



2021 Nutrients Permitting Workshop Lake Champlain Basin Restoration

**Oliver Pierson
Lakes and Ponds Program
Vermont Department of Environmental Conservation
October 26, 2021**

Presentation Overview

- Lake Champlain Context
- Monitoring Data
- Regulatory Efforts
- Results
- Looking Forward



VERMONT DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
WATERSHED
MANAGEMENT DIVISION
LAKES & PONDS PROGRAM



Lake Champlain Context

- Lake is 120 miles long, 400 feet deep and 12 miles across
- 8,000 miles² of mountains, forests, farmlands
- 600K people (NY, VT, Quebec), 45% rely on lake for drinking water
- 587 miles of shoreline, watershed is 19x greater than the lake (high ratio)
- Important Economic Role in Region: 2016 UVM Study showed 1m decrease in clarity -> \$12.6M drop in tourism expenditures, 37% property depreciation



Lake Champlain Water Quality Context

- Excess phosphorus from variety of sources impaired water quality in Lake Champlain, so Vermont and New York developed a phosphorus TMDL in 2002
- TMDL was based on phosphorus loading and in-lake concentration targets defined in a 1993 agreement signed by New York, Vermont, and Québec
- In 2011, the EPA disapproved VT portion of the TMDL based on two concerns: insufficient assurance that phosphorus reductions from polluted runoff would be achieved, and inadequate margin of safety to account for uncertainty
- 2016: New TMDL established for segments of lake w/ target in-lake TP conc and targeted load reductions
 - Phase I Implementation plan includes policy commitments, enhanced regulatory programs, funding and financial incentives, and technical assistance to reduce of sources of pollution at a basin-wide scale

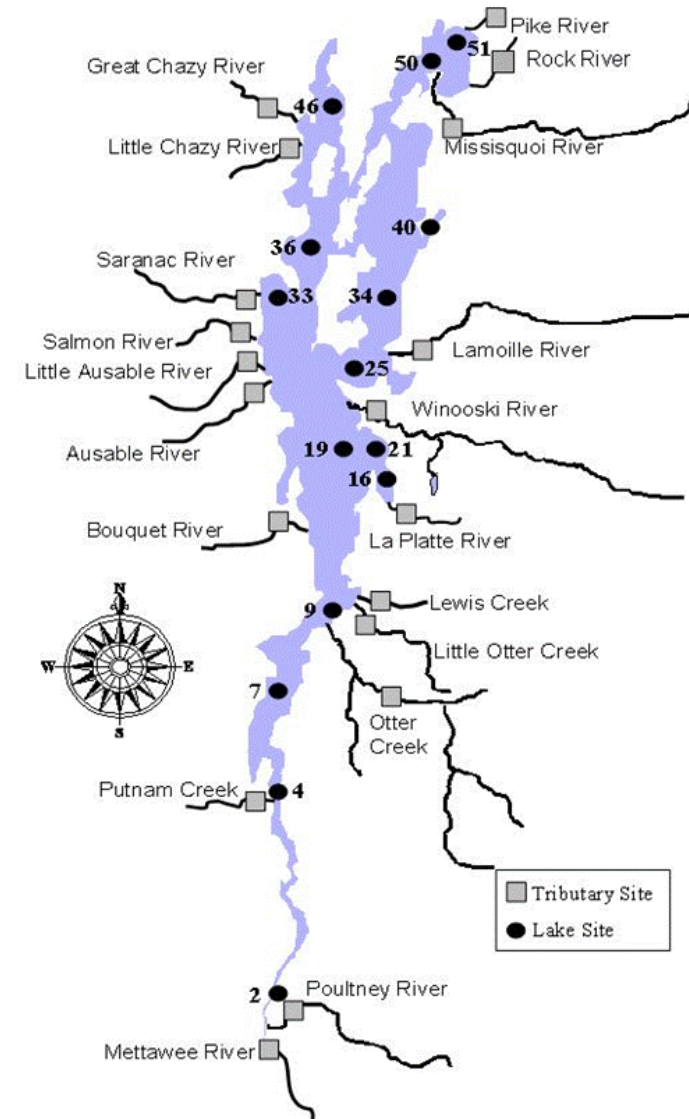
Champlain Water Quality Policy Context

- Vermont Water Quality Standards
- 2014: Shoreland Protection Act
- **2015: Act 64 – Vermont Clean Water Act**
 - Clean Water Initiative Funding Program
- 2018: Required Agricultural Practices Rule & Logging Acceptable Management Practices
- 2019: Act 76 – Clean Water Service Delivery Act
 - P Load Reduction Formulas & Fund Allocation
 - Clean Water Service Providers
- 2020: 3-acre stormwater permit in effect



Lake & Tributary Water Quality Monitoring Approach

- Champlain Long-Term Water Quality Project measures overall ecosystem health of lake using key ecosystem indicators & assesses long-term effects of management actions & climate change
- LTM Project surveys quality of Champlain's waters at 15 locations throughout the lake & 21 tribs every 2 wks
- Sample for phosphorus, nitrogen and organic carbon; chlorophyll-a; base cations, alkalinity; TSS; dissolved oxygen; conductivity; and pH
- Biological sampling to assess phytoplankton, zooplankton, and macroinvertebrates
- Key actors are VT DEC, SUNY Plattsburgh LCRI, LCBP



