



TETRA TECH

Climate Change and TMDL's

July 31, 2017

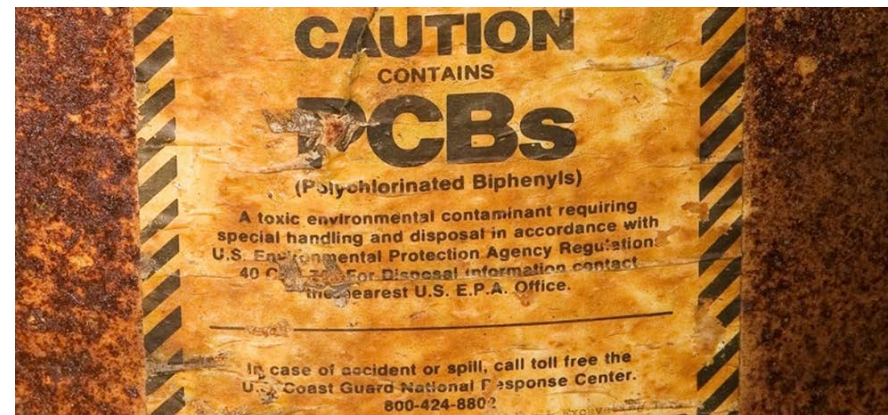
Hope Herron, Climate Change Lead



Objectives and Outline of the Presentation

Objectives

- Provide a brief overview of how climate change has been integrated in TMDLs to date, including drivers, to promote thoughtful engagement on today's exercise on the Potomac River PCB TMDL



Outline of the Presentation

Presentation Overview

- Provide a conceptual overview of the linkages between the climate change assessment process and the TMDL process
- Present a brief overview of drivers of climate change and TMDL integration
- Discuss 3 example TMDLs that have incorporated climate change



Photo credit: The Potomac Conservancy

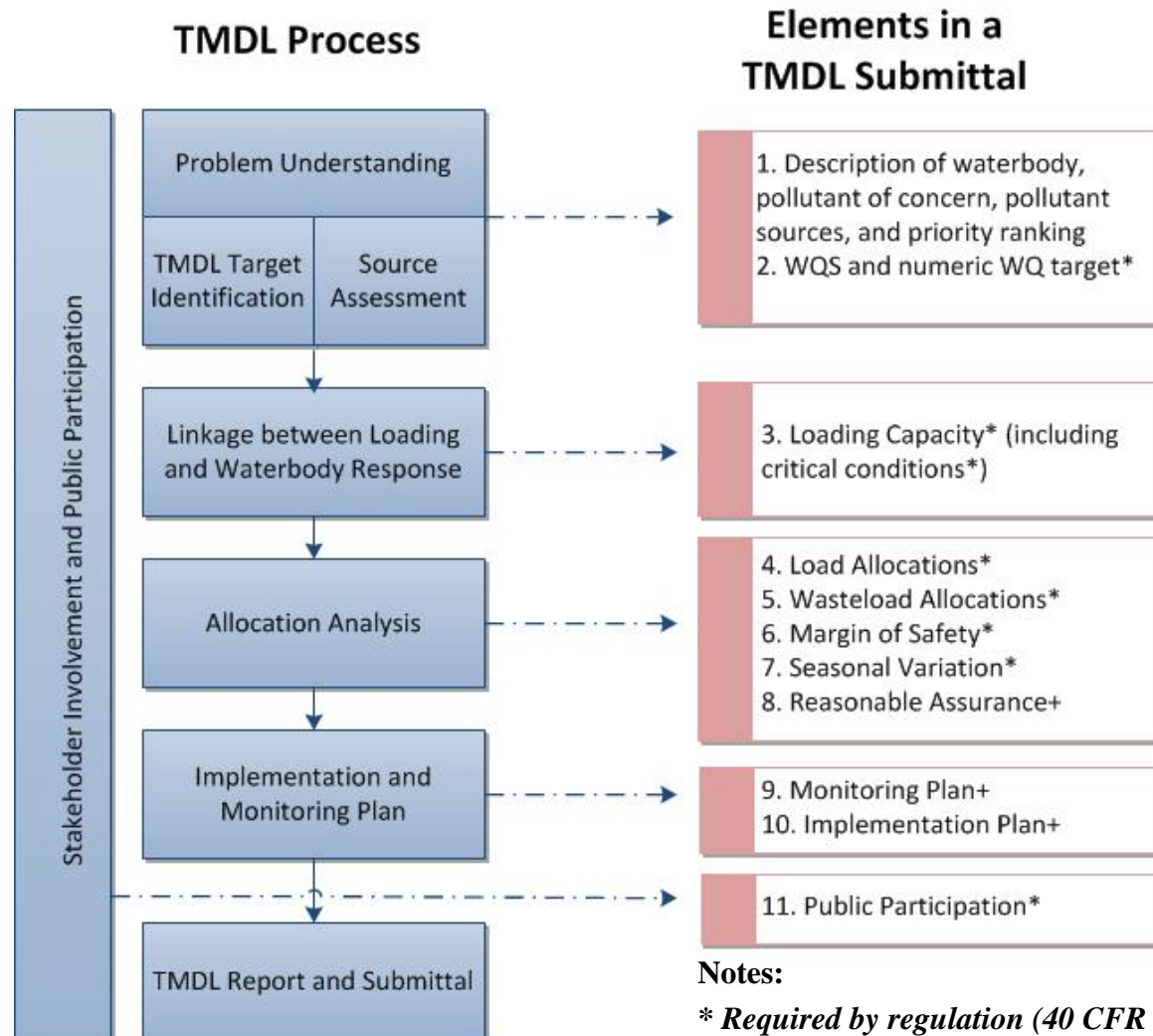
Conceptual Overview – Climate Change and TMDLs

