CORE/TREND trends results through 2019

In order to understand the health of the Chesapeake Bay and track progress of restoration efforts, the state, through the Maryland Department of Natural Resources, regularly monitors non-tidal waters at non-tidal 53 CORE/TREND sites. These monitoring data provide highly accurate information on the amount of pollutants in our waterways today and in the past. Monitoring data cannot, however, identify the sources of the pollutants nor predict future pollutant loads resulting from planned pollutant reduction efforts, the impacts of climate change, growth, etc.; for that information we must depend on models.

Statistical analysis of monitoring data collected at CORE/TREND stations from 1999 through 2019 demonstrates that the current impact of historical Chesapeake Bay restoration spending has resulted in significant reductions in nitrogen concentrations at 49% of stations (Figure 1), phosphorus concentrations at 70% of stations (Figure 2), and sediment concentrations at 38% of stations (Figure 3).

Over the last several years, the EPA, Maryland, and the other Bay states staff have worked to develop new statistical methods to assess water quality trends. A flow-adjusted method was first implemented in 2017. This flow-adjusted method uses daily flow data from U.S. Geological Service gaging stations to include the impact of changes in river flow on the nutrients and sediments levels; higher nutrients and sediments are associated with high river flows. Changes in the levels of nutrients and sediments are flow adjusted by using flow as one of the factors that determines the differences between years. The flow-adjusted method is much more robust for determining the impact of changes in water quality over a long-time period, and for determining what changes over time have resulted from management actions, not due to changes in rainfall from one year to the next. When the results of the flow-adjusted method are compared to the results of the non-adjusted method there are some differences, especially when the most recent years of data (2018 and 2019) were record- setting high- flow years. *As a result, it is inappropriate to compare the water quality monitoring trends presented below with similar trends presented in previous years' reports that did not use the flow-adjusted method.*

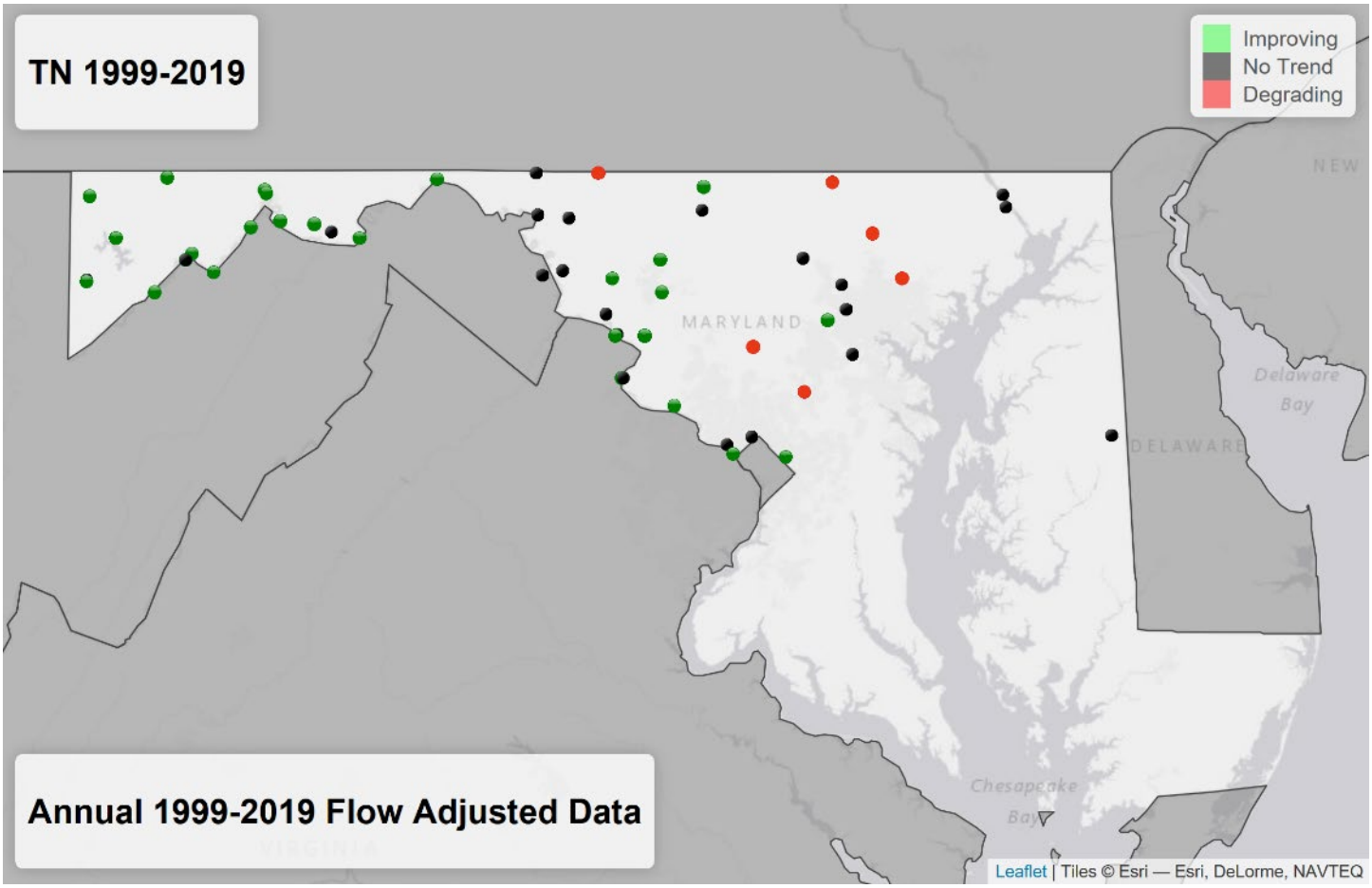

Figure 1. Trends in flow-adjusted total nitrogen concentrations 1999–2019

- 49% of stations (26 of 53) have improved total nitrogen levels compared to 1999
- 11% of stations (6 of 53) have degraded total nitrogen levels compared to 1999
- 40% of stations (21 of 53) do not have total nitrogen levels that are significantly different from 1999

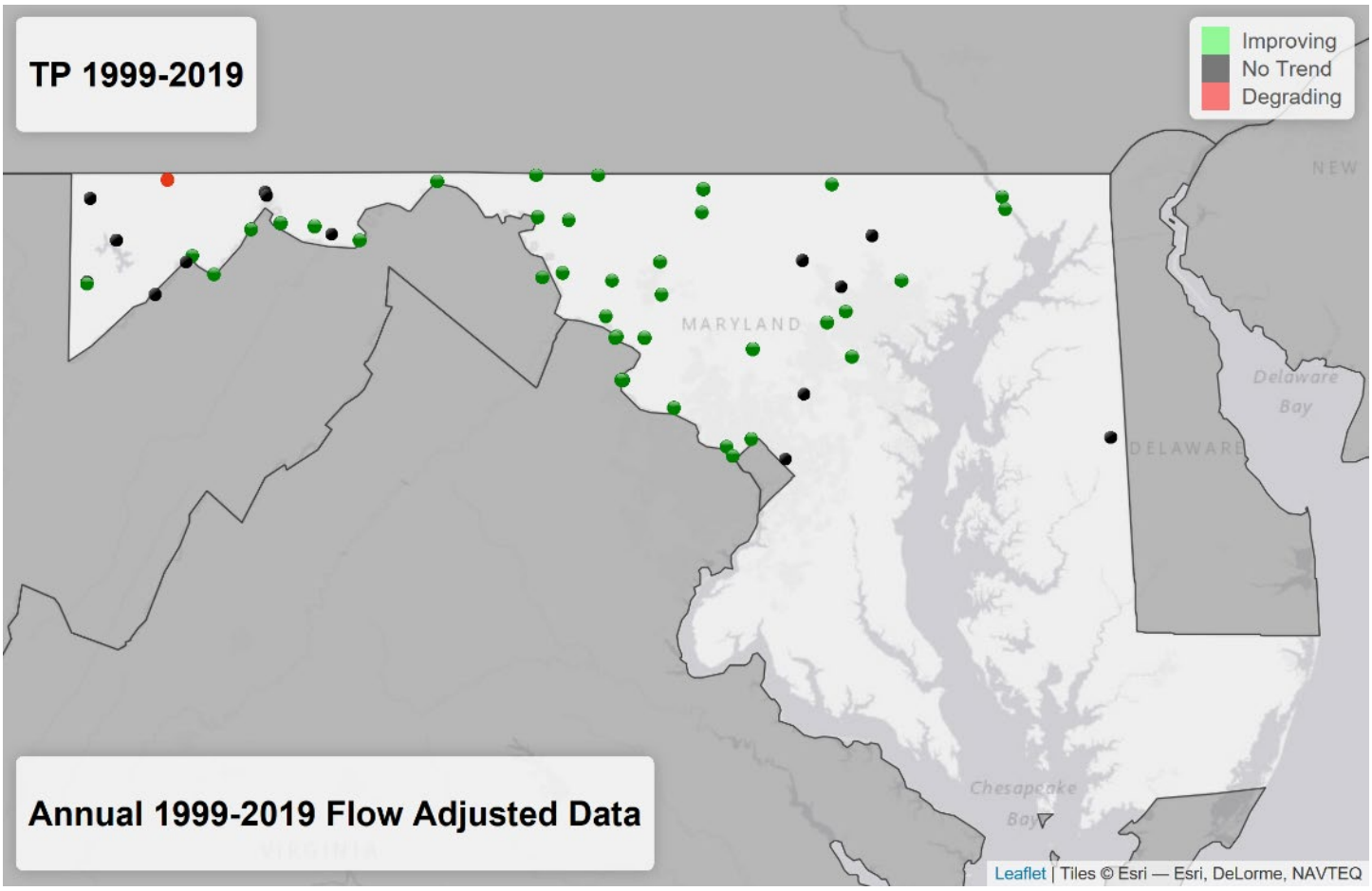

Figure 2. Trends in flow adjusted total phosphorus concentrations 1999–2019

- 70% of stations (37 of 53) have improved total phosphorus levels compared to 1999
- 2% of stations (1 of 53) have degraded total phosphorus levels compared to 1999
- 28% of stations (15 of 53) do not have total phosphorus levels that are significantly different from 1999

