



Chesapeake Bay Program
A Watershed Partnership

Final Milestone (2020-2021)

Land Use

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LUWG Call

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2019 Milestone Land Use

Updated Data

Population Estimates (from 2016 ed. to 2018 ed.)

Population Projections (VA, NY, DE, MWCOCG, and BMC)

Protected Lands (from 2016 ed. to 2018 ed.)

Sewer Service Areas (51 counties/cities)

MS4 Boundaries (VA only)

2017 Ag Census with new error rates

LUWG Majority Recommendation:

Update MS4s, Sewer Service Areas, 2025 Population Projections, and 2014 - 2017 Population Estimates

- **Adjust 2025 population projections for all counties using population estimates.**
- **Postpone any updates to the land use until the summer of 2021 in preparation for the 2021-23 Milestones**

Population Projection Adjustments:

County Average = -1.3% (min= -8.2%; max= +5.0%)

Counties with large populations growing slower than expected:

- **Spotsylvania, VA**
- **Indiana, PA**
- **Cambria, PA**

Counties with large populations growing faster than expected:

- **Alexandria, VA**
- **Arlington, VA**
- **Frederick, VA**

Final* Milestone Land Use Change (2013-2025, from CAST)

2017 WIPs (2013 - 2025)	Impervious	Pervious-Dev	Natural	Agriculture	Other
DC	201	(87)	(113)	-	0
DE	976	3,992	(850)	(3,182)	(936)
MD	10,547	19,895	(16,444)	(47,635)	33,637
NY	142	445	(155)	(37,941)	37,509
PA	14,932	35,875	(17,195)	(71,598)	37,985
VA	25,600	78,938	(62,255)	(35,457)	(6,827)
WV	2,979	3,394	(1,777)	(3,270)	(1,327)
Total	55,376	142,452	(98,789)	(199,082)	100,042

2019 Milestones (2013 - 2025)	Impervious	Pervious-Dev	Natural	Agriculture	Other
DC	242	(50)	(191)	-	(0)
DE	804	3,899	(6,186)	4,081	(2,599)
MD	14,002	27,197	323	(52,680)	11,157
NY	12,004	6,355	99,697	(138,054)	19,998
PA	15,480	33,798	33,951	(115,844)	32,615
VA	29,578	94,731	(85,351)	(30,219)	(8,739)
WV	4,594	951	(10,161)	8,496	(3,881)
Total	76,704	166,880	32,083	(324,219)	48,552

- revised as per LUWG and WQGIT review and suggestions
- from LoadSources_2013_2025_v3.xlsx

How Milestone Updates Affect 2025 Conditions (2025 Milestones vs 2025 WIPs):

Milestone Update Effects	Impervious	Pervious-Dev	Natural	Agriculture	Other
DC	55	51	(70)	-	(36)
DE	(446)	(603)	(8,231)	11,758	(2,478)
MD	1,363	1,320	8,687	7,930	(19,300)
NY	3,564	6,852	51,846	(44,944)	(17,318)
PA	8,753	(23,299)	(6,043)	13,299	7,290
VA	7,943	49,348	(13,710)	(45,457)	1,877
WV	5,534	(4,595)	(6,505)	6,312	(747)
Total	26,767	29,074	25,973	(51,102)	(30,712)

Milestones_v_WIPs	Septic_2025	Pop25_Septic	Pop25_Sewer
DC	-	-	-
DE	(2,132)	(2,003)	944
MD	(21,386)	(19,618)	(22,455)
NY	(363)	7,893	(42,554)
PA	(16,223)	(1,582)	7,587
VA	(28,520)	(25,037)	(7,114)
WV	2,398	5,461	(8,075)
Total	(66,258)	(34,952)	(71,602)

2019 Milestones: Updated Land Use Effects of Land Policy BMPs on 2025 Conditions

State-Custom Land Policy BMPs

CUST_v_CZ	Impervious	Pervious	Natural	Agriculture	OpenSpace
DC	-	-	-	-	-
DE	(851)	(3,922)	257	4,082	434
MD	(968)	(5,628)	4,280	2,123	192
NY	-	-	-	-	-
PA	(152)	64	630	(405)	(136)
VA	(5,270)	(11,743)	15,340	1,946	(273)
WV	(0)	(223)	(32)	228	28
Total	(7,242)	(21,452)	20,475	7,975	244

Growth Management Land Policy BMP

GM_v_CZ	Impervious	Pervious	Natural	Agriculture	OpenSpace
DC	(84)	(107)	191	-	-
DE	(15)	(258)	471	(346)	147
MD	(2,985)	(6,738)	5,650	3,645	428
NY	(3)	(13)	6	7	3
PA	(1,853)	(3,935)	3,257	2,782	(250)
VA	(8,463)	(16,856)	18,241	5,073	2,005
WV	(117)	(770)	639	213	35
Total	(13,521)	(28,676)	28,455	11,374	2,368

