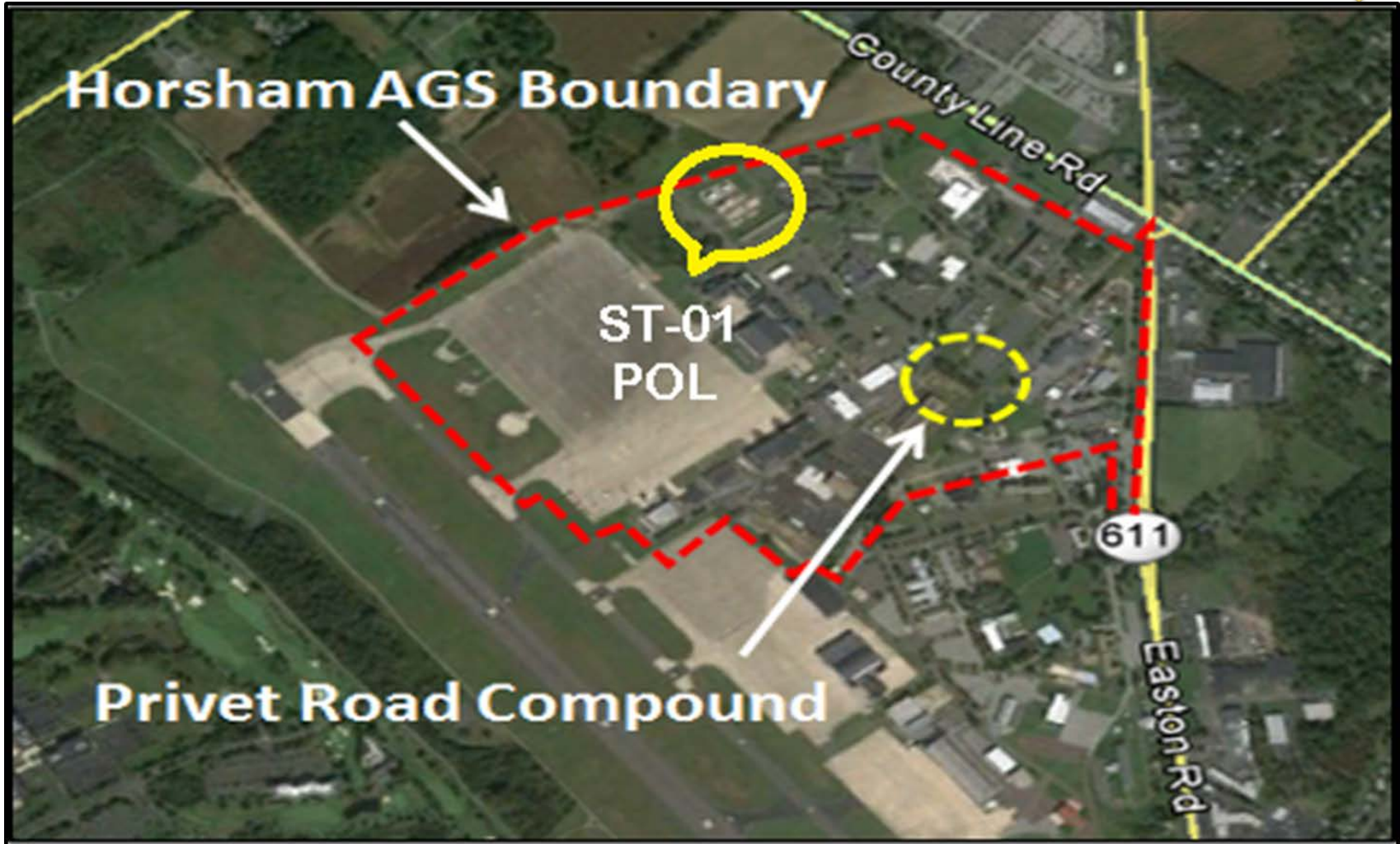




# Restoration Advisory Board Horsham Air Guard Station

Keith Freihofer  
NGB/A4OR  
14 March 2018

# Environmental Restoration Program Sites



# Air Force Reserve ST-01 POL



- Former Air Force Reserve Petroleum Tank Area
  - Site originated from a jet fuel spill in the 1970's
  - Injections of persulfate and Epsom salt replaced the biosparge system in 2016
  - Petroleum tanks were dismantled in 2016 allowing for removal of any petroleum impacted soil that may be present under the tanks. 175 tons of presumed petroleum impacted soil removed from beneath tanks and disposed of at licensed facility.
  - Confirmatory sampling expected to begin Summer 2018 in accordance with 25 Pennsylvania Code, Section 245.310 of the Department of Environmental Protection (DEP)'s Rules and Regulations.

# Privet Road Compound



- Former waste management area for Naval Air Station Joint Reserve Base Willow Grove
- Sampling completed in June 2016 indicates trichloroethene (TCE) and tetrachloroethene (PCE) exist in the groundwater but levels are below maximum contaminant levels (MCL) set by the U.S. Environmental Protection Agency for drinking water quality
- Leidos, Inc. is contracted for continued long-term monitoring. Biannual groundwater sampling and land use control inspections will continue to be conducted pending a final site remedy
- Second Five-Year Review underway for Privet Road groundwater contamination by BB&E Inc. on behalf of the ANG
- The purpose of the Five-Year Review is to evaluate the implementation and performance of the remedy to determine if it is and will continue to be protective of human health and the environment

# PFOS/PFOA on Horsham AGS



- In 2015, ANG completed a Preliminary Assessment of potential PFOS/PFOA release sites at the Horsham Air Guard Station (AGS). Ten potential source areas identified in the PA include:
  - Buildings that contained foam fire suppression systems
  - Areas that may have received runoff from foam releases
  - Stormwater sediment basin
  - Former waste water treatment plant
  - Former storage area for wastewater treatment sludge
  - These potential source areas are being further investigated by Leidos in a PFOS/PFOA Facility Investigation



# Potential PFOS/PFOA Source Areas



# Leidos Facility Investigation Project

## Scope



- Leidos tasked by the National Guard Bureau to complete a facility investigation (FI) for PFOS/PFOA at the Horsham Air Guard Station.
- The FI is being conducted in response to paragraph 41 of the Administrative Order issued by the U.S. Environmental Protection Agency (EPA) dated May 29, 2015.
- Project scope outlined in the Statement of Objectives for Perfluorinated Compound Facility Investigation at Horsham Air Guard Station for Project ZAQA20159150 (NGB 2015) and finalized in the March 2015 work plan approved by EPA and PADEP.
- Scope includes: records review; sampling of soil, sediment, fire suppression storage tanks, surface water, and groundwater across Base.
- The scope also includes: borehole geophysics, packer testing, rock coring, water level monitoring and potentiometric mapping, stratigraphic correlation, contaminant pathway analysis and receptor evaluation.