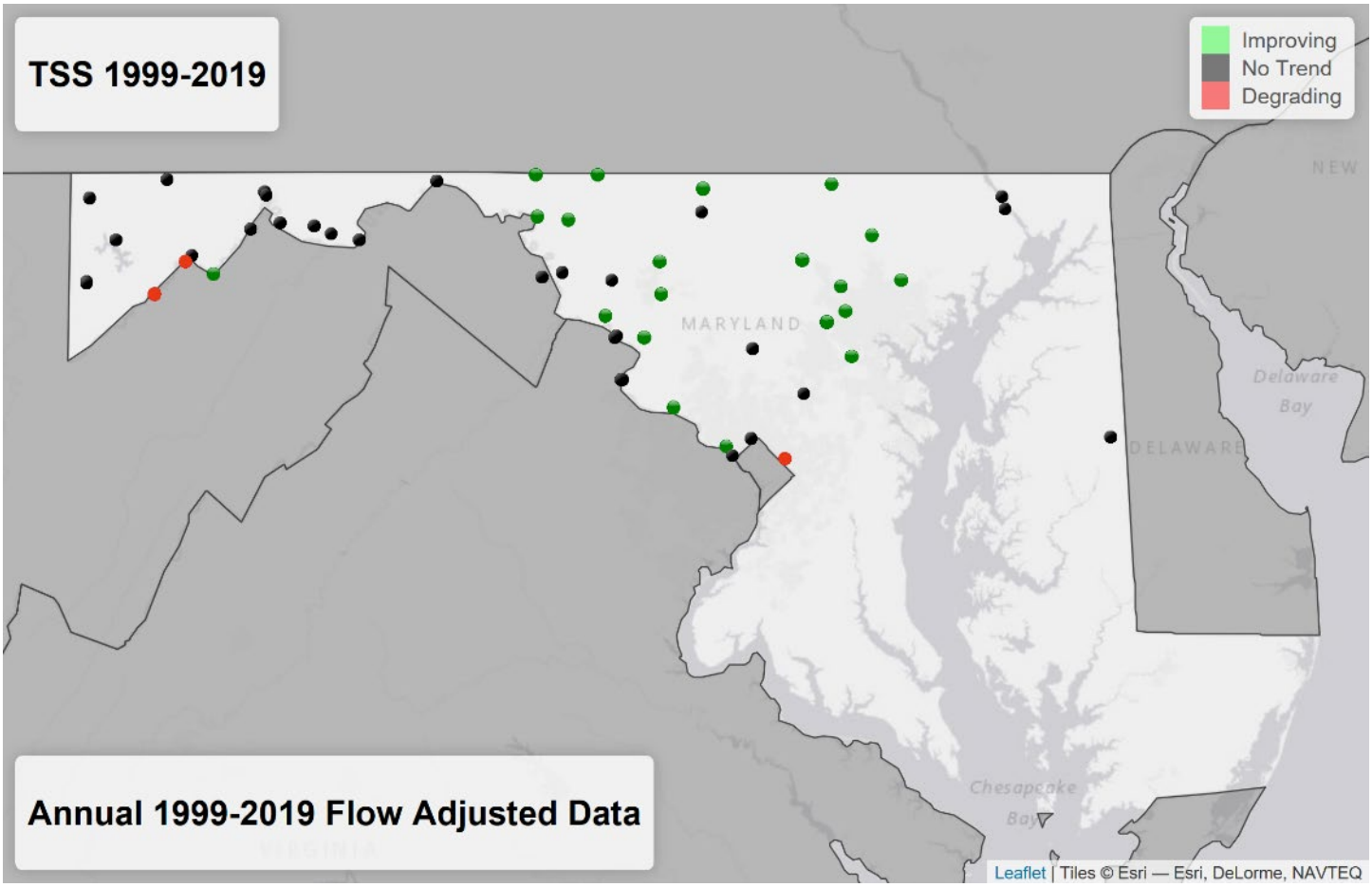

Figure 3. Trends in flow adjusted total suspended solids concentrations 1999–2019

- 38% of stations (20 of 53) have improved total suspended solids levels compared to 1999
- 8% of stations (4 of 53) have degraded total suspended solids levels compared to 1999
- 55% of stations (29 of 53) do not have total suspended solids levels that are significantly different from 1999

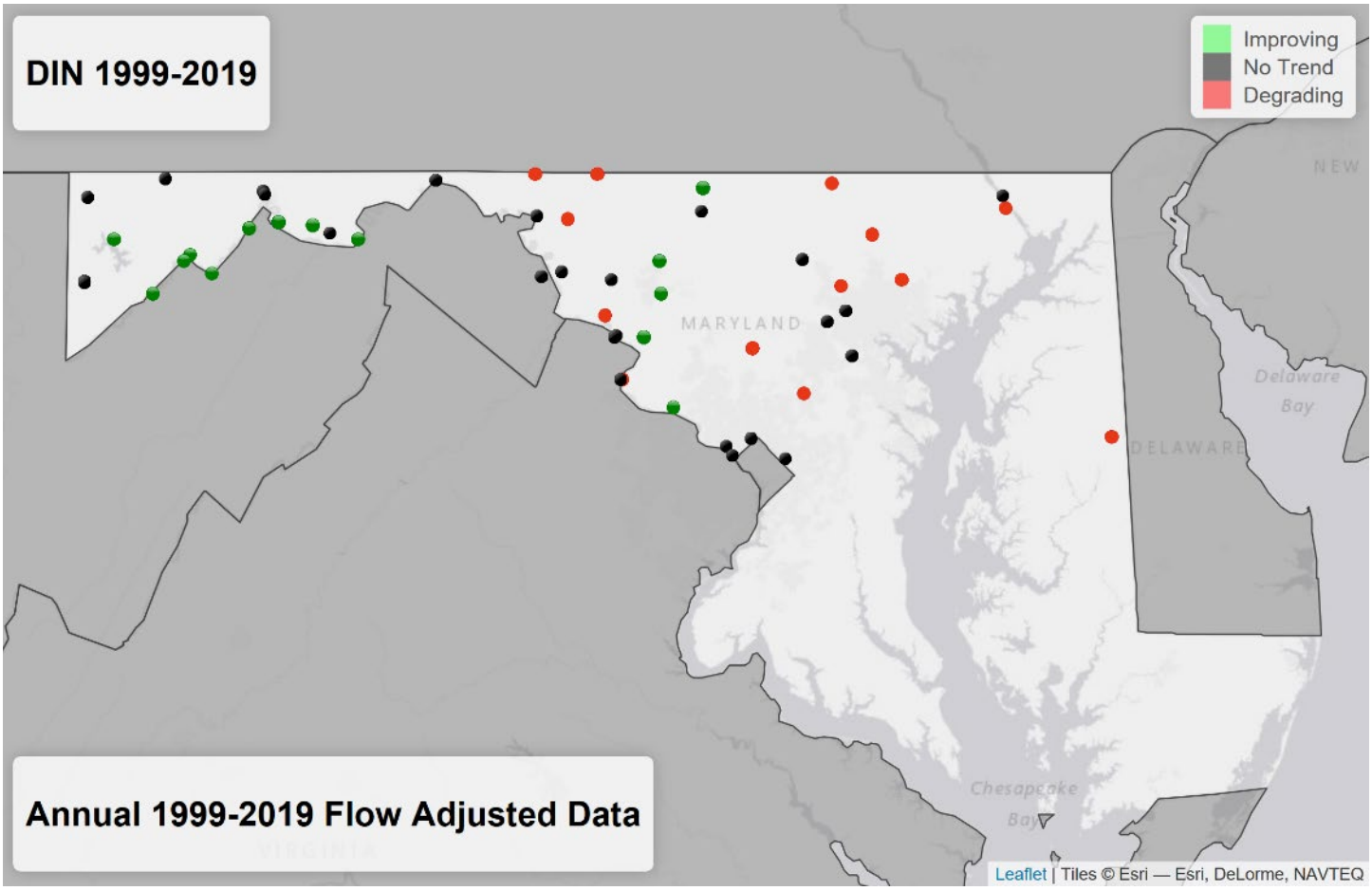

Figure 4. Trends in flow adjusted dissolved inorganic nitrogen concentrations 1999–2019