Forest Conservation Land Policy BMP

FC_v_CZ	Impervious	Pervious	Natural	Agriculture	OpenSpace
DC	(53)	(37)	90	-	-
DE	(119)	(402)	644	(248)	125
MD	(185)	876	3,313	(3,188)	(816)
NY	(3)	(11)	6	6	2
PA	(788)	441	3,788	(2,827)	(614)
VA	(4,328)	(6,696)	20,580	(9,518)	(37)
WV	(47)	(387)	179	232	23
Total	(5,524)	(6,215)	28,600	(15,544)	(1,317)

Agricultural Conservation Land Policy BMP

AC_v_CZ	Impervious	Pervious	Natural	Agriculture	OpenSpace
DC	(48)	(27)	74	-	-
DE	(255)	(1,639)	(570)	2,174	290
MD	(333)	(2,028)	(5,876)	7,398	839
NY	(3)	(16)	5	10	5
PA	(1,313)	(6,540)	(11,602)	17,618	1,837
VA	(6,039)	(22,121)	(6,635)	29,414	5,381
WV	(272)	(1,367)	(986)	2,280	345
Total	(8,263)	(33,737)	(25,589)	58,894	8,697

2019 Milestones: Updated Septic/Sewer Effects of Land Policy BMPs

State-Custom Land Policy BMPs

CUST_v_CZ	Septic_2025	Pop25_Septic	Pop25_Sewer
DC	-	-	-
DE	(385)	(1,402)	(4,625)
MD	(2,019)	(7,941)	7,899
NY	-	-	-
PA	426	1,669	(1,720)
VA	(2,726)	(10,814)	9,188
WV	(668)	(2,569)	2,569
Total	(5,372)	(21,057)	13,312

Growth Management Land Policy BMP

GM_v_CZ	Septic_2025	Pop25_Septic	Pop25_Sewer
DC	-	-	-
DE	(456)	(1,674)	1,015
MD	(8,660)	(30,256)	31,143
NY	(9)	(32)	0
PA	(16,046)	(58,476)	58,992
VA	(24,107)	(97,813)	105,774
WV	(1,445)	(5,559)	5,559
Total	(50,723)	(193,811)	202,484

Forest Conservation Land Policy BMP

FC_v_CZ	Septic_2025	Pop25_Septic	Pop25_Sewer
DC	-	-	-
DE	36	137	(1,720)
MD	154	646	(842)
NY	(9)	(29)	-
PA	1,011	3,945	(5,643)
VA	1,154	5,812	(4,966)
WV	(896)	(3,446)	3,446
Total	1,451	7,066	(9,725)

Agricultural Conservation Land Policy BMP

AC_v_CZ	Septic_2025	Pop25_Septic	Pop25_Sewer
DC	-	-	-
DE	(139)	(503)	(915)
MD	(1,096)	(4,301)	4,266
NY	(11)	(38)	-
PA	265	1,245	(2,921)
VA	(3,028)	(12,239)	14,965
WV	(882)	(3,387)	3,387
Total	(4,891)	(19,225)	18,781

How the 2017 Census of Agriculture Affects 2013 Baseline Conditions:

Ag Census Update Effects	Impervious	Pervious-Dev	Natural	Agriculture	Other
DC	14	14	8	-	(36)
DE	(275)	(510)	(2,895)	4,495	(815)
MD	(2,092)	(5,982)	(8,081)	12,975	3,180
NY	(8,298)	942	(48,006)	55,169	194
PA	8,205	(21,222)	(57,189)	57,545	12,660
VA	3,965	33,556	9,386	(50,695)	3,788
WV	3,920	(2,152)	1,879	(5,454)	1,808
Total	5,439	4,646	(104,898)	74,034	20,779

Note that incorporating the 2017 Census of Agriculture affected non-agricultural land uses.

This helps explain why the WIP land use should not be compared with the 2019 Milestone land use, the baselines are different.