# Facility Investigation Data Update



- No additional groundwater sampling results since previous meeting.
- Groundwater monitoring event started 5 March 2018.
- Joint gauging event conducted 8 March 2018.
- Surface water sampling events on-going pending suitable weather
- No additional surface water sampling results since previous meeting, however additional results and mass-loading data are available.
- Sampling for NPDES permit are underway.
- Facility Investigation Report finalized.
- Monitoring Report for July 2017 groundwater sampling is being finalized.



# Surface Water Data Update



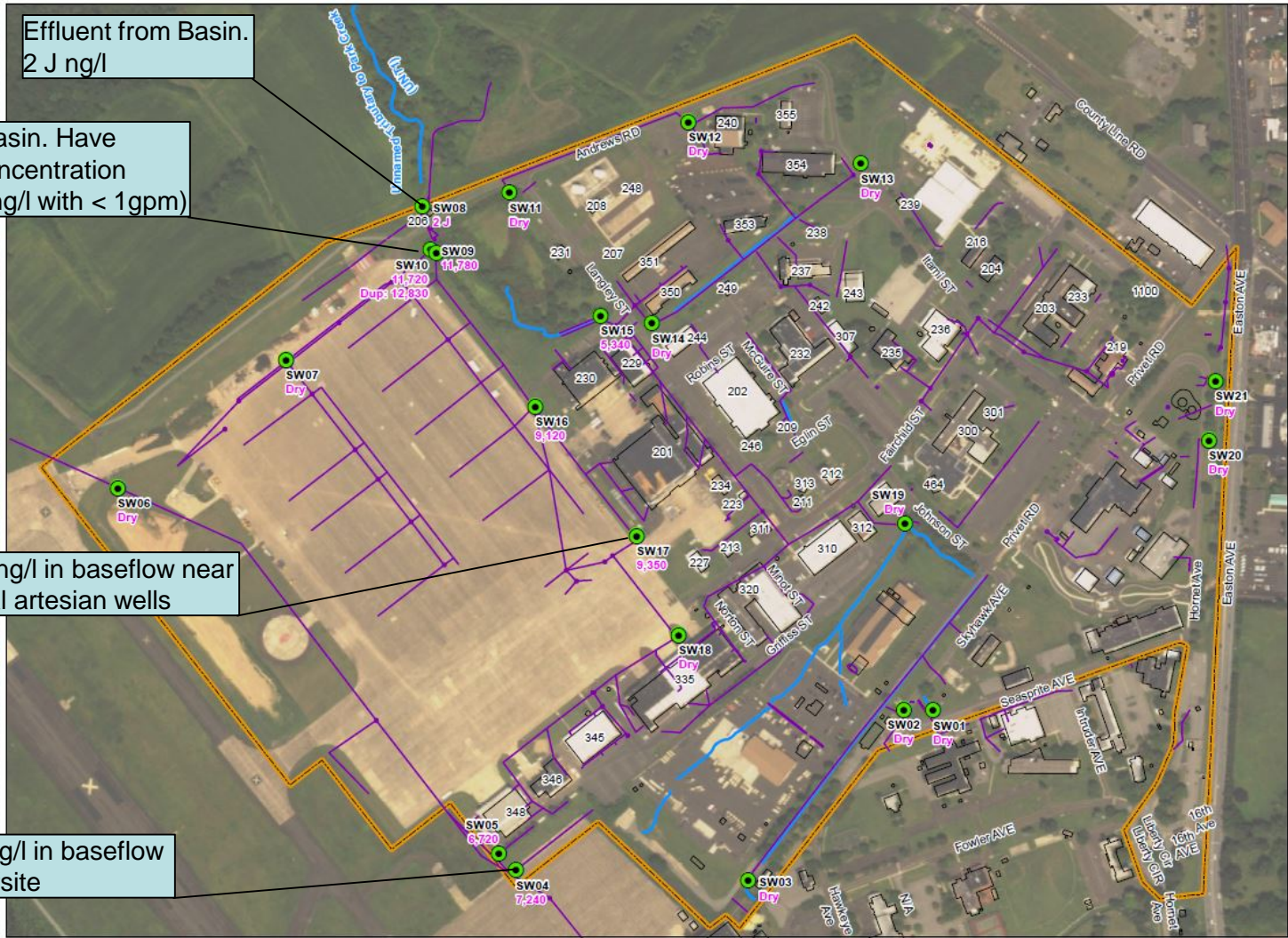
- Conducted 2 sampling events in October. Baseflow and Precipitation events.
- Precipitation approximately 0.5 inch
- 36 locations sampled and flow measured.
- Flow measurements estimated via flow meter, manually, USGS gauge, or visually estimated.
- Instantaneous mass flow rate (ng/min) calculated based on observed concentration (ng/l) and measured flow rate (liter/minute)

# Surface Water Data Findings



- Precipitation led to lower concentrations (ng/l) but higher mass flow rate (ng/min). 17 of 22 samples had lower concentration. 16 of 22 had higher mass flow.
- 5 locations with higher concentration: Basin Outfall, Park Creek, and 2 samples with minor increase. Temporary treatment system at Basin and WWTP may be over capacity during precipitation events.
- Largest changes in concentration observed in samples from HAGS. Dilution from precipitation vs baseflow.
- Largest changes in mass flow rate observed in samples along stream system. Flow up, conc down, but overall increase in mass.
- Hot spots observed at SW corner, Basin, and near Buildings 201/230.
- Rainfall not likely to convey new source. Instead rainfall dilutes groundwater discharge/baseflow.

