
16	13	Beaver Hollow	N	N	N	N	N	N	N	N	N

Note: Y = Yes, which means possibly present, and N = No, which means not likely to be present, based on metering results; U means Unknown

Storm Analysis

- Two recent storms were analyzed for this report:
  - June 7, 2013
    - Township received between 3-4 inches of rain following approx. 0.16 in of rain from June 6th
  - July 23, 2013
    - Township received between 1-1.67 inches of rain during a very short but intense 2 hour period.
- All meters were in place during these storms, allowing comparisons between the meters and prioritization based on those comparisons.

Recommendations

- The top 4 priorities for I&I reduction based on this study are listed with the highest priority first.

Priority 1

- Investigate the sewershed contributing to Meter 14, which consists of only 14 manholes located mostly along Mystic Lane.
  - Metering identifies an average dry weather flow of approx. 40 gdm; expected values are 4 gpm.
  - This sewershed has the highest rate of I&I per manhole of any of the metered areas.
    - Peak inflows of 14.3 gpm per manhole were experienced.

Priority 2

- Investigate a single 7-manhole run along School Lane, contributory to Metter 11-1 for I&I
  - Peak flows reached 10gpm per manhole.

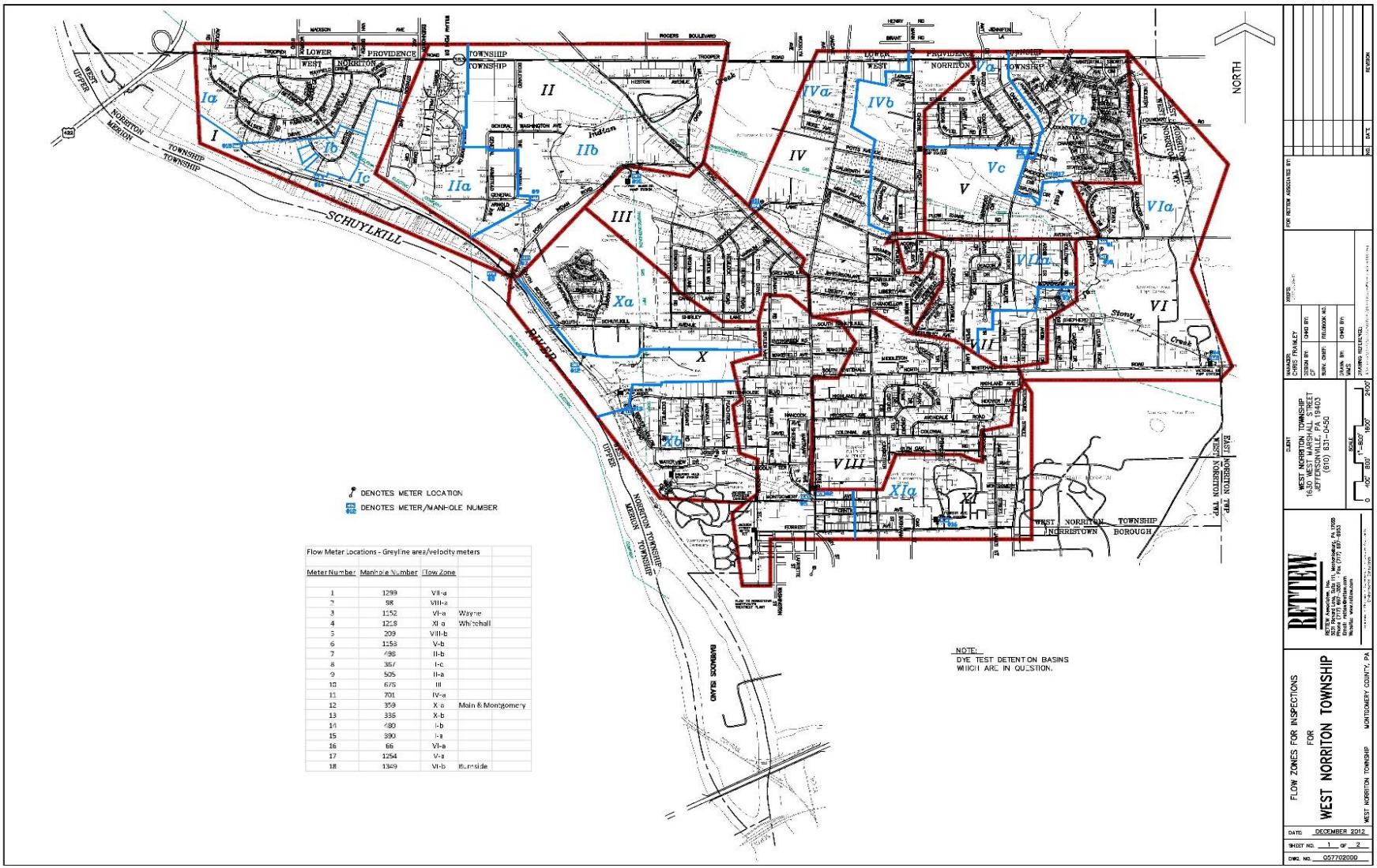
Priority 3

- Investigate the sewershed contributory to Meter 1, which is located in the manhole at 360 Burnside Ave.
  - This sewershed generally extends from Burnside Ave. to Trooper Rd. on each side of Oakland Dr.
  - Inflows levels reached 5.7 gpm per manhole, which is tremendous amount of extra flow due to 141 contributing manholes.

Priority 4

- Investigate the sewer shed contributory to Meter 4 (essentially the sewershed to the Whitehall Pump Station), which includes the areas flowing through Meter 18, Meter 3, and Meter 17.
  - Peak inflow from this sewershed was estimated at 4.2 gpm per manhole from a total of 236 manholes.