Monitoring Data

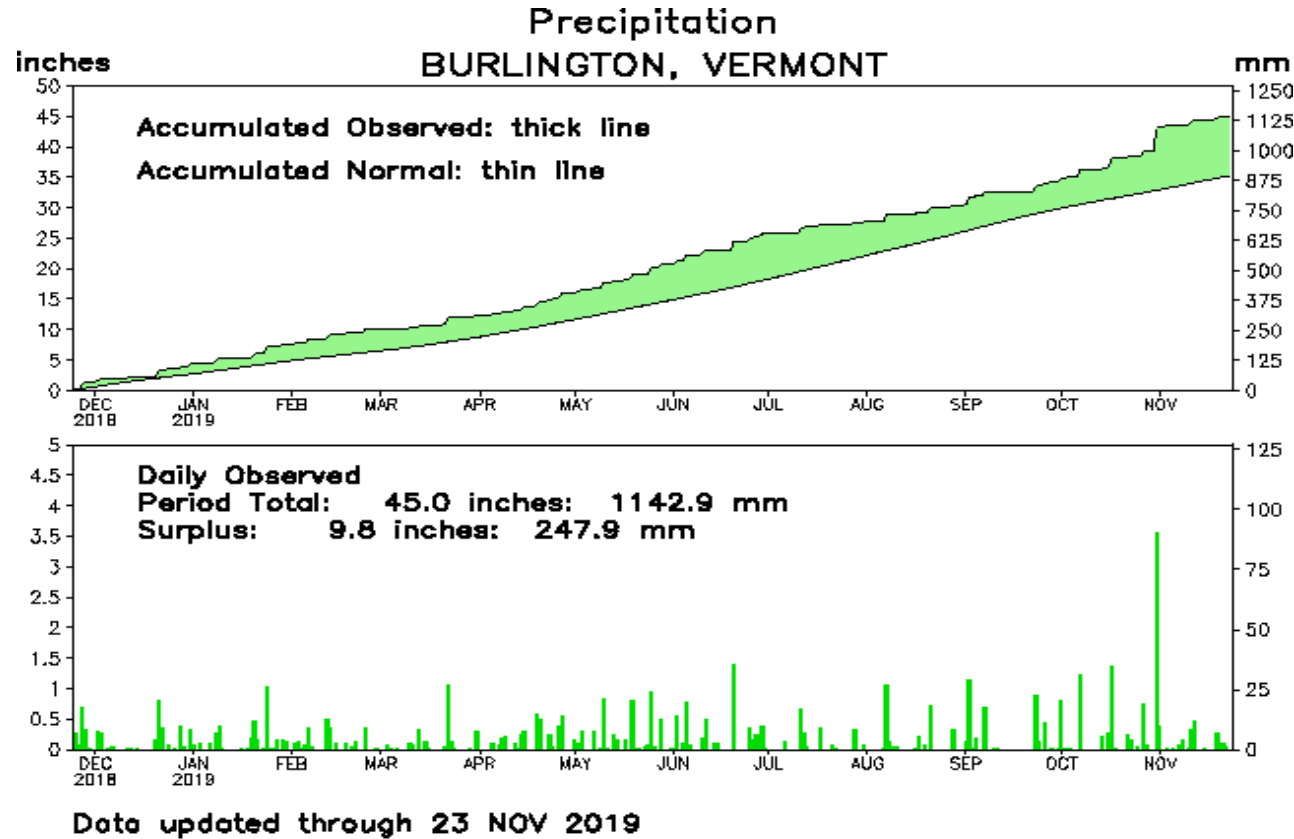
- Environmental
- Phosphorus Loading

- In-Lake P Concentration
- Cyanobacteria
- Invasive Species

			MISSISQUOI BAY		NORTHEAST ARM*		MALLETT'S BAY		MAIN LAKE		SOUTH LAKE		
			STATUS	TREND	STATUS	TREND	STATUS	TREND	STATUS	TREND	STATUS	TREND	
CLEAN WATER	Phosphorus in Lake (p. 13)	Trend Start	1990	●	~	●	👎	●	~	●	~	●	~
	Phosphorus from rivers (p. 14)	1991	●	👎	●	👎	●	~	●	~	●	👎	~
	Phosphorus from WWTFs [†] §(p. 15)	1995	●	👍	●	👍	●	👍	●	👍	●	👍	~
	Cyanobacteria blooms (p. 11)	2013	●	~	●	👎	●	~	●	~	●	~	~
	Fish consumption advisories [†] (p. 7)	2018	●	~	●	~	●	~	●	~	●	~	~
HEALTHY ECOSYSTEMS	Sea lamprey wounding [†] (p. 24)	2003	●	👍	●	👍	●	👍	●	👍	●	👍	👍
	New aquatic invasive species (p. 22)	2018	●	👎	●	👎	●	👎	●	👎	●	👎	👎
	Invasive water chestnut coverage (p. 26)	2018	●	👍	●	👎	●	~	●	~	●	👍	👍
CLIMATE IMPACTS	Lake Champlain freeze-over (p. 21)	1906	Trend: Lake surface freezing over less frequently.										

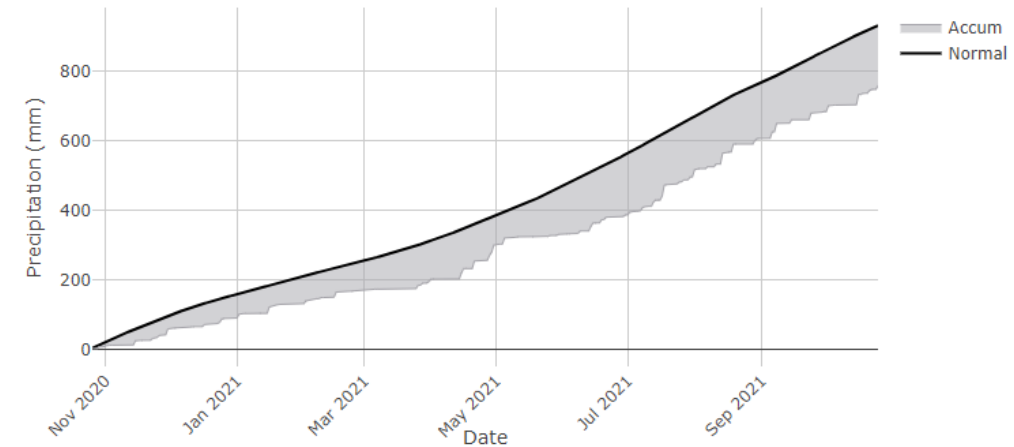
Environmental Data: Precipitation

- 2017 to 2019: Above average
- 2020 & 2021: Well below average

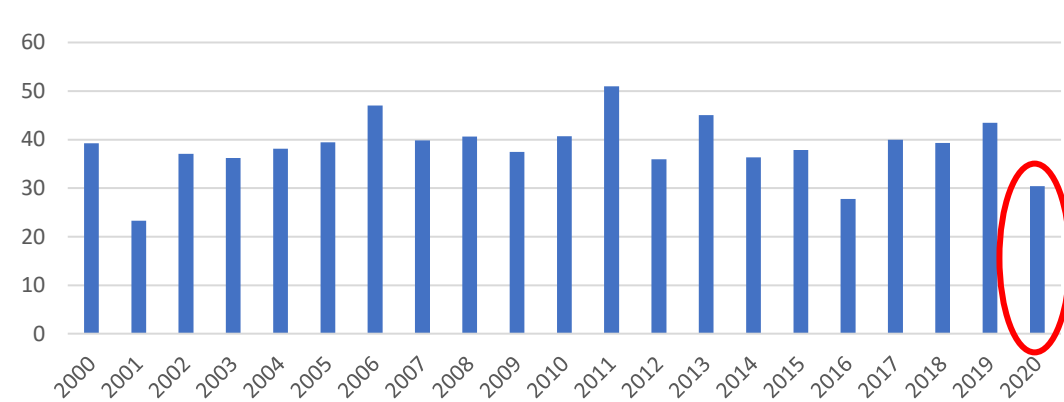


CLIMATE PREDICTION CENTER/NCEP

Accumulated Observed and Normal Precipitation

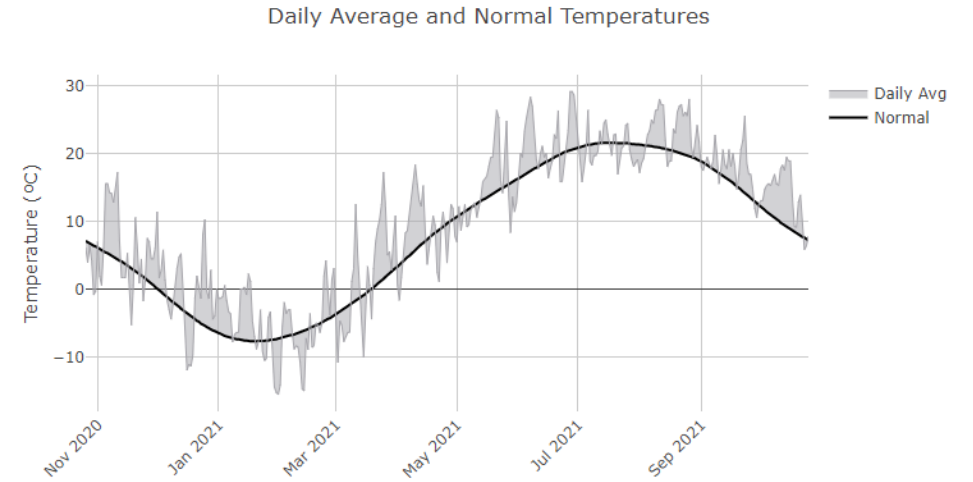
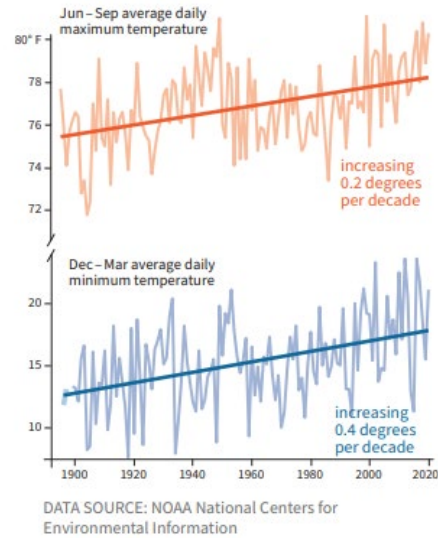