A TMDL -

- Is a calculation of the **maximum amount of a pollutant** that a water body can receive and still safely meet applicable water quality standards, and an allocation of that amount to the pollutant's point (wasteload allocation) and nonpoint (load allocation) sources
- Approved wasteload allocations for **point sources** must be incorporated into applicable National Pollutant Discharge Elimination System (NPDES) permits
- Load allocations for **nonpoint sources** are implemented through a wide variety of state, local, and federal programs, which are primarily voluntary or incentive-based
- Implementation plans describe how a TMDL will be implemented but are not required by Section 303(d)

The strength of a TMDL is the ability to support development of information-based water quality management strategies.

Overview of the TMDL Process

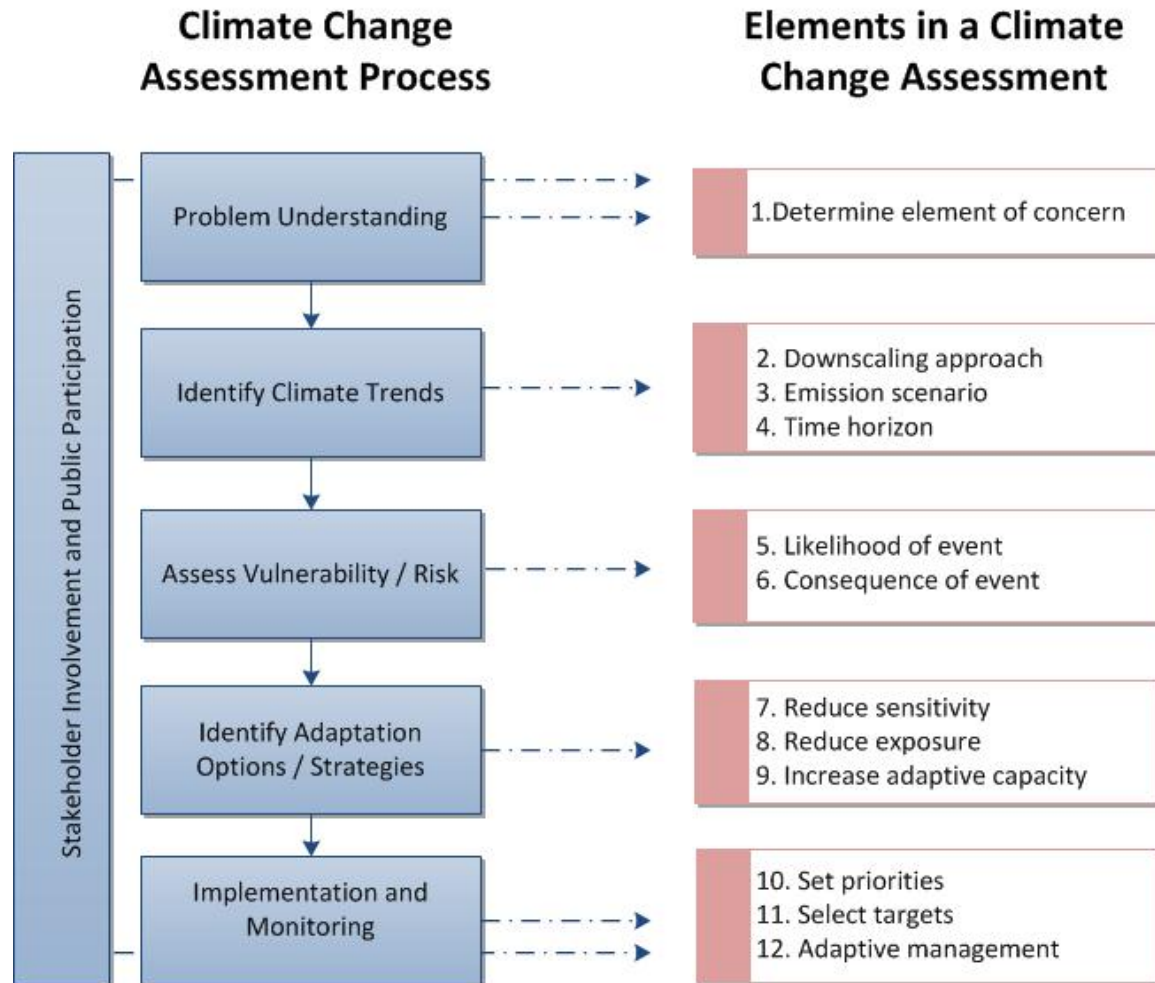


Notes:

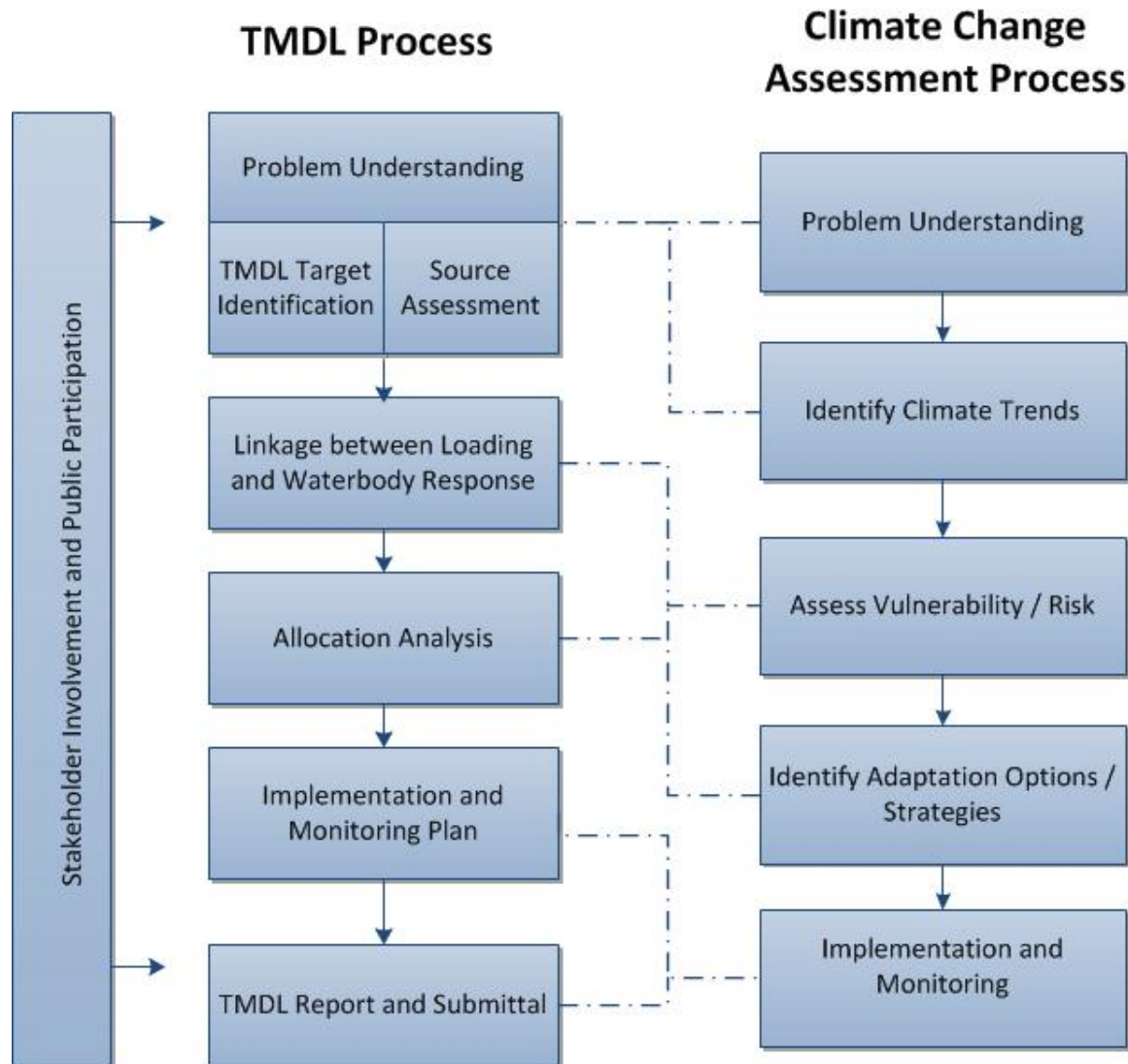
* **Required by regulation (40 CFR 130.7)**

