Land Use Time Series Feedback

Review Period March 12th – March 27th, 2026

1 Feedback Summary

1.1 Errors

The term “errors” is used to describe problems in the data that are requested to be resolved before they are used in the Chesapeake Bay Program models. The two errors identified by reviewers that require a change to the land use time series, or back-cast, model are described below.

1.1.1 Solar

It was identified that the solar land uses (i.e. Solar Infrastructure and Solar Pervious) existed throughout the time series (1985-2022). This error is being corrected in the model by incorporating Energy Information Agency (EIA) data to represent the earliest year that utility-scale solar fields were implemented in each county. The existing methods will persist, which utilize the annual National Land Cover Database (NLCD) to map when each solar field was built. For the solar fields that NLCD does not map, the reported EIA data will be used to “cut-off” solar, meaning no solar acres will exist in any county prior to the reported year of utility-scale solar. The NLCD will be used to estimate how much of the solar area will be allocated to the other sectors (i.e. agriculture, natural, water, open space).

1.1.2 Cropland versus Pasture/Hay

While total agriculture trends are smooth, there are drastic flips between Cropland and Pasture/Hay in some jurisdictions (see example below). This issue is being resolved by interpolating % cropland and % pasture from two end points (1982 and 2013/14), dropping the intermediate years (1987, 1992, 1997, 2002, 2007). This will ensure smoother trends in Cropland and Pasture/Hay.

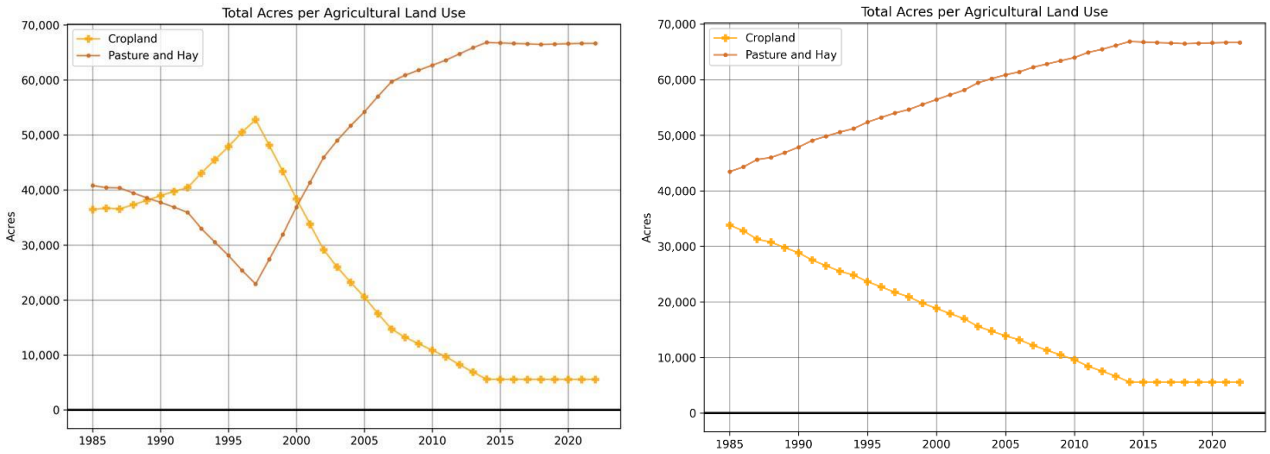

Figure 1 Cropland and Pasture/Hay acres over time. Left shows original trends provided for review. Right shows an example draft of the corrected trends.

1.2 Issues

The term “issues” is used to describe known limitations to the data that are not going to be corrected. One issue, or limitation, was raised that was not described as an error by other reviewers.

1.2.1 Infill, Redevelopment and Low-Density Development

The land use time series may underestimate development trends in some areas by not capturing infill, redevelopment, and low-density development. The land use data is most likely to capture these areas as development throughout the time series, not detecting them as a change. This is due to the categorical and spatial resolution of the NLCD.

1.3 Feedback

The term feedback is used to describe comments and observations of the data that are not necessarily critiques. Below is a very high-level summary of the feedback received. The detailed feedback is available in the “Detailed Feedback” table.

