“Accounting for Growth”
In the Bay TMDL

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January 26, 2018

Pennsylvania Phase 3 Watershed Implementation Plan
Steering Committee Meeting
Chesapeake Bay Watershed Population Trends

2010 population = 17.4 million
2025 population = 19.4 million (11.5% increase)
Accounting for Growth Equitability Across Jurisdictions

1. Watershed population is increasing by over 1 million persons/decade

2. Chesapeake Bay Land Change Model (CBLCM) is a peer reviewed and CBP approved model for estimating the land use and wastewater impacts of future population and employment growth in the watershed.

3. CBP Partnership has agreed to a set of future land use scenarios reflecting a range of planning and conservation actions.

4. Development of the Phase III WIPs on 2025 land use conditions will enable the consideration of planning and conservation actions to “account for growth” in the TMDL.
Crediting Conservation in the TMDL

- Jurisdictions will use the “Chesapeake Assessment Scenario Tool (CAST)” to develop their Phase III Watershed Implementation Plans against simulated 2025 baseline conditions (https://cast.chesapeakebay.net/).

- Alternative future land use scenarios will be added to CAST to represent the collective effects of different planning and conservation actions.

- Users of CAST will be able to consider planning and conservation actions as BMPs:
  - Select an alternative future land use scenario corresponding to the anticipated effects of planning and conservation actions implemented from 2018-2025.
  - Understand the effects of these actions on county-level nitrogen, phosphorus, and sediment pollution.
  - Select a variety of engineered BMPs to further reduce pollution to meet their reduction targets.
The Chesapeake Bay Land Change Model (CBLCM)
What’s under the hood?
Partnership’s Chesapeake Bay Land Change Model

Chesapeake Bay Land Change Model v3a

County Population Projections → Total Housing Demand → County Employment Projections

Historic Infill Patterns → Potential Infill Development → Historic Development Patterns

Greenfield Housing Demand
- Unprotected and Developable?
  - Residential Probability
  - Road Gravity
  - Housing Density
  → Residential Development

Greenfield Employment Demand
- Unprotected and Developable?
  - Commercial Probability
  - Road Gravity
  - Job Density
  → Commercial Development

2013 High-res Developed Land Use

Future Land Cover

Summary Unit (Land-River Modeling Segments)

Future Development Statistics

Iterative & Stochastic

- Commercial
- Residential
- Mixed Use
Assessing Uncertainty at Local Scales
Assessing Uncertainty at Local Scales

Every county is simulated 101 times for each scenario and target year, i.e., 2025.

Average of simulations by land-river segment = amount of development
Relative Standard Deviation = estimate of uncertainty
Land Change Model Outputs

- Impervious surface and turf grass expansion
- Forest conversion to development
- Farmland conversion to development
- Future population on sewer and septic

Rural Residential
57 acres
227 households on sewer
0.25 acre lots
- 27.8% Impervious
- 72.2% Turf grass
20-acres farmland loss
37-acres forest loss
Residential Infill/Redevelopment Rates
Probability of Residential Development

- Proximity to Urban Areas (closer the better)
- Proximity to Areas served by Sewer (closer the better)
- Proximity to Residential Growth Hot Spots (closer the better)
- Proximity to Regional Employment Centers (further the better)
- Proximity to Amenities (lakes, large rivers, and parks) (further the better)
- Forest vs Farms (bias towards development on farmland)
Probability of Commercial Development

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Year 2025 Land Use

Reported County-level Construction Acres

Extrapolated Census of Agriculture

True-Up Process

Phase 6 2025 Land Use Dataset
Future Growth Scenarios

**Purpose:**
To help jurisdictions account for the effects of land use planning and conservation actions on reducing future growth in pollutant loads in their Phase III WIPs and two-year milestones.

