Scenario Optimization Tool for CAST
(the time-averaged Phase 6 watershed model)

A brief update in 3 parts

7 January 2020 – Modeling Workgroup Quarterly Meeting
Danny Kaufman and the CBPO Modeling Team

Project Goal: *Investigate, develop, test, and implement an optimization system for the Chesapeake Assessment Scenario Tool (CAST) that will facilitate identification of more cost-effective and otherwise optimal approaches to pollutant load reduction for non-federal CBP partners.*

Work continuing for next 6 years

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Straw version

Evaluation of a "straw" version prototype (formulated for a single land-river segment)

Tool Updates and Prototyping
- Efficiency BMP online tool is updated with new features for **Beta-2**
- Non-efficiency BMPs are researched and strategy for including them in optimization is developed.

Optimization application for Climate Change targets

Optimization tool with non-efficiency BMPs begins to be used for climate change target planning
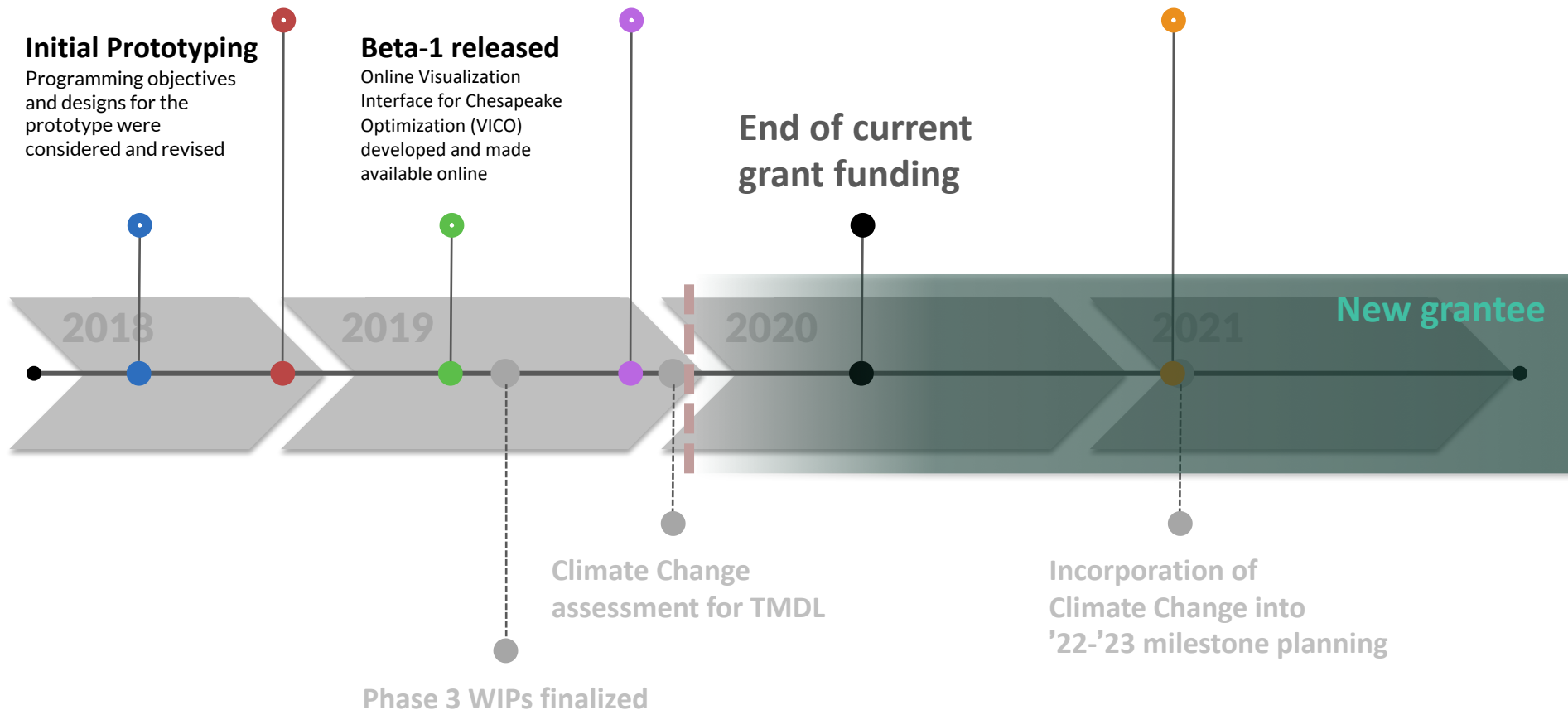
Initial Prototyping

