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EXHIBIT O5

NOTICE OF VIOLATION - FOLLOW-UP STUDY

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**STONY CREEK NO. 1 INTERCEPTOR  
FLOW AND CAPACITY STUDY  
UPDATE NO. 1**

**MAY 1, 2015**

**PREPARED FOR:**

**EAST NORRITON TOWNSHIP  
2501 STANBRIDGE STREET  
EAST NORRITON, PA 19401**

**PREPARED BY:**

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## EXECUTIVE SUMMARY

A flow and capacity analysis is being performed for the Stony Creek No. 1 Interceptor between North Wales Road and the Timberlake Pump Station, which is a distance of 7,680 feet, or 1.45 miles. Estimated average flow through the interceptor downstream of Manhole 331, before combining with sewers from Germantown Pike, is 323,350 gpd. Actual average metered flow in the interceptor during the period of September 12 through November 18 is 401,725 gpd, which is significantly higher than the flow estimate based on EDU count of 323,350 gpd. However, due to the limited monitoring period and some inconsistent data at Manhole 378, conclusions cannot be drawn. Additional monitoring is recommended as described below.

Based on flow records for the Timberlake Pump Station and for the Germantown Pump Station, the flow rates attributed to the Interceptor based on meter data would initially appear too high. As can be seen from Table 5, when subtracting the interceptor flow from the recorded flow for the Timberlake Pump Station, remaining flow that can be attributed to the Germantown Pump Station is less than what was recorded at the Germantown Pump Station during the same metering period. This does not address additional flows from Einstein Pump Station and from the gravity service area along Germantown Pike and further south (i.e. Felton Road, Timberlake Apartments and Briarwood). Although some of the discrepancies may be attributed to a time differential between the daily flow period of measurement for the interceptor meters versus the pump station meters, this still does not appear to satisfy all of the inconsistencies. Therefore we conclude that the portable interceptor meters and/or the pump station flow meters may not be properly calibrated.

Although peak flow rates, as metered, exceed the full flow capacity of certain sections of Stony Creek No. 1 Interceptor, accuracy of the readings are in question and therefore, no actionable conclusions can be made at this time relative to the capacity of the Interceptor. However, we also note that a random check of flows at Germantown, Einstein and Timberlake Pump Station suggests inconsistent Pump Station Meter data, since subtraction of Germantown and Einstein Pump Station Flows from that Recorded at Timberlake Pump Station leaves insufficient flow to address the remaining 1,326 EDUs contributed by the Stony Creek No. 1 Interceptor below MH 331, the 698 EDUs of gravity flow entering at or below Germantown Pike, and additional flow from Felton Road and institutional, commercial and industrial facilities currently unaccounted for.

We recommend that the portable flow meters and Township Pump Station flow meters be checked and calibrated and that Township personnel check recommendations of the meter manufacturer relative to installation locations. As a further check, it may be worthwhile for the Township to hire an outside consultant to meter flows in the Interceptor and upstream of both the Timberlake and Germantown Pump Stations to verify data collected by the Township.

Following a check in portable meter and pump station meter calibration, along with a review of manufacturer recommended installation procedures, additional flow metering of the Stony Creek No. 1 Interceptor should be performed simultaneously at Manhole 375, 337, 299 and 251, for a least a 30 day period.

SECTION 1.0  
INTERCEPTOR METERING LOCATIONS AND FLOW ESTIMATE

1.1 General Description of Interceptor

A flow and capacity analysis has been performed for the Stony Creek No. 1 Interceptor from North Wales Road to the Timberlake Pump Station, which is a distance of 7,680 feet, or 1.45 miles. Figure 1 provides a map of the Stony Creek No. 1 Interceptor. Sewer Manholes are numbered from the Timberlake Pump Station, beginning at Sewer Manhole (MH) 249 and progressing upstream in a northward direction, across Germantown Pike and parallel with Stony Creek, reaching MH 353, approximately 500 feet south of Township Line Road. Here it turns eastward, crossing the Conrail Railroad, past Deer Run and Stony Creek Residential Developments, terminating at its upstream end at MH 381 in North Wales Road. The Interceptor size and slope is defined in Table 1. Between MH 249 and 300, the sewer is 18-inch Reinforced Concrete Sewer Pipe (RCSP). Between MH 300 and 331 it is 15-inch Vitrified Clay Pipe (VP). Between MH 331 and 342 it is 12-inch VP. Upstream from MH 342, the remaining portion of the interceptor is 10-inch VP.

1.1.1 Existing Plans of the Interceptor

- A. Plans of the Stony Creek No. 1 Interceptor extending from the Timberlake Pump Station at MH 249 upstream to MH 353:

CONTRACT NO. EN-1  
PLAN AND PROFILE  
INTERCEPTOR NORTH BRANCH  
Plan Number 59016-14 through 59016-16  
Prepared by Albright & Friel, Inc., of Philadelphia, PA  
Dated October 29, 1959 and Last Revised December 18, 1962 as Record Plans

- B. Plans of the Stony Creek No. 1 Interceptor Extending from MH 353, where it crosses Stony Creek toward the Conrail Railroad, and extending to MH 381 at North Wales Road:

CONTRACT NO. EN-1  
PLAN AND PROFILE  
R.O.W.  
Plan Number 59016-26  
Prepared by Albright & Friel, Inc., of Philadelphia, PA  
Dated October 29, 1959 and Last Revised December 18, 1962 as Record Plans

1.2 Description of Flow Monitoring Locations

Figure 1 is a map of the Stony Creek No. 1 Interceptor, showing locations where flows were metered between September 12, 2014 and November 18, 2014. Specifically, these locations are as follows:

- Interceptor Manhole 378, located on the southeast side of North Wales Road, one manhole downstream of the confluence with Stony Creek Condominiums. Main interceptor flow was measured.
- Interceptor Manhole 373, located at the northwest boundary with the Conrail Railroad. Only the flow entering the interceptor from Deer Run Residential Development was metered at this location.
- Interceptor Manhole 331, located four manholes upstream of Germantown Pike, receiving flow from residential development through an easement from Stony Creek Road. Only flow from the residential development entering the interceptor was metered at this location.

### 1.3 Estimates of Development Tributary to Interceptor Based on EDUs

The Stony Creek No. 1 Interceptor flows to Timberlake Pump Station, which receives flow from the Stony Creek No. 1 Interceptor, Germantown Pump Station, Einstein Pump Station and gravity flow from the remaining drainage area. Figure 2 provides a flow schematic that illustrates the Timberlake Pump Station Drainage Area. The Stony Creek No. 1 Interceptor is differentiated in orange line type in Figure 2. The number of EDUs contributing flow to the Stony Creek No. 1 Interceptor is estimated for the following locations:

#### A. Manhole 378:

- 558 EDUs from development along North Wales Road and from development North and West of North Wales Road (CEC Count).
- 163 EDUs from Stony Creek Condominiums (number provided by Bryan Bortnichak).

#### B. Manhole 373:

- 138 EDUs from Deer Run Development (number provided by Bryan Bortnichak).

#### C. Manhole 331:

- 467 EDUs from development along Stony Creek Road, Norwood Lane, Sycamore Lane, Green Hill Lane, Oak Tree Road, Beechwood Road, Brookside Road, Bryans Road, Orchard Road, Woodlawn Road, Cottage Lane and a portion of Penn Square Road. (CEC Count).

#### D. Timberlake Pump Station

Flow at Timberlake Pump Station is comprised of the above flow from Stony Creek No. 1 Interceptor, plus the following additional development:

- 176 EDUs from development along Kenwood Road, Norriton Drive, Avon Road, Pinecrest Road, Dermon Road, Scenic Road, North Wales Road, Portions of Barbara Drive, portions of Denise Road, portions of Michelle Drive and portions of Germantown Pike.(CEC Count).
- 55 EDUs from development along Penn Square Road, portions of Germantown Pike, Dorp Lane, Dorp Circle and Stanbridge Street.(CEC Count).
- 318 EDUs from Timberlake Development (number provided by Bryan Bortnichak).
- 1730 EDUs from Germantown Pump Station (based on recorded Township average flow for 2014 of 432,472 gpd, divided by 250 gpd per EDU).
- 390 EDUs from Einstein Pump Station (based on average flow for 2014 of 97,410 gpd, divided by 250 gpd per EDU). Note that bypass flows to Einstein Pump Station from Germantown Pump Station Parallel Force Main were not deducted from the Einstein PS average annual flow for the EDU calculation. In 2013, the amount diverted to the Einstein Pump Station through the Parallel Force Main affected the average annual flow for that year by 5,163 gpd, which was slightly over 5% of the annual average. Figures for 2014 were not available at this time.
- 67 EDUs from Briarwood (number provided by Bryan Bortnichak)
- 82 EDUs from Barley Sheaf Drive (CEC Count).
- Felton Road – Unknown

#### 1.4 Average Flow Estimate for Stony Creek No. 1 Interceptor

Based on the above, calculated average Stony Creek No. 1 Interceptor flow expected at each location is as follows:

##### A. Manhole 378:

**172,100 gpd**, based on EDU Count and assumed flow per EDU of 250 gpd, except for Stony Creek Condominiums, which are assumed to have a flow rate of 200 gpd per EDU.

##### B. Manhole 373:

**206,600 gpd**, which includes estimated flow from MH 378 as described above, plus 34,500 gpd average flow from Deer Run, based on EDU count at flow rate of 250 gpd per EDU.



C. Manhole 331:

**323,350 gpd**, which includes estimated flow from MH 373 plus 116,750 gpd average flow from development tributary to the interceptor from Stony Creek Road, based on EDU Count at flow rate of 250 gpd per EDU.

