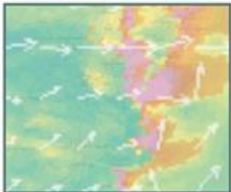


Data and Model Inputs

Pollution Control Data
Land Use Data
Point Sources Data
Septic Data
U.S. Census Data
Agricultural Data



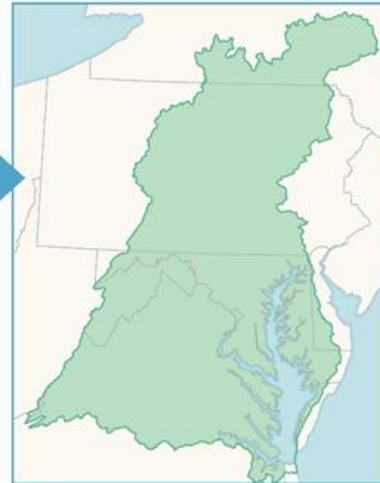
Land Use
Change
Model



Airshed
Model

Precipitation Data
Meteorological Data
Elevation Data
Soil Data

Phase 6 Watershed Model/CAST

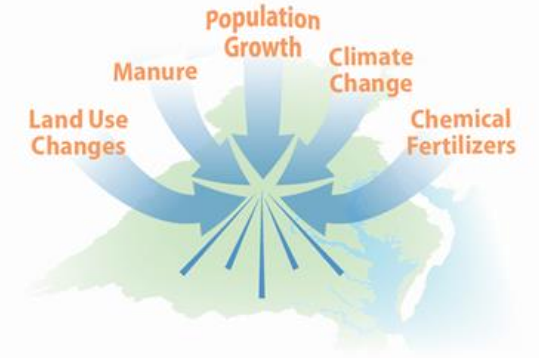


Estuary Model

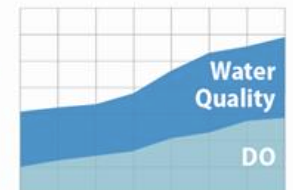
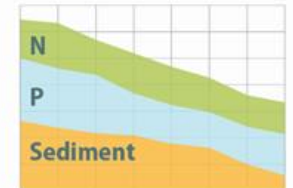


Model Outputs

Prediction of Impacts



BMP Implementation Results



Model Updates

Water Quality Goal Implementation Team

October 25 – 26, 2021

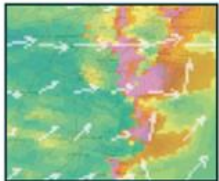
Olivia Devereux

Data and Model Inputs

Pollution Control Data
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Point Sources Data
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Land Use
Change
Model



Airshed
Model

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Phase 6 Watershed Model/CAST



Estuary Model

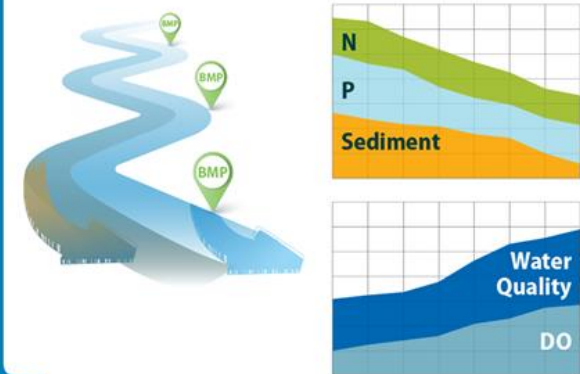


Model Outputs

Prediction of Impacts



BMP Implementation Results

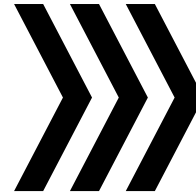


Model Uses

Dynamic Watershed Model

Incorporates the following in the calibration process and produces the data used in CAST

- Assess lag times in UNEC, and Modflow
- Determines river delivery factors
- Supplies average hydrology (storm/baseflow inches per year)
- Provides hourly input the Estuarine model



Data Analyses used in CAST

- Phase 5.3.2 for average loads and nitrogen sensitivity
- USGS Sparrow regression model for average loads, nitrogen sensitivity, land to water and stream delivery factors
- USDA CEAP/APEX Chesapeake model for average loads and nitrogen sensitivity
- APLE for phosphorus sensitivity
- RUSLE (equation, not software product) for sediment edge of field loads