Programming objectives and designs for the prototype were considered and revised

Beta-1 released

Online Visualization Interface for Chesapeake Optimization (VICO) developed and made available online
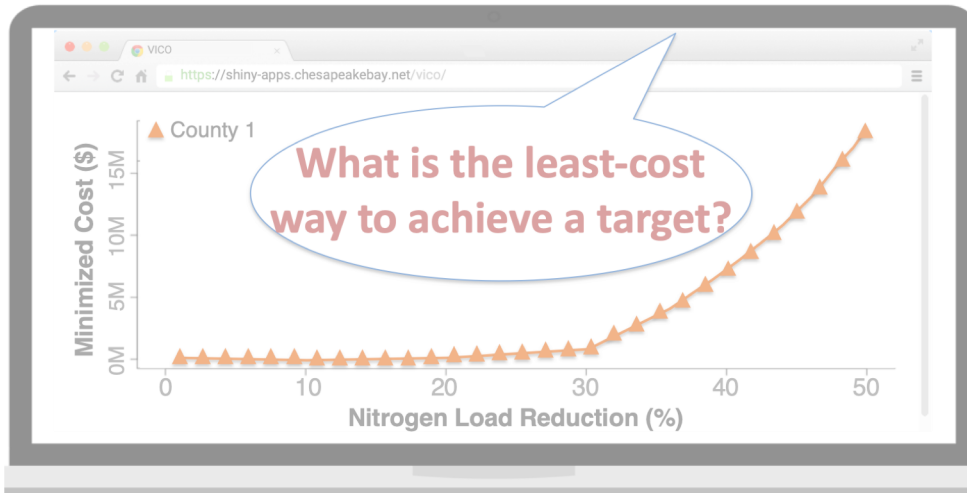
End of current grant funding

New grantee

2018   2019   2020   2021

Climate Change assessment for TMDL

Incorporation of Climate Change into '22-'23 milestone planning

Phase 3 WIPs finalized

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VICO (Visualization Interface for Chesapeake Optimization)

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October 8th – 2nd Beta release
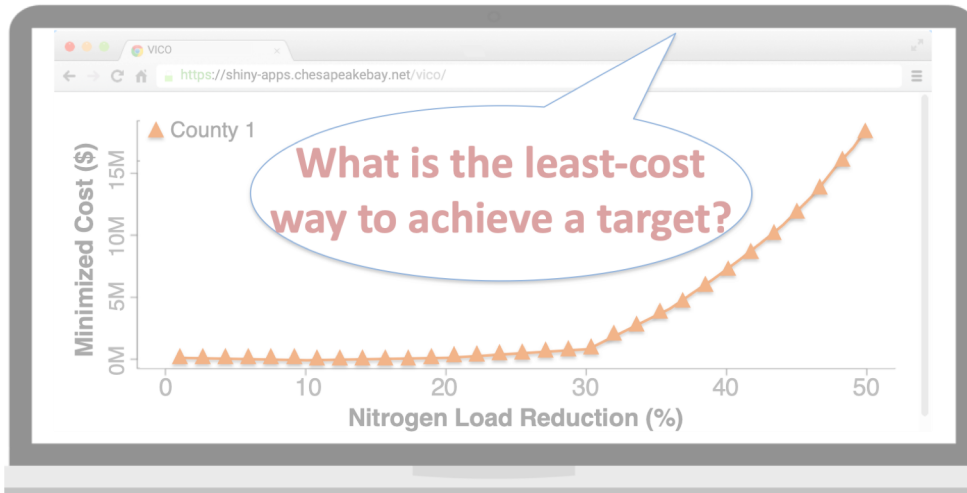
https://shiny-apps.chesapeakebay.net/vico/

2) Online tool
VICO (Visualization Interface for Chesapeake Optimization)