1.3.1 Trends

Overall, the feedback was positive. Noting that the Phase 7 trends are an improvement to Phase 6 trends and generally appear smoother.

1.3.2 Follow-Up Discussion

There is a request for this feedback to be discussed at LUWG office hours and raised to the Clean Water Goal Team.

1.3.3 Data Accessibility and Documentation

The Land-River Segment scale data was too large to open in Excel. Adding a FIPS column to the LRSEG database could make it more user-friendly. Documentation to accompany the data, particularly items that were described in the workplan, can improve the user experience and understanding of data limitations.

1.4 Questions

The term question is used to describe requests for information/explanations to aid in the review process. Below are the question(s) that were received from more than one reviewer. Questions from individual reviewers are answered in the “Response” column of the detailed feedback table.

1.4.1 Why is Phase 7 Natural Area Larger than Phase 6?

This is occurring in Tidal counties due to a data aggregation error. Phase 6 natural area excludes tidal area, where the Phase 7 natural area included it. This is only an issue for the plots displayed on the viewer, not in the source data.

2 DETAILED FEEDBACK

Category	Date	Reviewer(s)	Feedback	Response
Error	3/20/2026	Arianna Johns, VADEQ	In looking through the solar back cast I was wondering if there are plans to zero out the acreage that is coming up in times when it is known there were no utility scale solar fields? Thus far this is the thing I have found that seems to be a systemic issue. After talking to our Solar experts they told me that the earliest utility level solar was 2016. This matches well with what Bill and I have been able to find in the imagery from that time frame. “According to EIA, Virginia's first utility-scale solar farm came online in early 2016: United States - U.S. Energy Information Administration (EIA) There are downloads on this page: Preliminary Monthly Electric Generator Inventory (based on Form EIA-860M as a supplement to Form EIA-860) - U.S. Energy Information Administration (EIA)”	Thanks for the feedback and the links to the EIA data! I've been doing some digging and wanted to share my thoughts on how to address this. Assessing the Problem First, I compared the 1-meter, 2014 Land Use/Land Cover map for Accomack, VA (the county with the most mapped solar in 2013/14). I agree with you and Bill's findings, in that the mapped "solar" was in fact not solar. In the case of Accomack, it appears to be agriculture. Second, I touched base with some CBP folks to ensure any tweaks to the high-res period wouldn't conflict with any CBP decisions. From what I can tell, this shouldn't be an issue as the decisions are focused on process. That means it shouldn't be an issue to make edits to the data/land use area between 2013/14-2021/22. Third, I pulled the EIA data you shared (December 2025) and filtered to the Bay counties. I computed the minimum "Operating Year" per county and state and compared with the acres of mapped solar in the three high-res maps (2013/14, 2017/18, and 2021/22). It isn't a perfect comparison, as the high-res maps aren't limited to utility-scale solar fields. But it does highlight places where there is likely to be misclassification/over-mapping of solar fields. From these comparisons, I agree that there is a systematic over-mapping of solar fields back through time. There are two sources to this error.

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				The first is incorrect mapping of solar fields in 2013/14 in the high-res maps. This is due to the input solar layer used in the high-res model being derived from Sentinel-2 imagery, which didn't begin until 2017. The second is the annual NLCD missing or under-mapping impervious associated with solar back through time. <u>Proposed Solution</u> First, I will use the annual NLCD to assess the land cover within the solar footprint in each LRSEG each year. This gives me annual estimates of Developed, Natural, Agricultural, Open Space, and Water within the solar footprint in each LRSEG. From this I can compute what % of solar area should be assigned to each land use sector for each year. From the EIA table (example below), I can derive state (or county) year of first utility-scale solar field. For each year that contains solar area that is prior to this EIA reported year, I can proportionally move the solar area to the NLCD-detected sectors. This approach allows for: 1. Spatially-explicit flexibility as to which sector(s) the solar area should be assigned, preventing a hard-coded rule to transfer the solar area to specific land uses (i.e. variability by land use use sector and LRSEGs). 2. Jurisdiction-specific year of first utility-scale solar field.
Question	3/25/2026	Tom Butler, EPA	I am noticing a few counties where natural land use is a little higher in P7 vs P6. Not marking it as anything serious but wanted to get your thoughts?	Tidal was incorrectly included in the Natural area for Phase 7, which is excluded in Phase 6. This is an issue with how the data are being presented, but doesn't appear to be an issue with the data itself.