- 26% of stations (14 of 53) have improved dissolved inorganic nitrogen levels compared to 1999
- 26% of stations (14 of 53) have degraded dissolved inorganic nitrogen levels compared to 1999
- 48% of stations (25 of 53) do not have dissolved inorganic nitrogen levels that are significantly different from 1999

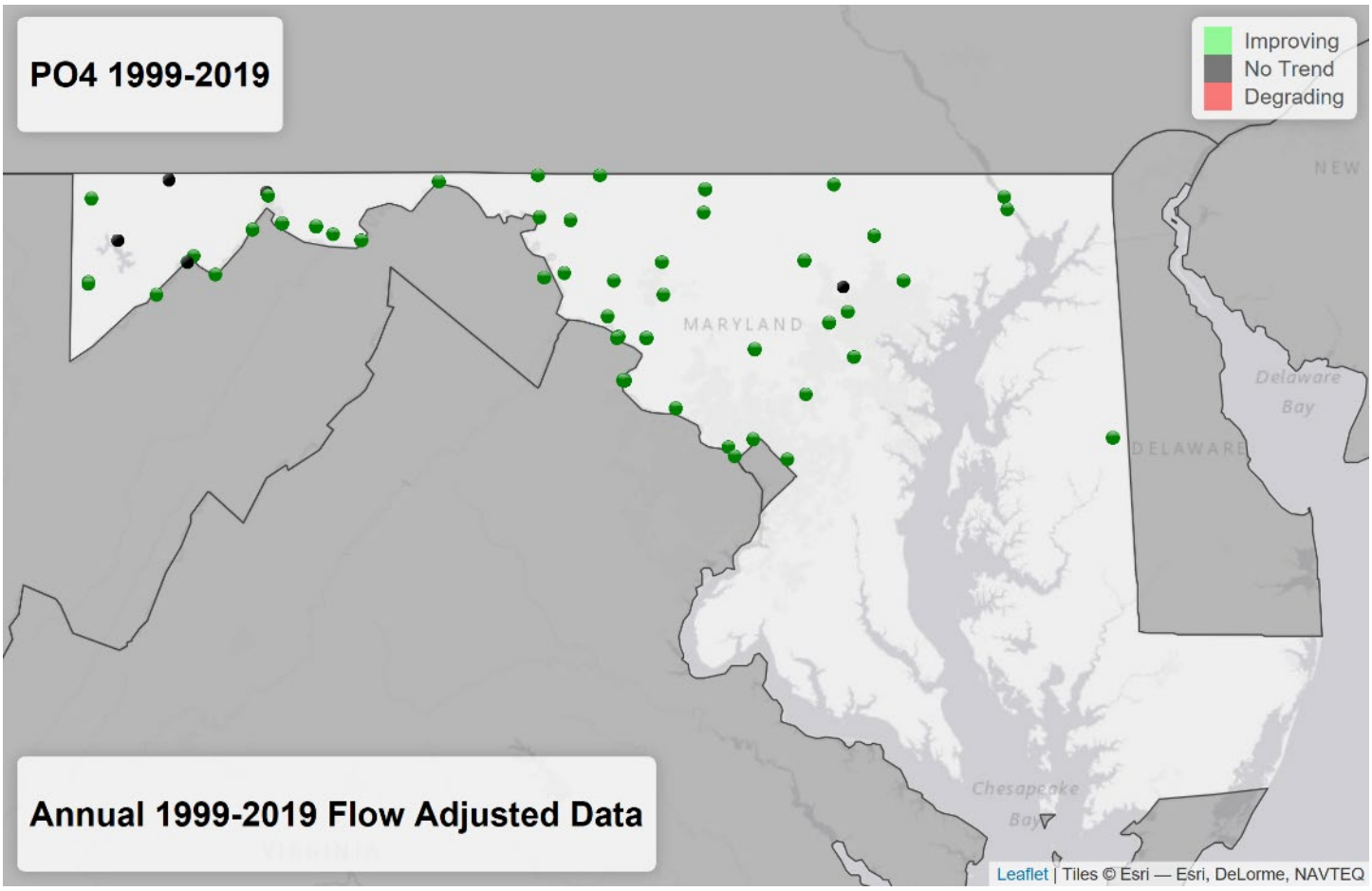

Figure 5. Trends in flow adjusted orthophosphate concentrations 1999–2019

- 91% of stations (48 of 53) have improved orthophosphate levels compared to 1999
- 0% of stations (0 of 53) have degraded orthophosphate levels compared to 1999
- 9% of stations (5 of 53) do not have orthophosphate levels that are significantly different from 1999

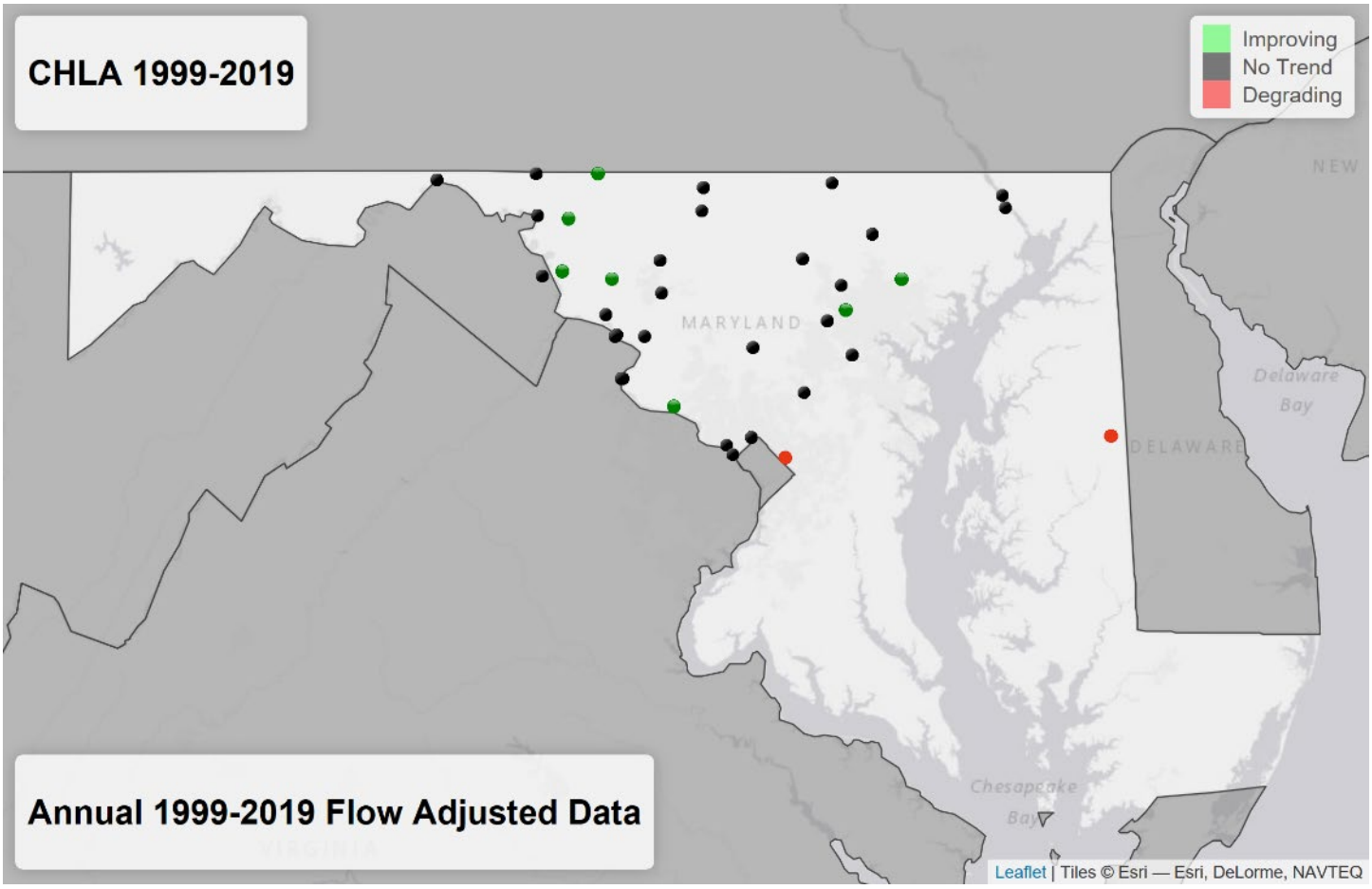

Figure 6. Trends in flow adjusted chlorophyll-α concentrations 1999–2019

- 19% of stations (7 of 36) have improved chlorophyll levels compared to 1999
- 6% of stations (2 of 36) have degraded chlorophyll levels compared to 1999
- 75% of stations (27 of 36) do not have chlorophyll levels that are significantly different from 1999