**Baseline Scenario: “Historic Trends”**
Continuation of historic development patterns and constraints as existed over the 2000’s. Includes the best available regional and local data representing current conditions.
Alternative Future Scenario Narratives

**Current Zoning:**
Same as Historic Trends with the addition of local zoning, increased infill rates (MD counties), and expanded sewer service areas (Jefferson and Berkeley Counties, WV) to reflect current constraints on new development and reported rates of growth on septic. While this scenario represents a desired future condition, it is the scenario adopted by the Chesapeake Bay Program Partners to serve as the baseline for accounting for growth under the TMDL.

**Forest Conservation:**
Same as Historic Trends but with organizations and governments proactively pursuing a variety of actions to conserve forests and wetlands which provide the greatest benefits to society including nutrient uptake, bank stabilization, stream temperature moderation, flood hazard avoidance and minimization, and wildlife habitat. Examples priority areas include high-priority conservation areas, riparian zones, shorelines, large contiguous forest tracts, and lands adjacent to protected areas.
Alternative Future Scenario Narratives

**Growth Management:**
Same as Historic Trends but with organizations and governments proactively pursuing a variety of actions to encourage growth in areas with supporting infrastructure. Example priority areas include undeveloped or under-developed areas with adequate existing roads, sewer, water, and internet.

**Agriculture and Soil Conservation:**
Same as Historic Trends but with organizations and governments proactively pursuing a variety of actions to conserve farmland and productive soils. Example priority areas include agricultural districts, prime farmland, farmland of state importance, and floodplains.
Current Zoning Scenario

• Local zoning data where provided to designate areas as residential, commercial, mixed use, and no growth.

• Expansion of sewer service areas in Berkeley and Jefferson Counties, West Virginia to account for anticipated future connections.

• Increased infill/redevelopment levels in the greater Washington D.C. Metropolitan Area and throughout Maryland to coincide with local data on anticipated development locations and septic development rates.

Collected by CBP from local and state agencies, 2013 - 2017
1. **Forest Conservation (FC) scenario (1st Priority)**
   - Conserve riparian zones (100-ft)
   - Conserve wetlands (NWI, State Designated Wetlands, and Potential Conserving Wetlands( PA only))
   - Conserve areas subject to a 1m-rise in sea levels by 2100 and within 1-mile of National Wildlife Refuges
   - Conserve large forest tracts (250+ acres)
   - Conserve shoreline forests (all contiguous tracts within 1000-ft of the shoreline)
   - Conserve all high-value conservation lands identified by the Chesapeake Conservation Partnership

2. **Growth Management (GM) scenario (2nd Priority)**
   - Increase percent of infill/redevelopment by 10% for 2025 and per decade thereafter
   - Increase urban densities by 10% for 2025 and per decade thereafter
   - Increase proportion of urban vs rural growth by 10% for 2025 and per decade thereafter
   - Expand sewer service areas by 1-mile for 2025 and hold static thereafter
   - Avoid growth on soils unsuitable for septic systems

3. **Agriculture and Soil Conservation (ASC) scenario (3rd Priority)**
   - Conserve all designated Agricultural Districts and areas zoned rural agricultural
   - Conserve 100-year floodplain and frequently-flooded soils
   - Conserve prime farmlands and farmland of state importance
   - Conserve potential restorable wetlands (PA only)
Impact of Forest Conservation and Current Zoning on Land Availability
Impact of Forest Conservation and Current Zoning on Land Availability
Next Steps to Credit Planning & Conservation Practices

• Finish developing the alternative future scenarios and one custom scenario per jurisdiction by April 2018.

• Establish expectations for documenting conservation and planning actions in the Phase III WIPs.

• Establish standards to verify the effects of conservation and planning actions, e.g., monitor with moderate resolution imagery every 2 years and with high-resolution imagery every 4 years.

• Develop CBP Partnership consensus on assumptions about pre-development conditions and post-development practices.
Estimated Percent Increase in Nitrogen Delivered to Bay from PA Streams within the Chesapeake Bay Watershed from by 2025 when compared to 2016*

Total N Loads by Sector 2016

- Total: 0.1%
- Developed: 5.5%
- Septic: 13.9%
- Agriculture: -2.0%
- Natural: -0.3%

2016* loads may change due to BMP implementation reported by PA DEP.