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Feedback	3/25/2026	Alisha Mulkey, MDA	MDA has coordinated our review with Dept. of Planning, and appreciates the opportunity to provide feedback. We note 1) the latest time series reflects smoother trends/changes for agricultural lands than our past discussions, and 2) Baltimore City now reflects appropriate acreage for reflecting our urban ag activities. Thank you for both of these. The one anomaly county we note is Calvert, MD (24009). The P6 to P7 mapped acreage change is more significant than expected. No suggested change, but we will continue to review internal data and circle back with any new insights. My suspicion is transition from row crop to hay systems with the latter being underestimated by CofA.	
Issue	3/26/2026	Samuel Cranfield, WVDEP Dave Montali, Tetratech	Dave and I looked at the Cropland, Pasture, and Hay P7 Total Acres graphs in the WV PDF reports. The trend for combined land uses seems accurate (e.g. substantial decreasing acreage in developed areas like Berkeley and Jefferson, but flat or slightly increasing/decreasing acreage in Pendleton and Hardy County). However, the individual land uses show patterns of drastic conversion of one to the other. In the 1990s, cropland showed an increasing trend followed by a sharp decline starting in 1997 that continues to the present. Pasture and Hay show the opposite pattern. These patterns can generally be seen across every county, and in neighboring counties of Maryland and Virginia.	

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			Otherwise, we do not need any additional review time.	
Error	3/26/2026	Bill Keeling, VADEQ	I have been digging into the cropland data in particular first comparing both p6 and p7 data for the time period 2013/2014 with the state produced HR LULC data used in p6. The VA data classified cropland with reasonably high accuracy based on the independent 3rd party evaluation. Based on that snapshot in time the p7 data appears to be in closer agreement with the state data than p6 was with either of the other datasets or as I see it an improvement. However, when comparing p6 and p7 over time I am seeing a pattern in the data that looks to be present in around 75% of the locality scale data. The below screenshot provides examples of this pattern. Where there is a relatively large delta between phases with p7 having more to significantly more acres in the early parts of the data then a peak around 1997 then a sharp decline to near the same levels sometime between 2007 and 2013. Attached is a list of FIPS codes where I am seeing at least a large delta between phases for the early part of the calibration data. I also remember NASS changed methodology in the 1997 Census that caused all sorts of issues with CBP interpretations across time. I have not review other states data because I am not as familiar with their counties and which are high cropland acreage counties or more urban like I can with VA. But suggest you do and see if this pattern is more than just an VA thing. Management says yes this is a hard stop for VA. This also seems to be affecting Hay/Past in p7 as well but in the inverse.	

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Feedback	3/26/2026	Tammie Veith, USDA	I looked through most counties in PA at super-speed and didn't see anything overly disturbing except Carbon County — I get that it has very little ag, but Phase 7 is showing it at 0 acres. Is this just because the ag portion is so low?	The viewer is focused on the portion of the county within the watershed which may help to explain why you are seeing the zero. Good catch though, there are some links that take you deeper but they are probably not as visible as they could be. Here is the one for Carbon county. I will make sure to articulate this to the web team so that in the future it is more visible.
Question	3/25/2026	Deb Sward, MDP	I am still working through my review, but wanted to flag a potential isolated error regarding Montgomery County, MD (24031) in the meantime. Phase 7 land use from 1985 through 2013 appears completely stable, which contradicts parcel data showing significant development during that period. Is the development shown on Page 7 of the PDF missing from the web application's data?	Looks like something weird happened with the tables. I re-ran that part of the code and updated the report. The updated data are available for review.
Feedback / Issue	3/27/2026	Deb Sward, MDP	County-level development patterns shown in Phase 7 generally align with MDP's internal land use and parcel records. I might expect to see a little more development in Anne Arundel, Calvert, Baltimore County, and possibly even Baltimore City in Phase 7 relative to Phase 6 from 1985-2013, but this is not a show-stopper from my perspective. As described in the validation, some of these areas experienced infill and intensified development that cannot be picked up as new development in the NLCD. Additionally, change may not have been detected in some low-density subdivisions where the NLCD still shows turf as agricultural land even after the subdivision was built. This is just an observation; MDP does not request any changes at this time.	