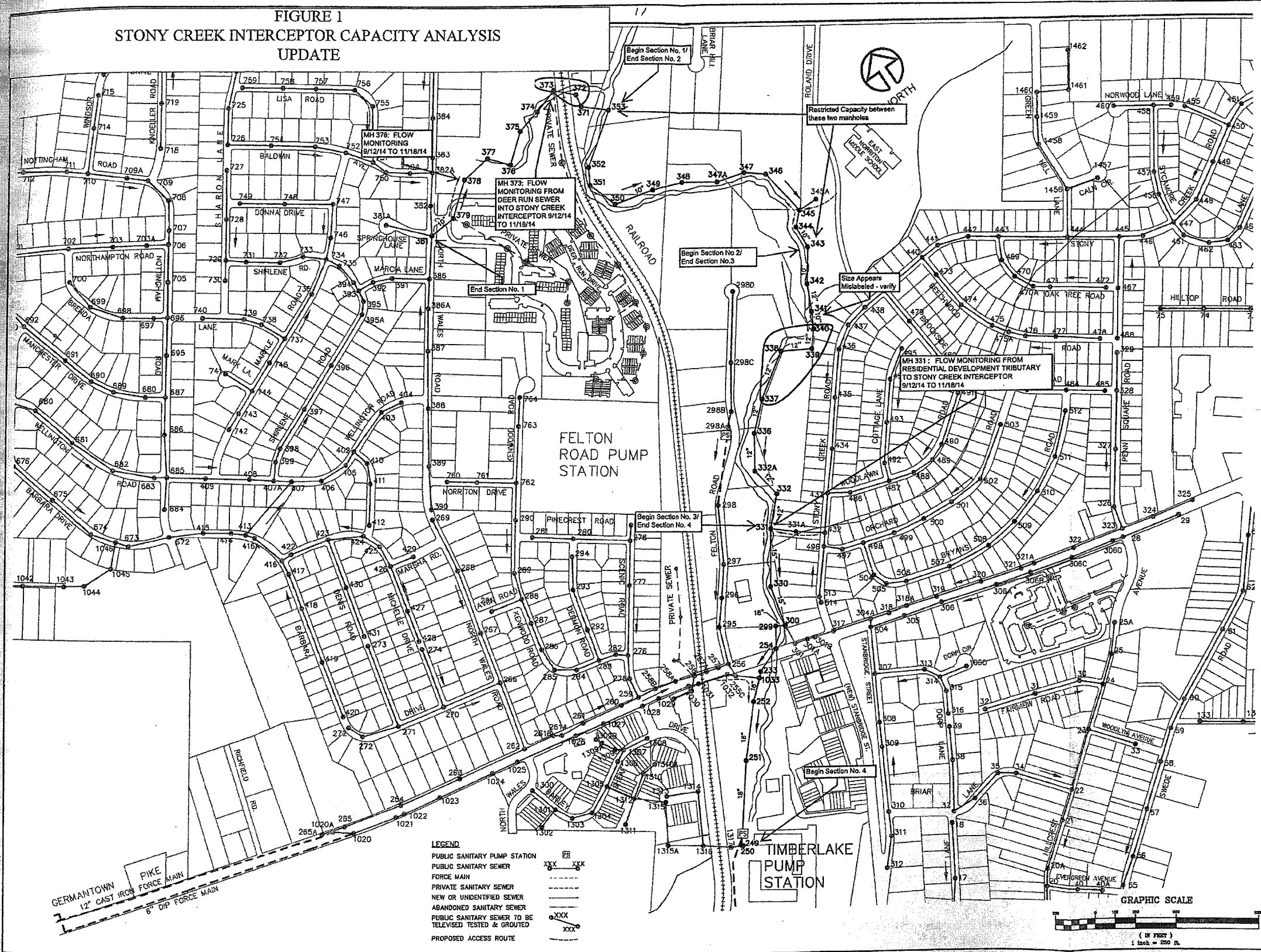
D. Timberlake Pump Station:

**1,011,950 gpd**, which includes flow at MH 331 plus 1730 EDUs from Germantown Pump Station, 390 EDUs from Einstein Pump Station, 318 EDUs from Timberlake Development, 67 EDUs from Briarwood, 82 EDUs from Barley Sheaf Drive Residential Development and 231 EDUs from remaining gravity service area.

In summary, flow tributary to the Timberlake Pump Station is estimated to be 4,144 EDUs. Of this, 3663 EDUs are expected to generate a flow rate of 250 gpd per EDU and 481 EDUs associated with Stony Creek Condominiums and Timberlake Apartments are assumed to generate a lower flow rate of 200 gpd per EDU. This estimate does not include flow from Felton Road.

Actual recorded average flow to Timberlake Pump Station for 2014 is 871,966 gpd, which is lower than that estimated based on EDU count and assumed flow per EDU. Since our estimate based on EDUs does not include additional EDUs for Felton Road flow or for any other commercial, institutional or industrial use (schools, food establishments, office condominiums along Germantown Pike, etc.), the differential would be even greater.

FIGURE 1  
STONY CREEK INTERCEPTOR CAPACITY ANALYSIS  
UPDATE

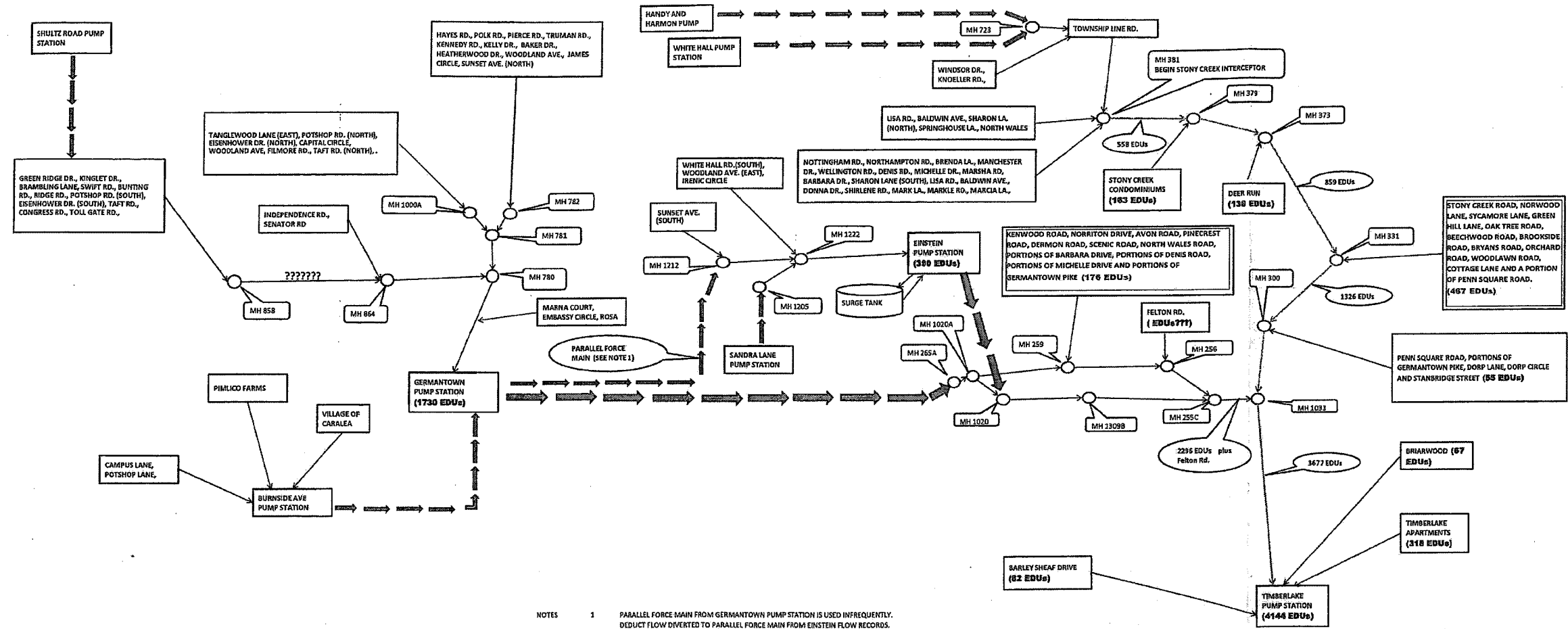


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2013 SANITARY SEWER  
TELEVISION, JOINT TESTING & GROUTING  
STONY CREEK INTERCEPTOR  
SITUATED IN TOWNSHIP  
EAST NORRITON TOWNSHIP  
PREPARED FOR  
EAST NORRITON TOWNSHIP  
2501 STANBRIDGE STREET  
EAST NORRITON, PA 19401

DATE	07-18-12
CADD FILE	1398130033
JOB NO	12-9809.00
DSG BY	BMF
DWN BY	DCF
CKD BY	KEH
SCALE	1"=250'
DRAWER NUMBER	D39-107
SHEET	1 OF 1 SHEETS
DRAWING NUMBER	C-101

FIGURE 2  
TIMBERLAKE PUMP STATION FLOW SCHEMATIC



NOTES 1 PARALLEL FORCE MAIN FROM GERMANTOWN PUMP STATION IS USED INFREQUENTLY. DUCT FLOW DIVERTED TO PARALLEL FORCE MAIN FROM EINSTEIN FLOW RECORDS.

**TABLE 1**  
**STONY CREEK INTERCEPTOR CAPACITY ANALYSIS**  
 MAXIMUM FLOW CAPACITIES - based on Manning's Equation (for given slope)

Manning's Equation

$$Q = (1.486/n) * A * R^{0.667} * S^{0.5}$$

WHERE:

Q = Cubic Feet Per Second

A = Cross-Sectional Area of Pipe (sf)

R = Hydraulic Radius ( Pipe dia./4) (ft.)