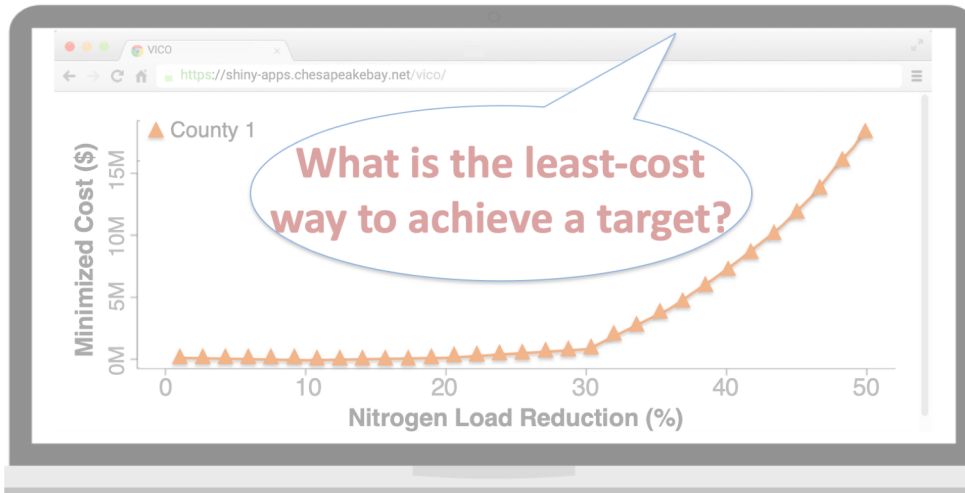https://shiny-apps.chesapeakebay.net/vico/

October 8th – 2nd Beta release

Since October 8th:

Included delineations between federal and non-federal agency acres, as in CAST
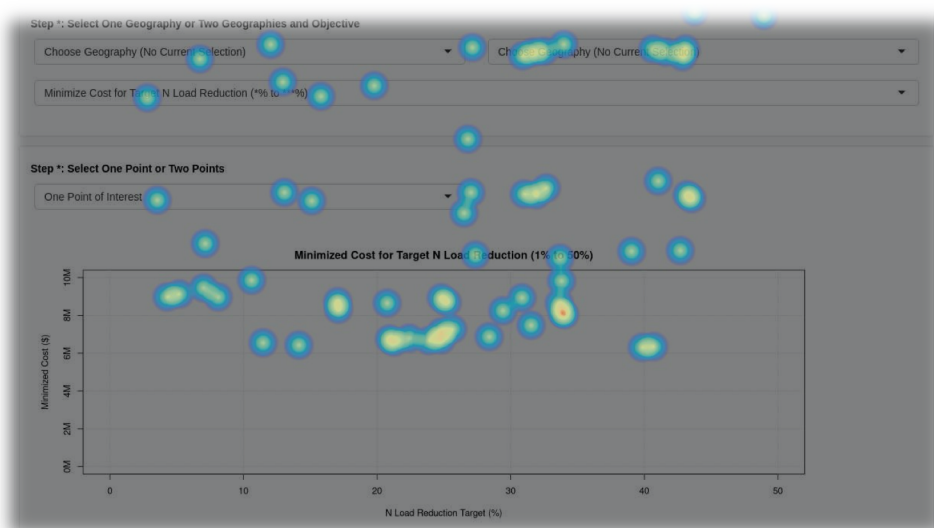
Fixed issue with mapping between load source groups and load sources available for BMP implementation

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With hotjar addition, we were able to find and fix a bug in the tool interface

1st large-scale runs using docker and AWS Batch

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Optimization Development

Optimization Development

Benchmarking

# of variables	# of constraints (with only lower bound; with both bounds; with only upper bound)	Solve time (sec) (in IPOPT w/o function evals; with function evals)	Solver iterations	Peak Memory usage (model generation; IPOPT solving)
92242	3; 0; 19519	45; 118	~200	2255920K; 489496K
131342	3; 0; 52808	17; 15	~40	2407296K; 687944K

# Optimization Development

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Report/Manuscripts

– *Process, approach, tool*

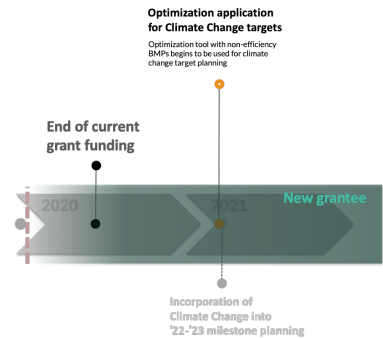– *Problem's mathematical*

characteristics

Blue Arrow ➔ Blue Equation
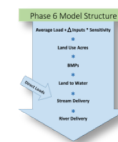
$$\sum_{s \in S} \left[\zeta_s^{sbb} * \sum_{u \in U_N} \left(\left[\mathcal{L}_u^w + \sum_{t \in T} \left((\mathcal{L}_{u,t,k} - I_{u,t}) * \sigma_{u,t} \right) \right]_{s,u} * \alpha_{s,u} * \theta_{s,u}^* * \psi_{s,u} \right) + \sum_{u \in U_D} (\mathcal{L}_{s,u} * \psi_{s,u}) \right]$$

Summary

Grantee transition

VICO

Documenting