+ **Recommended through guidance**

Overview of the Climate Change Assessment Process



TMDL and Climate Change Assessment Process Linkages



Key Challenges

- TMDL development is complex and resource-intensive
 - Requires significant technical information and modeling
 - *Climate change presents an extra resource/technical requirement and may alter attainability of some designated uses and parameters related to water quality standards*
- Implementation is a major uncertainty
 - Section 303(d) does not require implementation, and states' strategies for implementation vary widely.
 - Often insufficient funding.
 - Require support from wide variety of actors.
 - *Climate change requires reassessing priorities with short- and long-term considerations in mind*



Drivers to Integrate Climate Change into TMDLs

Why Include Climate Change in TMDLs?

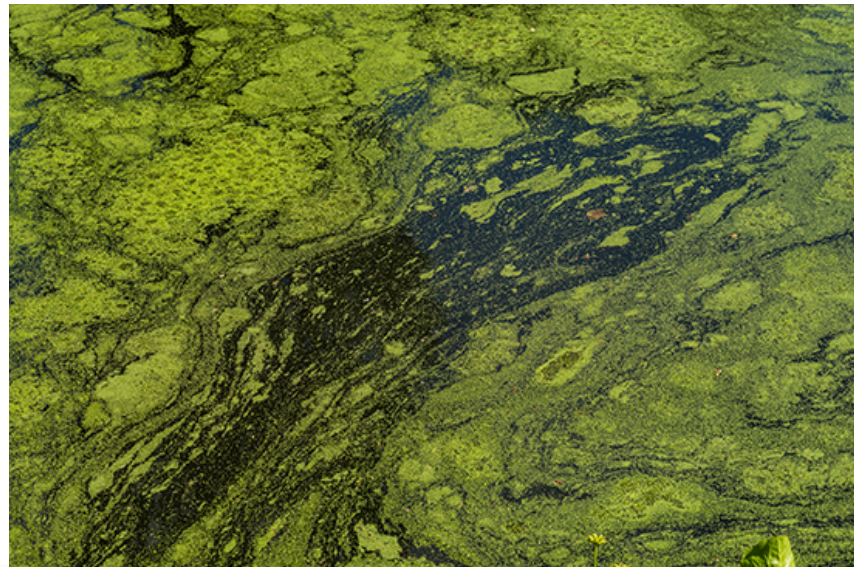
There is no regulatory requirement* to include climate change in a TMDL, but, some TMDLs have included climate change –

- Litigation
- Proactive states/parties



Except for the Chesapeake Bay TMDL!

- * Executive Order 13508 - assess impacts of climate change on the Bay's water quality
 - Specifically cited nutrient and sediment loading as a specific concern
 - Development of models to better understand climate change impacts – but, will this impact load allocations?



Illustrative Case Law

- Conservation Law Foundation v. U.S. Environmental Protection Agency, filed 2010, settled
 - Alleges - EPA's approval of the TMDL challenged, including for failure to consider water resource effects associated with documented and predicted climate change
 - Settlement - EPA conducted a study of potential effects of climate change and phosphorus loads to Lake Champlain.
- Conservation Law Foundation v. EPA, filed 2013, settled
 - Alleges - EPA's approvals of TMDLs for Cape Code and Nantucket embayment "ignored entirely an important aspect of the water problem facing the embayments: the actual and potential impacts of climate change on the attainment of water quality standards."
 - Settlement - EPA to encourage Mass to incorporate climate change in future nitrogen TMDLs

Illustrative Case Law, continued

- American Farm Bureau v. EPA, filed 2011 (Supreme Court of the United States denied certiorari)
 - EPA has the authority to issue the Chesapeake Bay TMDL and take certain enforcement measures to ensure the completion of TMDL goals
 - *Thus - EPA has the requisite authority and enforcement tools to modify the TMDL if the impact of climate change makes it necessary to do so.*
- United States v. Metropolitan Water Reclamation District of Greater Chicago, filed 2015, court approved permit as is
 - Enforcement suit alleging violations of Clean Water Act related to combined sewer overflows in Chicago area in violation of NPDES permits
- Columbia Riverkeeper v. Pruitt, filed 2017
 - Alleges - EPA violated the CWA by failing to issue a TMDL for temperature pollution in the Columbia and Snake Rivers in Oregon and Washington....and that high water temperatures were expected to worsen due to continuing climate change