Wastewater loads for 2025 set to equal 2016. This assumption may change based upon recommendations from the CBP’s Wastewater Workgroup.
Estimated Percent Increase in Nitrogen Delivered to Bay from **Lancaster Streams** within the Chesapeake Bay Watershed from by 2025 when compared to 2016*

<table>
<thead>
<tr>
<th>Sector</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0.7%</td>
</tr>
<tr>
<td>Developed</td>
<td>5.7%</td>
</tr>
<tr>
<td>Septic</td>
<td>22.9%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>-0.6%</td>
</tr>
<tr>
<td>Natural</td>
<td>-0.7%</td>
</tr>
</tbody>
</table>

2016* loads may change due to BMP implementation reported by PA DEP.

Wastewater loads for 2025 set to equal 2016. This assumption may change based upon recommendations from the CBP’s Wastewater Workgroup.
Estimated Percent Increase in Nitrogen Delivered to Bay from York Streams within the Chesapeake Bay Watershed from 2016 when compared to 2025*

Total N Loads by Sector 2016:
- Total: -0.3%
- Developed: 5.6%
- Septic: 16.4%
- Agriculture: -4.2%
- Natural: -0.8%

2016* loads may change due to BMP implementation reported by PA DEP.

Wastewater loads for 2025 set to equal 2016. This assumption may change based upon recommendations from the CBP’s Wastewater Workgroup.
Estimated Percent Increase in Nitrogen Delivered to Bay from Centre Streams within the Chesapeake Bay Watershed from by 2025 when compared to 2016*

- **Total N Loads by Sector 2016**
  - Total: 0.0%
  - Developed: 8.5%
  - Septic: 24.0%
  - Agriculture: -4.5%
  - Natural: -0.3%

2016* loads may change due to BMP implementation reported by PA DEP.

Wastewater loads for 2025 set to equal 2016. This assumption may change based upon recommendations from the CBP’s Wastewater Workgroup.
For Agriculture

-2.1% N to streams
-0.4% P to streams

- Slight decrease in acres; increase in “intensity”
- Big increases in poultry and swine populations
- Decrease in dairy
- Increases in manure N and P
- Decreases in fertilizer N and P due to increases in available manure
### Comparison of Per Acre AVERAGE Nitrogen Delivery to Local Streams within PA's Chesapeake Bay Watershed in 2016*

<table>
<thead>
<tr>
<th>Land Use Group</th>
<th>Pounds of TN per Acre Delivered to Streams</th>
<th>Percent Increase in Load over Forest</th>
<th>Forest Equivalent Acres**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>1.8</td>
<td>NA</td>
<td>1.0</td>
</tr>
<tr>
<td>Open Space</td>
<td>2.8</td>
<td>51%</td>
<td>1.5</td>
</tr>
<tr>
<td>Hay</td>
<td>8.3</td>
<td>350%</td>
<td>4.5</td>
</tr>
<tr>
<td>Tree Canopy over Pervious</td>
<td>10.0</td>
<td>441%</td>
<td>5.4</td>
</tr>
<tr>
<td>Pasture</td>
<td>11.2</td>
<td>507%</td>
<td>6.1</td>
</tr>
<tr>
<td>Pervious</td>
<td>12.7</td>
<td>587%</td>
<td>6.9</td>
</tr>
<tr>
<td>Tree Canopy over Impervious</td>
<td>20.9</td>
<td>1032%</td>
<td>11.3</td>
</tr>
<tr>
<td>Impervious</td>
<td>21.2</td>
<td>1046%</td>
<td>11.5</td>
</tr>
<tr>
<td>Crop</td>
<td>30.5</td>
<td>1552%</td>
<td>16.5</td>
</tr>
</tbody>
</table>

*Average per acre loads from 2016 will change based upon updated implementation information provided by PA DEP.

**The acres of forest needed to equal the same load from a single acre of this land use group.