# Draft Surface Water Sampling Results: Baseflow October 2017



# Surface Water Data Update



Location ID	Sample ID	Date Collected	PFHpA	PFNA	PFOA	PFBS	PFHxS	PFOS	PFOA + PFOS	Approximate Flow Rate (liter/min)	Instantaneous Mass Flow Rate (ng/min)
2016 USEPA Health Advisory for Drinking Water			---	---	70	---	---	70	70	---	---
SW01	--	--	---	---	---	---	---	---	--	Dry	---
SW02	--	--	---	---	---	---	---	---	--	Dry	---
SW03	--	--	---	---	---	---	---	---	--	Dry	---
SW04	SW04-01-01	10/4/2017	190	29	340	340	2,100	6,900	7,240	18.9	136,836
SW05	SW05-01-01	10/4/2017	230	30	420	400	2,400	6,300	6,720	18.9	127,008
SW06	--	--	---	---	---	---	---	---	--	Dry	---
SW07	--	--	---	---	---	---	---	---	--	Dry	---
SW08	SW08-01-01	10/4/2017	0.9 U	0.9 U	0.9 U	0.9 U	2 U	2 J	2.9	163	471
SW09	SW09-01-01	10/4/2017	330	17	780	650	3,000	11,000	11,780	3.78	44,528
SW10	SW10-01-01	10/4/2017	310	15	720	670	3,100	11,000	11,720	3.78	44,302
	SW10-01-01 Field DUP-01		320	18	830	710	2,900	12,000	12,830	3.78	48,497
SW11	--	--	---	---	---	---	---	---	--	Dry	---
SW12	--	--	---	---	---	---	---	---	--	Dry	---
SW13	--	--	---	---	---	---	---	---	--	Dry	---
SW14	--	--	---	---	---	---	---	---	--	Dry	---
SW15	SW15-01-01	10/4/2017	120	12	540	240	1,500	4,800	5,340	95	505,835
SW16	SW16-01-01	10/4/2017	310	14	720	690	2,900	8,400	9,120	5.67	51,710
SW17	SW17-01-01	10/4/2017	250	13	650	660	3,000	8,700	9,350	5.73	53,538
SW18	--	--	---	---	---	---	---	---	--	Dry	---
SW19	--	--	---	---	---	---	---	---	--	Dry	---
SW20	--	--	---	---	---	---	---	---	--	Dry	---
SW21	--	--	---	---	---	---	---	---	--	Dry	---
SW22	--	--	---	---	---	---	---	---	--	Dry	---
SW23	SW23-01-01	10/4/2017	130	14	360	190	1,100	4,100	4,460	183	817,207
SW24	SW24-01-01	10/4/2017	7	2	21	12	36	52	73	3,417	249,434
SW25	SW25-01-01	10/4/2017	8	3	22	12	40	56	78	3,415	266,386
SW26	SW26-01-01	10/4/2017	6	3	37	25	3	14	51	3,442	175,560
SW27	SW27-01-01	10/4/2017	18	4	55	28	150	370	425	2,349	998,287
SW28	SW28-01-01	10/4/2017	17	7	63	27	160	1,000	1,063	1,861	1,978,398
	SW28-01-01 Field DUP-02		16	4	49	23	120	310	359	1,861	668,151
SW29	SW29-01-01	10/5/2017	13	3	46	24	87	320	366	4,502	1,647,684
SW30	SW30-01-01	10/5/2017	35	5	150	54	420	1,000	1,150	226	259,492
SW31	SW31-01-01	10/5/2017	14	5	48	28	100	600	648	5,302	3,435,844
SW32	SW32-01-01	10/5/2017	14	3	48	25	90	260	308	10,044	3,093,471
SW33	SW33-01-01	10/5/2017	8	3	26	13	39	110	136	13,101	1,781,697
	SW33-01-01 Field DUP-03		8	3	26	12	36	120	146	13,101	1,912,705
SW34	SW34-01-01	10/5/2017	9	3	19	12	15	45	64	57,737	3,695,173
SW35	SW35-01-01	10/5/2017	10	2	14	12	4	11	25	40,718	1,017,946
SW36	SW36-01-01	10/5/2017	7	2	17	10	14	47	64	65,658	4,202,083