How the 2017 Census of Agriculture Affects 2013 Baseline Conditions:

Phase 6 True-up Method: 39 land uses are “true-up” at the LRSEG scale to accommodate the Census of Agriculture

County-scale “true-up” example: Clearfield County, Pennsylvania

2012 Census		2013 Unconstrained	Available				2017 Census		2013 Unconstrained	Available			
Clearfield_PA	Acres	Error Rates	Acres	Proportion	Add Acres	Final_Acres	Clearfield_PA	Acres	Error Rates	Acres	Proportion	Add Acres	Final_Acres
IR_013	5,530	0.04	221	1%	728	6,258	IR_013	5,530	0.04	221	1%	444	5,975
INR_013	8,551	0.05	428	2%	1,406	9,957	INR_013	8,551	0.05	428	1%	859	9,409
TCI_013	2,769	0.05	138	1%	455	3,224	TCI_013	2,769	0.05	138	0%	278	3,047
TG_013	31,349	0.05	1,567	7%	5,156	36,504	TG_013	31,349	0.05	1,567	4%	3,148	34,496
TCT_013	11,671	0.05	584	3%	1,919	13,591	TCT_013	11,671	0.05	584	2%	1,172	12,843
FORE_013	484,104	0.02	9,682	43%	31,846	515,950	FORE_013	484,104	0.02	9,682	26%	19,444	503,549
WLO_013	20,741	0.05	1,037	5%	3,411	24,152	WLO_013	20,741	0.05	1,037	3%	2,083	22,824
WLF_013	11,389	0.05	569	3%	1,873	13,262	WLF_013	11,389	0.05	569	2%	1,144	12,533
WAT_013	10,784	0.01	108	0%	355	11,139	WAT_013	10,784	0.01	108	0%	217	11,001
MO_013	36,304	0.05	1,815	8%	5,970	42,274	MO_013	36,304	0.05	1,815	5%	3,645	39,949
AG_Census*	41,667	0.15	6,250	28%	20,557	62,224	AG_Census**	40,959	0.51	20,889	56%	41,951	82,910
Total	664,859		22,400	100%	73,676	738,536	Total	664,151		37,039	100%	74,384	738,536
County Acres	738,536						County Acres	738,536					
Mapped Surplus Ag Area	73,676						Mapped Surplus Ag Area	74,384					
Mapped Deficit Ag Area	-						Mapped Deficit Ag Area	-					

*Actual Ag Acres in 2017 CAST: 55,594

**Actual Ag Acres in 2019 CAST: 71,588

Estimated Change in 2013 Baseline Conditions:

Land Use	IR_013	INR_013	TCI_013	TG_013	TCT_013	FORE_013	WLO_013	WLF_013	WAT_013	MO_013	AG_Census
Change	(283)	(548)	(177)	(2,008)	(747)	(12,401)	(1,328)	(729)	(138)	(2,325)	20,686
Percent	-5%	-6%	-6%	-6%	-6%	-3%	-6%	-6%	-1%	-6%	51%

Table C. Summary of Coverage, Nonresponse, and Misclassification Adjustments by County. 2017 (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
LAND IN FARMS (ACRES) - Con.						
Counties - Con.						
Cambria	79,341	13,839	23.6	8.3	8.7	6.5
Cameron	5,278	1,669	43.9	25.7	8.8	9.4
Carbon	19,498	4,052	29.4	12.3	8.7	8.4
Centre	149,858	19,859	27.8	11.8	10.1	6.0
Chester	150,514	12,026	27.2	6.8	16.1	4.3
Clarion	100,344	9,918	28.0	13.7	7.2	7.0
Clearfield	60,957	15,488	31.6	8.1	17.2	6.3
Clinton	40,057	4,748	23.3	10.4	7.3	5.6
Columbia	106,748	11,235	19.7	6.5	9.0	4.2
Crawford	194,447	23,572	26.0	9.1	10.1	6.8