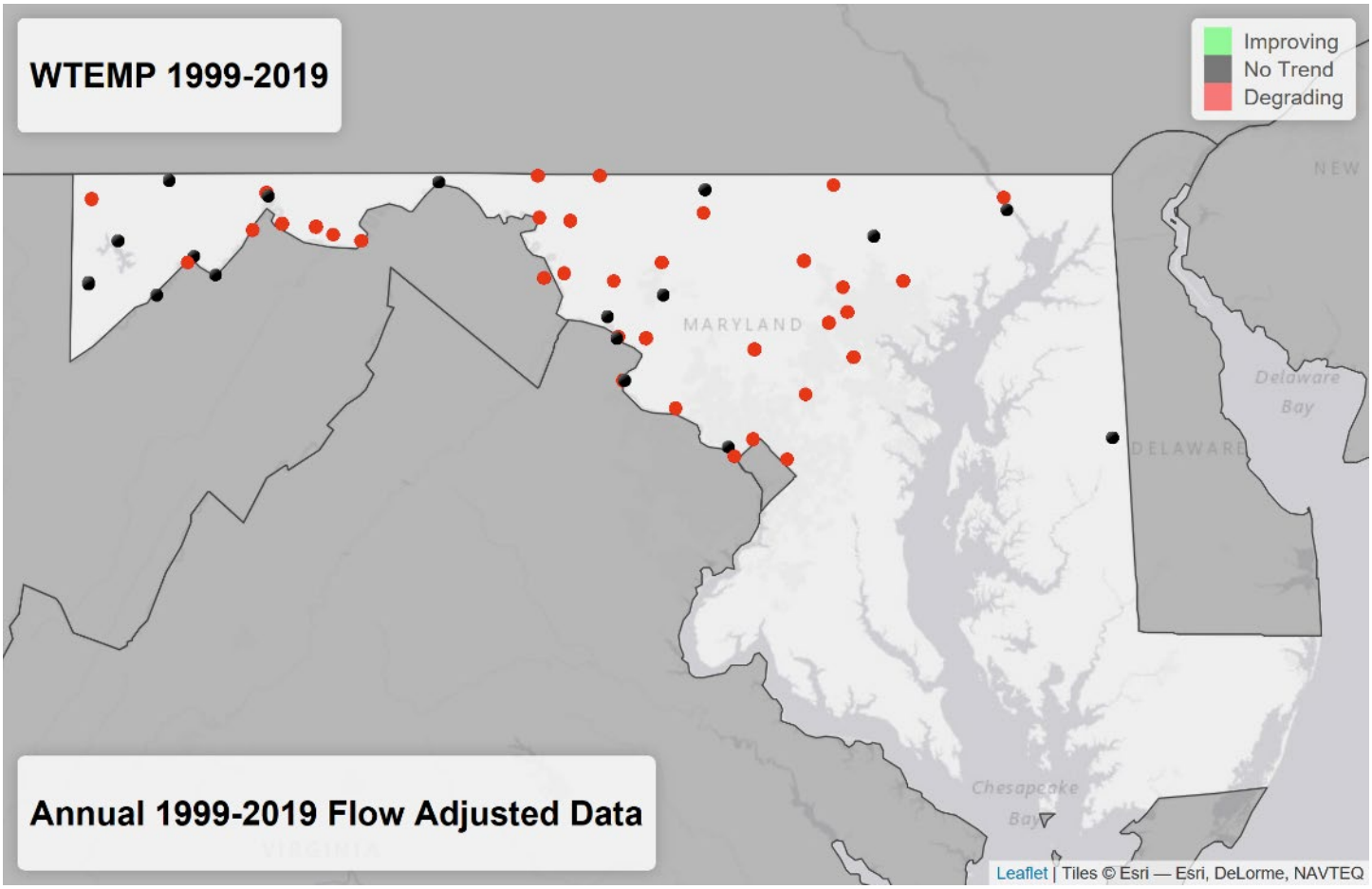

Figure 7. Trends in flow adjusted water temperature concentrations 1999–2019

- 0% of stations (0 of 53) have improved water temperature levels compared to 1999
- 66% of stations (35 of 53) have degraded water temperature levels compared to 1999
- 34% of stations (18 of 53) do not have water temperature levels that are significantly different from 1999
- Maximum temperature change 2.12°C, mean change 0.99°C

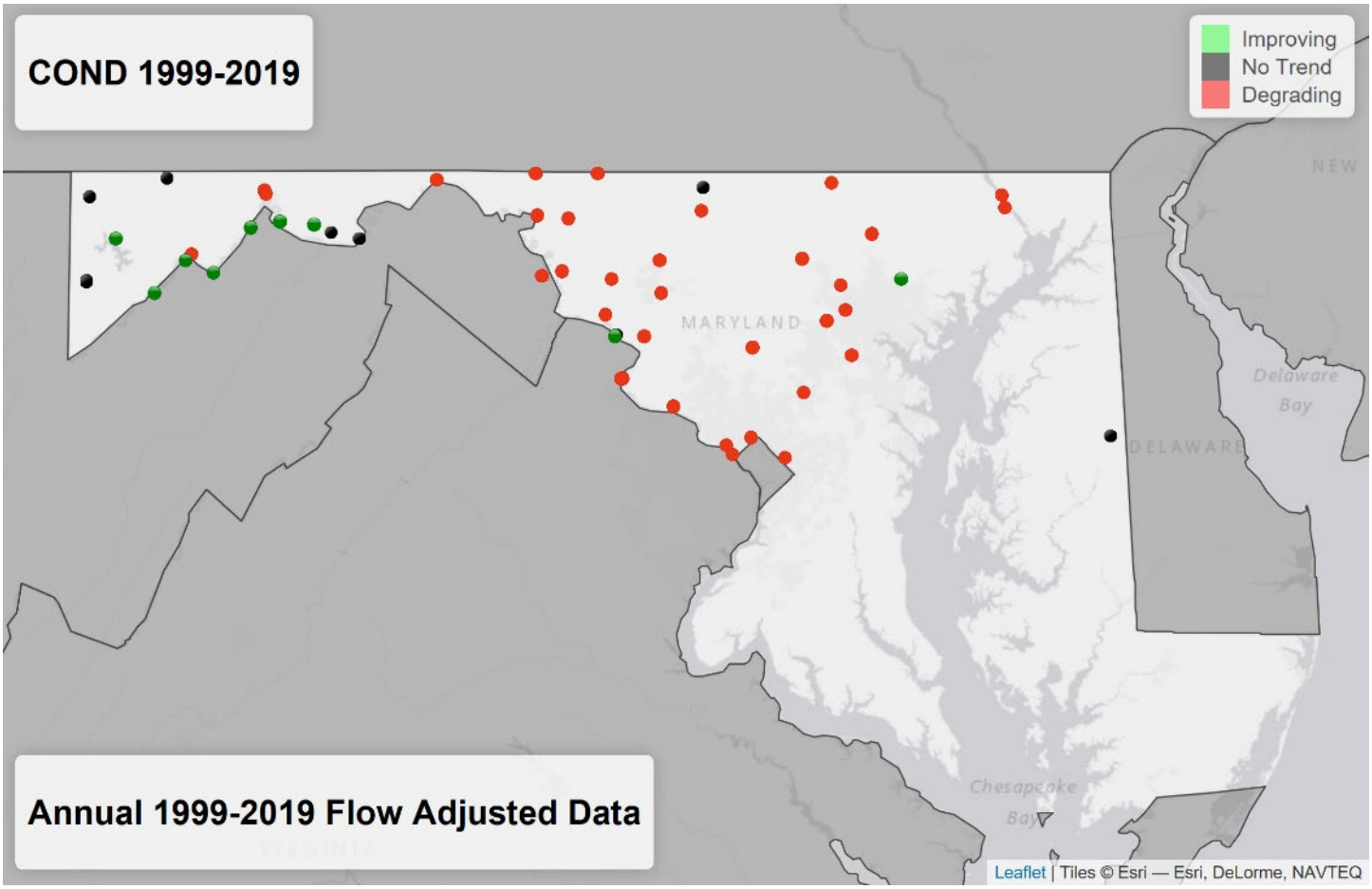

Figure 8. Trends in flow adjusted conductivity concentrations 1999–2019

- 19% of stations (10 of 53) have improved conductivity levels compared to 1999
- 64% of stations (34 of 53) have degraded conductivity levels compared to 1999
- 17% of stations (9 of 53) do not have conductivity levels that are significantly different from 1999