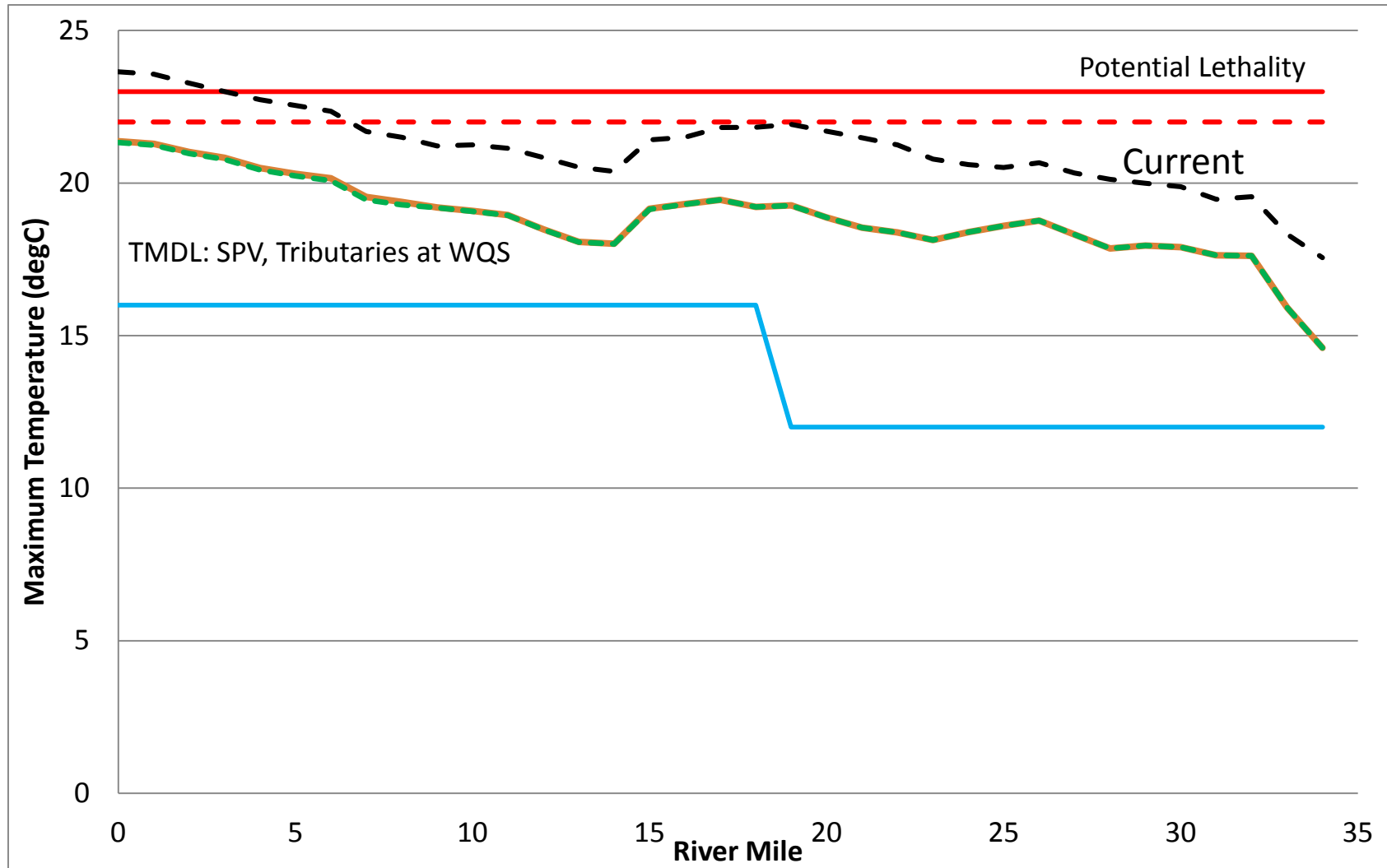
Illustrative Cases of TMDLs Addressing Climate Change

South Fork Nooksack River TMDL

- Location: Washington State
- Driver: Proactive stakeholder engagement (Nooksack Indian Tribe, Washington Department of Ecology, EPA R10 and OW) and funding (EPA ORD)
- Linkage: TMDL Implementation Plan
- Key finding: Attainment of WQS already difficult, more so under climate change; added impetus to implementation plan (Nooksack Tribe)