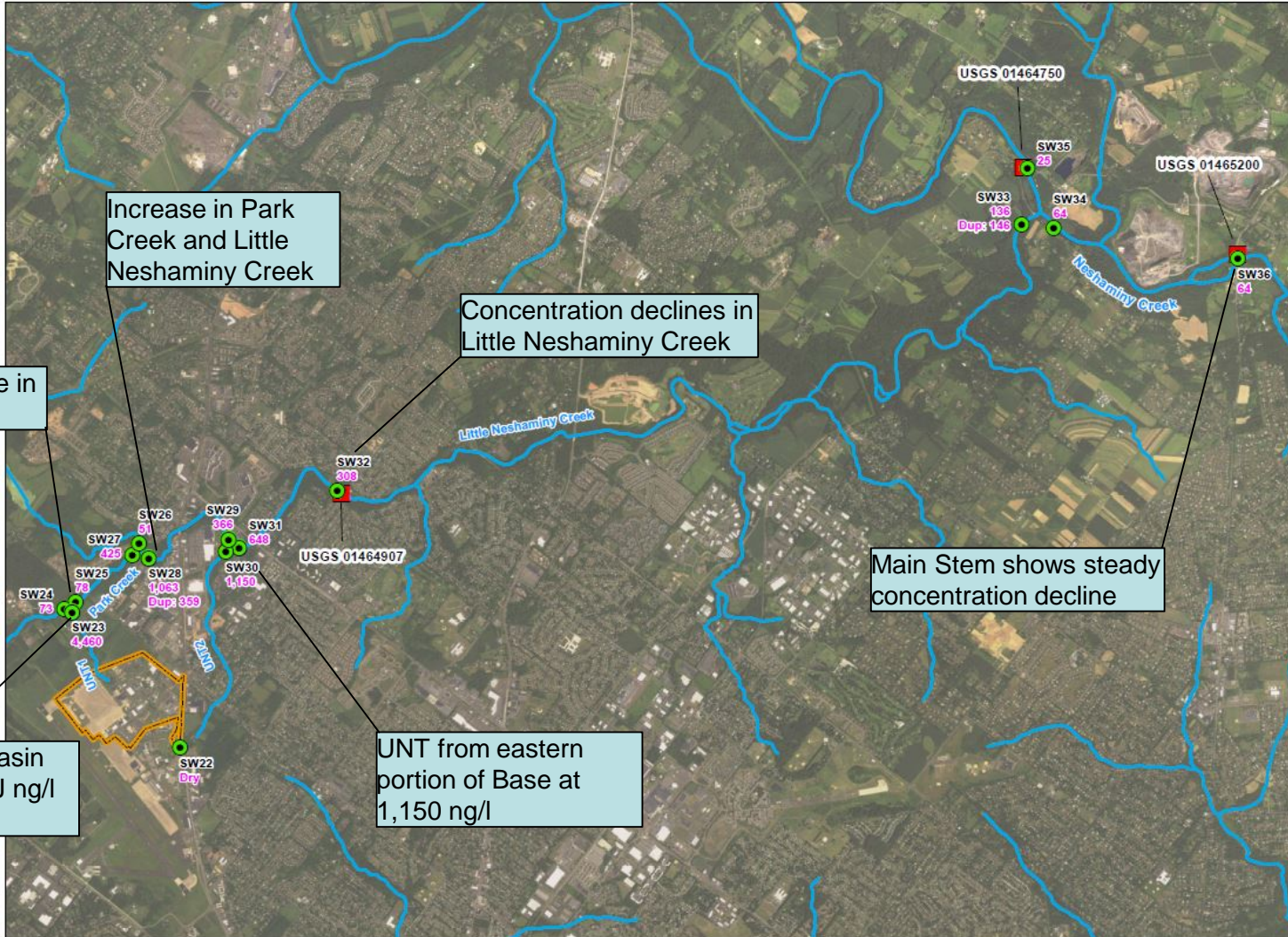
Basin Effluent

Minimal Flow

Basin Inlet

Central Base underflow

# Draft Surface Water Sampling Results: Baseflow October 2017



# Surface Water Data Update

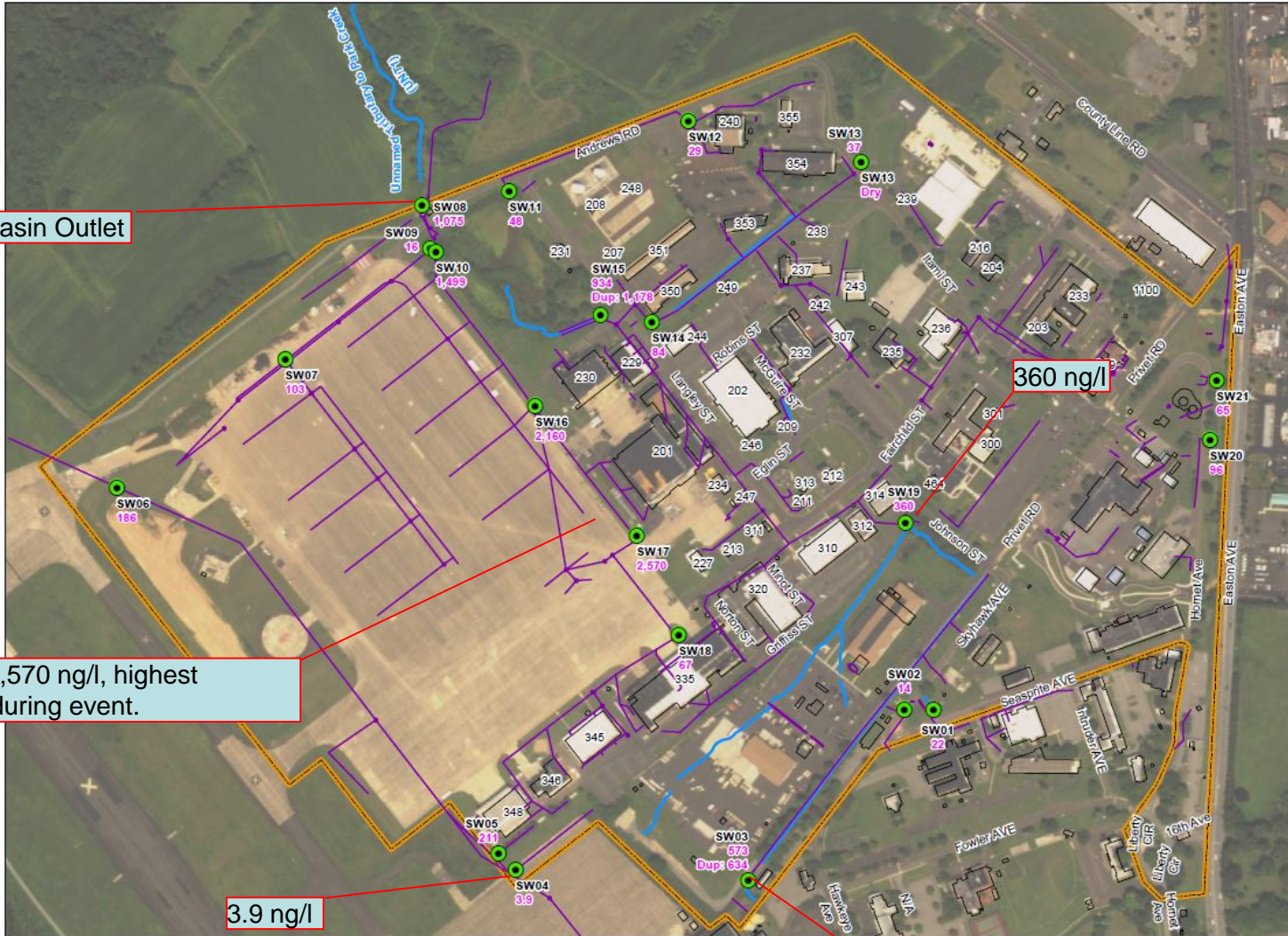


Location ID	Sample ID	Date Collected	PFHpA	PFNA	PFOA	PFBS	PFHxS	PFOS	PFOA+ PFOS	Approximate Flow Rate (liter/min)	Instantaneous Mass Flow Rate (ng/min)
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SW02	--	--	---	---	---	---	---	---	--	Dry	---
SW03	--	--	---	---	---	---	---	---	--	Dry	---
SW04	SW04-01-01	10/4/2017	190	29	340	340	2,100	6,900	7,240	18.9	136,836
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SW06	--	--	---	---	---	---	---	---	--	Dry	---
SW07	--	--	---	---	---	---	---	---	--	Dry	---
SW08	SW08-01-01	10/4/2017	0.9 U	0.9 U	0.9 U	0.9 U	2 U	2 J	2.9	163	471
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SW10	SW10-01-01	10/4/2017	310	15	720	670	3,100	11,000	11,720	3.78	44,302
	SW10-01-01 Field DUP-01		320	18	830	710	2,900	12,000	12,830	3.78	48,497
SW11	--	--	---	---	---	---	---	---	--	Dry	---
SW12	--	--	---	---	---	---	---	---	--	Dry	---
SW13	--	--	---	---	---	---	---	---	--	Dry	---
SW14	--	--	---	---	---	---	---	---	--	Dry	---
SW15	SW15-01-01	10/4/2017	120	12	540	240	1,500	4,800	5,340	95	505,835
SW16	SW16-01-01	10/4/2017	310	14	720	690	2,900	8,400	9,120	5.67	51,710
SW17	SW17-01-01	10/4/2017	250	13	650	660	3,000	8,700	9,350	5.73	53,538
SW18	--	--	---	---	---	---	---	---	--	Dry	---
SW19	--	--	---	---	---	---	---	---	--	Dry	---
SW20	--	--	---	---	---	---	---	---	--	Dry	---
SW21	--	--	---	---	---	---	---	---	--	Dry	---
SW22	--	--	---	---	---	---	---	---	--	Dry	---
SW23	SW23-01-01	10/4/2017	130	14	360	190	1,100	4,100	4,460	183	817,207
SW24	SW24-01-01	10/4/2017	7	2	21	12	36	52	73	3,417	249,434
SW25	SW25-01-01	10/4/2017	8	3	22	12	40	56	78	3,415	266,386
SW26	SW26-01-01	10/4/2017	6	3	37	25	3	14	51	3,442	175,560
SW27	SW27-01-01	10/4/2017	18	4	55	28	150	370	425	2,349	998,287
SW28	SW28-01-01	10/4/2017	17	7	63	27	160	1,000	1,063	1,861	1,978,398
	SW28-01-01 Field DUP-02		16	4	49	23	120	310	359	1,861	668,151
SW29	SW29-01-01	10/5/2017	13	3	46	24	87	320	366	4,502	1,647,684
SW30	SW30-01-01	10/5/2017	35	5	150	54	420	1,000	1,150	226	259,492
SW31	SW31-01-01	10/5/2017	14	5	48	28	100	600	648	5,302	3,435,844
SW32	SW32-01-01	10/5/2017	14	3	48	25	90	260	308	10,044	3,093,471
SW33	SW33-01-01	10/5/2017	8	3	26	13	39	110	136	13,101	1,781,697
	SW33-01-01 Field DUP-03		8	3	26	12	36	120	146	13,101	1,912,705
SW34	SW34-01-01	10/5/2017	9	3	19	12	15	45	64	57,737	3,695,173
SW35	SW35-01-01	10/5/2017	10	2	14	12	4	11	25	40,718	1,017,946
SW36	SW36-01-01	10/5/2017	7	2	17	10	14	47	64	65,658	4,202,083

Loss of mass?

Concentration at 34 = 36 but mass loading is higher at 36