S = Slope (ft./ft.) Based on Calculated slope from in/out inverts and stationing, not slope stated on plan

n = Manning Coeff of Roughness

DOWNSTREAM MANHOLE			UPSTREAM MANHOLE			LENGTH (FEET)	SLOPE		PIPE MATERIAL	D (FT)	A (SF)	R (FT)	n	Q (Based on Calculated Slope)			VELOCITY (FPS)
NO.	RIM	INVERT	NO.	RIM	INVERT		Calculated (FT/FT)	From Plan (FT/FT)						(CFS)	(MGD)	(GPM)	
249	156	147.73	250	155.2	147.93	80	0.002500	0.0026	RCSP	1.500	1.7671	0.375	0.013	5.250452	3.393958	2356.6	2.97
250	155.2	147.93	251	159	150.93	389	0.007712	0.0081	RCSP	1.500	1.7671	0.375	0.013	9.221733	5.961043	4139.0	5.22
251	159	150.93	252	160.4	151.86	333	0.002793	0.0026	RCSP	1.500	1.7671	0.375	0.013	5.549401	3.587201	2490.7	3.14
252	160.4	151.86	253	160.1	152.28	167.7	0.002504	0.0026	RCSP	1.500	1.7671	0.375	0.013	5.255146	3.396992	2358.7	2.97
253	160.1	152.28	254	159.8	152.58	125.8	0.002385	0.0026	RCSP	1.500	1.7671	0.375	0.013	5.127988	3.314795	2301.6	2.90
254	159.8	152.58	299	161.9	152.82	118	0.002034	0.0025	RCSP	1.500	1.7671	0.375	0.013	4.735778	3.061266	2125.6	2.68
299	161.9	152.82	300	164.3	153.00	84	0.002143	0.002	RCSP	1.500	1.7671	0.375	0.013	4.860974	3.142194	2181.8	2.75
300	164.3	155.06	330	161.9	156.59	263.5	0.005806	0.006	VP	1.250	1.2272	0.313	0.013	4.920460	3.180647	2208.5	4.01
330	161.9	156.59	331	164.6	158.60	328	0.006128	0.006	VP	1.250	1.2272	0.313	0.013	5.054887	3.267542	2268.8	4.12
331	164.6	158.93	332	168.3	159.59	224.5	0.002940	0.003	VP	1.000	0.7854	0.250	0.013	1.930879	1.248144	866.6	2.46
332	168.3	159.59	332A	167	161.24	251	0.006574	0.0066	VP	1.000	0.7854	0.250	0.013	2.887330	1.866406	1295.9	3.68
332A	167	161.24	336	171.1	162.76	294	0.005170	0.0066	VP	1.000	0.7854	0.250	0.013	2.560587	1.655195	1149.3	3.26
336	171.1	162.76	337	169.8	163.32	186.5	0.003003	0.003	VP	1.000	0.7854	0.250	0.013	1.951398	1.261408	875.8	2.48
337	169.8	163.32	338	171.7	164.21	275.5	0.003000	0.003	VP	1.000	0.7854	0.250	0.013	1.950527	1.260845	875.5	2.48
338	171.7	164.21	339	175.7	164.67	155	0.002968	0.003	VP	1.000	0.7854	0.250	0.013	1.940012	1.254048	870.7	2.47
339	175.7	164.67	340	171.9	165.06	127.5	0.003059	0.0025	VP	1.000	0.7854	0.250	0.013	1.969557	1.273146	884.0	2.51
340	171.9	165.06	341	175.2	166.22	115.5	0.010043	0.01	VP	1.000	0.7854	0.250	0.013	3.568858	2.306954	1601.8	4.54
341	175.2	166.22	342	176.4	167.99	169	0.010473	0.01	VP	1.000	0.7854	0.250	0.013	3.644472	2.355832	1635.7	4.64
342	176.4	167.99	343	177.4	170.30	232	0.009957	0.01	VP	0.833	0.5450	0.208	0.013	2.182798	1.410988	979.7	4.01

**TABLE 1**  
**STONY CREEK INTERCEPTOR CAPACITY ANALYSIS**  
 MAXIMUM FLOW CAPACITIES - based on Manning's Equation (for given slope)

Manning's Equation  
 $Q = (1.486/n) * A * R^{0.667} * S^{0.5}$

WHERE:

- Q = Cubic Feet Per Second
- A = Cross-Sectional Area of Pipe (sf)
- R = Hydraulic Radius ( Pipe dia./4) (ft.)
- S = Slope (ft./ft.) Based on Calculated slope from in/out inverts and stationing, not slope stated on plan
- n = Manning Coeff of Roughness

DOWNSTREAM MANHOLE			UPSTREAM MANHOLE			LENGTH (FEET)	SLOPE		PIPE MATERIAL	D (FT)	A (SF)	R (FT)	n	Q (Based on Calculated Slope)			VELOCITY (FPS)
NO.	RIM	INVERT	NO.	RIM	INVERT		Calculated (FT/FT)	From Plan (FT/FT)						(CFS)	(MGD)	(GPM)	
343	177.4	170.30	344	178.2	170.85	135	0.004074	0.004	VP	0.833	0.5450	0.208	0.013	1.396259	0.902559	626.7	2.56
344	178.2	170.85	345	179.4	171.22	95	0.003895	0.004	VP	0.833	0.5450	0.208	0.013	1.365182	0.882471	612.7	2.51
345	179.4	171.22	346	179.5	172.46	310	0.004000	0.004	VP	0.833	0.5450	0.208	0.013	1.383508	0.894316	621.0	2.54
346	179.5	172.46	347	180.3	173.01	136	0.004044	0.004	VP	0.833	0.5450	0.208	0.013	1.391116	0.899235	624.4	2.55
347	180.3	173.01	347A	179.9	173.65	160.5	0.003988	0.004	VP	0.833	0.5450	0.208	0.013	1.381351	0.892922	620.0	2.53
347A	179.9	173.65	348	181	174.50	212.5	0.004000	0.004	VP	0.833	0.5450	0.208	0.013	1.383508	0.894316	621.0	2.54
348	181	174.50	349	182.5	175.19	173.5	0.003977	0.004	VP	0.833	0.5450	0.208	0.013	1.379515	0.891735	619.2	2.53
349	182.5	175.19	350	185.4	176.22	259.5	0.003969	0.004	VP	0.833	0.5450	0.208	0.013	1.378166	0.890863	618.6	2.53
350	185.4	176.22	351	186.3	176.98	188	0.004043	0.004	VP	0.833	0.5450	0.208	0.013	1.390847	0.899061	624.3	2.55
351	186.3	176.98	352	187.4	177.52	132.5	0.004075	0.004	VP	0.833	0.5450	0.208	0.013	1.396499	0.902714	626.8	2.56
352	187.4	177.52	353	188.9	178.93	355	0.003972	0.004	VP	0.833	0.5450	0.208	0.013	1.378627	0.891162	618.8	2.53
353	188.9	178.93	371	190.8	184.04	210	0.024333	0.0242	VP	0.833	0.5450	0.208	0.013	3.412340	2.205779	1531.6	6.26
371	190.8	184.04	372	192.5	185.83	75	0.023867	0.0242	VP	0.833	0.5450	0.208	0.013	3.379461	2.184525	1516.8	6.20
372	192.5	185.83	373	195.8	188.52	157	0.017134	0	VP	0.833	0.5450	0.208	0.013	2.863373	1.850920	1285.2	5.25
373	195.8	188.52	374	196.9	189.92	96	0.014583	0.0146	VP	0.833	0.5450	0.208	0.013	2.641678	1.707614	1185.7	4.85
374	196.9	189.92	375	197.9	192.08	158	0.013671	0.014	VP	0.833	0.5450	0.208	0.013	2.557702	1.653330	1148.0	4.69
375	197.9	192.08	376	200.9	195.41	208.5	0.015971	0.016	VP	0.833	0.5450	0.208	0.013	2.764526	1.787024	1240.8	5.07
376	200.9	195.41	377	206.3	199.49	164	0.024878	0.0248	VP	0.833	0.5450	0.208	0.013	3.450323	2.230331	1548.6	6.33
377	206.3	199.49	378	208.5	201.50	201.5	0.009975	0.01	VP	0.833	0.5450	0.208	0.013	2.184802	1.412283	980.6	4.01
378	208.5	201.50	379	212.4	204.81	332	0.009970	0.01	VP	0.833	0.5450	0.208	0.013	2.184221	1.411907	980.3	4.01
379	212.4	204.81	381	216.3	206.50	181	0.009337	0.0093	VP	0.833	0.5450	0.208	0.013	2.113760	1.366360	948.7	3.88

7860

Top of Spread Sheet is most downstream section of the Stony Creek Interceptor. Progression of spreadsheet is from downstream to upstream, beginning at Section 4 and progressing upstream to Section 1.

Blue shaded portion represents Section No. 4 of the Stony Creek Interceptor, which is the most downstream section leading to Timberlake Pump Station.

Green shaded portion represents Section No. 3 of the Stony Creek Interceptor.

Yellow shaded portion represents Section No. 2 of the Stony Creek Interceptor.

Orange shaded portion represents Section No. 1 of the Stony Creek Interceptor, which is the most upstream section, terminating at MH 381 in North Wales Road.



SECTION 2.0  
STONY CREEK NO. 1 INTERCEPTOR CAPACITY ANALYSIS

2.1 Full Flow Capacity

Table 1 provides a capacity evaluation of Stony Creek No. 1 Interceptor based on existing plans provided by East Norriton Township. Full flow capacity of each manhole run was calculated using Manning's Equation and assuming a roughness coefficient (n value) of 0.013. Slope was determined based on invert elevations and pipe lengths noted on the drawings. This was compared with the slope noted on the drawing profiles. Some minor differences were found between the two values. Therefore, full flow capacity was calculated based on the invert elevations and pipe length, rather than the noted slope. Full flow capacity is presented in cubic feet per second (cfs), million gallons per day (mgd) and in gallons per minute (gpm). Velocity was also calculated. The Interceptor was evaluated from MH 249, which is adjacent to the Timberlake Pump Station, upstream to MH 381, which is at North Wales Road.

2.2 Sectional Analysis of Capacity

2.1.1 Section No. 1

With respect to capacity, it was found that the upstream most reach, between MH 381 and MH 353, the estimated full flow capacity of the 10-inch interceptor is between 1.37 and 2.23 mgd (between 949 and 1549 gpm, respectively). This section is shaded orange on Table 1, at the bottom of page 2.