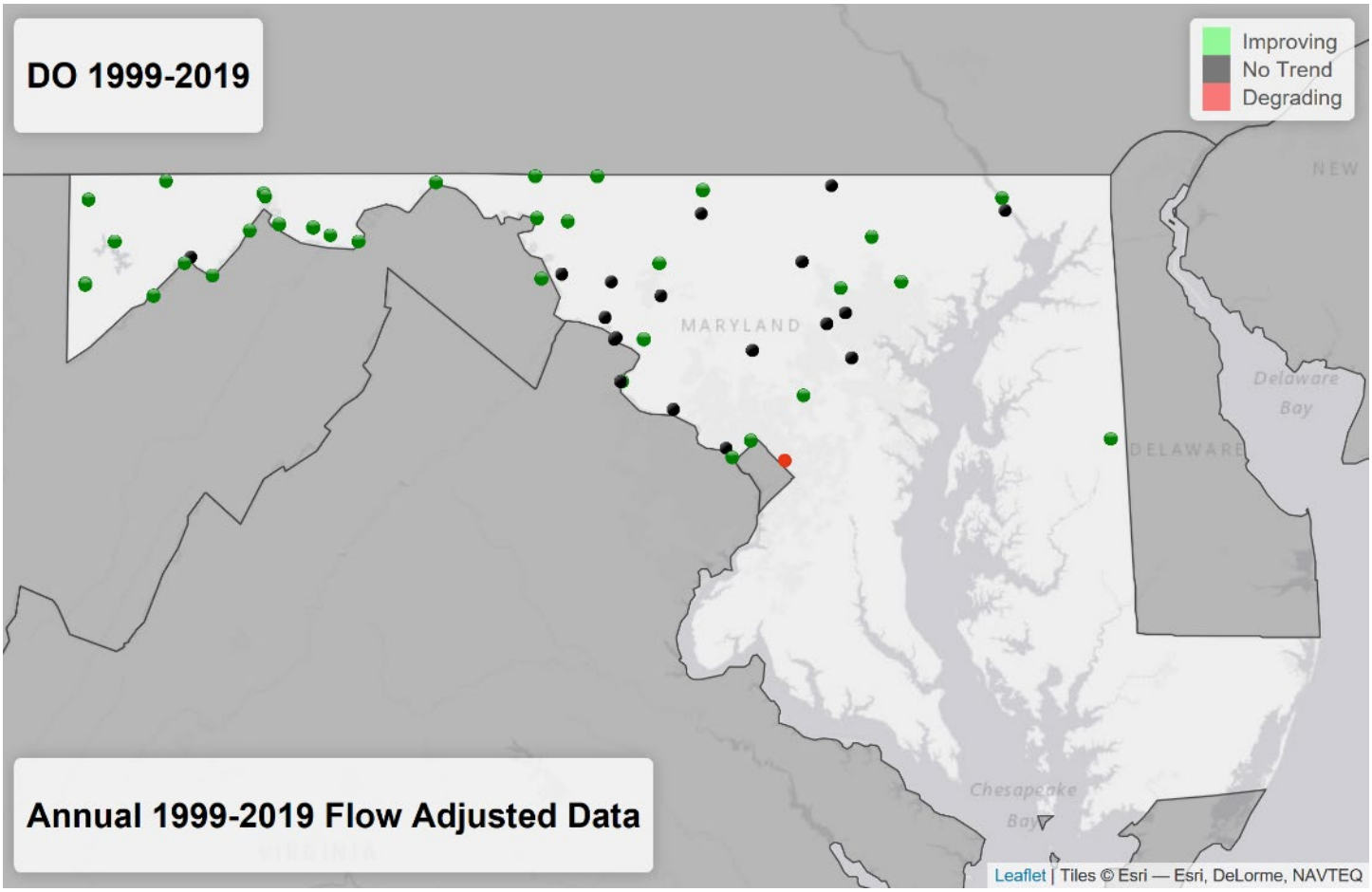

Figure 9. Trends in flow adjusted dissolved oxygen concentrations 1999–2019

- 64% of stations (34 of 53) have improved dissolved oxygen levels compared to 1999
- 2% of stations (1 of 53) have degraded dissolved oxygen levels compared to 1999
- 34% of stations (18 of 53) do not have dissolved oxygen levels that are significantly different from 1999

Table 1. Trends in nutrients and total suspended solids at CORE/TRENDS stations for the period 1999-2019. Highlighted values change by more than 50%, bolded values changed by more than 20%, red indicates degrading trends, green indicates improving trends, empty cells indicate no significant trend, grey cells indicate stations not sampled for that parameter. Trends are significant at p <= 0.05.

Order	System	Station	Total Nitrogen		Total Phosphorus		Total Suspended Solids		Dissolved Inorganic Nitrogen		Orthophosphate	
			Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed
1	Western Maryland	LYO0004	dec.		**dec > 20%**	**dec > 20%**					**dec > 50%**	**dec > 50%**
2	Western Maryland	YOU1139									**dec > 50%**	**dec > 50%**
3	Western Maryland	YOU0925	dec.					**inc > 50%**			**dec > 50%**	**dec > 50%**
4	Western Maryland	CCR0001	**dec > 20%**	**dec > 20%**					**dec > 20%**	**dec > 20%**		
5	Western Maryland	CAS0479	dec.		**inc > 50%**	**inc > 50%**		**inc > 50%**				**dec > 20%**
6	West. Upp. Potomac	NBP0689	**dec > 20%**	**dec > 20%**		**inc > 50%**	**inc > 50%**	**inc > 50%**	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 20%**
7	West. Upp. Potomac	NBP0534	**dec > 20%**	**dec > 20%**			**inc > 50%**	**inc > 50%**	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 20%**
8	West. Upp. Potomac	SAV0000		inc.			**inc > 50%**	**inc > 50%**	inc.	**inc > 20%**		
9	West. Upp. Potomac	GEO0009	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**			**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**
10	West. Upp. Potomac	NBP0461	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**	dec.		dec.		**dec > 50%**	**dec > 50%**
11	West. Upp. Potomac	NBP0326	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**			dec.		**dec > 50%**	**dec > 50%**
12	West. Upp. Potomac	BDK0000	**dec > 20%**							**inc > 20%**		
13	West. Upp. Potomac	WIL0013	dec.	**inc > 20%**						**inc > 50%**	**dec > 20%**	
14	West. Upp. Potomac	NBP0103	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**			**dec > 20%**	dec.	**dec > 50%**	**dec > 50%**
15	West. Upp. Potomac	NBP0023	**dec > 20%**	**dec > 20%**	**dec > 50%**	**dec > 50%**			**dec > 20%**	dec.	**dec > 50%**	**dec > 50%**
16	West. Upp. Potomac	TOW0030		**inc > 20%**				**inc > 50%**		**inc > 50%**	**dec > 20%**	
17	West. Upp. Potomac	POT2766	**dec > 20%**		**dec > 50%**	**dec > 20%**			**dec > 20%**		**dec > 50%**	**dec > 50%**
18	West. Upp. Potomac	POT2386	dec.		**dec > 20%**	**dec > 20%**				**inc > 50%**	**dec > 20%**	**dec > 20%**
19	East. Upp. Potomac	CON0180		inc.	**dec > 50%**	**dec > 50%**	**dec > 20%**		inc.	**inc > 20%**	**dec > 50%**	**dec > 50%**
20	East. Upp. Potomac	CON0005		inc.	**dec > 50%**	**dec > 50%**	**dec > 50%**	**dec > 20%**		**inc > 20%**	**dec > 50%**	**dec > 50%**
21	East. Upp. Potomac	POT1830			**dec > 50%**	**dec > 50%**				**inc > 20%**	**dec > 50%**	**dec > 50%**
22	East. Upp. Potomac	ANT0366	**inc > 20%**	inc.	**dec > 50%**	**dec > 50%**	**dec > 50%**	**dec > 20%**	**inc > 20%**	**inc > 20%**	**dec > 50%**	**dec > 50%**
23	East. Upp. Potomac	ANT0203			**dec > 50%**	**dec > 50%**	**dec > 20%**	**dec > 20%**	inc.	inc.	**dec > 50%**	**dec > 50%**
24	East. Upp. Potomac	ANT0044		inc.	**dec > 50%**	**dec > 50%**				inc.	**dec > 50%**	**dec > 50%**
25	East. Upp. Potomac	CAC0148	dec.	inc.	**dec > 50%**	**dec > 50%**				**inc > 50%**	**dec > 50%**	**dec > 50%**
26	East. Upp. Potomac	CAC0031		**inc > 20%**	**dec > 20%**	**dec > 20%**	**dec > 50%**		**inc > 20%**	**inc > 50%**	**dec > 20%**	**dec > 20%**