The screenshot shows the homepage of the Chesapeake Assessment Scenario Tool (CAST). The URL is <https://cast.chesapeakebay.net>. The page features a navigation bar with links: HOME, PUBLIC REPORTS, LEARNING, ABOUT, and CONTACT US. A prominent banner at the top asks "New to CAST?" and encourages users to "Rapidly develop scenarios for reducing nitrogen, phosphorus, and sediment with varying best management practices to streamline environmental planning. Register for increased functionality and to stay updated." Below the banner, there are two buttons: "Register" and "Where To Start". The main content area is titled "RESOURCES" and contains six cards, each with a title, a brief description, and a "Learn More" button. The cards are: "DEVELOP A PLAN" (Get answers to your questions about how to use CAST to develop a plan.), "SOURCE DATA" (Download data tables including information on load sources and agencies, BMPs, animals, geographic references and delivery factors.), "BMPS" (View information on best management practices (BMPs) including calculations, a quick reference guide, and protocol and expert panel reports.), "MAP TOOLS & SPATIAL DATA" (View geographical information and shapefiles.), "COSTS" (Download BMP costs data and view cost profiles for each state and Chesapeake Bay Watershed.), and "TRACK PROGRESS" (View helpful information on verification, river trends, how to submit progress data via NEIEN, and modeling Federal facilities.). The footer of the page indicates "Chesapeake Bay Program Office" and "Software Release: 6.10.1".

- CAST is the model used for assessing impacts of BMPs
- CAST incorporates data from the time-variable, Dynamic Watershed Model

Comparing CAST and the Dynamic Watershed Model

CAST

- Online, publicly accessible
- Hydrology is the 10-year average
- Uses the data from the calibration
- No change to hydrology and delivery factors
- Informed by the Airshed and Land Use Change Models
- Use the same septic, human and animal population and crop datasets
- Predict nitrogen, phosphorus, and sediment loads based on changes to inputs
- Includes the official management scenarios

DYNAMIC WATERSHED MODEL

- Available to CBPO modelers
- Hydrology is time variable
- Calibration determines river delivery factors
- Feeds the Estuarine Model

Why conduct updates to CAST and the Dynamic Watershed Model?

Incorporate improved data and methods

Data

- High resolution land use, includes human population, sewer service and septic area changes
- New years of monitoring data for the hydrology
- New agricultural census and other crop and animal population and yield data
- New or revised BMPs, including in the critical period
- Updated BMP history, including in the critical period
- New animal data including weights and manure nutrients

Methods

- Calibration targets for loading rate on land uses
- Nutrient distribution to land uses
- Different categories of land use
- Other physical processes

CAST Update Versus Phase Update

CAST UPDATE POSSIBILITIES

- Static planning targets
- Incorporating spatially explicit data into CAST for planning
- Upgrades to the interface
- Improving climate change—possible to adjust planning targets as was done with those planning targets (pushed down a bit, per 2020 decision)
- Incorporation of co-benefits/eco-system services
- Nutrient species in CAST, but not in delivery factors
- No additional years of hydrology beyond 2012
- As changes are made to the critical period or earlier, the adjustment factor will be used
 - Critical period is 1993 - 1995

PHASE UPDATE POSSIBILITIES

- Change in planning targets
- New delivery factors, including nutrient speciation
- New segmentation (finer scale)
- New data for Estuary Model
- Uncertainty quantification

Adjustment
Factor:
Maintains
consistency
with the critical
period and
planning targets

For the 1995 progress scenario, calculate: CAST-17d minus CAST-21
Consider,

CAST-17d for a load source, agency, Irseg = 180

CAST-21 (pre-adjustment) for a load source, agency, Irseg = 100
 $180 - 100 = 80$

Add 80 from the CAST-21 load source, agency, Irseg at EOS for every scenario 1996 forward