2.1.2 Section No. 2

Between MH 353 and MH 343, full flow capacity of the 10-inch interceptor drops significantly to between 0.88 and 0.90 mgd (between 613 and 627 gpm, respectively), due to the reduced slope in this section. This section is shaded yellow on page 2 of Table 1.

2.1.3 Section No. 3

Between MH 343 and MH 331, full flow capacity increases to 1.25 mgd (867 gpm), with intermittent sections having a greater capacity of between 1.66 MGD and 2.35 MGD (between 1150 and 1,636 gpm, respectively). With the exception of the upstream most portion of this section of Interceptor, the increased capacity is primarily associated with an increase in pipe diameter from 10-inch to 12-inch. This section is shaded green on page 1 of Table 1.

2.1.4 Section No. 4

Downstream of MH 331, the interceptor increases in diameter to 15-inch in order to accommodate the additional flow entering from Stony Creek Road. It subsequently increases to 18-inch pipe downstream of MH 300. Full flow capacity of the final section of Interceptor ranges between 3.06 MGD and 3.59 mgd (2,126 to 2,491 gpm, respectively), except for one isolated section near the pump station with a capacity of 5.96 mgd. This section is shaded blue on page 1 of Table 1.

SECTION 3.0  
FLOW METERING AND DATA ANALYSIS

3.1 General Description and Correlation with Precipitation Events

Between September 12 and November 18, 2014, flow was metered at MH 378, 373 and 331 in an effort to evaluate the impact of rain events on overall flow rates and to compare measured flow rates with interceptor capacity. Hach Sigma 910 portable flow meters were installed in each manhole location by Township Personnel. Flows at MH 378 and MH 331 were recorded at 10 minute intervals. Flows at MH 373 were recorded at 15 minute intervals. Tables 2, 3 and 4 present daily flow data summaries as compared with rain events and daily flows recorded at both Timberlake and Germantown Pump Stations.

Rain events are as taken from the following data sources:

- East Norriton Township Rain Gauge, reported every month by East Norriton Sewer Maintenance Supervisor, Edward White.
- FAA Wings Field Airport (Lat. 40.14, Lon. 75.27, Elev. 302 Ft) as supplied through Pennsylvania State University, entitled "Pennsylvania State Climatologist".
- NOAA Norristown, PA US (Lat. 40.120, Lon. 75.358, Elev. 70 Ft) as supplied through the NOAA National Climatic Data Center.
- NOAA Graterford 1 E, PA US (Lat. 40.230, Lon. 75.435, Elev. 240 Ft) as supplied through the NOAA National Climatic Data Center.

The Norristown and Wings Field Airport weather stations are both approximately equidistant to the Stony Creek No. 1 Interceptor, being 4.85 miles apart and each approximately 3.0 miles from the interceptor. Graterford weather station is significantly further to the northwest of the Interceptor, being 8.6 miles northwest of the Norristown weather station and 10.7 miles northwest of the Wings Field weather station.

3.2 Flow Data Analysis

3.2.1 Flow Metering at MH 378 (TABLE 2)

The average flow recorded in MH 378 of 242,450 gpd is slightly higher than the estimated flow of 172,100, which was based on EDU count and 250 gallons per EDU. The Peak Daily Flow of 483,497 gpd was 199% of average day flow; this flow is associated with 1.3 inches of rain on November 17. The Peak instantaneous flow of 846.9 gpm is 503% of average flow, which is high. However, this peak event occurred on a separate day from when the peak daily flow was recorded and is not associated with a rain event. The next highest peak flow of 674 gpm is 400% of average flow.

Flow measurements were disrupted between October 6 and October 26. Flow data during this period is shaded orange and should not be considered relevant data. Therefore, the impact of four separate Precipitation events within that period of time on flows within this section of Interceptor could not be established.

On two occasions, the maximum flow rate exceeded capacity of downstream Section No 2 of the interceptor, which has limiting capacity of 612 gpm.

- Flow rates ranging between 583 gpm and 674 gpm, occurring between 3:00 and 3:50 pm on November 17
- Flow rates ranging between 661 gpm and 847 gpm, occurring between 6:40 and 7:20 AM on November 12

Flows from Deer Run entering at Manhole 373 must be added to the above in order to assess the total exceedance of downstream capacity. However, this would add only 30 to 36 gpm additional flow on the 17<sup>th</sup>. On November 12, there was a slight lag in time, but additional flows from Deer Run appear to peak between 58 and 100 gpm shortly after the flows recorded at MH 378.

Peak flow on November 12, combined with flow from Deer Run, possibly also exceeded capacity of a downstream portion of Section No. 3, between Manhole No. 336 and 340, and between MH 331 and 332, which have estimated flow capacities of between 876 gpm and 866 gpm respectively.

The event on November 17 could be correlated with a high precipitation event on that day. Precipitation at the East Norriton Rain Gauge on that day was 1.3 inches and at Wings Field Weather Station it was 0.93 inches. At Norristown Weather Station, precipitation was recorded over a two day period, 0.34 inches on November 17 and 0.78 inches on November 18. The associated flow at Timberlake Pump Station on November 17 increased by 706,923 gpd, from 508,086 gpd to 1,215,009 gpd. Flow at the Germantown Pump Station increased on that day by 442,000 gpd from 269,000 gpd to 711,000 gpd.

No extreme rain event could be tied to the high flow event on November 12 and daily flow on that day of 237,039 gpd at MH 278, was close to average flow recorded for the metering period.

### 3.2.2 Flow Metering at MH 373 (TABLE 3)

Average flow from the Deer Run Development was 34,704 gpd during the flow monitoring period. This is consistent with our flow estimate based on EDU count, since the above flow divided by 138 EDUs within the development, equals 251.5 gpd per EDU.

The peak daily flow of 69,750 gpd from this development, which occurred on November 6, equated to 200% of average flow. Peak instantaneous flow of 149.2 gpm, which also occurred on November 6, was 619% of average flow. This peak flow event correlates with 0.5 inches of precipitation that occurred on that day as recorded by East Norriton Township. For comparison purposes, 0.34 inches of precipitation was recorded at the Norristown Weather Station and 0.37 inches was recorded at the Wings Field Weather Station on that day.



The next highest peak daily flow occurred on November 1, where daily flow was 68,289 gpd and peak instantaneous flow was 144.3 gpm; precipitation on that day, as recorded at the East Norriton Rain Gauge, was 0.75 inches; Precipitation at Wings Field was 0.45 inches and Precipitation at Norristown was 0.28 inches, followed by 0.48 inches the following day.

Flow rates recorded at this location on November 17 apparently were not affected by the 1.3 inches of rain that occurred on that day, unlike the flows at Manhole 378, Timberlake Pump Station and at Germantown Pump Station.

### 3.2.3 Flow Metering at MH 331 (TABLE 4)

Average flow recorded during the monitoring period from the development tributary to this manhole was 123,017 gpd. This equates to a calculated flow of 263 gpd per EDU based on 467 EDUs contributing flow at this location. The peak daily flow of 280,444 gpd was recorded on November 17; this was 228% of average flow recorded during the monitoring period. Peak instantaneous flow rates of between 375 and 405.5 gpm were recorded at this station on November 17 between 2:40 and 3:05 pm. This is 475% of average.

### 3.3 Metered Flows Compared with Timberlake Pump Station Records

Table 5 presents a summary of daily flow at all three meter locations as well as that recorded for Timberlake PS and Germantown PS as reported by East Norriton Township. The sum of all three metered flow rates (Combined Flow) on a daily basis is then compared with the daily flow at Timberlake Pump Station. The results indicate significant discrepancies between the metered flow rates and the flow recorded for both Germantown Pump Station and for Timberlake Pump Station during the period of interest.

If one were to subtract the Combined Flow from the Timberlake Pump Station Flow, the remaining value is substantially less than what is reported for Germantown Pump Station. The opposite should be true. The difference between the Combined Flow and the Timberlake Pump Station Flow should exceed the Germantown Pump Station Flow to account for the Einstein Pump Station Flow and for flows contributed from the gravity service area. This suggests that there may be a problem with accuracy of one or multiple meters in the interceptor or at the pump stations. In addition, the extended period of incomplete flow data generated at MH 378 resulted in limited Combined Flow data for comparison with Timberlake Pump Station Flows. Therefore, forming a conclusion at this time as to the actual flow in the interceptor relative to capacity of the interceptor is not justified.