# Draft Surface Water Sampling Results: Precipitation October 2017



# Surface Water Data Update



Location ID	Sample ID	Date Collected	PFHpA	PFNA	PFOA	PFBS	PFHxS	PFOS	PFOA + PFOS	Approximate Flow Rate (liter/min)	Instantaneous Mass Flow Rate (ng/min)
<i>2016 USEPA Health Advisory for Drinking Water</i>			---	---	70	---	---	70	70	---	---
SW01	SW01-01-02	10/24/2017	4	3	6	0.8 J	4	16	22	509	11,197
SW02	SW02-01-02	10/24/2017	0.8 J	0.9 J	2	0.5 J	2 J	12	14	348	4,867
SW03	SW03-01-02	10/24/2017	6	3	13	9	140	560	573	2,146	1,229,756
	SW03-01-02 Field DUP-01		7	4	14	9	200	620	634	2,146	1,360,672
SW04	SW04-01-02	10/24/2017	0.9 U	0.4 J	1	0.9 U	0.5 J	3	4	189	737
SW05	SW05-01-02	10/24/2017	19	4	21	4	53	190	211	454	95,710
SW06	SW06-01-02	10/24/2017	13	4	16	3	37	170	186	113	21,092
SW07	SW07-01-02	10/24/2017	5	4	13	3	43	90	103	76	7,787
SW08	SW08-01-02	10/24/2017	36	5	75	44	340	1,000	1,075	1639	1,761,888
SW09	SW09-01-02	10/24/2017	3	1 J	5	0.9 J	5	11	16	3.78	60
SW10	SW10-01-02	10/24/2017	47	4	99	96	460	1,400	1,499	3.78	5,666
SW11	SW11-01-02	10/24/2017	6	3	8	2	11	40	48	2.84	136
SW12	SW12-01-02	10/24/2017	5	2	6	2	7	23	29	19	548
SW13	SW13-01-02	10/24/2017	2 J	2 J	4	3	42	33	37	378	13,986
SW14	SW14-01-02	10/24/2017	6	2	8	6	100	76	84	227	19,051
SW15	SW15-01-02	10/24/2017	28	6	84	43	340	850	934	211	196,903
	SW15-01-02 Field DUP-02		28	5	78	43	340	1,100	1,178	211	248,342
SW16	SW16-01-02	10/24/2017	74	4	160	150	590	2,000	2,160	378	816,480
SW17	SW17-01-02	10/24/2017	92	4	170	160	700	2,400	2,570	57	145,719
SW18	SW18-01-02	10/24/2017	7	0.9 J	11	2	23	56	67	57	3,799
SW19	SW19-01-02	10/24/2017	13	5	20	16	200	340	360	223	80,316
SW20	SW20-01-02	10/24/2017	12	4	17	3	39	79	96	7.56	726
SW21	SW21-01-02	10/24/2017	7	3	10	2	18	55	65	3.78	246
SW22	--	--	---	---	---	---	---	---	---	dry	---
SW23	SW23-01-02	10/24/2017	23	5	45	22	190	580	625	2,924	1,827,532
SW24	SW24-01-02	10/24/2017	9	4	28	12	59	150	178	33,974	6,047,365
SW25	SW25-01-02	10/24/2017	9	6	26	12	63	300	326	34,642	11,293,427
SW26	SW26-01-02	10/25/2017	4	3	21	15	3 J	16	37	11,970	442,882
	SW26-01-02 Field DUP-03		4	3	21	17	2 J	13	34	11,970	406,972
SW27	SW27-01-02	10/25/2017	10	4	28	14	92	250	278	12,447	3,460,249
SW28	SW28-01-02	10/25/2017	7	6	25	15	27	79	104	21,805	2,267,747
SW29	SW29-01-02	10/25/2017	8	4	27	16	43	190	217	24,200	5,251,304
SW30	SW30-01-02	10/25/2017	24	7	120	36	240	1,000	1,120	537	601,403
SW31	SW31-01-02	10/25/2017	8	7	31	16	56	450	481	21,818	10,494,655
SW32	SW32-01-02	10/25/2017	8	3	31	16	47	130	161	16,796	2,704,175
SW33	SW33-01-02	10/25/2017	7	2	19	10	33	68	87	54,827	4,769,951
	SW33-01-02 Field DUP-04		7	2	19	11	32	98	117	54,827	6,414,761
SW34	SW34-01-02	10/25/2017	6	6	17	9	19	110	127	185,582	23,568,891
SW35	SW35-01-02	10/25/2017	5	3	13	8	5	18	31	103,831	3,218,747
SW36	SW36-01-02	10/25/2017	6	3	15	8	13	44	59	173,051	10,210,003