Precipitation at Burlington International Airport
2000 – 2020

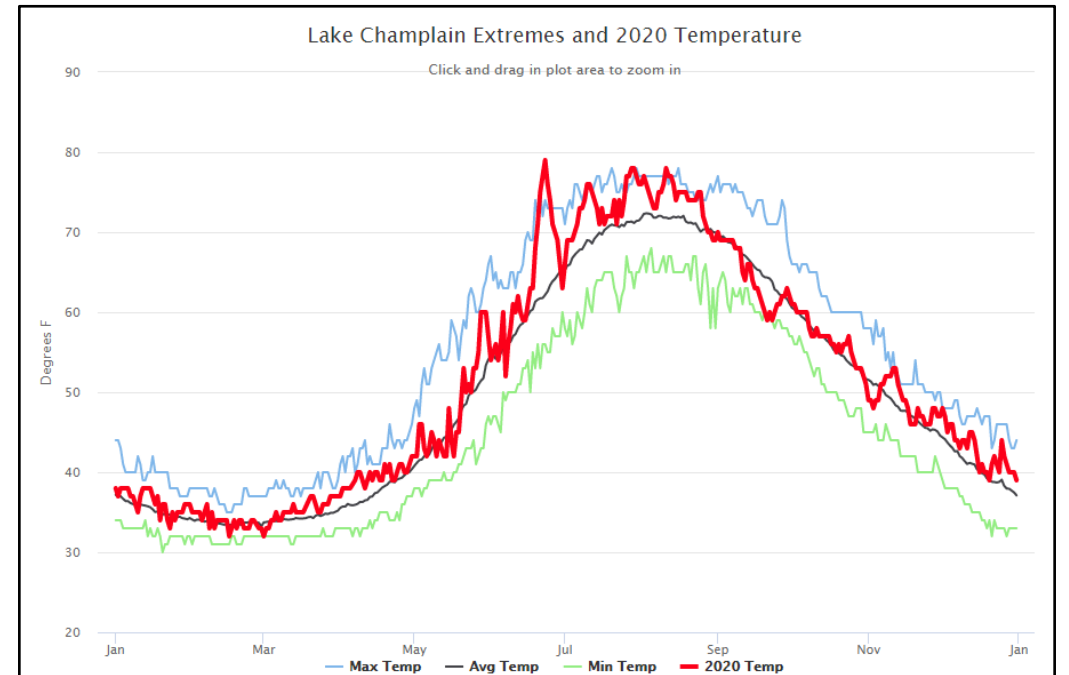
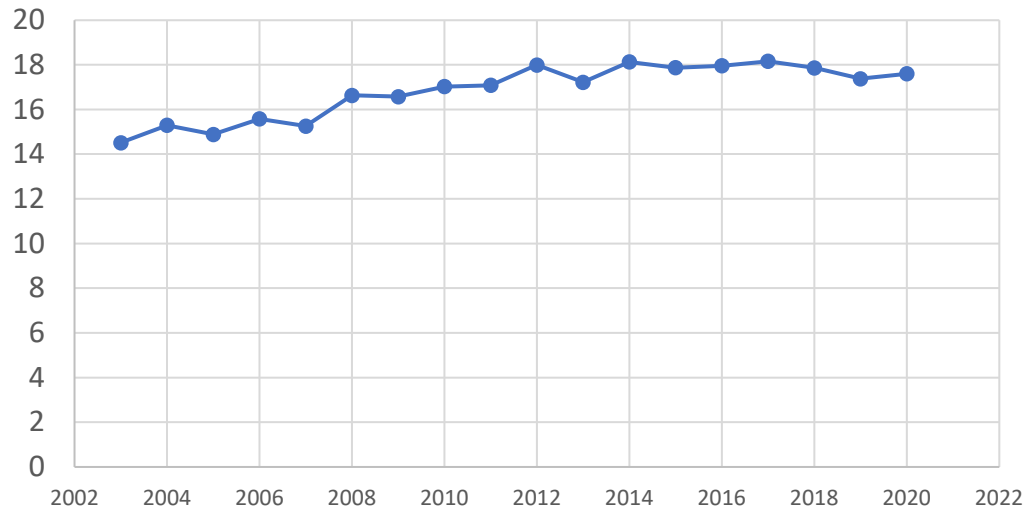


Environmental Data: Temperature

- Increasing air and lake temps over last century
- 2020 set lake temp records

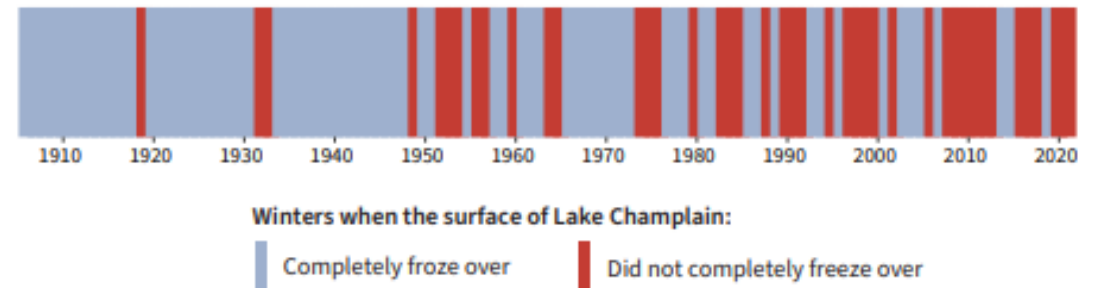
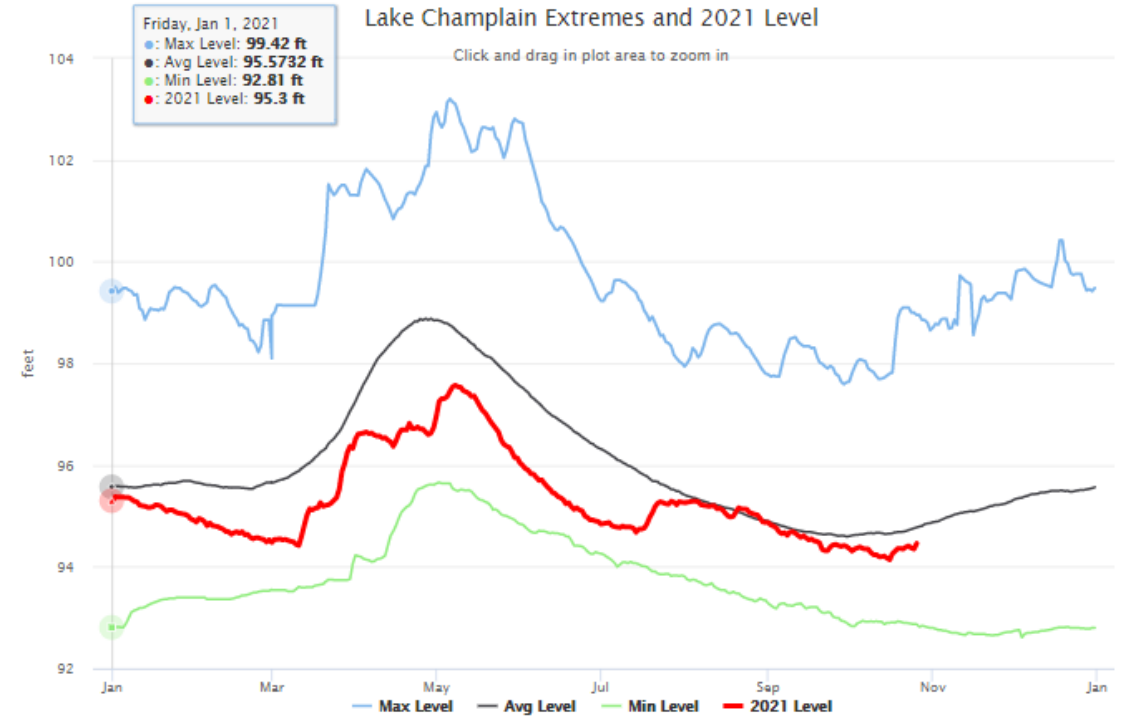