**TABLE 2**  
**STONY CREEK INTERCEPTOR MANHOLE 378**

DATE	Min Flow (gpm)	Max Level (Inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg flow (gpm)	Total Flow (gpd)	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	NOAA Graterford Precipitation (Inches)	NOAA Norristown Precipitation (Inches)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	Germentown PS (GPD)	Flow Increase (GPD)
9/12/2014	0.00	2.76	4.56	249.9	71.7	partial day					473,452		195,000	
9/13/2014	6.24	3.12	4.67	298.7	113.7	163,731	0.5	0.36			527,011	53,559	283,000	88,000
9/14/2014	0.00	2.54	4.61	220.8	84.7	121,980			0.24	0.45	512,940		269,000	
9/15/2014	0.00	3.28	4.62	308.7	110.8	159,560					484,572		206,000	
9/16/2014	35.34	3.57	4.59	349.0	160.2	230,618	0.25	0.03	0.1	0.03	497,129	12,557	255,000	49,000
9/17/2014	0.00	3.47	4.51	340.7	157.8	227,181					472,572		229,000	
9/18/2014	56.71	3.60	4.55	341.2	209.7	302,013					478,473		201,000	
9/19/2014	69.43	3.50	4.55	346.7	200.0	292,340					421,206		250,000	
9/20/2014	73.05	3.64	4.53	364.7	220.4	317,410					468,058		236,000	
9/21/2014	79.29	3.57	4.6	350.9	236.2	340,084					501,112		214,000	
9/22/2014	74.43	3.70	4.54	373.6	215.8	310,724				0.05	471,249		248,000	
9/23/2014	0.00	3.49	4.45	329.7	160.2	230,708					462,448		222,000	
9/24/2014	49.92	2.67	4.52	237.5	129.4	186,372					470,648		188,000	
9/25/2014	40.02	3.21	4.66	315.8	201.6	290,274	0.75	0.27	0.24	0.36	625,809	155,161	346,000	158,000
9/26/2014	0.26	2.82	4.61	251.4	141.1	203,221			0.54	0.30	499,311		271,000	
9/27/2014	44.94	2.81	4.53	254.1	138.1	198,863					494,807		213,000	
9/28/2014	32.72	2.84	4.55	258.1	143.3	206,325					490,642		263,000	
9/29/2014	39.29	2.72	4.55	239.9	125.7	180,945					463,398		238,000	
9/30/2014	42.90	2.91	4.58	271.3	126.4	181,994					467,074		191,000	
10/1/2014	42.24	2.57	4.55	225.7	123.4	177,711					457,943		244,000	
10/2/2014	38.51	2.80	4.59	257.8	122.5	176,339					446,374		216,000	
10/3/2014	38.40	2.74	4.59	234.4	124.8	179,759					455,963		183,000	
10/4/2014	1.35	3.31	4.88	333.4	181.2	260,965	0.5	0.39	0.19	0.27	564,948	108,985	302,000	119,000
10/5/2014	58.86	2.74	4.61	250.5	153.8	221,477			0.1	0.29	504,065		269,000	
10/6/2014	0.00	2.53	4.48	218.3	45.0	36,279					477,859		200,000	
10/7/2014	0.00	4.51	4.48	366.3	7.6	10,978		0.04		0.03	486,188		246,000	
10/8/2014	0.00	1.76	4.57	112.3	2.3	5,526	0.5	0.23	0.47	0.41	524,953	58,765	282,000	36,000
10/9/2014	0.00	2.16	4.5	161.8	1.4	2,051					482,231		208,000	
10/10/2014	0.00	1.82	4.55	117.6	15.0	21,633					465,404		248,000	
10/11/2014	9.65	3.35	5.08	356.7	145.2	209,341	0.75	0.4	0.42	0.52	724,691	259,287	392,000	144,000
10/12/2014	0.00	2.24	4.6	185.8	88.7	147,756		0.01	0.08	0.17	562,816		267,000	
10/13/2014	0.62	1.65	4.49	119.2	43.2	47,135					507,700		273,000	
10/14/2014	0.00	0.94	4.4	50.3	1.4	1,014			0.04	0.02	480,872		252,000	
10/15/2014	0.00	-0.39	4.8	0.0	0.0	0	0.6	0.65			583,046	102,174	263,000	11,000
10/16/2014	0.00	-0.39	4.96	0.0	0.0	0	0.4	0.46	1.11	0.95	823,291	240,245	487,000	224,000

**TABLE 2**  
**STONY CREEK INTERCEPTOR MANHOLE 378**

DATE	Min Flow (gpm)	Max Level (inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg Flow (gpm)	Total Flow (gpd)	EN Rain Gauge Precipitation (inches)	FAA Wings Field Precipitation (inches)	NOAA Graterford Precipitation (inches)	NOAA Norristown Precipitation (inches)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	Germantown PS (GPD)	Flow Increase (GPD)
10/17/2014	0.00	-0.39	4.51	0.0	0.0	Bad Data				0.01	564,505		309,000	
10/18/2014	0.00	-0.39	4.53	0.0	0.0	Bad Data					530,015		237,000	
10/19/2014	0.00	-0.39	4.58	0.0	0.0	Bad Data					516,220		259,000	
10/20/2014	0.00	-0.39	4.49	0.0	0.0	Bad Data					475,544		234,000	
10/21/2014	0.00	-0.39	4.49	0.0	0.0	Bad Data		0.11	0.08		473,570		199,000	
10/22/2014	0.00	1.03	4.76	62.4	9.0	12,366	0.75	0.41		0.57	614,392	140,822	319,000	120,000
10/23/2014	0.00	0.85	4.71	47.3	16.5	23,728		0.17	0.28	0.61	703,718		383,000	
10/24/2014	0.00	0.94	4.54	51.6	8.8	12,588			0.1	0.08	562,005		264,000	
10/25/2014	0.00	1.02	4.53	54.1	13.2	18,973					529,195		288,000	
10/26/2014	0.47	2.22	4.55	182.0	85.5	123,148					526,016		290,000	
10/27/2014	26.88	2.29	4.56	192.0	105.9	152,479					487,228		216,000	
10/28/2014	30.68	2.20	4.5	180.0	106.5	153,294					500,342		260,000	
10/29/2014	34.65	2.49	4.39	207.6	106.8	153,782	0.1	0.05			475,668	-24,674	234,000	-26,000
10/30/2014	29.41	2.64	4.48	222.6	113.0	162,764			0.1	0.09	468,210		199,000	
10/31/2014	40.03	2.31	4.40	186.2	110.6	159,287					478,278		233,000	
11/1/2014	36.38	3.97	5.06	457.2	234.8	338,102	0.75	0.45	0.38	0.28	775,982	297,704	407,000	174,000
11/2/2014	99.00	3.39	4.67	329.7	215.4	310,161			0.21	0.48	636,645		314,000	
11/3/2014	114.90	3.45	4.65	335.1	194.1	279,495					530,614		280,000	
11/4/2014	64.29	2.89	4.52	263.9	146.9	211,587					503,801		256,000	
11/5/2014	37.52	4.73	4.48	428.5	159.7	230,022					488,705		211,000	
11/6/2014	57.13	4.73	4.86	428.5	218.5	314,607	0.5	0.34	0.37	0.31	649,836	161,131	317,000	106,000
11/7/2014	92.91	3.05	4.65	278.8	184.3	265,406			0.1	0.15	555,946		298,000	
11/8/2014	132.00	3.54	4.55	348.7	211.4	304,487					521,296		263,000	
11/9/2014	2.25	3.56	4.64	349.5	214.4	308,718				0.06	532,843		233,000	
11/10/2014	79.86	3.69	4.48	359.3	206.1	296,725					486,890		247,000	
11/11/2014	110.54	4.14	4.47	297.1	179.0	257,831					478,918		231,000	
11/12/2014	47.96	8.08	4.43	846.9	164.6	237,039		0.13			472,087		195,000	
11/13/2014	70.52	3.52	4.64	347.5	195.0	280,736	0.25	0.18			488,939		258,000	
11/14/2014	138.87	3.76	4.54	361.3	247.4	356,222			0.24	0.23	541,468		275,000	
11/15/2014	3.85	3.86	4.59	394.6	241.1	347,242					501,225		225,000	
11/16/2014	77.41	3.24	4.57	306.7	184.4	265,496		0.06			508,086		269,000	
11/17/2014	77.38	5.10	5.38	674.9	335.8	483,497	1.3	0.93	0.34	0.43	1,215,009	706,923	711,000	442,000
11/18/2014	225.84	3.96	4.73	405.3	295.8	partial day			0.78	0.73	790,175		444,000	
Maximum				846.9		483,497					1,215,009		711,000	
Average						242,450	Average Flow eliminates first day, last day and bad data range				535,200		267,765	
Minimum						121,980	Minimum Flow eliminates first day, last day and bad data range				421,206		189,000	

Yellow shading represents weekend flows  
 Orange shading represents bad data  
 Blue shading represents instantaneous maximum flow rate on day noted.  
 Green shading represents typical base flow rate/low flow

**TABLE 3**  
**STONY CREEK INTERCEPTOR MANHOLE 373 - DEER RUN**

DATE	Min Flow (gpm)	Max Level (Inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg flow (gpm)	Total Flow (gpd)	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	USGS Graterford Precipitation (Inches)	USGS Norristown Precipitation (Inches)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	Germantown PS (GPD)	Flow Increase (GPD)
9/11/2014	0.39	1.29	4.19	68.3	16.1	23,187					473,452		195,000	
9/13/2014	0.29	1.23	3.64	50.5	19.0	27,419	0.5	0.36			527,011	53,559	283,000	88,000
9/14/2014	0.74	1.23	3.92	58.9	18.0	25,860			0.24	0.45	512,940		269,000	
9/15/2014	0.03	1.32	3.70	62.3	14.8	21,242					484,572		206,000	
9/16/2014	0.28	1.30	3.73	58.9	17.1	24,608	0.25	0.03	0.1	0.08	497,129	12,557	255,000	49,000
9/17/2014	0.46	1.41	3.90	72.3	16.1	23,169					472,572		229,000	
9/18/2014	0.23	1.16	3.86	54.0	15.1	21,690					478,473		201,000	
9/19/2014	0.26	1.32	4.06	68.6	14.4	20,794					421,206		250,000	
9/20/2014	0.22	1.37	3.99	70.9	17.5	25,194					468,058		236,000	
9/21/2014	0.29	1.18	3.88	53.6	18.1	26,063					501,112		214,000	
9/22/2014	2.87	1.25	3.97	62.1	17.5	25,226				0.05	471,249		248,000	
9/23/2014	0.19	1.12	3.67	44.3	12.3	17,644					462,448		222,000	
9/24/2014	0.05	1.01	3.71	40.9	12.1	17,400					470,648		188,000	
9/25/2014	0.11	1.17	3.97	56.1	14.1	20,324	0.75	0.27	0.24	0.36	625,809	155,161	346,000	158,000
9/26/2014	0.31	1.10	3.82	49.9	12.7	18,272			0.54	0.30	499,311		271,000	
9/27/2014	0.07	1.07	3.77	46.8	15.3	22,807					494,807		213,000	
9/28/2014	0.82	1.30	3.82	63.3	20.7	29,877					490,642		263,000	
9/29/2014	0.76	1.19	4.00	58.3	13.4	19,226					463,398		238,000	
9/30/2014	0.20	1.17	4.11	58.6	14.8	21,267					467,074		191,000	
10/1/2014	0.15	1.07	3.86	48.3	12.1	17,357					457,943		244,000	
10/2/2014	0.11	1.10	3.77	48.6	13.9	20,022					446,374		216,000	
10/3/2014	0.27	1.10	3.71	47.9	14.4	20,682					455,963		183,000	
10/4/2014	0.57	1.11	3.73	48.7	17.0	24,438	0.5	0.39	0.19	0.27	564,948	108,985	302,000	119,000
10/5/2014	0.82	1.29	4.11	62.0	19.9	28,661			0.1	0.29	504,065		269,000	
10/6/2014	0.29	1.36	4.13	72.6	18.1	26,042					477,859		200,000	
10/7/2014	0.21	1.35	4.13	72.4	17.1	24,677		0.04		0.03	466,188		246,000	
10/8/2014	0.30	1.30	3.85	63.0	14.6	21,044	0.5	0.23	0.47	0.41	524,953	58,765	282,000	36,000
10/9/2014	0.54	1.27	3.93	58.3	15.4	22,121					482,231		208,000	
10/10/2014	0.16	1.22	3.80	55.0	17.7	25,506					465,404		248,000	
10/11/2014	0.73	1.36	4.15	73.4	21.2	30,457	0.75	0.4	0.42	0.52	724,691	259,287	392,000	144,000
10/12/2014	0.44	1.24	3.88	58.5	23.1	33,317		0.01	0.08	0.17	562,816		267,000	
10/13/2014	2.87	1.36	4.10	72.4	18.7	26,968					507,700		273,000	
10/14/2014	0.18	1.29	3.98	64.9	18.7	26,947			0.04	0.02	480,872		252,000	
10/15/2014	1.36	1.31	3.80	63.7	20.0	28,732	0.6	0.65			583,046	102,174	263,000	11,000
10/16/2014	3.38	1.30	3.61	54.1	21.7	31,198	0.4	0.46	1.11	0.95	823,291	240,245	487,000	224,000