This does not apply to WW, CSO, stream or shoreline load sources





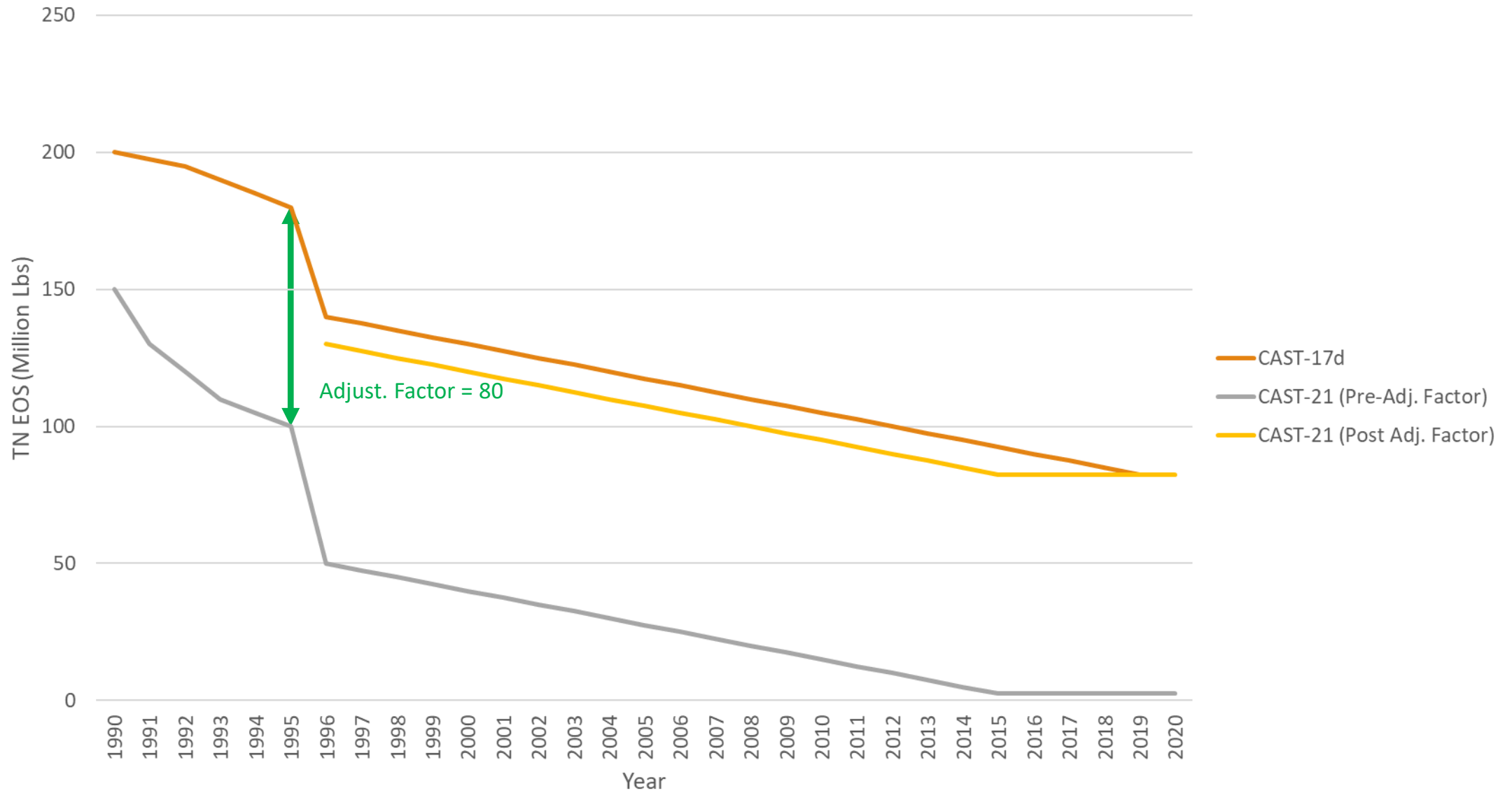
Impacts

BMPs submitted, including in the TMDL critical period, are updated

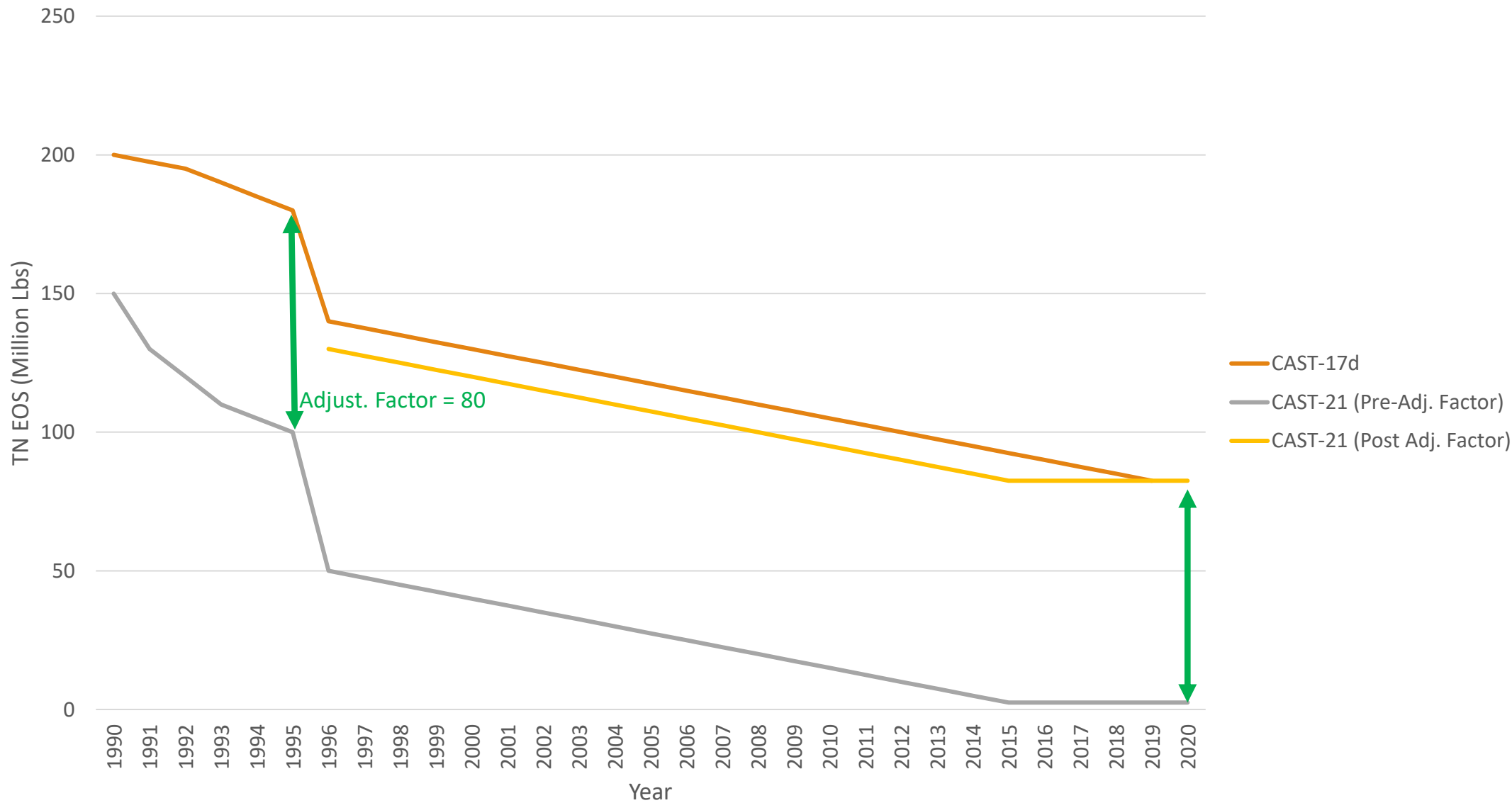
Impacts multiple estimates

- BMPs credited through the 2017 land use (except for forest buffers, tree and forest planting, which are 2002)
- Amount of nutrients applied to meet crop needs
- Historic manure transport of total phosphorus through 2016