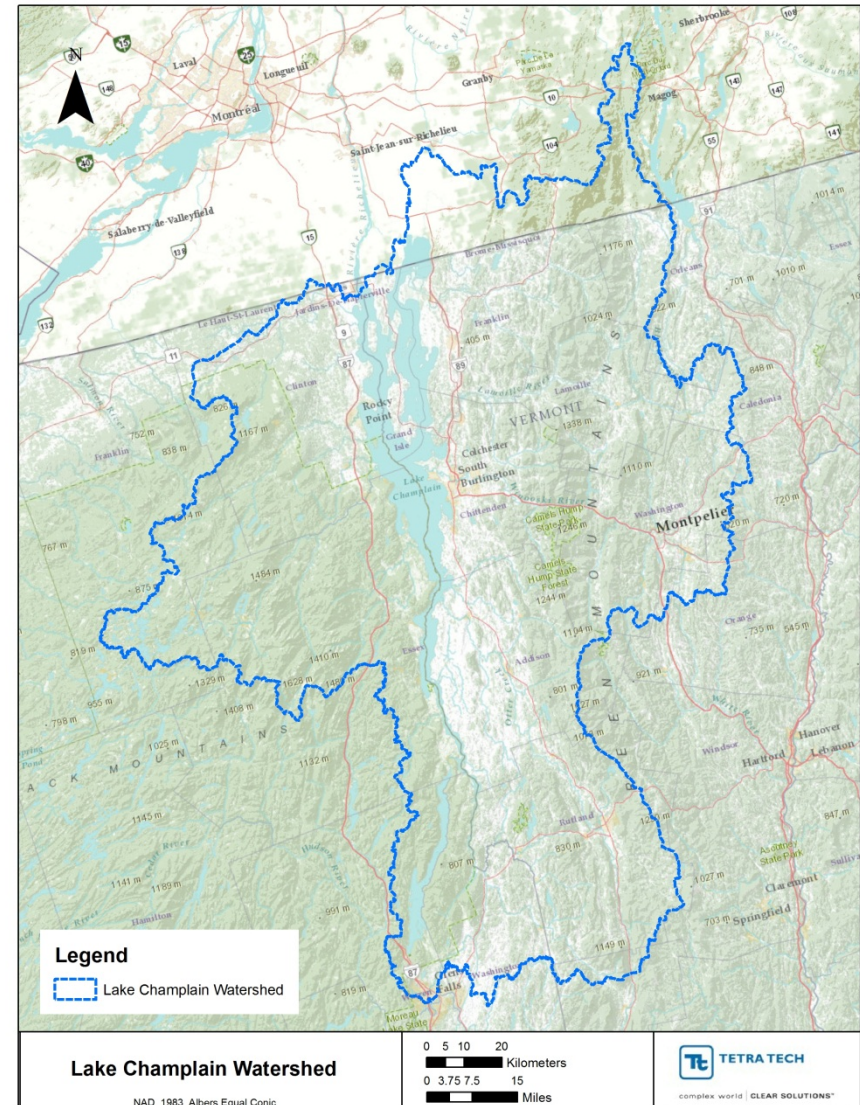


SFNR TMDL Scenario: 7Q10, Critical August Week



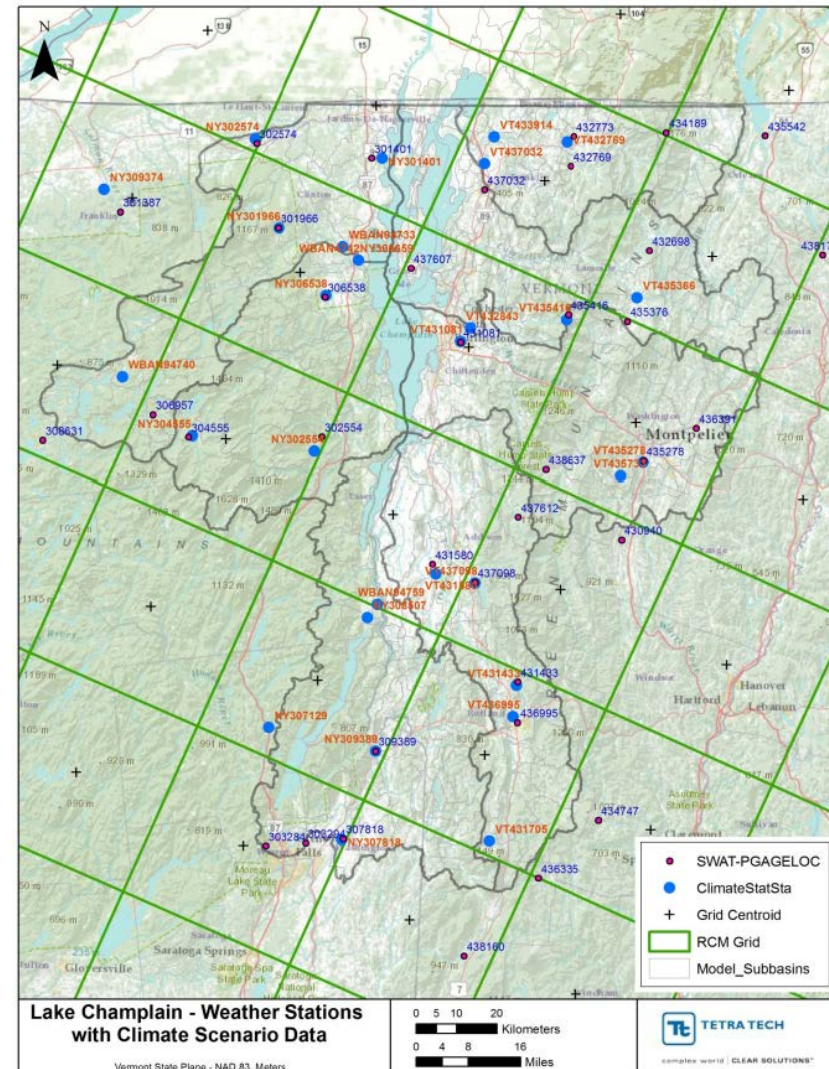
Lake Champlain TMDL Revision

- Location: Vermont
- Driver: Litigation
 - Phosphorus TMDL approved in 2002
 - CLF litigation in 2008
 - EPA disapproval in 2011
 - TMDL revision from 2011 to present
- TMDL Revision Approach
 - Funded and led by EPA Region 1
 - Developed phosphorus load estimates from subwatersheds and key sources