Champlain Main Lake Average Temp (C)
May to October, 2003-2020

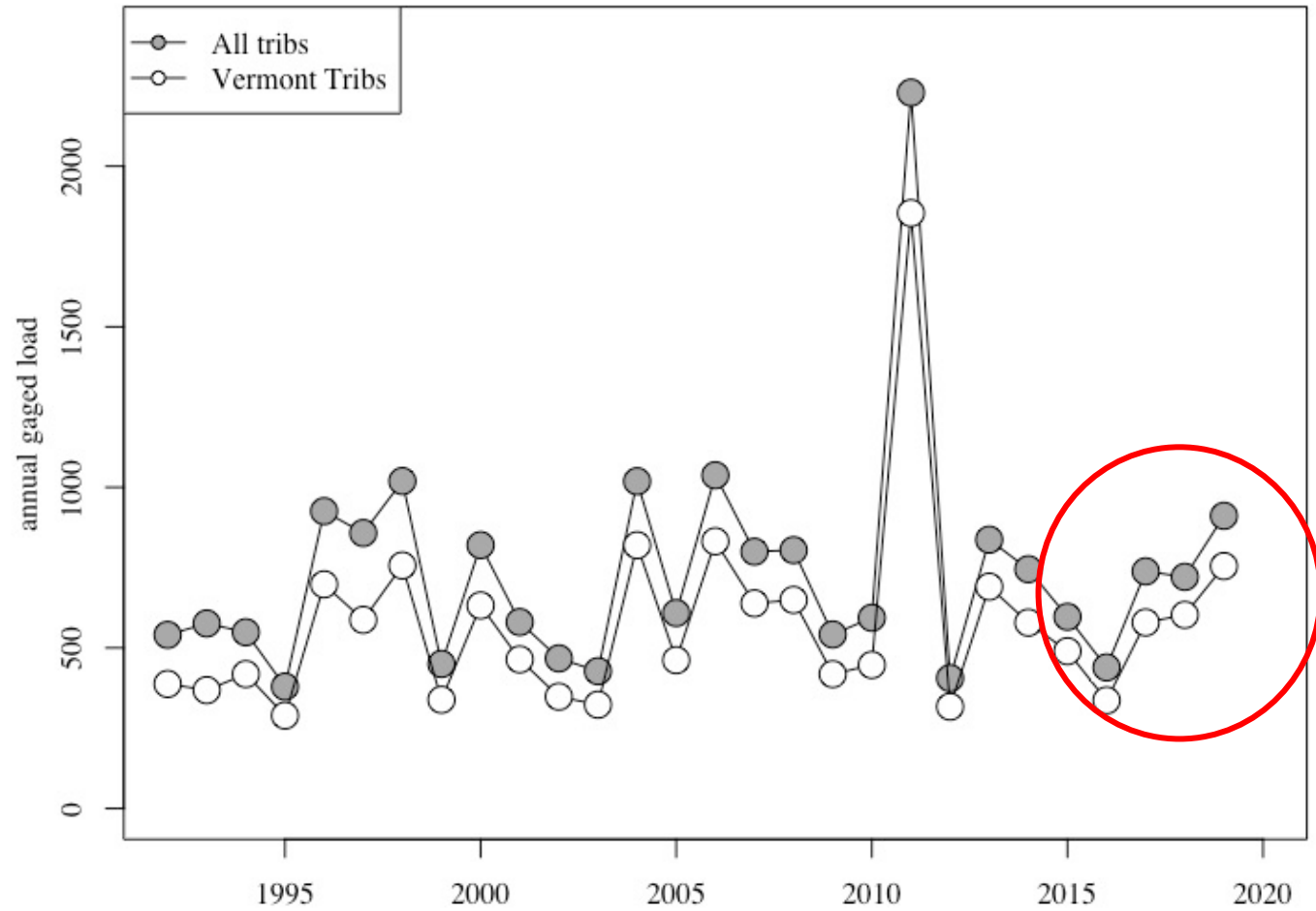


Environmental Data: Impacts on Lake

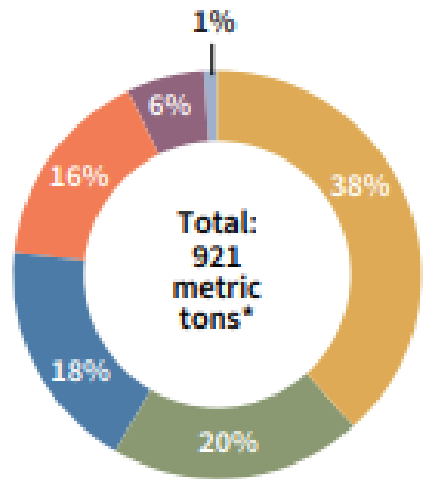
- Lower lake levels, less ice cover
- Short-term reductions in nutrient and pollutant loads to lake
- Lower water levels can increase nutrient concentrations
- Warmer lake temperatures can increase internal P loading and cyanobacteria blooms
- Warmer lake temperatures can reduce dissolved oxygen, cause stress to aquatic life, promote growth of invasive species