Sewer Flow Zones



Flow Meter Locations - Greyline area/velocity meters			
Meter Number	Manhole Number	Flow Zone	
1	1299	VII-a	
7	98	VIII-a	
3	1152	VI-a	Wayne
4	1228	XI a	Whitehall
5	209	VIII-b	
6	1153	V-b	
7	498	II-b	
8	357	I-c	
9	505	II-a	
10	675	III	
11	701	IV-a	
12	359	X a	Main & Montgomery
13	335	X-b	
14	480	I-b	
15	390	I-a	
16	66	VI-a	
17	1254	V-a	
18	1349	VI-b	Burnside

Estimated Costs

Inflow & Inflitration Work

Projects (priority order) Inflow & Inflitration	Anticipated Inception	Completion	Total Cost	2014	2015	2016	2017	2018	2019
Mystic Lane									
Engineering- design, bidding & inspection	2014	2014	40,000	40,000					
Televise and clean mains & laterals	2014	2014	25,000	25,000					
Mystic Lane									
Repairs to mains	2015	2015	150,000		150,000				
Repairs to laterals	2015	2015	112,000		112,000				
Sewer Zone IVa (See mapping)									
Engineering- design, bidding & inspection	2015	2015	25,000		25,000				
Televise and clean mains & laterals	2015	2015	150,000		150,000				
Sewer Zone IVa (See mapping)									
Repairs to mains	2016	2016	500,000			500,000			
Repairs to laterals	2016	2016	450,000			450,000			
Sewer Zone V (Va, Vb & Via: see mapping)									
Engineering- design, bidding & inspection	2016	2016	40,000			40,000			
Televise and clean mains & laterals	2016	2016	250,000			250,000			
Sewer Zone V (Va, Vb & Via: see mapping)									
Repairs to mains	2017	2017	500,000				500,000		
Repairs to laterals	2017	2017	675,000				675,000		
Sewer Zone VI, VII & VIIa (see mapping)									
Engineering- design, bidding & inspection	2017	2017	40,000				40,000		
Televise and clean mains & laterals	2017	2017	250,000				250,000		
Sewer Zone VI, VII & VIIa (see mapping)									
Repairs to mains	2018	2018	500,000					500,000	
Repairs to laterals	2018	2018	450,000					450,000	
Sewer Zone IVb (see mapping)									
Engineering- design, bidding & inspection	2018	2018	30,000					30,000	
Televise and clean mains & laterals	2018	2018	150,000					150,000	
Sewer Zone IVb (see mapping)									
Repairs to mains	2019	2019	300,000						300,000
Repairs to laterals	2019	2019	157,500						157,500
Sub-total Inflow & Inflitration Plan			**4,794,500**	**65,000**	**437,000**	**1,240,000**	**1,465,000**	**1,130,000**	**457,500**
Contigency at 15%			719,175						
Total			**5,513,675**						

Questions?

Rittenhouse Pump Station

Construction of New Pump Station

Rittenhouse Pump Station

- The existing station was built in the mid 1960's as part of the original sanitary sewer system expansion and is comprised of (3) 75hp pumps, each capable of pumping 1,750gpm, with controls, emergency generator and misc. equipment .
- The pump station was upgraded in 1983 with enlarged pumps rated at 200hp, each capable of pumping 2,700gpm. The pump station is a wet pit/dry pit design with a concrete dry pit.
  - The expansion was done in 1983 by constructing an additional generator room to the southwest corner of the pump station. The station is approximately 40 feet below grade (ground Level).

Rittenhouse Pump Station

- The pumps are run by flow paced unit called a flow matcher (older method of controlling).
- The flow matcher senses rate of flow and turns pumps on/off automatically. The pumps are in the lowest level of the station and the electrical motors on the highest level.
  - A shaft runs the full depth of the station to run the pumps.
- Other equipment in the station is a comminuter, which is a grinder which chops large pieces of waste and debris into pieces (normally 3 inches or less).

Rittenhouse Pump Station

- The existing permit is for a peak flow of 6.65mgd.
  - The pump station handles an average daily of 2.0 mgd. Currently the pumping station is handling by-pass flow from the Jackson Street drainage basin to Rittenhouse PS.
  - The rate of flow varies day to day hour to hour but approximately 75% of flow which normally flows (between 0.50mgd to 0.75mgd) to Norristown Municipal Waste Authority's plant is diverted to this pump station.
  - During wet weather (rains, snow melt, etc.) our current DEP permit is exceeded by up to 2mgd.
- The proposed pump station will be permitted to allow for these increased flows and prevent a flow violation. Flows will not be increased on a normal day.
  - The flows given to DEP for the new permit are actual average flows from our current Chapter 94 plan.

History of New Pump Station

- Identified for replacement in FY 2006, along with Whitehall Road Pump Station
  - Permit to build Whitehall Road Pump Station was secured in 2010
  - Placed on hold pending financing
- Rettew Project #08-05770-008 was approved in FY 2008 for the design of the new Rittenhouse Pump Station
- Design completed in late FY 2009
- Ordinance 10-659 passed on 11/9/10 approving $9.7 million for capital improvements
  - Refinanced existing debt and borrowed for new projects
  - Money allocated for Rittenhouse Pump Station

Projected Costs

- Engineering (update design, bidding & inspection)
  - $275,000
- Construction
  - $4,500,000
- Contingency (15%)
  - $716,250
- **Estimated Total Cost: $5,491,250**

Next Steps

- Permit has been submitted to DEP for review
- Approval from Board of Commissioners to proceed with bidding process
- Development of bidding documents and formal advertisement of bids