**Land Use/Land Cover Data for Phase 7: 1950 – 2050**

For the Phase 7 model, consistent annual land use/land cover (LULC) data aggregated to National Hydrography Dataset catchments (1:100K) are essential for the years 1985 – 2035 and desired for the broader the period: 1950 – 2050. LULC represents a hybrid of land use and land cover information. The production of “land cover” data involves the direct classification of aerial imagery based on the spectral properties of the imagery and height information derived from LiDAR. Land cover represents the surface characteristics of the land with classes such as impervious cover, tree canopy, low vegetation, and barren. In contrast, “land use” represents how humans use the land with classes such as turf grass, cropland, and timber harvest. Land use information is critical for understanding the impact of human activities on the Chesapeake Bay because, for example, low vegetation can represent the highest polluting land use (e.g., corn) or one of the lowest (e.g., natural succession).

Important benchmark dates for the Phase 7 LULC data include:

1950: Beginning of agricultural intensification, broad use of chemical fertilizers, and suburban sprawl in the watershed;

1950 – 1985: Consideration of time lag effects requires a longer historical monitoring period

1985: Starting point for assessing progress;

1985 – 2024: Watershed Model calibration period;

1991 – 2000: Hydrologic Averaging period for Bay TMDL;

1993 – 1995: Critical period for Bay TMDL;

2010: Base year for establishing planning targets;

2025: Final year for Phase III WIP implementation;

2035: Climate change assessment target year;

2050: Furthest outyear for state population projections and water resource and infrastructure project planning.

Available data and techniques used to estimate and/or map annual LULC from 1950 to 2050 include the following:

1950 – 1973: Only sample data exist, e.g., USDA-NASS Census of Agriculture, US Census Bureau Decennial Census of Population and Housing, USDA-USFS Forest Inventory & Assessment, USDA-NRCS National Resources Inventory;

1974: USGS GIRAS land use data (1:100K derived from aerial imagery);

1975 – 1984: Sample data (same as first bullet);

1985 – 2019: Landsat-satellite derived land use/land cover datasets (30m resolution), e.g., USGS Land Change, Monitoring, Assessment, and Projection (annual, 9-class), USDA Cropland Data Layer (annual, 2008 – 2021), USGS National Land Cover Dataset (every 3-4 years from 2001 - 2019,16-class);

2013 – 2021: High-resolution land use/land cover (1m resolution, 2013/14, 2017/18, 2021/22, 62-class);

2023 – 2050: CBLCM forecasted land use (5-year increments, 30m resolution, 3-10 classes).

The above data will be leveraged to estimate LULC conditions by NHD catchment over the 1950 – 2050 period. The 1-meter resolution land use data will serve as the baseline for backcasting land use conditions from 2013/14 to 1950 and forecasting them from 2021/22 to 2050. The high-resolution LULC data include 62 different classes which can be directly aggregated to NHD catchments due to their very-high resolution. Starting with the 2013/14 high-resolution LULC data, change in general LULC conditions (e.g., development, forest, open space, and agriculture) back to 1985 will be estimated at the tax parcel scale using Landsat-derived LULC data developed by the U.S. Geological Survey’s Land Change Monitoring, Assessment, and Projection (LCMAP) program in combination with the National Land Cover Database. The GIRAS data will be used to backcast parcel land use conditions from 1985 to 1974. Over this period, estimates of cropland and pasture will be mathematically reconciled with data from the Census of Agriculture, National Resources Inventory, and the Decennial Census of Population and Housing. These sampled data will also be used to estimate proportional changes in cropland, and pasture from 1973 to 1950 at the county level and proportional changes in housing at the Census Block Group level. Because the Decennial Census provides estimates of housing built over the past decade at the Block Group level, it will be relied on to guide the spatial deconstruction of development over the From the 1950’s through the early 1980’s. Pre-developed land use will be estimated as either agriculture or forest based on local conditions (e.g., neighboring forests vs farmland) guided by the degree of county-level agricultural expansion or contraction indicated by the Census of Agriculture. Generally, agriculture was more extensive but less intensive in 1950 compared to present while human populations were still mostly concentrated in towns and cities where public transportation and services were available (the first mass-produced suburban subdivision, Levittown, was constructed in the early 1950’s).

The USGS’s Chesapeake Bay Land Change Model (CBLCM) will be used to forecast future land use conditions from 2021/22 to 2050. The CBLCM is an open-source, stochastic land-use change model designed to forecast future land-use change under various future land-use policy and conservation scenarios. The model can accommodate fine-scale local data such as county land use and zoning information coupled with housing and employment data at the Census Block scale. The model is driven by future county-level projections of population and employment produced by states and regional governments and simulates future scenarios which reflect the assumed-successful implementation of various combinations of land use policies and conservation actions, such as protection of large priority forest and agricultural lands or restrictions on development and development densities. Since 2018, the CBLCM has been used by the CBP Partners to forecast future land use conditions for use in Chesapeake Assessment and Scenario Tool (CAST). The simulation of future land use conditions enables the CBP Partners to consistently account for growth in loads due to changing land use conditions coupled with changes in climate.