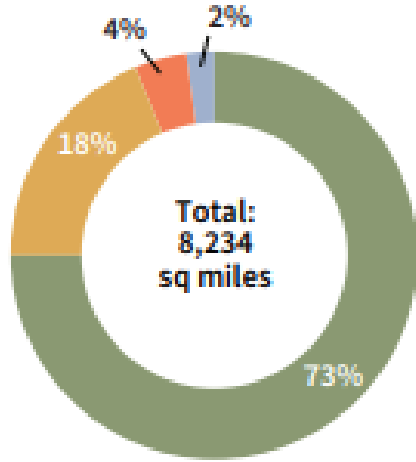
Tributary TP loads



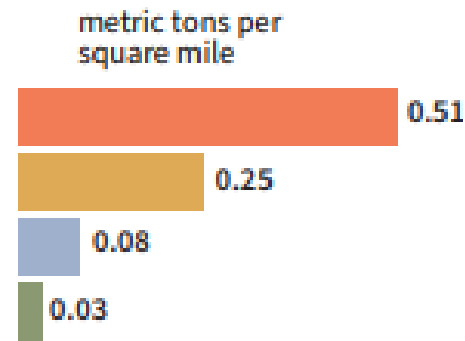
Tributary TP loads



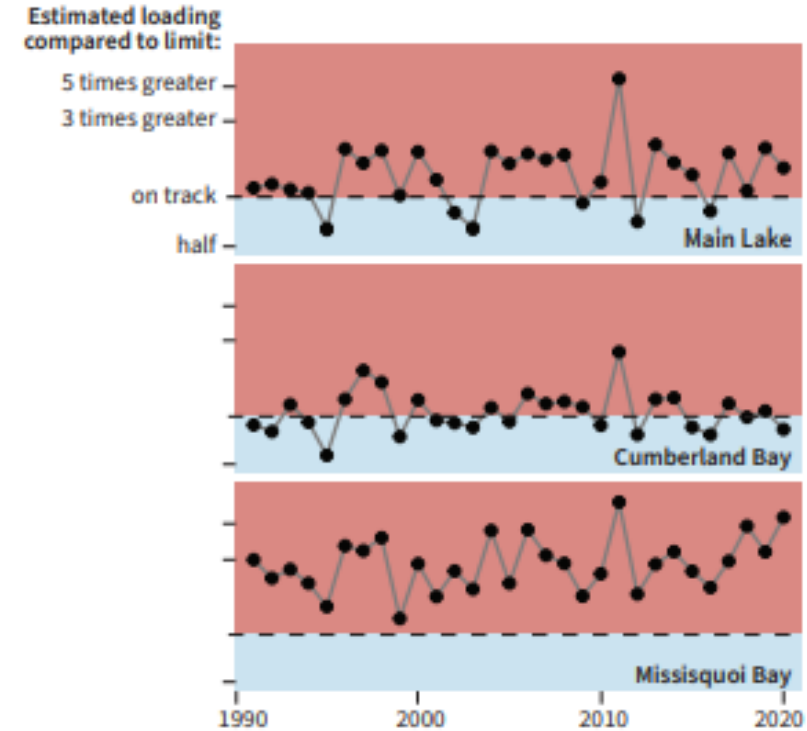
annual load



land area

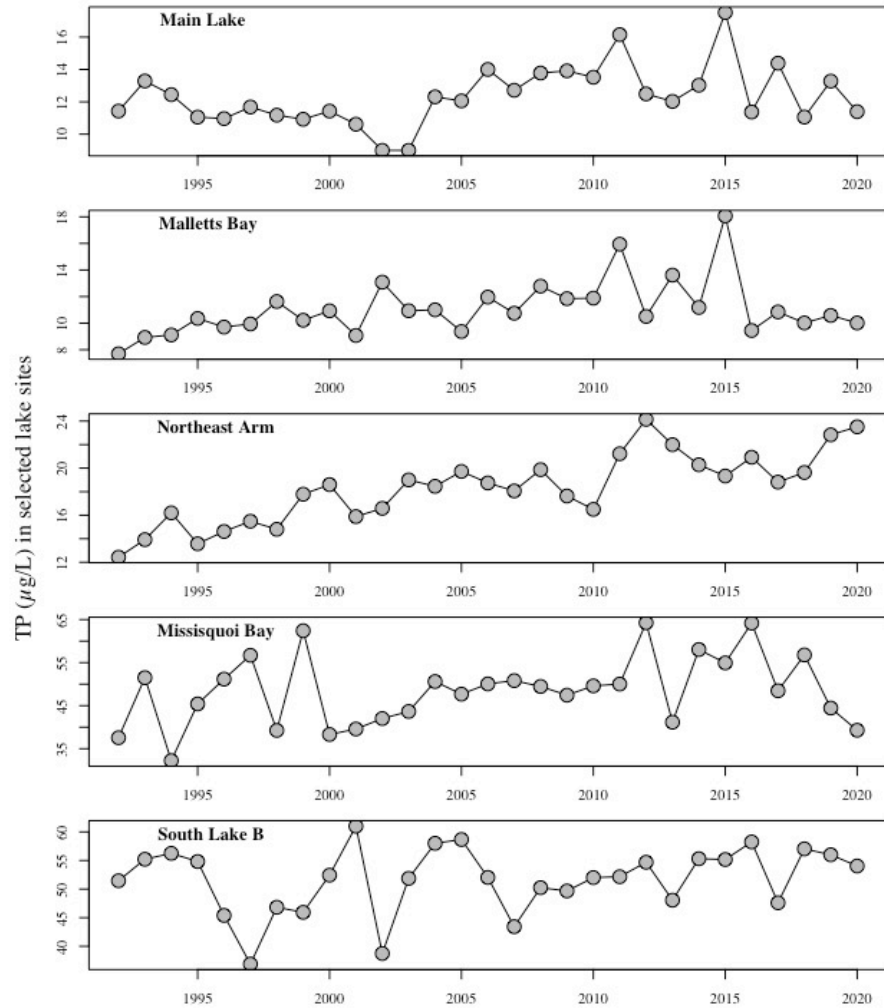


load per land area[†]

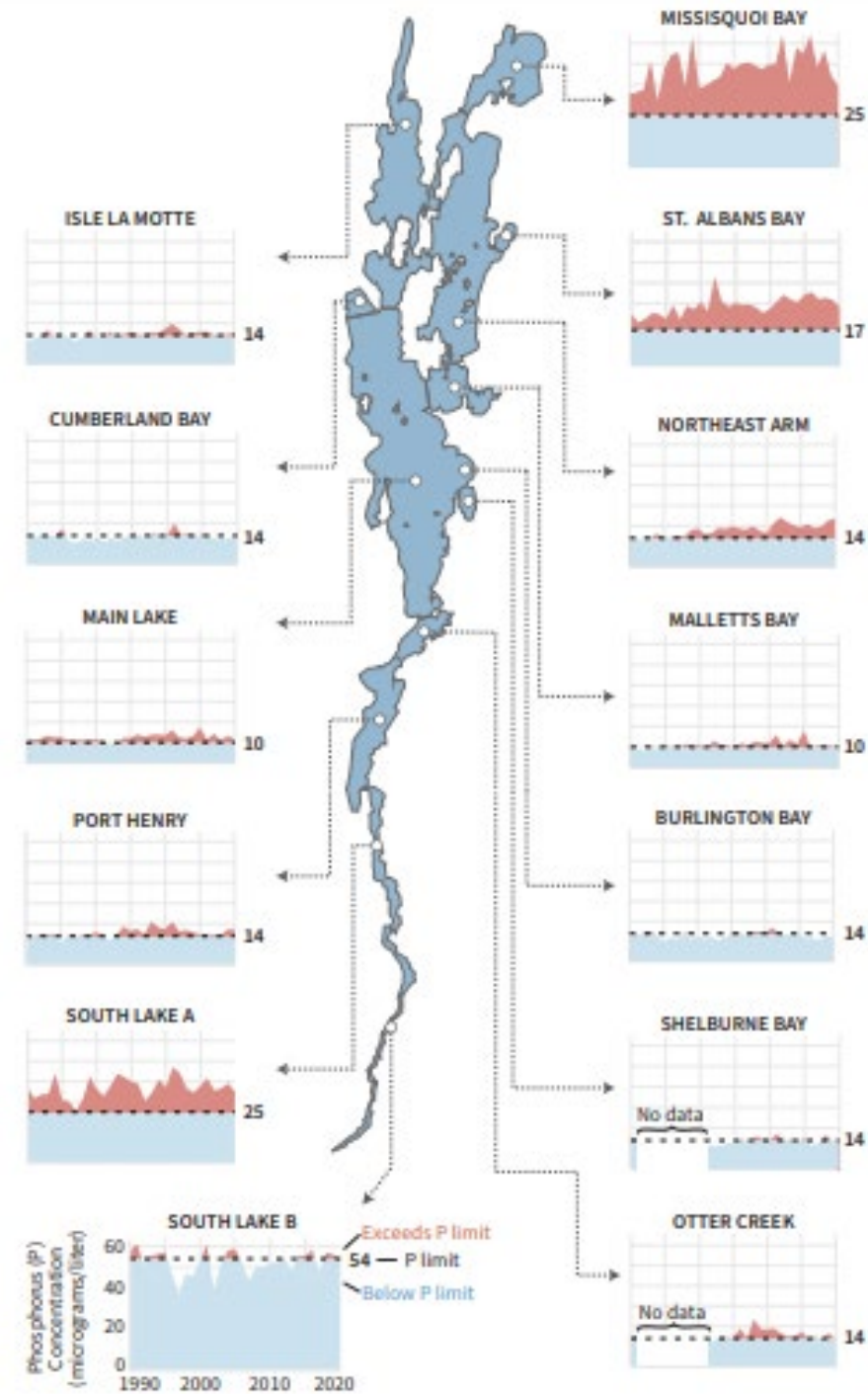


Phosphorus loading to Lake Champlain varies greatly from year to year and generally needs to be reduced to meet water quality goals.