Order	System	Station	Total Nitrogen		Total Phosphorus		Total Suspended Solids		Dissolved Inorganic Nitrogen		Orthophosphate	
			Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed
27	East. Upp. Potomac	POT1596	dec.		dec > 50%	dec > 20%					dec > 50%	dec > 50%
28	East. Upp. Potomac	POT1595			dec > 50%	dec > 20%				inc.	dec > 50%	dec > 50%
29	Monocacy	MON0528	dec > 20%		dec > 20%	dec > 20%	dec > 20%	dec > 20%	dec > 20%		dec > 20%	
30	Monocacy	BPC0035			dec > 20%	dec > 20%					dec > 50%	dec > 20%
31	Monocacy	MON0269	dec.		dec > 50%	dec > 20%	dec > 20%		dec.		dec > 50%	dec > 20%
32	Monocacy	MON0155	dec > 20%	dec.	dec > 50%	dec > 50%	dec > 20%		dec.		dec > 50%	dec > 50%
33	Monocacy	MON0020	dec > 20%	dec.	dec > 50%	dec > 50%	dec > 20%		dec.	dec.	dec > 50%	dec > 50%
34	Middle Potomac	POT1472	dec.		dec > 50%	dec > 50%				inc > 20%	dec > 50%	dec > 50%
35	Middle Potomac	POT1471			dec > 50%	dec > 20%			inc > 20%	inc > 20%	dec > 50%	dec > 50%
36	Middle Potomac	SEN0008	dec > 20%	dec > 20%	dec > 50%	dec > 50%	dec > 20%		dec.	dec > 20%	dec > 50%	dec > 50%
37	Middle Potomac	CJB0005			dec > 20%		dec > 50%			inc > 20%	dec > 20%	
38	Middle Potomac	RCM0111			dec > 20%	dec > 20%				inc.	dec > 20%	dec > 20%
39	Middle Potomac	POT1184	dec.		dec > 50%	dec > 20%				inc > 20%	dec > 50%	dec > 50%
40	Middle Potomac	ANA0082	dec.				inc > 50%	inc > 50%			dec > 50%	dec > 50%
41	Gunpowder	GUN0476	inc.	inc.	dec > 20%	dec > 20%	dec > 50%	dec > 20%	inc.	inc > 20%	dec > 20%	dec > 20%
42	Gunpowder	GUN0258	inc.	inc.			dec > 20%		inc > 20%	inc > 20%	dec > 50%	dec > 20%
43	Gunpowder	GUN0125	inc.	inc > 20%	dec > 50%	dec > 50%	dec > 50%	dec > 50%	inc > 20%	inc > 50%	dec > 50%	dec > 50%
44	Susquehanna	DER0015		inc.	dec > 50%	dec > 20%			inc.	inc.	dec > 20%	dec > 20%
45	Susquehanna	CB1.0			dec.			inc > 50%		inc.	dec > 50%	dec > 50%
46	Patapsco	NPA0165					dec > 20%	dec > 20%			dec > 50%	dec > 20%
47	Patapsco	PAT0285	dec.		dec > 50%	dec > 50%	dec > 50%	dec > 50%			dec > 50%	dec > 50%
48	Patapsco	PAT0176			dec > 50%	dec > 20%	dec > 20%	dec > 20%		inc > 20%	dec > 50%	dec > 50%
49	Patapsco	JON0184					dec > 50%	dec > 50%	inc.	inc.		
50	Patapsco	GWN0115			dec > 50%	dec > 20%	dec > 50%	dec > 50%			dec > 20%	dec > 20%
51	Patuxent	PXT0972	inc.	inc > 20%	dec > 20%	dec > 20%			inc.	inc > 20%	dec > 20%	dec > 20%
52	Patuxent	PXT0809	inc.	inc > 20%					inc > 20%	inc > 20%	dec > 20%	dec > 50%
53	Choptank	ET5.0							inc.	inc.	dec > 20%	dec > 20%

Table 2. Mean start, end, and difference in mean parameter value for period 1999-2019. Highlighted values change by more than 50%, bolded values changed by more than 20%, red indicates degrading flow-adjusted trends, green indicates improving trends, black text indicates no significant trend (see Table1).

Order	Station	Total Nitrogen			Total Phosphorus			Total Suspended Solids			Dissolved Inorganic Nitrogen			Orthophosphate		
		1999/2000 Mean Value	2018/2019 Mean Value	Change	1999/2000 Mean Value	2018/2019 Mean Value	Change	1999/2000 Mean Value	2018/2019 Mean Value	Change	1999/2000 Mean Value	2018/2019 Mean Value	Change	1999/2000 Mean Value	2018/2019 Mean Value	Change
1	LYO0004	1.55	1.34	-0.21	**0.07**	**0.05**	**-0.02**	4.24	2.80	-1.45	1.01	1.04	0.02	**0.04**	**0.01**	**-0.02**
2	YOU1139	1.15	1.08	-0.07	0.04	0.03	-0.01	5.39	6.69	1.30	0.79	0.86	0.06	**0.01**	**0.01**	**-0.01**
3	YOU0925	0.76	0.66	-0.10	0.02	0.02	0.00	2.47	3.20	0.73	0.48	0.44	-0.04	**0.01**	**0.00**	**0.00**
4	CCR0001	**0.57**	**0.42**	**-0.15**	0.01	0.02	0.00	9.32	4.86	-4.46	**0.19**	**0.13**	**-0.06**	0.01	0.00	0.00
5	CAS0479	0.87	0.75	-0.12	**0.02**	**0.04**	**0.01**	3.04	1.30	-1.74	0.55	0.52	-0.03	0.02	0.02	0.00
6	NBP0689	**1.20**	**0.74**	**-0.46**	0.01	0.01	0.00	**5.64**	**6.98**	**1.34**	**0.99**	**0.59**	**-0.40**	**0.00**	**0.00**	**0.00**
7	NBP0534	**1.07**	**0.72**	**-0.34**	0.01	0.01	0.00	**6.66**	**4.39**	**-2.26**	**0.87**	**0.60**	**-0.27**	**0.00**	**0.00**	**0.00**
8	SAV0000	0.85	0.86	0.02	0.01	0.01	0.00	**3.49**	**3.04**	**-0.45**	0.62	0.74	0.12	0.01	0.00	0.00
9	GEO0009	**1.27**	**0.76**	**-0.51**	**0.03**	**0.01**	**-0.02**	3.72	1.53	-2.19	**0.94**	**0.62**	**-0.33**	**0.01**	**0.00**	**-0.01**
10	NBP0461	**1.10**	**0.79**	**-0.31**	**0.05**	**0.02**	**-0.03**	4.82	4.29	-0.53	0.74	0.63	-0.11	**0.02**	**0.00**	**-0.02**
11	NBP0326	**1.10**	**0.79**	**-0.31**	**0.05**	**0.01**	**-0.03**	5.80	4.97	-0.83	0.67	0.58	-0.09	**0.02**	**0.00**	**-0.02**
12	BDK0000	**0.69**	**0.50**	**-0.18**	0.01	0.01	0.00	6.45	4.68	-1.77	0.47	0.41	-0.06	0.00	0.00	0.00
13	WIL0013	0.84	0.70	-0.14	0.01	0.01	0.00	2.23	2.44	0.21	0.53	0.53	0.00	**0.01**	**0.00**	**0.00**
14	NBP0103	**1.28**	**0.82**	**-0.46**	**0.06**	**0.02**	**-0.04**	7.77	7.04	-0.73	**0.85**	**0.62**	**-0.22**	**0.03**	**0.01**	**-0.02**
15	NBP0023	**1.16**	**0.77**	**-0.39**	**0.06**	**0.02**	**-0.04**	6.67	5.57	-1.10	**0.75**	**0.54**	**-0.21**	**0.03**	**0.01**	**-0.02**
16	TOW0030	0.56	0.54	-0.02	0.01	0.01	0.00	1.47	1.70	0.23	0.22	0.33	0.10	**0.01**	**0.00**	**0.00**
17	POT2766	**0.92**	**0.62**	**-0.30**	**0.03**	**0.02**	**-0.02**	5.17	3.25	-1.92	**0.62**	**0.43**	**-0.19**	**0.01**	**0.00**	**-0.01**
18	POT2386	0.90	0.76	-0.14	**0.03**	**0.02**	**-0.01**	3.31	3.18	-0.13	0.46	0.50	0.03	**0.01**	**0.01**	**-0.01**
19	CON0180	3.96	4.25	0.29	**0.10**	**0.04**	**-0.06**	**12.15**	**1.84**	**-10.30**	3.45	3.79	0.34	**0.06**	**0.02**	**-0.03**
20	CON0005	3.89	4.05	0.16	**0.08**	**0.03**	**-0.05**	**3.15**	**3.18**	**0.03**	3.40	3.52	0.12	**0.05**	**0.02**	**-0.03**
21	POT1830	1.60	1.45	-0.14	**0.04**	**0.02**	**-0.02**	4.16	3.83	-0.33	1.14	1.25	0.11	**0.02**	**0.01**	**-0.02**
22	ANT0366	**4.02**	**4.83**	**0.81**	**0.14**	**0.06**	**-0.09**	**14.06**	**5.53**	**-8.54**	**3.40**	**4.56**	**1.16**	**0.08**	**0.04**	**-0.05**
23	ANT0203	4.81	4.97	0.15	**0.24**	**0.05**	**-0.18**	**12.95**	**7.47**	**-5.48**	4.16	4.70	0.53	**0.15**	**0.03**	**-0.12**
24	ANT0044	4.41	4.38	-0.03	**0.16**	**0.04**	**-0.12**	8.78	7.15	-1.63	3.90	4.04	0.14	**0.09**	**0.03**	**-0.07**
25	CAC0148	1.53	1.38	-0.14	**0.08**	**0.03**	**-0.04**	8.17	8.22	0.05	1.05	1.17	0.13	**0.05**	**0.02**	**-0.03**
26	CAC0031	1.94	2.07	0.13	**0.09**	**0.05**	**-0.04**	**4.40**	**2.99**	**-1.42**	**1.39**	**1.81**	**0.42**	**0.06**	**0.03**	**-0.02**