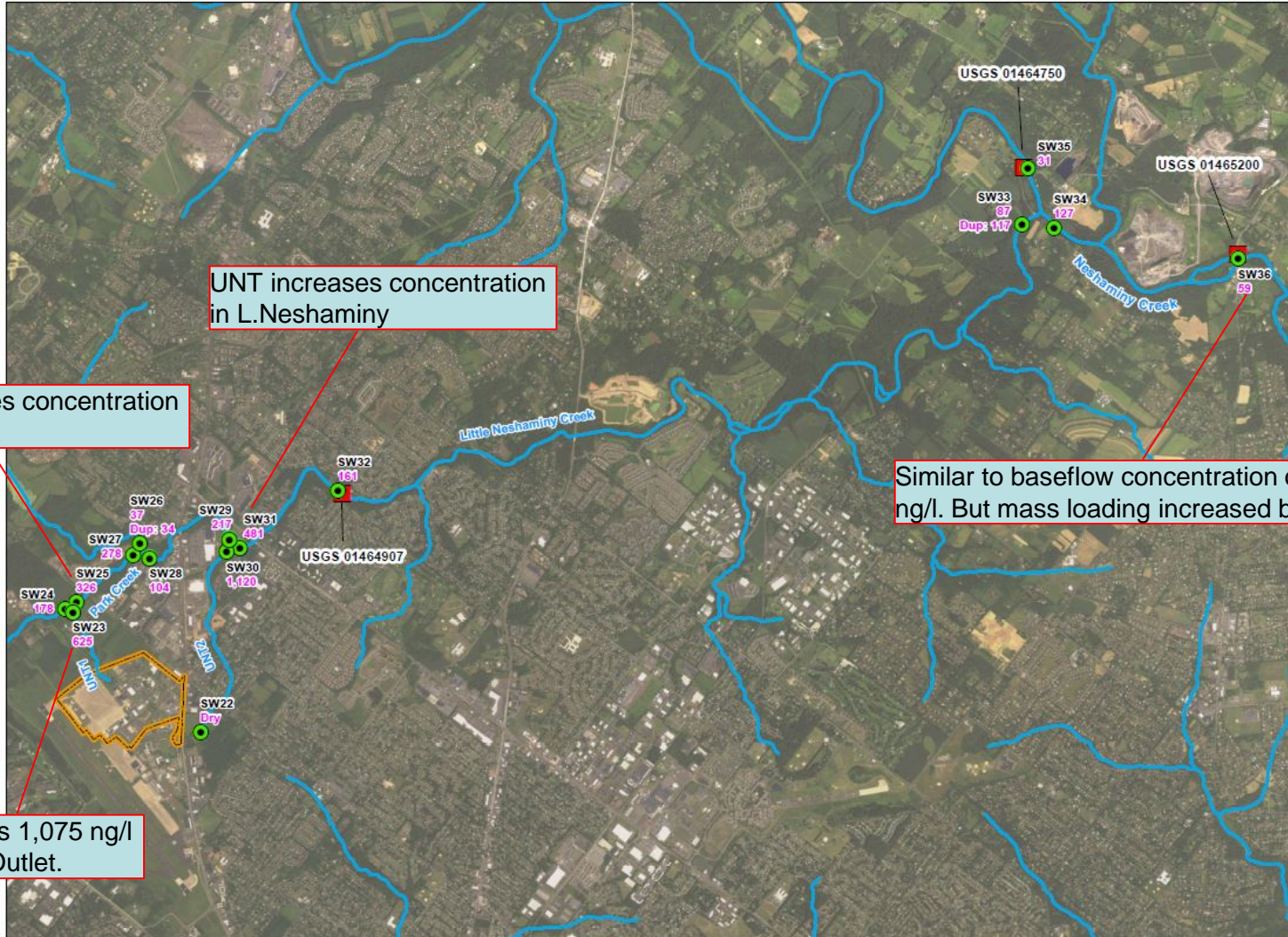
Flow from offsite

Basin discharge

Downstream from Basin discharge



# Draft Surface Water Sampling Results: Precipitation October 2017



UNT increases concentration in L.Neshaminy

UNT increases concentration in Park Creek

Similar to baseflow concentration of 64 ng/l. But mass loading increased by ~2.5x

625 ng/l vs 1,075 ng/l at Basin Outlet.

# Surface Water Data Update



Location ID	Sample ID	Date Collected	PFHpA	PFNA	PFOA	PFBS	PFHxS	PFOS	PFOA + PFOS	Approximate Flow Rate (liter/min)	Instantaneous Mass Flow Rate (ng/min)
2016 USEPA Health Advisory for Drinking Water			---	---	70	---	---	70	70	---	---
SW01	SW01-01-02	10/24/2017	4	3	6	0.8 J	4	16	22	509	11,197
SW02	SW02-01-02	10/24/2017	0.8 J	0.9 J	2	0.5 J	2 J	12	14	348	4,867
SW03	SW03-01-02	10/24/2017	6	3	13	9	140	560	573	2,146	1,229,756
	SW03-01-02 Field DUP-01		7	4	14	9	200	620	634	2,146	1,360,672
SW04	SW04-01-02	10/24/2017	0.9 U	0.4 J	1	0.9 U	0.5 J	3	4	189	737
SW05	SW05-01-02	10/24/2017	19	4	21	4	53	190	211	454	95,710
SW06	SW06-01-02	10/24/2017	13	4	16	3	37	170	186	113	21,092
SW07	SW07-01-02	10/24/2017	5	4	13	3	43	90	103	76	7,787
SW08	SW08-01-02	10/24/2017	36	5	75	44	340	1,000	1,075	1639	1,761,888
SW09	SW09-01-02	10/24/2017	3	1 J	5	0.9 J	5	11	16	3.78	60
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SW12	SW12-01-02	10/24/2017	5	2	6	2	7	23	29	19	548
SW13	SW13-01-02	10/24/2017	2 J	2 J	4	3	42	33	37	378	13,986
SW14	SW14-01-02	10/24/2017	6	2	8	6	100	76	84	227	19,051
SW15	SW15-01-02	10/24/2017	28	6	84	43	340	850	934	211	196,903
	SW15-01-02 Field DUP-02		28	5	78	43	340	1,100	1,178	211	248,342
SW16	SW16-01-02	10/24/2017	74	4	160	150	590	2,000	2,160	378	816,480
SW17	SW17-01-02	10/24/2017	92	4	170	160	700	2,400	2,570	57	145,719
SW18	SW18-01-02	10/24/2017	7	0.9 J	11	2	23	56	67	57	3,799
SW19	SW19-01-02	10/24/2017	13	5	20	16	200	340	360	223	80,316
SW20	SW20-01-02	10/24/2017	12	4	17	3	39	79	96	7.56	726
SW21	SW21-01-02	10/24/2017	7	3	10	2	18	55	65	3.78	246
SW22	--	--	---	---	---	---	---	---	---	dry	---
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	SW33-01-02 Field DUP-04		7	2	19	11	32	98	117	54,827	6,414,761
SW34	SW34-01-02	10/25/2017	6	6	17	9	19	110	127	185,582	23,568,891
SW35	SW35-01-02	10/25/2017	5	3	13	8	5	18	31	103,831	3,218,747
SW36	SW36-01-02	10/25/2017	6	3	15	8	13	44	59	173,051	10,210,003