Lake TP Concentrations

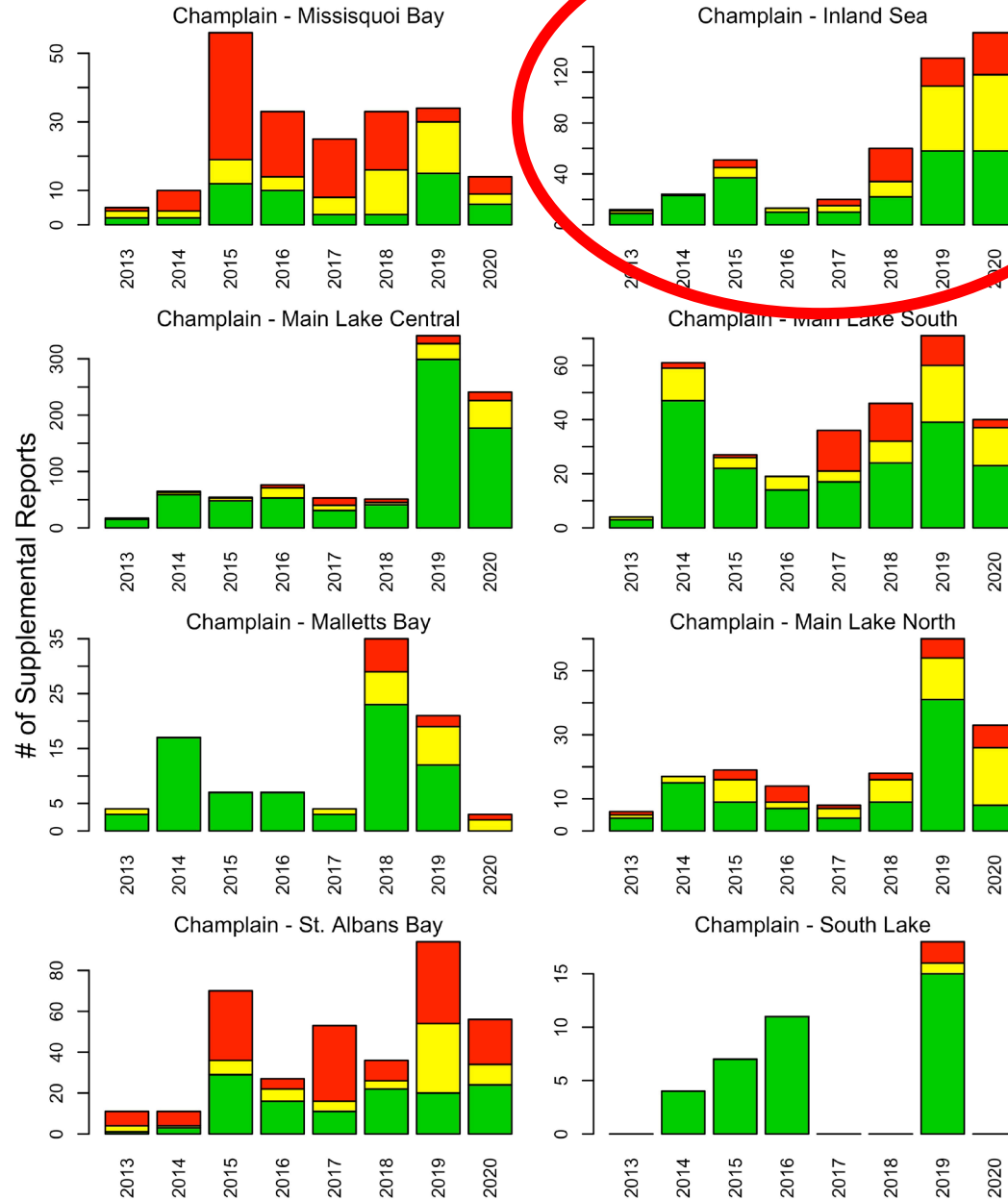


Many Lake segments have phosphorus concentrations that are often near or below targeted limits. However, phosphorus concentrations in Lake Champlain's shallow bays are often above these limits.



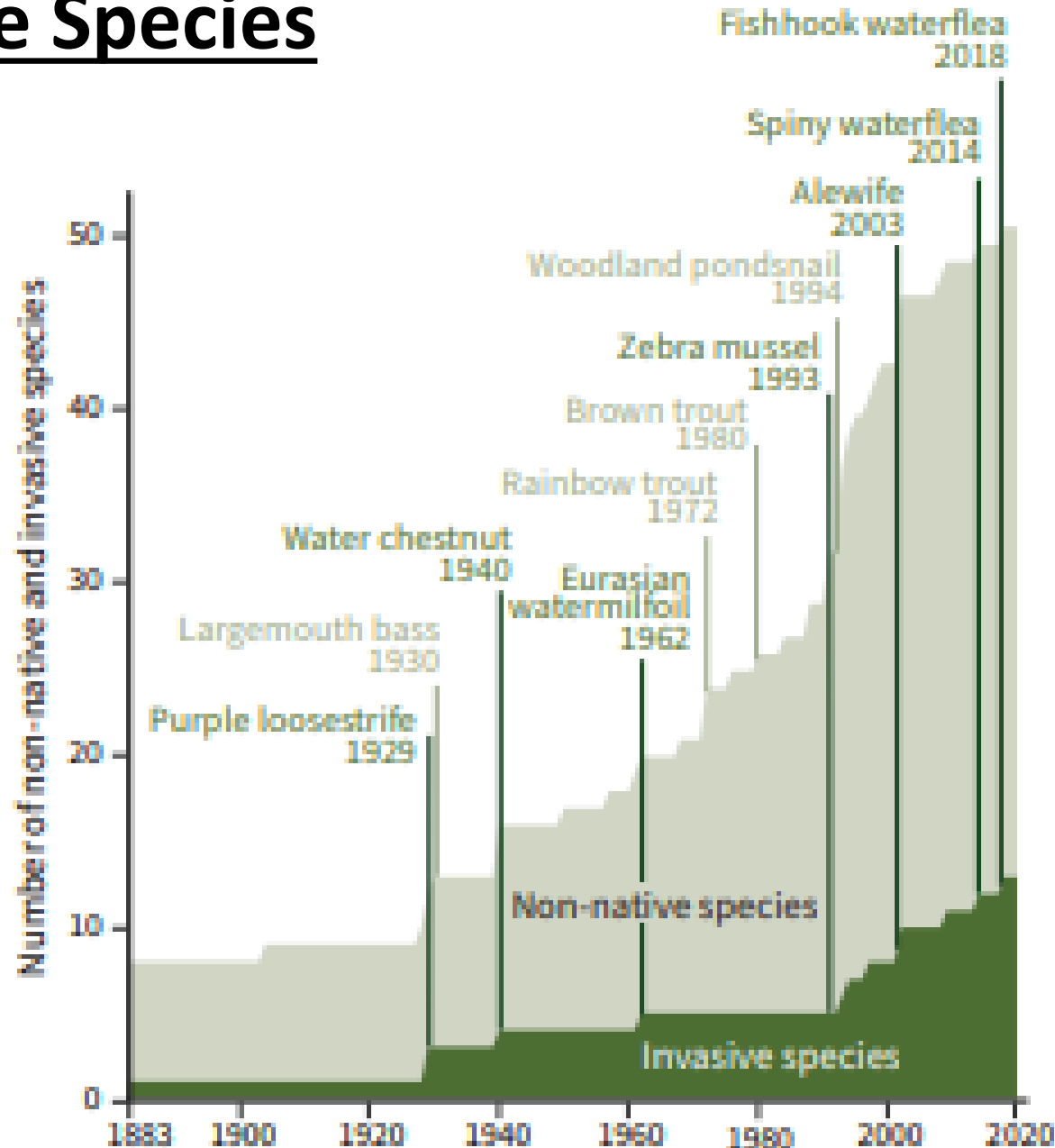
Cyanobacteria

- Stable poor or fair conditions lake wide except northeast arm (inland sea) where conditions are deteriorating
- Increases in beach closures due to cyanobacteria blooms as well



Aquatic Invasive Species

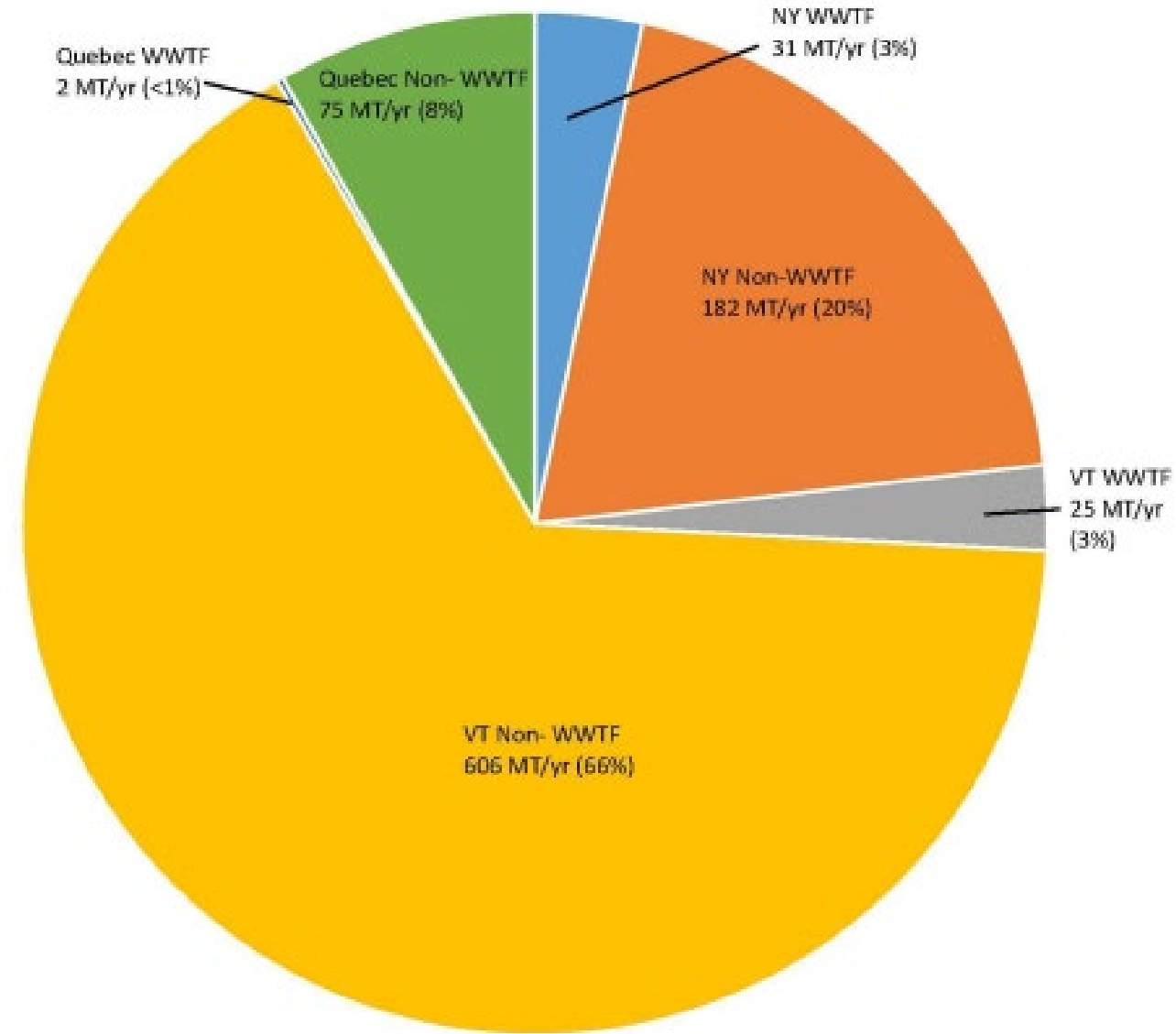
- Increasing trends in # of species and species abundance
- Nutrient pollution exacerbating milfoil and water chestnut
- Round Goby a species of concern