27	POT1596	1.47	1.19	-0.28	0.07	0.03	-0.04	8.16	8.09	-0.07	0.82	0.82	0.00	0.04	0.01	-0.03
28	POT1595	1.78	1.80	0.02	0.05	0.03	-0.03	6.48	11.31	4.83	1.30	1.35	0.05	0.03	0.01	-0.02
29	MON0528	1.96	1.21	-0.75	0.10	0.06	-0.04	8.09	7.21	-0.88	0.96	0.52	-0.44	0.06	0.04	-0.02
30	BPC0035	3.68	3.49	-0.20	0.04	0.03	-0.02	6.29	3.02	-3.27	3.16	3.08	-0.08	0.03	0.01	-0.02
31	MON0269	2.76	2.38	-0.38	0.09	0.04	-0.05	9.41	8.86	-0.55	2.15	1.90	-0.25	0.05	0.02	-0.03
32	MON0155	3.42	2.57	-0.86	0.18	0.04	-0.14	5.87	2.52	-3.35	2.67	2.19	-0.47	0.13	0.02	-0.11
33	MON0020	3.38	2.54	-0.84	0.15	0.04	-0.12	5.84	3.61	-2.23	2.76	2.29	-0.47	0.09	0.02	-0.07
34	POT1472	1.53	1.28	-0.25	0.07	0.02	-0.05	1.69	2.24	0.56	0.95	1.07	0.12	0.03	0.01	-0.03
35	POT1471	2.04	2.15	0.11	0.07	0.03	-0.04	2.48	2.83	0.35	1.49	1.83	0.33	0.04	0.01	-0.03
36	SEN0008	2.87	2.18	-0.68	0.13	0.02	-0.10	0.69	2.76	2.07	2.34	1.87	-0.47	0.09	0.01	-0.08
37	CJB0005	1.36	1.31	-0.06	0.03	0.02	-0.01	4.62	3.80	-0.82	0.88	1.05	0.17	0.01	0.01	-0.01
38	RCM0111	1.60	1.47	-0.13	0.05	0.04	-0.01	1.25	3.32	2.08	0.92	1.05	0.13	0.02	0.01	-0.01
39	POT1184	1.75	1.55	-0.20	0.07	0.03	-0.04	6.35	4.93	-1.42	1.13	1.19	0.06	0.03	0.01	-0.02
40	ANA0082	1.48	1.29	-0.19	0.04	0.04	0.00	5.67	8.53	2.86	0.87	0.84	-0.03	0.02	0.01	-0.01
41	GUN0476	3.25	3.65	0.41	0.03	0.02	-0.01	11.23	6.50	-4.73	2.87	3.35	0.49	0.01	0.01	-0.01
42	GUN0258	2.43	2.76	0.33	0.02	0.02	0.00	10.10	6.00	-4.10	2.07	2.55	0.48	0.01	0.00	0.00
43	GUN0125	1.46	1.65	0.19	0.04	0.02	-0.03	4.00	1.85	-2.15	0.99	1.36	0.38	0.01	0.00	-0.01
44	DER0015	3.46	3.59	0.13	0.05	0.02	-0.02	5.62	3.23	-2.39	2.94	3.33	0.39	0.02	0.01	-0.01
45	CB1.0	1.53	1.55	0.02	0.04	0.04	0.00	10.80	4.39	-6.41	1.13	1.24	0.11	0.02	0.01	-0.01
46	NPA0165	4.27	4.27	0.01	0.02	0.01	0.00	5.63	4.12	-1.51	3.86	3.97	0.11	0.01	0.00	-0.01
47	PAT0285	2.59	2.36	-0.23	0.05	0.02	-0.03	5.65	3.78	-1.87	2.13	2.11	-0.03	0.02	0.01	-0.02
48	PAT0176	2.24	2.10	-0.14	0.05	0.02	-0.03	7.31	6.51	-0.80	1.74	1.87	0.13	0.02	0.01	-0.02
49	JON0184	1.92	1.99	0.07	0.02	0.02	0.00	6.79	4.26	-2.53	1.62	1.83	0.21	0.01	0.01	0.00
50	GWN0115	1.80	1.65	-0.15	0.03	0.01	-0.02	7.88	4.39	-3.49	1.34	1.42	0.08	0.01	0.01	0.00
51	PXT0972	2.81	3.21	0.40	0.02	0.02	-0.01	1.12	2.63	1.51	2.44	2.91	0.47	0.01	0.01	-0.01
52	PXT0809	1.62	1.81	0.19	0.03	0.03	0.00	4.97	4.03	-0.94	1.18	1.42	0.25	0.01	0.01	-0.01
53	ET5.0	1.86	1.94	0.09	0.07	0.08	0.01	5.56	2.69	-2.87	1.32	1.55	0.23	0.04	0.02	-0.01

Table 3. Trends in chlorophyll, water temperature, conductivity and dissolved oxygen at CORE/TRENDS stations for the period 1999-2019. Grey cells indicate stations not sampled for that parameter. Highlighted values changed by more than 50%, bolded values changed by more than 20%, red indicates degrading trends, green indicates improving trends, empty cells indicate no significant trend. Trends are significant at p <= 0.05.

Order	System	Station	Chlorophyll-α		Water Temperature		Conductivity		Dissolved Oxygen	
			Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed	Flow Adjusted	Observed
1	Western Maryland	LYO0004							inc.	inc.
2	Western Maryland	YOU1139						dec.	inc.	inc.
3	Western Maryland	YOU0925			inc.				inc.	inc.
4	Western Maryland	CCR0001					**dec > 20%**	**dec > 20%**	inc.	inc.
5	Western Maryland	CAS0479						**dec > 20%**	inc.	inc.
6	West. Upp. Potomac	NBP0689					**dec > 20%**	**dec > 20%**	inc.	inc.
7	West. Upp. Potomac	NBP0534			inc.	inc.	dec.	**dec > 20%**	inc.	inc.
8	West. Upp. Potomac	SAV0000			inc.	inc.	dec.	dec.	inc.	inc.
9	West. Upp. Potomac	GEO0009					**inc > 20%**			
10	West. Upp. Potomac	NBP0461					dec.	**dec > 20%**	inc.	inc.
11	West. Upp. Potomac	NBP0326			inc.		dec.	**dec > 20%**	inc.	inc.
12	West. Upp. Potomac	BDK0000			inc.	inc.	**inc > 20%**		inc.	inc.
13	West. Upp. Potomac	WIL0013					inc.	**dec > 20%**	inc.	inc.
14	West. Upp. Potomac	NBP0103			inc.		dec.	**dec > 20%**	inc.	inc.
15	West. Upp. Potomac	NBP0023			inc.		dec.	**dec > 20%**	inc.	inc.
16	West. Upp. Potomac	TOW0030			inc.			dec.	inc.	inc.
17	West. Upp. Potomac	POT2766			inc.			dec.	inc.	inc.
18	West. Upp. Potomac	POT2386					inc.	dec.	inc.	inc.
19	East. Upp. Potomac	CON0180			inc.	inc.	inc.	inc.	**inc > 20%**	inc.
20	East. Upp. Potomac	CON0005			inc.	inc.	inc.	inc.	inc.	inc.
21	East. Upp. Potomac	POT1830			inc.		inc.		inc.	inc.
22	East. Upp. Potomac	ANT0366	**dec > 20%**	**dec > 20%**	inc.	inc.	inc.	inc.	inc.	inc.
23	East. Upp. Potomac	ANT0203	**dec > 50%**	**dec > 20%**	inc.		inc.		inc.	inc.
24	East. Upp. Potomac	ANT0044	**dec > 20%**		inc.		inc.			inc.
25	East. Upp. Potomac	CAC0148	**dec > 20%**	**dec > 20%**	inc.	inc.	inc.			inc.
26	East. Upp. Potomac	CAC0031					inc.			inc.

27	East. Upp. Potomac	POT1596					dec.	dec.		
28	East. Upp. Potomac	POT1595			inc.					
29	Monocacy	MON0528				inc.		dec.	inc.	inc.
30	Monocacy	BPC0035			inc.	inc.	inc.			
31	Monocacy	MON0269			inc.		inc.		inc.	inc.
32	Monocacy	MON0155					inc.			
33	Monocacy	MON0020			inc.	inc.	inc.		inc.	inc.
34	Middle Potomac	POT1472			inc.	inc.	inc.			
35	Middle Potomac	POT1471				dec.	inc.		inc.	inc.
36	Middle Potomac	SEN0008	dec > 20%		inc.	inc.	inc > 50%	inc > 20%		
37	Middle Potomac	CJB0005				inc.	inc > 50%	inc > 20%		
38	Middle Potomac	RCM0111			inc.	inc.	inc > 20%	inc > 20%	inc.	inc.
39	Middle Potomac	POT1184			inc.		inc.	inc.	inc.	inc.
40	Middle Potomac	ANA0082	inc > 50%		inc.		inc > 50%	inc > 50%	dec.	dec.
41	Gunpowder	GUN0476			inc.	inc.	inc.	inc > 20%		
42	Gunpowder	GUN0258					inc > 20%	inc.	inc.	inc.
43	Gunpowder	GUN0125	dec > 50%	dec > 20%	inc.	inc.	dec.	dec > 20%	inc.	inc.
44	Susquehanna	DER0015					inc.	inc.		
45	Susquehanna	CB1.0			inc.		inc.		inc.	inc.
46	Patapsco	NPA0165			inc.	inc.	inc > 20%	inc > 20%		
47	Patapsco	PAT0285			inc.	inc.	inc > 20%	inc.		inc.
48	Patapsco	PAT0176			inc.	inc.	inc.			
49	Patapsco	JON0184			inc.	inc.	inc > 20%	inc > 20%	inc.	
50	Patapsco	GWN0115	dec > 50%	dec > 20%	inc.	inc.	inc > 50%	inc > 50%		
51	Patuxent	PXT0972			inc.	inc.	inc.	inc.		
52	Patuxent	PXT0809			inc.	inc.	inc > 20%	inc.	inc.	
53	Choptank	ET5.0	inc > 50%	inc > 50%				dec.	inc.	inc.