**TABLE 3**  
**STONY CREEK INTERCEPTOR MANHOLE 373 - DEER RUN**

DATE	Min Flow (gpm)	Max Level (Inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg flow (gpm)	Total Flow (gpd)	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	USGS Graterford Precipitation (Inches)	USGS Norristown Precipitation (Inches)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	Germantown PS (GPD)	Flow Increase (GPD)
10/17/2014	0.70	1.53	3.84	80.1	20.2	29,129				0.01	564,505		309,000	
10/18/2014	0.36	1.23	3.85	58.8	19.4	27,959					530,015		237,000	
10/19/2014	0.41	1.33	3.98	64.7	20.3	29,222					516,220		259,000	
10/20/2014	0.57	1.37	3.96	71.1	22.0	31,735					475,544		234,000	
10/21/2014	0.66	1.38	3.70	65.7	22.0	31,713		0.11	0.08		473,570		199,000	
10/22/2014	0.30	1.54	3.88	81.6	27.6	39,732	0.75	0.41		0.57	614,392	140,822	319,000	120,000
10/23/2014	0.35	1.45	3.95	71.0	20.6	29,698		0.17	0.28	0.61	703,718		383,000	
10/24/2014	0.81	1.56	3.94	79.8	19.3	27,739			0.1	0.08	562,005		264,000	
10/25/2014	0.12	1.53	3.70	72.9	24.0	34,491					529,195		288,000	
10/26/2014	0.48	1.53	3.95	75.1	28.8	41,465					526,016		290,000	
10/27/2014	0.48	1.59	3.73	76.7	19.9	28,657					487,228		216,000	
10/28/2014	0.96	1.94	4.22	116.5	26.8	38,656					500,342		260,000	
10/29/2014	1.08	2.06	4.06	126.6	33.9	48,870	0.1	0.05			475,668	-24,674	234,000	-26,000
10/30/2014	1.08	1.93	4.28	113.3	29.0	41,754			0.1	0.09	468,210		199,000	
10/31/2014	0.86	2.23	4.06	131.6	28.2	40,670					478,278		233,000	
11/1/2014	2.09	2.32	4.01	144.3	47.4	68,289	0.75	0.45	0.38	0.28	775,982	297,704	407,000	174,000
11/2/2014	0.98	2.40	3.87	143.8	46.7	67,255			0.21	0.48	636,645		314,000	
11/3/2014	1.97	2.59	3.87	145.4	41.0	59,002					530,614		280,000	
11/4/2014	0.63	2.41	3.84	148.7	44.8	64,466					503,801		256,000	
11/5/2014	1.12	2.36	3.88	148.9	39.1	56,353					488,705		211,000	
11/6/2014	0.85	2.22	4.32	149.2	48.4	69,750	0.5	0.34	0.37	0.31	649,836	161,131	317,000	106,000
11/7/2014	1.70	2.04	4.20	108.9	36.5	52,546			0.1	0.15	555,946		298,000	
11/8/2014	1.00	2.23	4.08	136.7	38.0	54,689					521,296		263,000	
11/9/2014	1.06	2.16	4.08	120.6	44.6	64,180				0.06	532,843		233,000	
11/10/2014	0.90	2.30	4.02	139.9	35.0	50,449					486,890		247,000	
11/11/2014	10.34	2.04	3.80	112.1	39.2	56,469					478,918		231,000	
11/12/2014	1.11	2.04	3.75	101.0	29.1	41,922		0.13			472,087		195,000	
11/13/2014	0.52	2.05	4.11	124.7	33.9	48,755	0.25	0.18			488,939		258,000	
11/14/2014	1.18	1.85	3.92	85.4	30.7	44,289			0.24	0.23	541,468		275,000	
11/15/2014	0.51	2.29	3.88	123.0	40.5	58,310					501,225		225,000	
11/16/2014	0.95	2.22	3.52	116.2	38.9	55,983		0.06			508,086		269,000	
11/17/2014	2.00	1.82	3.69	96.3	35.8	51,585	1.3	0.93	0.34	0.43	1,215,009	706,923	711,000	442,000
11/18/2014	0.27	1.42	4.01	75.49	20.8	Partial Day			0.78	0.73	790,175		444,000	

Maximum 249.2 69,750  
Average 34,704  
Minimum 17,557

Yellow shading represents weekend flows  
Orange shading represents bad data  
Blue shading represents instantaneous maximum flow rate on day noted.  
Green shading represents typical base flow rate/flow

**TABLE 4**  
**STONY CREEK INTERCEPTOR MANHOLE 331**

DATE	Min Flow (gpm)	Max Level (Inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg flow (gpm)	Total Flow (gpm)	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	NOAA Graterford Precipitation (Inches)	NOAA Norristown Precipitation (Inches)	Timberlake PS (GPD)	Flow Increase (GPD)	Germanstown PS (GPD)	Flow Increase (GPD)
9/12/2014	0.00	1.92	4.08	97.2	25.3	Partial Day					473,452		195,000	
9/13/2014	17.14	2.03	4.20	107.9	63.9	92,032	0.5	0.36			527,011	53,559	283,000	88,000
9/14/2014	21.91	2.14	4.22	119.4	65.5	94,302			0.24	0.45	512,940		269,000	
9/15/2014	20.93	2.01	4.20	106.7	60.0	86,333					484,572		206,000	
9/16/2014	24.00	2.02	4.17	106.9	58.2	83,810	0.25	0.03	0.1	0.08	497,129	12,557	255,000	49,000
9/17/2014	23.26	2.15	4.20	121.0	57.4	82,689					472,572		229,000	
9/18/2014	20.11	2.03	4.15	108.3	57.8	83,295					478,473		201,000	
9/19/2014	18.20	2.09	4.14	114.0	55.6	80,024					421,206		250,000	
9/20/2014	18.59	2.06	4.32	111.2	59.6	85,803					468,058		236,000	
9/21/2014	21.79	2.16	4.21	121.8	63.3	91,120					501,112		214,000	
9/22/2014	16.96	2.56	4.11	167.0	81.1	116,745				0.05	471,249		248,000	
9/23/2014	64.08	2.61	4.20	173.1	105.8	152,418					462,448		222,000	
9/24/2014	89.28	2.14	4.10	119.7	76.4	109,998					470,648		188,000	
9/25/2014	27.50	2.30	4.24	137.3	92.3	132,845	0.75	0.27	0.24	0.36	625,809	155,161	346,000	158,000
9/26/2014	32.72	2.49	4.19	158.4	79.8	114,911			0.54	0.30	499,311		271,000	
9/27/2014	81.70	2.71	4.22	186.8	126.7	182,442					494,807		213,000	
9/28/2014	54.45	2.64	4.21	177.1	112.9	162,552					490,642		263,000	
9/29/2014	52.92	2.51	4.10	180.9	92.0	132,476					463,398		238,000	
9/30/2014	37.94	2.22	4.06	128.3	76.6	110,336					467,074		191,000	
10/1/2014	31.82	2.13	4.19	118.3	73.4	105,700					457,943		244,000	
10/2/2014	31.31	2.01	4.14	106.7	63.7	91,781					446,374		216,000	
10/3/2014	26.21	1.86	4.12	91.5	60.8	87,574					455,963		183,000	
10/4/2014	37.17	2.38	4.24	145.7	76.3	109,919	0.5	0.39	0.19	0.27	564,948	108,985	302,000	119,000
10/5/2014	26.07	2.04	4.27	109.1	71.6	105,144			0.1	0.29	504,065		269,000	
10/6/2014	25.47	1.92	4.20	107.1	71.2	102,513					477,859		200,000	
10/7/2014	27.64	2.09	4.19	114.6	63.5	91,472		0.04		0.03	466,188		246,000	
10/8/2014	35.16	2.00	4.20	104.9	71.1	102,356	0.5	0.23	0.47	0.41	524,953	58,765	282,000	36,000
10/9/2014	31.19	2.19	4.09	124.3	71.3	102,691					482,231		208,000	
10/10/2014	32.10	2.06	4.12	111.2	67.4	97,087					465,404		248,000	
10/11/2014	24.66	2.45	4.25	153.9	109.1	157,102	0.75	0.4	0.42	0.52	724,691	259,287	392,000	144,000
10/12/2014	76.49	2.93	4.18	216.4	143.0	205,904		0.01	0.08	0.17	562,816		267,000	
10/13/2014	80.18	2.79	4.11	196.8	140.1	201,765					507,700		273,000	
10/14/2014	89.82	2.47	4.06	157.2	96.3	138,728			0.04	0.02	480,872		252,000	
10/15/2014	31.09	2.30	4.31	137.1	81.2	116,986	0.6	0.65			583,046	102,174	263,000	11,000
10/16/2014	55.41	2.55	4.17	166.5	111.2	160,080	0.4	0.46	1.11	0.95	823,291	240,245	487,000	224,000
10/17/2014	42.09	2.16	4.17	121.9	78.1	112,424				0.01	564,505		309,000	