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Questions	3/27/2026	Deb Sward, MDP	Can CBP document the comparison between the aggregated NLCD and the high-resolution data referenced on page 5 of the June 2025 backcast workplan? This will help users understand where change may have been missed due to limitations in the source data. This can inform the development of future CBP modeling phases and assist state and local jurisdictions in using and interpreting this data for planning purposes that support the Bay Watershed Agreement. Would it be feasible to eventually include a county FIPS column in the final LRSEG database containing land use acres by year to facilitate data extraction and summary statistics by state and county? While not needed for this review period, it may help non-GIS users utilize the data in support of the Bay Watershed Agreement.	Yes – this information can be documented and made available. This information will be included in the relevant sections of the larger Phase 7 Model documentation. Great points. The final data will be published on ScienceBase and can absolutely be aggregated to scales that make the information useful for our partners.
Feedback	3/27/2026	Arianna Johns, VADEQ KC Filppino, HRPDC	I definitely think we are going to need a meeting to discuss this issue as well as any other issues that others are finding. I agree, at some point this information needs to be shared. I don't want it to slow things down but if there's a date that an office hours could be held that would be helpful. And I think this information should go to the Clean Water GT.	I completely agree. So far there are two issues that have been raised that I need to address. It's important that the feedback and how the data were updated is communicated. It's equally, if not more important, that the updated data addressing this feedback are also vetted for errors.
Feedback	3/31/2026	Lori Brown, DNREC	I reviewed the dashboard information and the reports and overall, I feel like things make sense when explain the reasons for the shifts between the phases. As I told you when we talked about the summary reports initially, I think where are useful and explain the reason for the differences in P6 and P7. I do feel like overall P7 is a more accurate representation of the land use history in our region. I think the pdf summary reports for the counties were good, but some of the figures	

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			were hard to see just because of the varying scales on our county and the general overlap of the data lines. So, I ended up pulling Delaware's information from the .csv file to quickly do some summarizing to look at the trends in the counties for the individual land uses. And goodness…I had a heck of a time with the backcast .csv file because it was too big to open in excel. I ended up pulling Delaware's data out and using a pivot chart to look at CBW Only data by county, since I didn't have the time, I wanted to focus…honestly it was a nice way to quickly view things for trends to see if stuff was logical. I did notice the solar data and thought that was strange, especially because it says there is a super small amount in Kent and then it just disappears in 2013. There are some in Kent now, but I don't think they were captured in the last LU dataset in the Chesapeake, so it does make sense and we will likely be seeing more in the next round of data. Sussex is where things first appeared, but the acres in the 80s, 90s, and 00s are not real, but it looks like there were only 15 to 17 acres – not tons in the Chesapeake scheme, but not real. We are primarily cropland vs pasture, so I guess that is good for us if things are wonky. I know it has been a challenge with the ag census. In the report pdf, I was surprised to see the census of ag reporting and increase in ag in New Castle County while what was mapped seemed more accurate based on the development trends…. Overall, I thought the trends made sense.	

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Question	3/30/2026	KC Filippino, HRPDC	I noticed that Hampton Roads has about 70,000 acres more in P7 than in P6, total. In VA, there are about 432,809 acres more in the P7 model compared to P6. Do you have an explanation for why we have more overall acres in P7? Also, I'm trying to dig into the different sectors and the LR segment data is too large, I can't download it all. Do you have a different way of accessing that data?	I accidentally included "Tidal" into the "Natural" sector for the plots on the viewer, which is adding area to Phase 7 that was excluded in Phase 6. A subset of the LRSEG data for the area of interest were provided.