23+24 < 25

Loss of mass?

# Surface Water: Next Steps



- Conduct sampling events in March 2018, weather permitting (baseflow and precipitation)
- Compare results to October sampling data. Develop conceptual design to address stormwater discharges.
- Potential options:
  - Enhanced/expanded centralized treatment at Basin
  - Decentralized treatment at hotspots
  - Segregate stormwater from groundwater discharge
  - Infiltrate stormwater to dilute/flush groundwater towards treatment system
  - Combined approach.



# Groundwater Water: Next Steps



- Complete current sampling event and compile report with updated Conceptual Site Model.
- Compare updated results to FIR and previous GW sampling event.
- Provide EPA/USGS with results from joint gauging event.

## Questions on Base PFOS/PFOA Investigation?

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# PFOS/PFOA in Surface Water on Horsham AGS



- PFOS/PFOA has been detected in surface water leaving the Horsham Air Guard Station. This water flows from a storm water detention basin on the northwest boundary of the Base to Park Creek which flows to the Little Neshaminy Creek.
  - ANG is taking action to reduce this release of PFOS/PFOA to the Creek:
    - Temporary carbon filtration was installed on the outfall in September 2017. The system is designed to treat the dry weather flow; heavy storm flow will bypass the treatment. Sampling indicates the water leaving the Base at this point is 2 ng/L for combined PFOS/PFOA.
    - Leidos to study the storm water basin, determine the source of dry weather flow and propose long term engineered solutions to filter effluent from detention basin.

# PFOS/PFOA in Drinking Water



- The Air National Guard has a \$13.5 million Cooperative Agreement with Warrington Township to:
  - Connect residents with PFOS/PFOA impacted drinking water wells above the Health Advisory to municipal water and abandon the impacted private wells
  - Install water mains as needed
  - Installation and maintenance of carbon filters on five Township wells
  - Install municipal water system interconnections with North Wales Water Authority to ensure Warrington Township has adequate access to water until carbon filtration is installed on municipal wells
- The Horsham AGS water supply wells are filtered with carbon and have extracted and treated over 20 million gallons of water