Adjustment Factor for Hypothetical Segment, Load Source, and Agency



Adjustment Factor for Hypothetical Segment, Load Source, and Agency



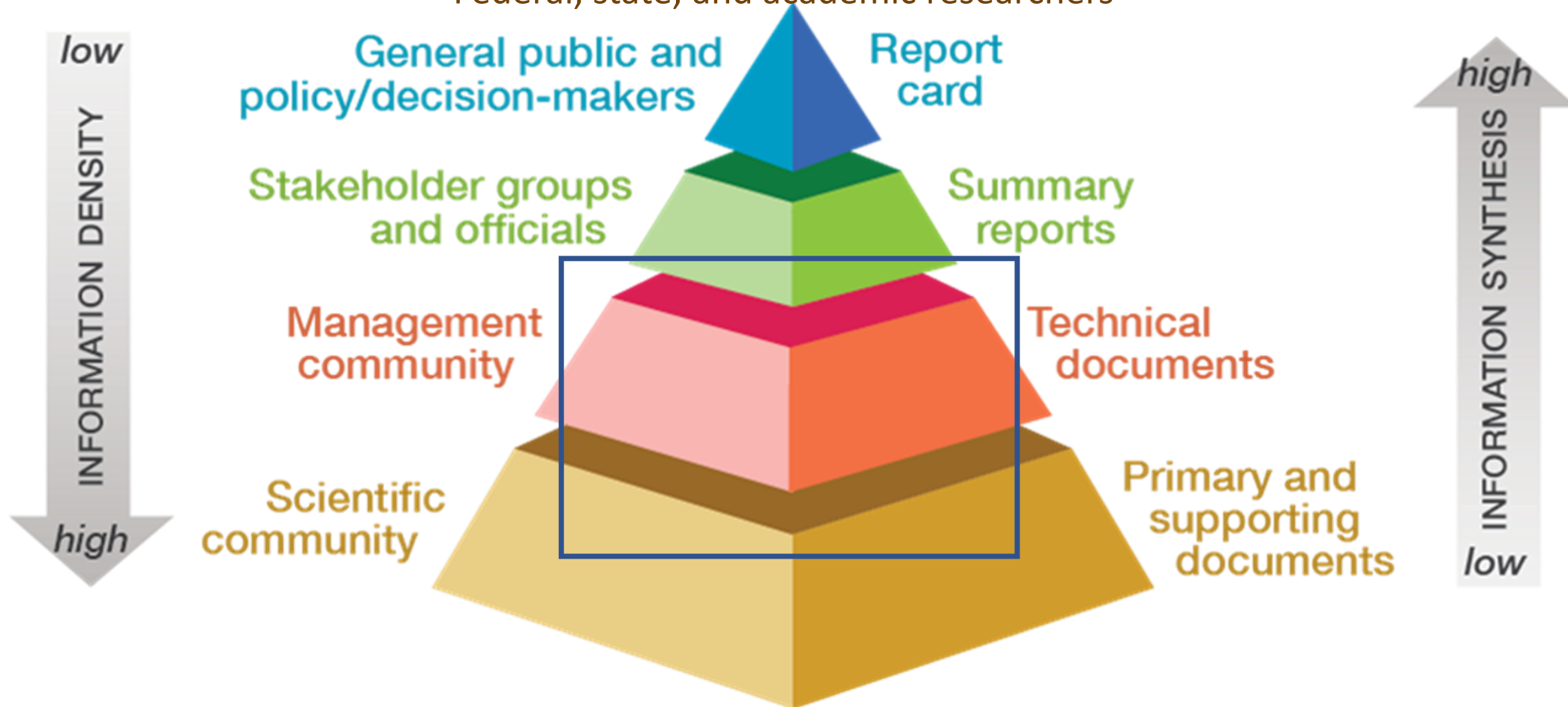
Who is CAST for?

Technical managers within jurisdiction agencies who plan and report for the 2010 Bay TMDL

Local watershed organizations

Local government planners

Federal, state, and academic researchers



Potential Areas of Focus	Recommendations	Impacts Estuarine Model	Impacts CAST	Level of effort	Benefits
Transparency in NEIEN/CAST Progress data	WQGIT		✓	High	Local governments and jurisdictions could better understand where to target for verification and improve CBP transparency
Finer-scale modeling	WQGIT, other GITs, STAC	✓	✓	High	Greater accuracy watershed modeling; Enables fine scale targeting of practices; Needed for some co-benefits
Spatially-explicit CAST	Non-CB TMDL partners		✓	Medium	Enables location specific information for BMPs and CAST output on a user-defined scale
Physical process simulation	STAC, WQGIT other GITs, CBPO	✓	✓	Low-High	Greater watershed model accuracy overall
Nutrient application calculation	CBPO		✓	Medium-High	Increases transparency of CAST scenarios; Reduces unintended consequences of model and data changes
Land use change 1985-2035	CBPO, WQGIT	✓	✓	High	Greater accuracy of land use changes through time. Allows direct use of fine-scale land use data in CAST
Improve climate change modeling	PSC, WQGIT	✓	✓	Low	Directly addresses PSC priorities; improves confidence in 2025 climate decision.
Uncertainty quantification	WQGIT, STAC			Medium	Helps prioritize model updates; Incorporates trends in monitored data
Co-benefits and ecosystem services	WQGIT, other GITs, STAC		✓	Low-High	Helps partners develop comprehensive plans that benefit local citizens.
WQ standards assessment	WQGIT, STAC			Low-Medium	Potential to assess all tidal oxygen standards and to delist segments



Questions?