Regulatory Efforts to Achieve TMDL

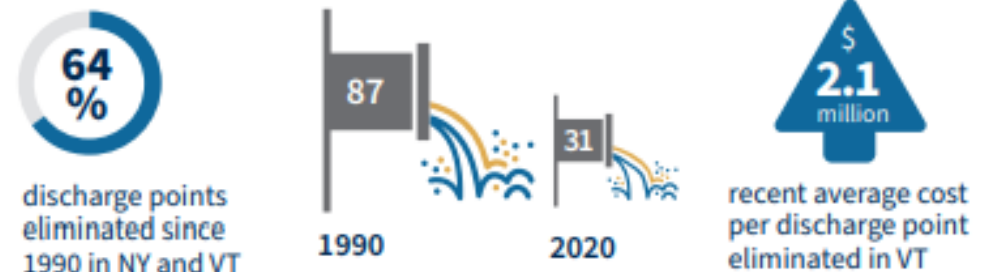
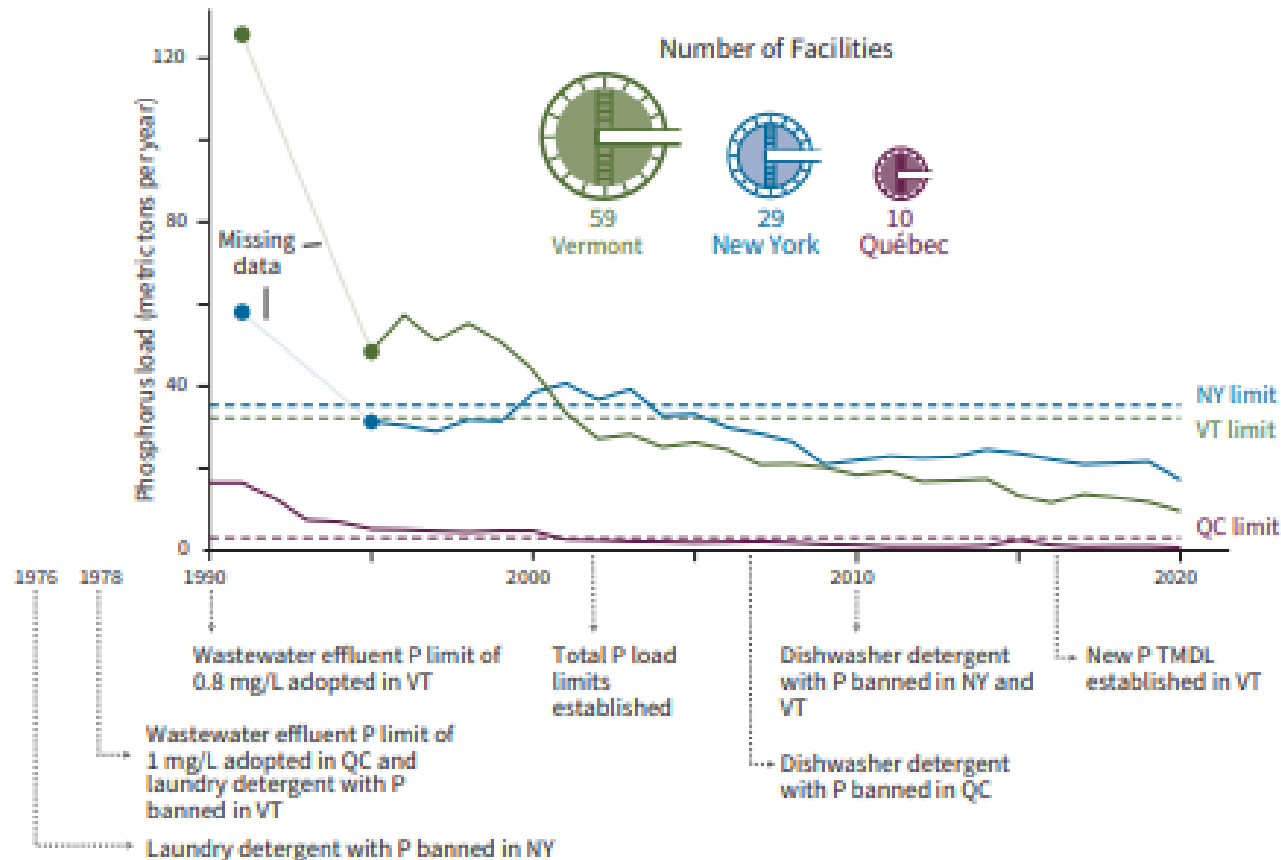
Total Load = 922 MT/year

- Wastewater
- Stormwater
- Shoreland Protection
- Agricultural
- Logging
- Roads
- Rivers



Wastewater:

- The 2016 Lake Champlain TMDL specifies allowable phosphorus loads, or waste load allocations, for each of the 59 WWTFs that discharge to the lake's watershed
- Reductions in waste load allocations are targeted only to WWTFs in those lake segment watersheds where the currently permitted wastewater load represents 10% or greater portion of the total phosphorus load to that segment from all sources (4 segments)



Stormwater:

- 3 Acre Stormwater General Permit: Landowners with more than 3 acres of “impervious surfaces” must undertake projects to treat water runoff, removing phosphorus, sediment, and other pollutants before water enters the lake
- Landowners have 18 months to complete an engineering analysis to determine "best-fit" stormwater treatment practices to filter, store, or soak up runoff
- Effective July 1, 2022, discharge from new development greater than ½ acre & discharge from existing impervious surface greater than 1 acre is covered
Financial support available to help permit applicants comply (ARPA, CWIP)
- Other Stormwater: MS4s, MSGPs for Industrial Activities, Operational Permits



Shoreland Protection

- Vermont's shorelands are most densely settled part of state and contribute significant phosphorus loads to our lakes, ponds, and rivers
- In 2014, VT passed the Shoreland Protection Act which regulates shoreland development within 250 feet of a lake's mean water level for all lakes
- Intent of the Act is to prevent degradation of water quality in lakes, preserve habitat and natural stability of shorelines, and maintain the economic benefits of lakes and their shorelands
- Any new development, redevelopment, or clearing within 250 feet from lake edge requires a permit (exemptions apply)
- VT established voluntary Lake Wise Program to encourage lake-friendly behavior