 - Estimated potential phosphorus reductions from implementation of management practices (reasonable assurance)
 - Revised lake model to reflect recent conditions
 - Evaluated effects of climate change



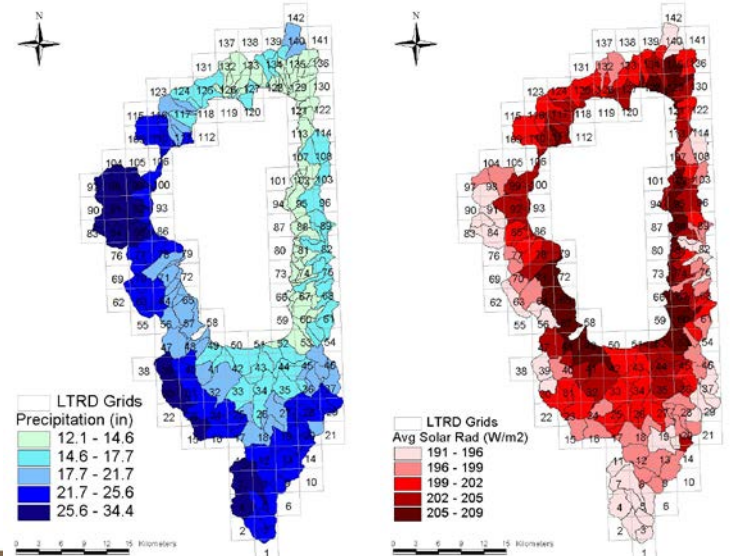
Lake Champlain TMDL Revision

- Used existing EPA approach
 - ORD-NCEA 20 Watersheds
 - Ran SWAT for predicted future conditions
- 6 climate scenarios
 - 2040-2070 horizon