**TABLE 4**  
**STONY CREEK INTERCEPTOR MANHOLE 331**

DATE	Min Flow (gpm)	Max Level (Inches)	Max Vel (ft/sec)	Max Flow (gpm)	Avg flow (gpm)	Total Flow (gpm)	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	NOAA Graterford Precipitation (Inches)	NOAA Norristown Precipitation (Inches)	Timberlake PS (GPD)	Flow Increase (GPD)	Germantown PS (GPD)	Flow Increase (GPD)
10/18/2014	34.28	2.20	4.19	125.6	76.0	109,497					530,015		237,000	
10/19/2014	31.95	2.19	4.20	125.0	76.1	109,589					516,220		259,000	
10/20/2014	25.31	2.06	4.16	111.1	62.9	90,561					475,544		234,000	
10/21/2014	24.89	1.88	4.16	93.8	61.0	87,875		0.11	0.08		473,570		199,000	
10/22/2014	43.19	2.37	4.21	145.4	91.7	132,010	0.75	0.41		0.57	614,392	140,822	319,000	120,000
10/23/2014	75.27	2.43	4.25	151.4	114.2	164,479		0.17	0.28	0.61	703,718		383,000	
10/24/2014	50.80	2.28	4.29	134.8	86.9	125,093			0.1	0.08	562,005		264,000	
10/25/2014	40.40	2.15	4.36	120.7	74.9	107,898					529,195		288,000	
10/26/2014	31.68	2.09	4.28	113.9	74.8	107,759					526,016		290,000	
10/27/2014	25.80	2.10	4.23	115.0	73.6	105,031					487,228		216,000	
10/28/2014	34.28	2.05	4.21	110.3	70.6	101,599					500,342		260,000	
10/29/2014	30.84	2.01	4.27	106.1	68.6	100,233	0.1	0.05			475,668	-24,674	234,000	-26,000
10/30/2014	30.35	1.92	4.29	97.6	67.6	97,349			0.1	0.09	468,210		199,000	
10/31/2014	29.25	1.93	4.21	98.0	68.8	91,933					478,278		233,000	
11/1/2014	38.21	2.54	4.26	165.3	100.9	145,324	0.75	0.45	0.38	0.28	775,982	297,704	407,000	174,000
11/2/2014	43.93	2.28	4.27	134.8	97.5	140,364			0.21	0.48	636,645		314,000	
11/3/2014	36.71	2.03	4.20	108.6	79.9	115,012					530,614		280,000	
11/4/2014	37.21	2.01	4.16	106.0	75.5	108,758					503,801		256,000	
11/5/2014	39.77	2.13	4.21	118.8	76.9	110,778					488,705		211,000	
11/6/2014	34.06	2.40	4.27	148.3	102.1	147,067	0.5	0.34	0.37	0.31	649,836	161,131	317,000	106,000
11/7/2014	63.31	2.10	4.14	115.8	95.9	138,095			0.1	0.15	555,946		298,000	
11/8/2014	42.43	2.32	4.46	138.8	96.3	138,662					521,296		263,000	
11/9/2014	52.43	2.40	4.26	148.4	103.7	149,316				0.06	532,843		283,000	
11/10/2014	51.93	2.27	4.22	133.6	96.4	138,774					486,890		247,000	
11/11/2014	53.93	2.24	4.23	130.1	96.2	138,536					478,918		231,000	
11/12/2014	54.94	2.27	4.19	134.0	97.2	139,944		0.13			472,087		195,000	
11/13/2014	52.04	2.58	4.24	169.4	106.9	153,877	0.25	0.18			488,939		258,000	
11/14/2014	72.12	2.45	4.27	154.2	115.3	165,969			0.24	0.23	541,468		275,000	
11/15/2014	51.78	2.36	4.27	143.3	102.8	147,988					501,225		225,000	
11/16/2014	49.81	2.38	4.23	146.4	102.1	147,002		0.06			508,086		269,000	
11/17/2014	78.42	4.10	5.46	405.5	194.8	280,444	1.3	0.93	0.34	0.43	1,215,009	706,923	711,000	442,000
11/18/2014	144.06	2.80	4.22	198.4	163.2	94,683			0.78	0.73	790,175		444,000	

Maximum 405.5 280,444  
 Average 123,017 Average flow eliminates first day, last day  
 Minimum 80,024 Minimum flow eliminates first day.

Yellow shading represents weekend flows  
 Orange shading represents bad data  
 Blue shading represents instantaneous maximum flow rate on day noted.  
 Green shading represents typical base flow rate/low flow

TABLE 5  
STONY CREEK INTERCEPTOR MANHOLES 378, 373 & 331 COMBINED - SUMMARY

DATE	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	NOAA Graterford Precipitation (Inches)	NOAA Norristown Precipitation (Inches)	MH 378		MH 373 - DEER RUN		MH 331		COMBINED FLOW (gpd)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	TIMBERLAKE PS MINUS COMBINED (= GERMANTOWN PS)	ACTUAL GERMANTOWN PS (GPD)	Flow Increase (GPD)
					Max Flow (gpm)	Total Flow (gpd)	Max Flow (gpm)	Total Flow (gpd)	Max Flow (gpm)	Total Flow (gpd)						
9/12/2014					243.9	partial day	68.3	23,187	97.2	partial day	#VALUE!	473,452		#VALUE!	195,000	
9/13/2014	0.5	0.36			298.7	163,731	50.5	27,419	107.9	92,012	283,162	527,011	53,559	243,849	283,000	88,000
9/14/2014			0.24	0.45	220.8	111,980	58.9	25,860	119.4	94,302	242,141	512,940		270,799	269,000	
9/15/2014					308.7	159,560	62.3	21,242	106.7	86,339	267,136	484,572		217,436	206,000	
9/16/2014	0.25	0.03	0.1	0.08	349.0	230,618	58.9	24,608	106.9	83,810	339,036	497,129	12,557	158,093	255,000	49,000
9/17/2014					340.7	227,181	72.3	23,169	121.0	82,689	333,039	472,572		139,533	229,000	
9/18/2014					341.2	302,013	54.0	21,690	108.3	83,295	406,998	478,473		71,475	201,000	
9/19/2014					346.7	292,340	68.6	20,794	114.0	80,024	399,158	421,205		28,048	250,000	
9/20/2014					364.7	317,430	70.9	25,194	111.2	85,803	428,408	468,058		39,650	236,000	
9/21/2014					350.9	340,084	58.6	26,063	121.8	91,120	457,267	501,112		43,845	214,000	
9/22/2014				0.05	373.6	310,724	62.1	25,226	167.0	116,745	452,695	471,249		18,554	248,000	
9/23/2014					329.7	230,708	44.3	17,644	173.1	152,418	400,770	462,448		61,678	222,000	
9/24/2014					237.5	186,372	40.9	17,400	119.7	109,998	313,770	470,648		156,878	188,000	
9/25/2014	0.75	0.27	0.24	0.36	315.8	290,274	56.1	20,324	137.9	132,845	443,443	625,809	155,161	182,366	346,000	158,000
9/26/2014			0.54	0.30	251.4	203,221	49.9	18,272	158.4	114,911	336,403	499,311		162,908	271,000	
9/27/2014					254.1	198,853	46.8	22,807	186.8	182,442	404,101	494,807		90,706	213,000	
9/28/2014					258.1	206,325	63.3	29,877	177.1	162,552	398,754	490,642		91,888	263,000	
9/29/2014					239.9	180,945	58.3	19,226	160.9	132,647	332,647	463,398		130,751	238,000	
9/30/2014					271.3	181,994	58.6	21,267	128.3	110,336	313,598	467,074		153,476	191,000	
10/1/2014					225.7	177,711	48.3	17,357	118.3	105,700	300,769	457,943		157,174	244,000	
10/2/2014					257.8	176,339	48.6	20,022	106.7	91,781	288,142	446,374		158,332	216,000	
10/3/2014					234.4	170,759	47.9	20,682	91.5	87,574	288,016	455,963		167,947	183,000	
10/4/2014	0.5	0.39	0.19	0.27	339.4	260,965	48.7	24,438	145.7	109,919	395,322	564,948	108,985	169,626	302,000	119,000
10/5/2014			0.1	0.29	250.5	221,477	62.0	28,661	109.1	103,144	353,283	504,065		150,782	269,000	
10/6/2014					218.3	64,278	72.6	26,042	107.1	102,513	Bad Data	477,859		Bad Data	200,000	
10/7/2014		0.04		0.03	366.3	19,378	72.4	24,677	114.6	91,472	Bad Data	466,188		Bad Data	246,000	
10/8/2014	0.5	0.23	0.47	0.41	112.3	3,823	63.0	21,044	104.9	102,356	Bad Data	524,953	58,765	Bad Data	282,000	36,000
10/9/2014					161.8	2,057	58.3	22,121	124.8	102,691	Bad Data	482,231		Bad Data	208,000	
10/10/2014					117.6	21,699	55.0	25,506	111.2	97,087	Bad Data	465,404		Bad Data	248,000	
10/11/2014	0.75	0.4	0.42	0.52	356.7	289,343	73.4	30,457	153.9	157,102	388,740	724,691	259,287	377,901	392,000	144,000
10/12/2014		0.01	0.08	0.17	185.8	147,763	58.5	33,317	216.4	205,904	266,456	562,816		195,840	267,000	
10/13/2014					119.2	62,146	72.4	26,968	196.8	201,765	Bad Data	507,700		Bad Data	273,000	
10/14/2014			0.04	0.02	50.3	7,814	64.9	26,947	157.2	138,728	Bad Data	480,872		Bad Data	252,000	
10/15/2014	0.6	0.65			0.0	Bad Data	63.7	28,732	137.1	116,986	Bad Data	583,046	102,174	Bad Data	263,000	11,000
10/16/2014	0.4	0.46	1.11	0.95	0.0	Bad Data	54.1	31,198	166.5	160,080	Bad Data	823,291	240,245	Bad Data	487,000	224,000
10/17/2014				0.01	0.0	Bad Data	80.1	29,129	121.9	112,424	Bad Data	564,505		Bad Data	309,000	
10/18/2014					0.0	Bad Data	58.8	27,959	125.6	109,497	Bad Data	530,015		Bad Data	237,000	
10/19/2014					0.0	Bad Data	64.7	29,222	125.0	109,589	Bad Data	516,220		Bad Data	259,000	
10/20/2014					0.0	Bad Data	71.1	31,735	111.1	90,561	Bad Data	475,544		Bad Data	234,000	
10/21/2014		0.11	0.08		0.0	Bad Data	65.7	31,713	93.8	87,875	Bad Data	473,570		Bad Data	199,000	
10/22/2014	0.75	0.41		0.57	62.4	12,746	81.6	39,732	145.4	132,010	Bad Data	614,392	140,822	Bad Data	319,000	120,000