Table 4. Mean start, end, and difference in mean parameter value for period 1999-2019. Grey cells indicate stations not sampled for that parameter. Highlighted values change by more than 50%, bolded values changed by more than 20%, red indicates degrading flow-adjusted trends, green indicates improving trends, black text indicates no significant trend (see Table 3).

Order	Station	Chlorophyll-α			Water Temperature			Conductivity			Dissolved Oxygen		
		1999/ 2000 Mean Value	2018/ 2019 Mean Value	Change	1999/ 2000 Mean Value	2018/ 2019 Mean Value	Change	1999/ 2000 Mean Value	2018/ 2019 Mean Value	Change	1999/ 2000 Mean Value	2018/ 2019 Mean Value	Change
1	LYO0004				10.00	9.86	-0.15	173.41	177.13	3.72	9.12	9.72	0.60
2	YOU1139				10.11	9.87	-0.24	125.38	115.36	-10.02	9.34	10.06	0.72
3	YOU0925				9.88	11.00	1.12	100.93	97.22	-3.72	10.17	10.77	0.59
4	CCR0001				8.58	9.22	0.64	**120.69**	**84.94**	**-35.74**	9.85	10.58	0.73
5	CAS0479				8.88	9.71	0.83	188.82	172.10	-16.72	10.00	11.27	1.27
6	NBP0689				10.29	10.76	0.47	**477.38**	**323.94**	**-153.44**	10.10	10.80	0.70
7	NBP0534				9.75	11.02	1.27	383.79	323.61	-60.18	10.48	10.96	0.48
8	SAV0000				9.10	10.58	1.48	129.26	112.18	-17.08	10.67	11.15	0.48
9	GEO0009				10.71	11.13	0.42	**827.35**	**1040.08**	**212.73**	10.62	10.94	0.33
10	NBP0461				11.35	12.29	0.94	477.05	403.60	-73.45	9.67	11.12	1.44
11	NBP0326				11.68	13.11	1.43	446.77	394.38	-52.39	9.32	10.87	1.56
12	BDK0000				9.14	10.70	1.56	**941.99**	**1227.84**	**285.85**	10.50	10.98	0.48
13	WIL0013				10.02	11.22	1.19	277.49	319.49	42.00	10.19	11.32	1.13
14	NBP0103				12.06	13.40	1.34	423.66	380.25	-43.40	9.50	10.75	1.26
15	NBP0023				12.26	13.38	1.12	406.04	368.03	-38.01	9.39	10.57	1.18
16	TOW0030				11.93	13.34	1.41	188.28	177.94	-10.34	10.16	11.16	1.00
17	POT2766				13.30	14.50	1.20	299.97	283.44	-16.53	9.68	10.69	1.01
18	POT2386	1.22	0.80	-0.43	13.91	14.24	0.34	301.00	315.38	14.38	9.76	10.16	0.40
19	CON0180	1.94	1.20	-0.75	12.30	14.23	1.93	384.95	426.25	41.31	**9.50**	**11.83**	**2.33**
20	CON0005	1.69	1.10	-0.59	13.16	15.03	1.87	388.35	461.04	72.69	9.81	11.58	1.77
21	POT1830	1.82	1.06	-0.76	14.53	15.79	1.26	310.76	347.05	36.29	9.73	10.44	0.71
22	ANT0366	**3.71**	**1.90**	**-1.81**	11.47	12.60	1.13	372.56	430.81	58.25	9.90	11.35	1.45
23	ANT0203	**2.04**	**0.70**	**-1.34**	12.82	13.46	0.64	505.00	570.94	65.94	9.40	9.93	0.52
24	ANT0044	**1.97**	**1.22**	**-0.75**	12.77	13.93	1.16	518.54	574.05	55.51	10.10	10.51	0.41
25	CAC0148	**2.94**	**1.78**	**-1.17**	12.08	13.07	0.99	217.46	241.03	23.57	10.59	10.68	0.09

26	CAC0031	1.93	1.74	-0.19	12.09	13.08	0.99	243.43	282.66	39.23	9.94	10.18	0.25
27	POT1596	1.74	1.54	-0.20	13.98	14.28	0.30	286.01	260.31	-25.70	9.66	9.87	0.21
28	POT1595	1.91	1.39	-0.51	13.80	14.29	0.49	322.11	339.05	16.93	9.68	9.83	0.16
29	MON0528	1.87	1.58	-0.29	12.63	13.68	1.05	285.63	279.29	-6.33	8.98	9.63	0.65
30	BPC0035	1.69	1.50	-0.19	12.00	12.99	1.00	239.97	253.34	13.37	9.88	10.17	0.29
31	MON0269	2.00	1.61	-0.39	13.01	14.18	1.18	271.30	291.79	20.49	9.36	10.25	0.89
32	MON0155	2.64	2.32	-0.33	12.97	13.83	0.86	294.54	328.68	34.13	9.20	9.69	0.49
33	MON0020	2.13	1.76	-0.37	13.47	14.08	0.61	316.61	340.90	24.30	9.48	10.19	0.71
34	POT1472	1.94	1.24	-0.70	15.00	15.73	0.73	294.68	317.06	22.38	9.78	10.14	0.36
35	POT1471	1.69	1.57	-0.11	15.56	15.24	-0.32	308.79	337.51	28.72	9.48	9.94	0.47
36	SEN0008	**2.40**	**1.41**	**-0.99**	13.10	14.89	1.79	**251.60**	**418.46**	**166.86**	10.65	10.95	0.30
37	CJB0005	2.14	1.48	-0.66	13.08	13.81	0.72	**380.55**	**605.69**	**225.14**	10.81	10.91	0.11
38	RCM0111	3.34	2.95	-0.39	13.25	14.86	1.62	**332.16**	**491.72**	**159.56**	9.14	9.76	0.62
39	POT1184	2.31	1.57	-0.74	15.49	16.08	0.59	283.98	339.82	55.84	9.64	10.38	0.74
40	ANA0082	**2.51**	**4.20**	**1.69**	15.15	16.34	1.19	**302.40**	**478.24**	**175.84**	10.50	9.76	-0.74
41	GUN0476	1.59	1.13	-0.46	11.41	12.34	0.94	163.46	194.21	30.75	10.88	11.11	0.24
42	GUN0258	2.07	1.78	-0.29	11.44	12.06	0.62	**170.87**	**209.20**	**38.32**	10.70	11.29	0.59
43	GUN0125	**4.17**	**1.86**	**-2.31**	13.60	15.72	2.12	422.65	350.88	-71.77	9.11	10.24	1.13
44	DER0015	1.77	1.20	-0.56	12.18	12.72	0.55	168.56	197.15	28.59	10.42	10.56	0.13
45	CB1.0	4.46	3.26	-1.20	15.20	16.46	1.26	238.90	256.22	17.32	9.66	10.38	0.73
46	NPA0165	1.41	1.24	-0.16	10.97	12.21	1.24	**222.49**	**279.52**	**57.03**	10.51	10.76	0.25
47	PAT0285	1.55	1.31	-0.24	12.24	13.65	1.41	**229.75**	**277.85**	**48.10**	10.05	10.40	0.35
48	PAT0176	1.92	1.45	-0.47	12.49	13.65	1.16	264.96	313.38	48.42	9.99	10.11	0.12
49	JON0184	1.80	1.54	-0.26	11.55	13.37	1.82	**388.19**	**508.14**	**119.95**	10.68	11.08	0.40
50	GWN0115	**1.50**	**0.71**	**-0.80**	11.60	13.11	1.51	**328.02**	**618.57**	**290.54**	10.20	10.26	0.07
51	PXT0972	0.99	1.09	0.11	11.44	12.53	1.09	136.29	161.76	25.47	10.26	10.45	0.20
52	PXT0809	4.43	5.36	0.93	13.59	14.38	0.80	**148.42**	**184.88**	**36.46**	9.44	9.88	0.44
53	ET5.0	**0.78**	**1.75**	**0.98**	13.95	13.99	0.05	147.34	144.27	-3.07	8.78	9.05	0.27