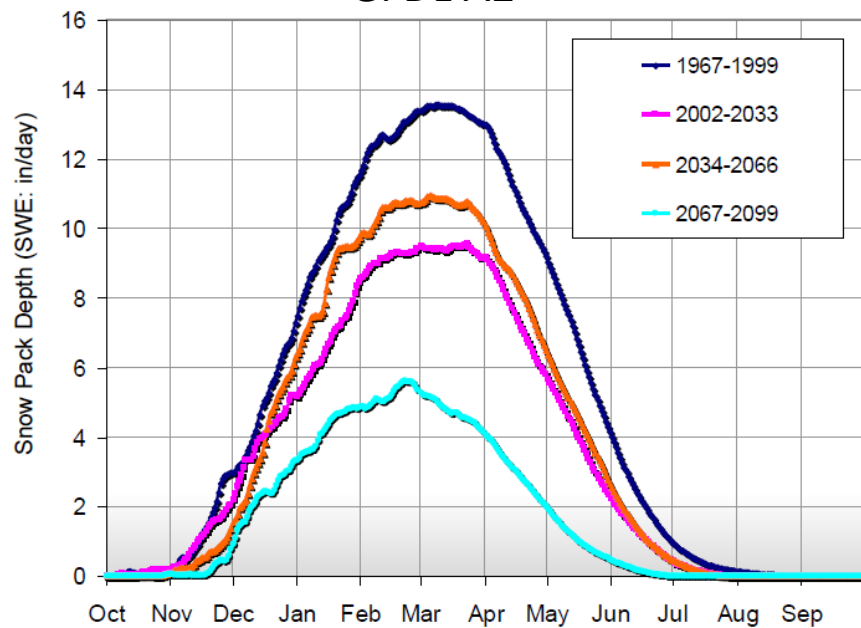
Lake Tahoe TMDL

- Location: Nevada
- Driver: Concern about reduced snowpack
- Evaluated flow and pollutant loading distribution spatially and temporally
- Identified key sources and tested implementation strategies
- Evaluated potential climate change impacts – included as the adaptive management approach for the TMDL Implementation Plan

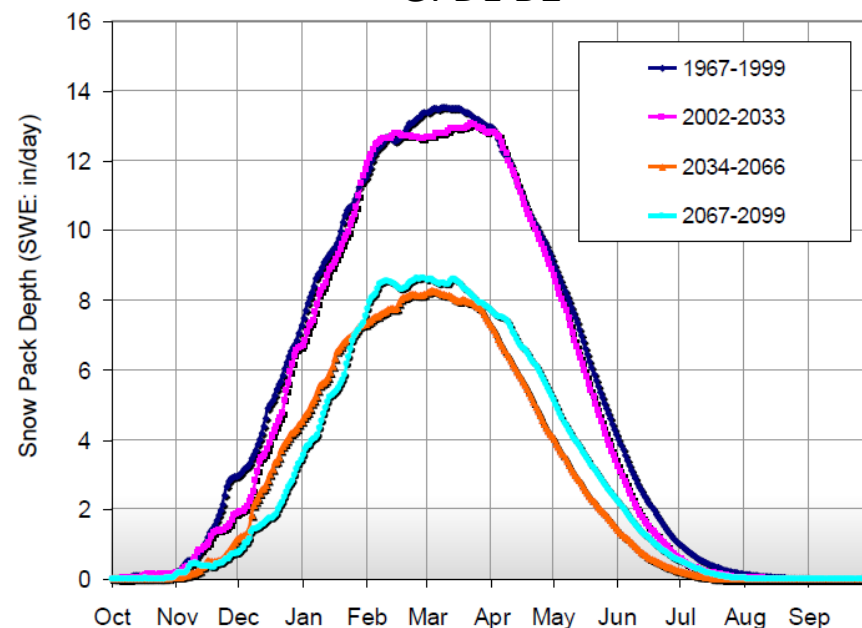


- Model Baseline: GFDL Historical (1967 – 1999)
- Scenario 1: GFDL A2 (2002 – 2099)
- Scenario 2: GFDL B1 (2002 – 2099)

GFDL A2



GFDL B1



Comparison of Modeling Approaches for TMDLs Considering Climate Change

Element	South Fork Nooksack River	Lake Champlain	Lake Tahoe
Model	QUAL2Kw	SWAT	LSPC
Model Type	River (quasi-steady state)	Watershed	Watershed
Climate Change Scenarios	3 (low, med, high)	6 (model-based)	11 (sensitivity analysis); 2 (emissions-based)*
Time Horizon	2080	2040 - 2070	2050; 2002-2099*

*Separate from TMDL analysis

Take-Away Messages

- In all Tt pilot cases, there was an increase in both flow and pollutant loads under the average of the climate change scenarios
- TMDL technical analyses that evaluate climate change scenarios will thus likely suggest revising loading capacities, etc; however, these are policy decisions that can be very contentious
- Including climate change as part of the Implementation Plan can be less contentious and also be very meaningful (prioritization, timing, and scale of actions).





Thanks!

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Additional Messages

- Climate change scenarios could:
 - set potential upper and lower allocation bounds
 - be used to define MOS
 - inform implementation
- Data perturbation methodology could be applied in absence of modeling to develop TMDLs
 - for example, apply new regime to load duration curves
- Factors to consider relative to the effects of climate change on TMDLs and water quality management strategies include:
 - Variation between climate change scenarios
 - Appropriate scale of watershed analysis
 - Choice of watershed model
 - Role of land use
 - TMDL development considerations
 - Implementation planning