**TABLE 5  
STONY CREEK INTERCEPTOR MANHOLES 378, 373 & 331 COMBINED - SUMMARY**

DATE	EN Rain Gauge Precipitation (Inches)	FAA Wings Field Precipitation (Inches)	NOAA Graterford Precipitation (Inches)	NOAA Norristown Precipitation (Inches)	MH 378		MH 373 - DEER RUN		MH 331		COMBINED FLOW (gpd)	Timberlake PS Flow (GPD)	Flow Increase (GPD)	TIMBERLAKE PS MINUS COMBINED (= GERMANTOWN PS)	ACTUAL GERMANTOWN PS (GPD)	Flow Increase (GPD)
					Max Flow (gpm)	Total Flow (gpd)	Max Flow (gpm)	Total Flow (gpd)	Max Flow (gpm)	Total Flow (gpd)						
10/23/2014		0.17	0.28	0.61	47.3	23,788	71.0	29,698	151.4	164,479	Bad Data	703,718		Bad Data	383,000	
10/24/2014			0.1	0.08	51.6	12,693	79.8	27,738	134.8	125,093	Bad Data	562,005		Bad Data	264,000	
10/25/2014					54.1	18,973	72.9	34,491	120.7	107,898	Bad Data	529,195		Bad Data	288,000	
10/26/2014					182.0	123,148	75.1	41,465	113.9	107,759	272,372	526,016		253,644	290,000	
10/27/2014					192.0	152,479	76.7	28,657	115.0	106,031	287,167	487,228		200,061	216,000	
10/28/2014					180.0	153,294	116.5	38,656	110.3	101,599	293,549	500,342		206,793	260,000	
10/29/2014	0.1	0.05			207.6	153,782	126.6	48,870	106.1	100,233	302,885	475,668	-24,674	172,783	234,000	-76,000
10/30/2014			0.1	0.09	222.6	162,764	113.3	41,754	97.6	97,349	301,867	468,210		166,343	199,000	
10/31/2014					186.2	159,287	131.5	40,670	98.0	91,933	291,891	478,278		186,387	233,000	
11/1/2014	0.75	0.45	0.38	0.28	457.2	338,102	144.3	68,289	165.3	145,328	551,715	775,982	297,704	224,267	407,000	174,000
11/2/2014			0.21	0.48	329.7	310,161	143.8	67,255	134.8	140,364	517,780	636,645		118,865	314,000	
11/3/2014					335.1	279,495	145.4	59,002	108.6	115,012	453,508	530,614		77,106	280,000	
11/4/2014					263.9	211,587	148.7	64,466	106.0	108,759	384,811	503,801		118,990	256,000	
11/5/2014					428.5	230,022	148.9	56,353	118.8	110,778	397,153	488,705		91,552	211,000	
11/6/2014	0.5	0.34	0.37	0.31	428.5	314,607	149.2	69,750	148.3	147,067	531,424	649,836	161,131	118,412	317,000	106,000
11/7/2014			0.1	0.15	278.8	265,406	108.9	52,546	115.8	138,095	456,047	555,946		99,899	298,000	
11/8/2014					348.7	304,487	136.7	34,689	138.8	138,662	497,837	521,296		23,459	263,000	
11/9/2014				0.06	349.5	308,718	120.6	64,180	148.4	149,316	522,214	532,843		10,629	233,000	
11/10/2014					359.3	296,725	139.9	50,449	133.6	138,774	485,948	486,890		942	247,000	
11/11/2014					297.1	257,831	112.1	56,469	130.1	138,536	452,836	478,918		26,082	231,000	
11/12/2014		0.13			846.9	237,039	101.0	41,922	134.0	139,944	418,905	472,087		53,182	195,000	
11/13/2014	0.25	0.18			347.5	280,736	124.7	48,755	169.4	153,877	483,368	488,939		5,571	258,000	
11/14/2014			0.24	0.23	361.3	356,222	85.4	44,269	154.2	165,969	566,460	541,468		-24,992	275,000	
11/15/2014					394.6	347,242	123.0	58,310	143.3	147,888	583,540	501,225		-52,315	225,000	
11/16/2014		0.06			306.7	265,496	116.2	55,983	146.4	147,002	468,481	508,086		39,605	269,000	
11/17/2014	1.3	0.93	0.34	0.43	674.9	483,497	96.3	51,585	405.3	280,444	815,526	1,215,009	706,923	399,483	711,000	447,000
11/18/2014			0.78	0.73	406.3	partial day	75.49	Partial Day	198.4	94,683	Partial Day	790,175		#VALUE!	444,000	
Maximum					846.9	483,497	149.2	69,750	405.5	280,444	815,526	1,215,009			711,000	
Average					242,450	242,450	123.0	34,704	123.0	123,017	401,725	535,200			267,765	
Minimum					121,980	121,980	17.357		80.024	242,141	421,206				183,000	

Yellow shading represents weekend flows  
Orange shading represents bad data  
Blue shading represents instantaneous maximum flow rate on day noted.  
Green shading represents typical base flow rate/low flow

SECTION 4.0  
CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Actual average metered flow in the Stony Creek No. 1 Interceptor downstream of MH 331, during the period of September 12 through November 18, 2014, was measured at 401,725 gpd. This is significantly higher than the estimated average annual flow of 323,350 gpd, which was based on EDU count, assuming a typical flow rate of 250 gpd per EDU. Based on 1163 EDUs from standard residential development and 163 EDUs from the Stony Creek Condominiums, and further assuming the flow rate for Stony Creek Condominiums remains at 200 gpd per EDU, flow for the remaining residential units would actually be 317.4 gpd per EDU, if the portable flow meters are reading accurately. As noted further below, these higher flow rates cannot be resolved with the flows recorded at both Timberlake and Germantown Pump Stations.

The combined Stony Creek No. 1 Interceptor flow (Combined Flow), calculated as the sum of flows recorded from all three meters, subtracted from the flow recorded at Timberlake Pump Station, results in flow values that are less than the flows recorded at the Germantown Pump Station for the same time period. In fact, on two dates during the metering period, the Combined Flow of the interceptor, as metered, exceeded the flow recorded for the Timberlake Pump Station. This does not account for remaining flow sources, including Einstein Pump Station, Felton Road and other institutional, commercial and industrial facilities within the drainage area. Although some of the inconsistencies can be attributed to a differential between the daily flow period of measurement for the interceptor meters versus the pump station meters, this still does not appear to satisfy all of the inconsistencies. Therefore we conclude that one or more of the portable interceptor meters and/or the pump station flow meters may not be properly calibrated.

Because the flow results obtained from the portable flow meters cannot be correlated with the daily flows recorded at the Timberlake and Germantown Pump Stations, conclusions regarding capacity of the Interceptor relative to peak flows cannot be made. Although peak flow rates recorded at MH 378 for short periods of time on November 12 and November 18 appear to exceed the downstream capacity of portions of the Stony Creek No. 1 Interceptor, if the flow meters are reading too high, any conclusion that capacity is not adequate would appear to be false.

With regard to the precipitation events that were recorded during the metering period, we note that there is a variation in recorded precipitation within the interceptor area as evidenced from review of the events at Wings Field and NOAA Norristown Weather Stations relative to the East Norriton Rain Gauge. Greater variations in precipitation between these three stations, and to a lesser extent with respect to the NOAA Graterford Weather Station, will result in a less predictable outcome relative to flow within the Stony Creek No. 1 Interceptor or at the Timberlake and Germantown Pump Stations.

#### 4.2 Recommendations

We recommend that the portable flow meters and Pump Station meters be checked and calibrated and that Township personnel check recommendations of the meter manufacturer relative to installation location. As a further check the Township may consider hiring an outside consultant to meter flows in the Interceptor and upstream of both the Timberlake and Germantown Pump Stations to verify data collected by the Township.

Following a check in portable meter and Pump Station meter calibration, we recommend flow metering of the Stony Creek No. 1 Interceptor at Manhole 375, 337, 299 and 251, simultaneously for a least a 30 day period.