$$\frac{(2 * 5,290)}{69,250} = 0.15$$

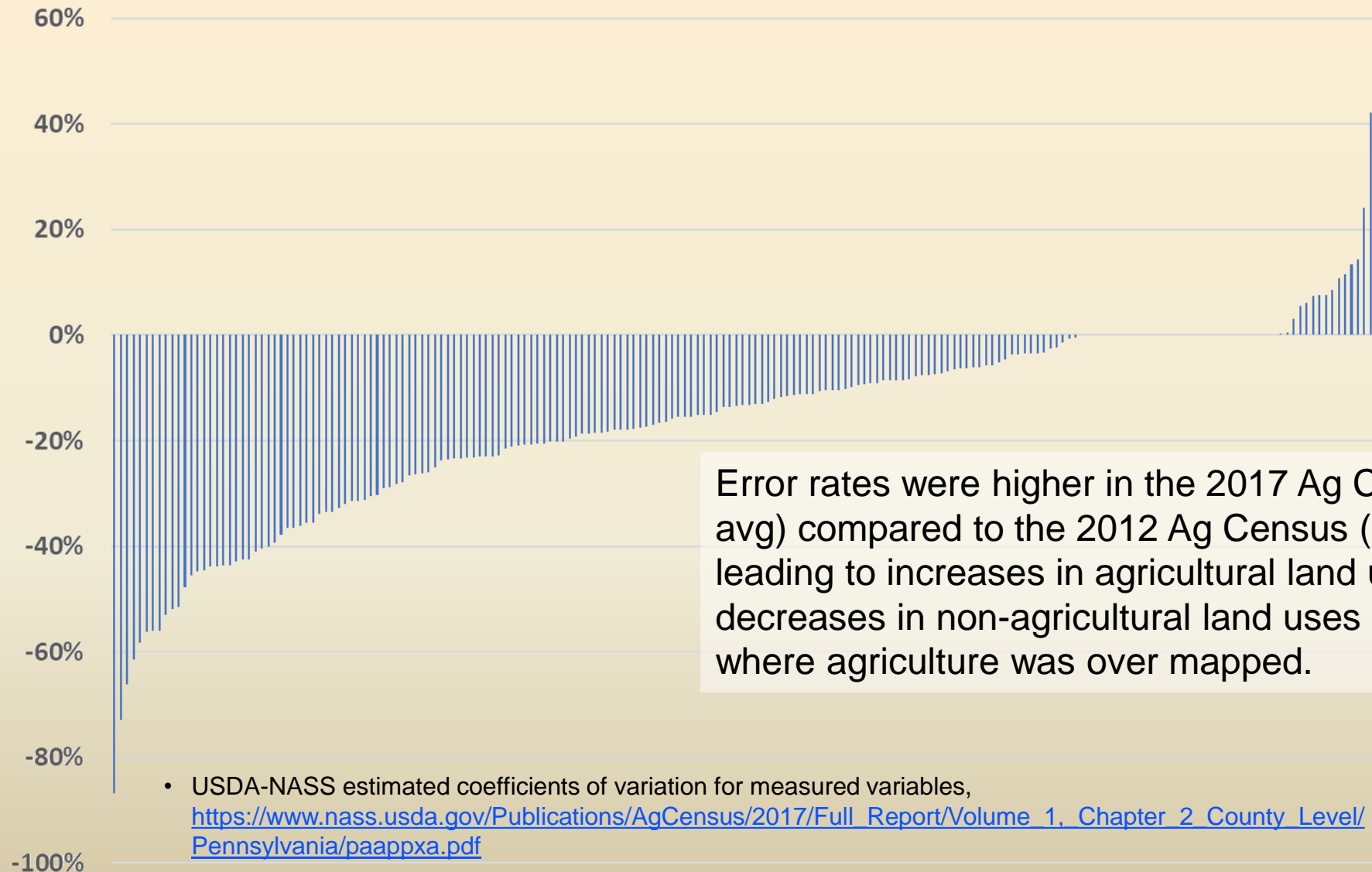
$$\frac{(2 * 15,488)}{60,957} = 0.51$$

Table C. Summary of Coverage, Nonresponse, and Misclassification Adjustments by County. 2012 (continued)

[For meaning of abbreviations and symbols, see introductory text.]

Geographic area	Total (number)	Standard error	Adjustment as percent of total	Percent of total adjustment from coverage	Percent of total adjustment from nonresponse	Percent of total adjustment from misclassification
LAND IN FARMS - Con.						
Counties - Con.						
Cambria	76,889	2,307	20.0	5.4	11.1	3.6
Cameron	6,215	553	49.7	13.7	24.9	11.1
Carbon	21,162	2,433	25.1	6.4	14.3	4.4
Centre	162,041	6,513	34.3	7.1	21.8	5.5
Chester	164,495	13,154	24.2	6.0	14.1	4.1
Clarion	115,076	6,312	27.7	8.0	14.9	4.7
Clearfield	69,250	5,290	35.4	11.6	17.0	6.8
Clinton	52,715	3,187	36.8	7.5	23.5	5.8
Columbia	122,743	9,343	23.7	7.1	12.4	4.1
Crawford	227,731	7,640	22.0	4.6	14.5	2.9

County-level differences in Ag Census Error Rates (2012 minus 2017)



Error rates were higher in the 2017 Ag Census (42% avg) compared to the 2012 Ag Census (26% avg) leading to increases in agricultural land uses and decreases in non-agricultural land uses in areas where agriculture was over mapped.

- USDA-NASS estimated coefficients of variation for measured variables, https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_2_County_Level/Pennsylvania/paappxa.pdf

Conclusions:

- WIP and Milestone land use are not directly comparable.
- 2017 Ag Census error rates are higher than those reported for 2012 and have affected the estimated acres for all land uses for the years 2013 – 2025, particularly in areas where agriculture was over mapped.

Recommendations:

- Investigate impact of 2017 Ag Census error rates on loads via CAST
- Contact NASS to determine if they have developed a translation factor between 2012 and 2017 error rates.
- Improve future versions of land use and retrospectively correct previous versions of the land use
 - include more ancillary data on mining, natural gas extraction, 2017 Common Land Units
 - improve QAQC of local land use and zoning data interpretation