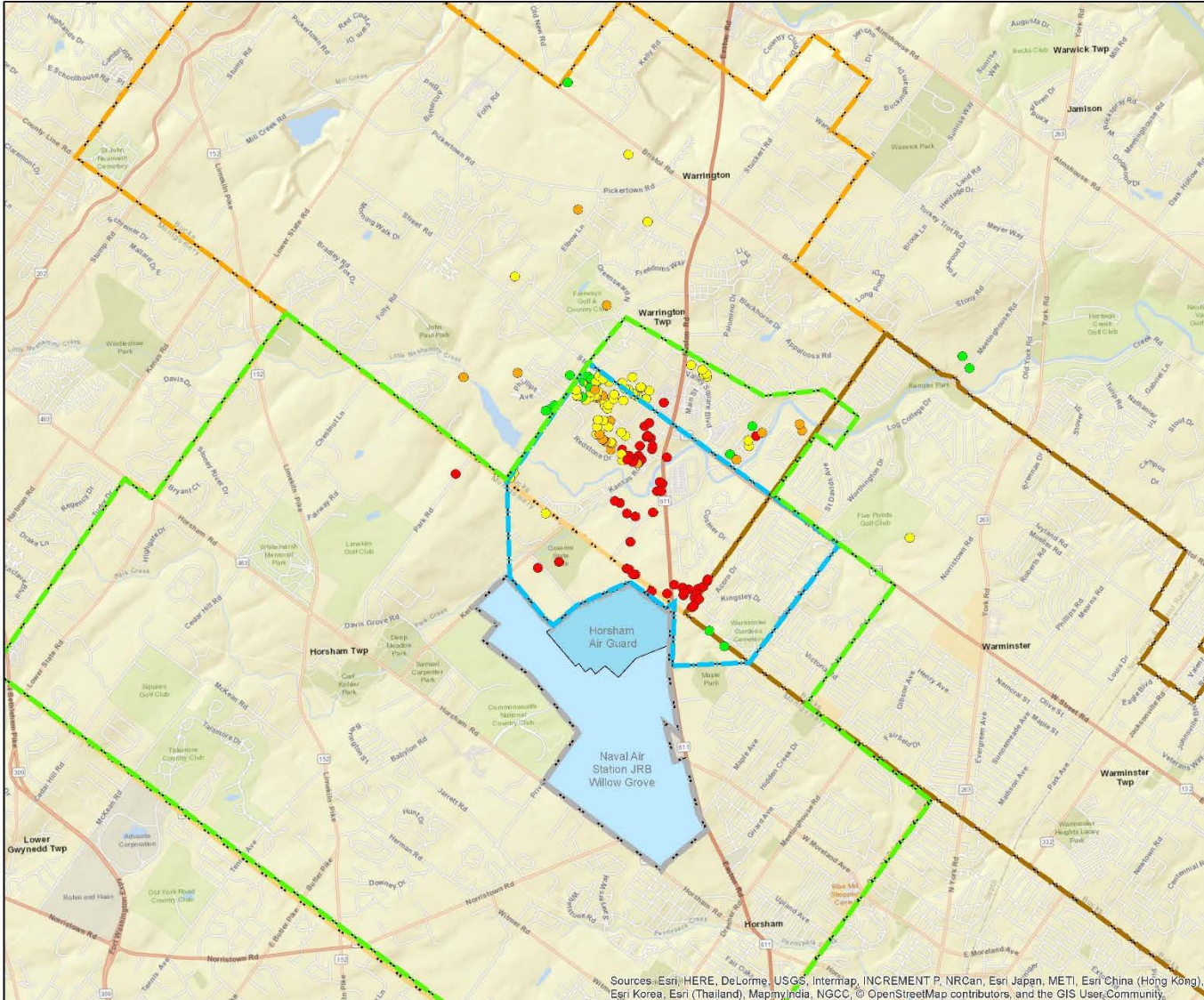
# Private Well Sampling



- ANG has contract in place with Amec Foster Wheeler to provide PFOS/PFOA testing of private drinking water wells and supply bottled water to properties with PFOS/PFOA at or above the lifetime health advisory level (HAL) for residents within our area of responsibility in Horsham, Warminster, and Warrington
    - The number of private wells sampled by ANG are:
      - Horsham: 5, all above HAL; 4 have been connected to municipal water (remaining one not in use)
      - Warrington: 136, 45 are above HAL; 29 have been connected
      - Warminster: 14\*, 11 are above HAL; 4 have been connected
- \*Some of these properties are on Valley Road with Warminster mailing addresses but are located in Warrington Township
- Sampling contact for ANG area of responsibility: David Side at [David.Side@amecfw.com](mailto:David.Side@amecfw.com) or (610) 877-6111



# Private Well Sampling Map



PFC Sample Location Map as of December 2017

Horsham Air Guard Station  
Horsham and Warrington Township

### Legend

- Health Advisory Level (HAL)  
HAL is the sum of both PFOA + PFOS  
(PFOA 0.070 ug/L, PFOS 0.70 ug/L)
- Sum of PFOA+PFOS concentrations above 0.070 ug/L
  - Sum of PFOA+PFOS concentrations detected between 0.040 ug/L and 0.070 ug/L
  - Sum of PFOA+PFOS concentrations detected at or below 0.040 ug/L
  - PFOA & PFOS not detected
- Horsham Air Guard
  - Former NAS JRB Willow Grove
  - Sampling Area
  - Air Force Administrative Order Boundary
  - Horsham Township
  - Warrington Township
  - Warminster Township

### Notes & Sources

Sources:  
Street Base Map hosted by ESRI.



Amec Foster Wheeler  
Environment & Infrastructure, Inc.  
751 Arbor Way  
Blue Bell, PA 19422  
(610) 828-8100



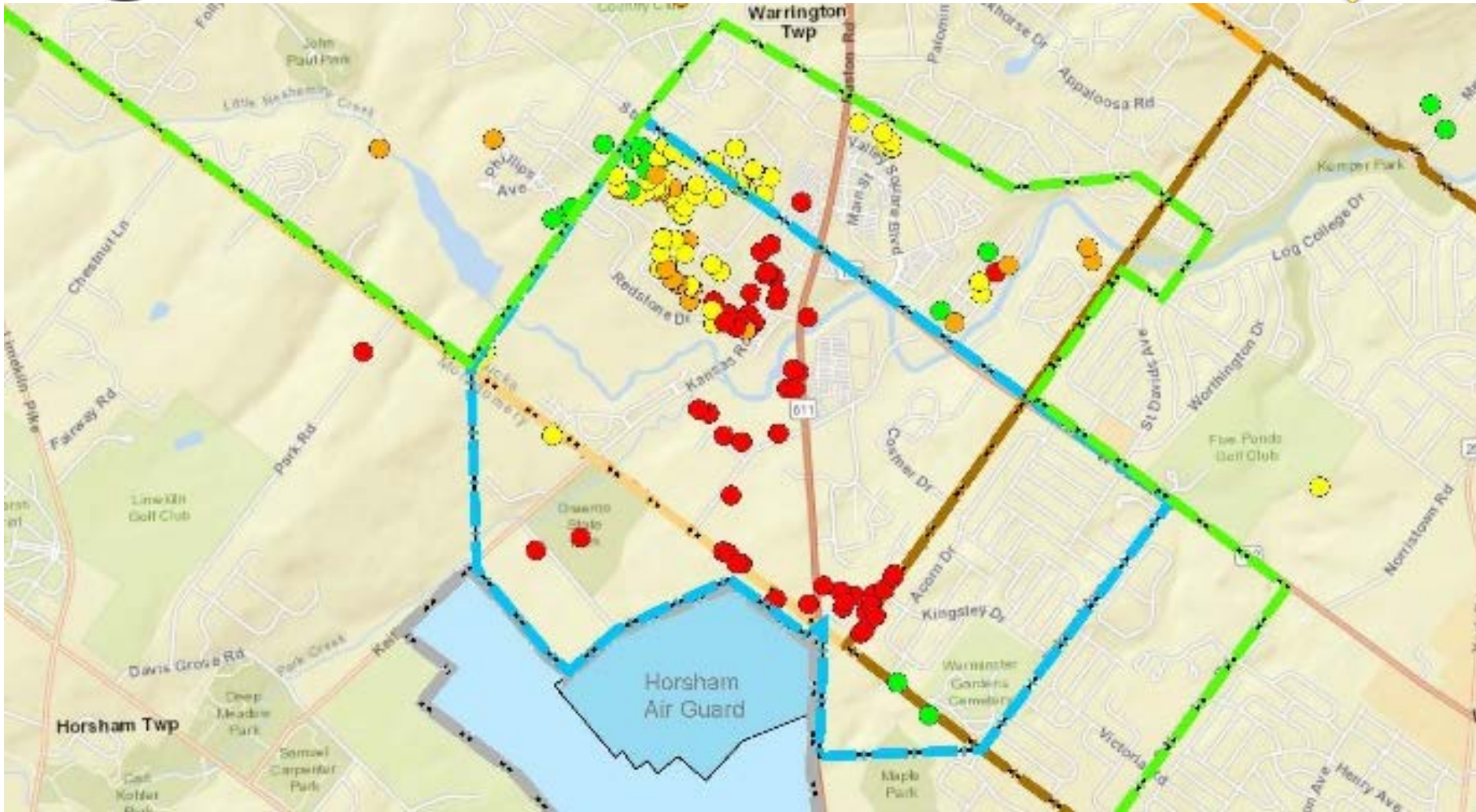
Figure

2





# Private Well Sampling Map





# Questions?

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