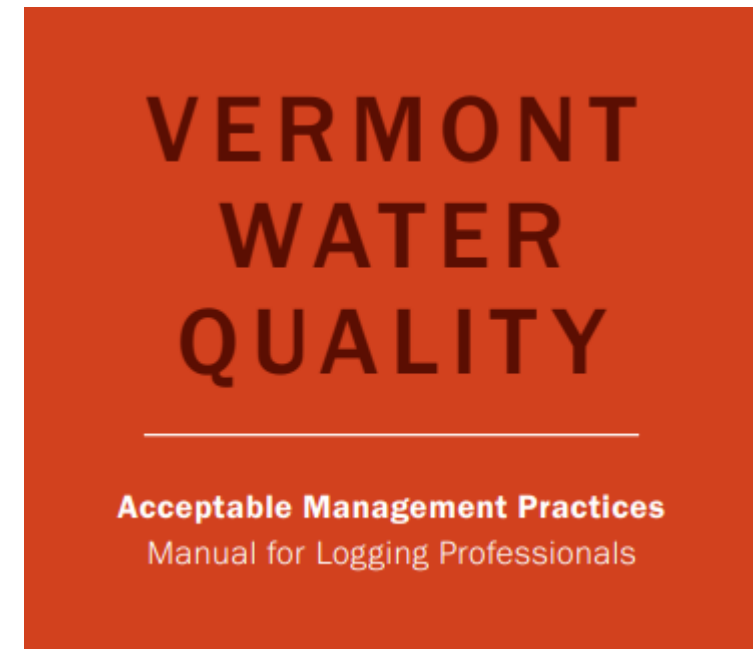


Agricultural

- Required Agricultural Practices (RAPs) are standards to which all farms must be managed to reduce impact of agricultural activities to water quality
- RAP standards are intended to improve the quality of Vermont's waters by reducing and eliminating cropland erosion, sediment losses, and nutrient losses through improved farm management techniques, technical and compliance assistance, and where appropriate, enforcement
- The RAPs establish nutrient, manure, and waste storage standards, make recommendations for soil health and establish requirements for vegetated buffer zones and livestock exclusion from surface water. The RAPs also establish standards for nutrient management planning and soil conservation.
- VT Agency of Agricultural supports / enforces RAP implementation

Logging

- Purpose of AMPs is to provide sound practices for loggers to utilize, before, during, and after logging to comply with VT's Water Quality Standards
- AMPs are intended to prevent discharges of sediment, along with other hazardous materials and woody debris from entering streams and other bodies of water, to control soil erosion and maintain natural water temps
- AMPs apply to all logging operations in VT regardless of purpose, enforceable
- Eg: Standards for Roads, Trails, Buffers, Landings, Waste, etc.



Roads

- **Municipal Roads General Permit:** intended to achieve significant reductions in stormwater-related erosion from municipal roads, paved and unpaved
- Municipalities will implement a customized, multi-year plan to stabilize their road drainage system and bring road drainage systems up to basic maintenance standards and reduce erosion
- Permit is required by VT Clean Water Act, and Lake Champlain TMDL

- **Transportation Separate Storm Sewer System:** New General Permit that covers stormwater discharges from all state roads
- Requires State to develop a Phosphorus Control Plan (PCP) for stormwater discharges in the Lake Champlain Basin and reduce the discharge of pollutants to the maximum extent practicable through compliance with six minimum control measure requirements throughout the State

Rivers

Stream Alteration Permit Program and River Corridor and Floodplain Protection Program are structured to manage rivers toward geomorphic equilibrium

- Based on detailed geomorphic assessments, 75% of VT's rivers are disconnected from floodplains and /or incised, leading to erosion and transport of nutrient-laden sediments that would otherwise be stored on landscape
- Encroachments and channel erosion are two primary stressors
 - Stream Alteration Permit program: legacy practice of post flood channelization is no longer allowed, only permits the minimum in-channel work to protect existing investments and infrastructure.
 - River Corridor & Floodplain Protection Program limits new encroachments and reduces bank armoring (which confines and energizes the river, resulting in more erosion elsewhere in the system)

Results

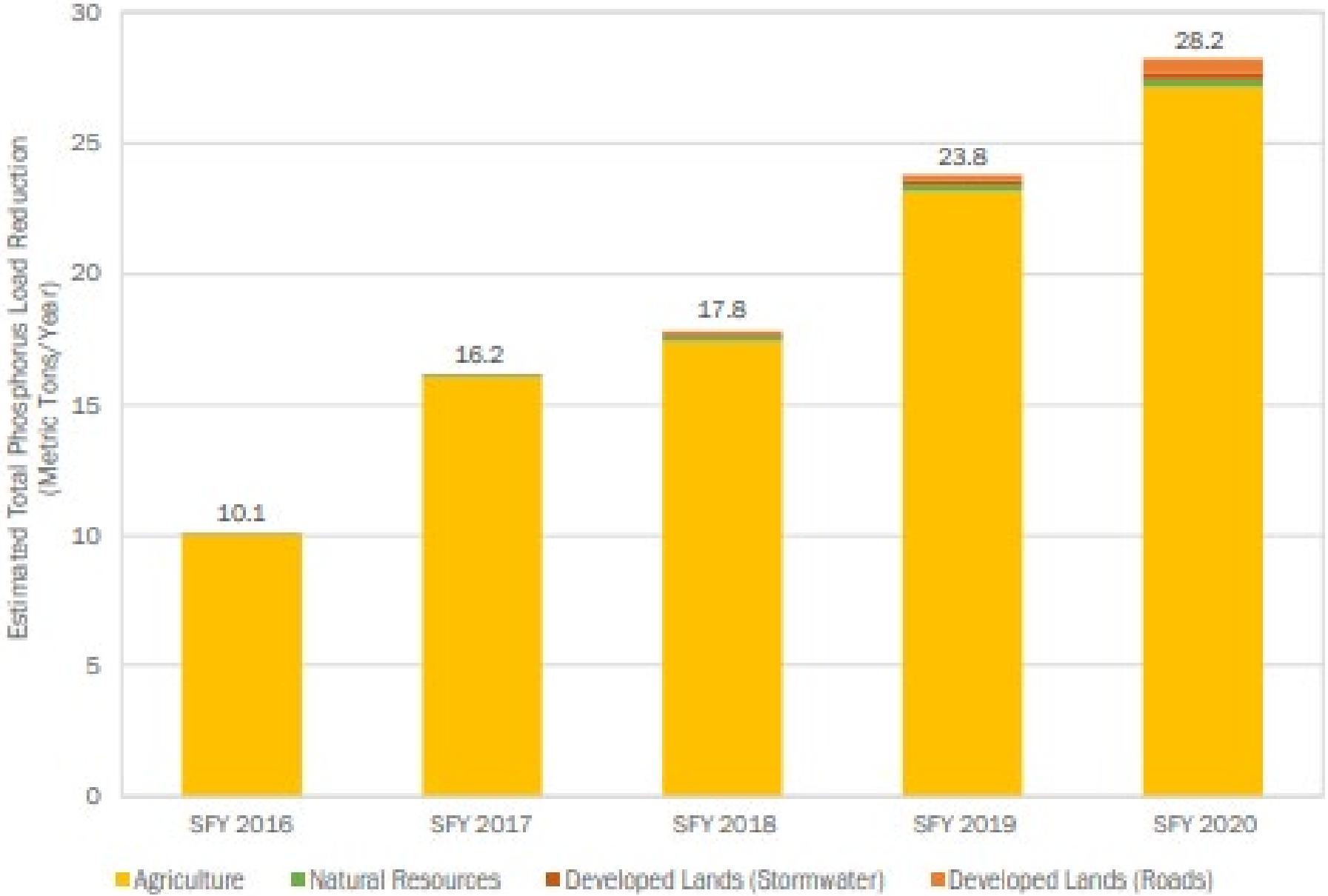
- DEC issued 2020 Clean Water Initiative Report
- Estimated 28.2 metric ton TP load reduction achieved as of SFY 2020, representing 13% of phosphorus reduction required for Lake Champlain to meet VT water quality standards by 2038
- Regulatory and funding programs are ramping up in the next 1-3 years, will result in significant reductions
- Wastewater treatment facilities in the Lake Champlain basin contributed 12 metric tons of total phosphorus load to Lake Champlain in 2019, 20 metric tons below the maximum permittable limit of 32 metric tons

VERMONT CLEAN WATER INITIATIVE 2020 PERFORMANCE REPORT

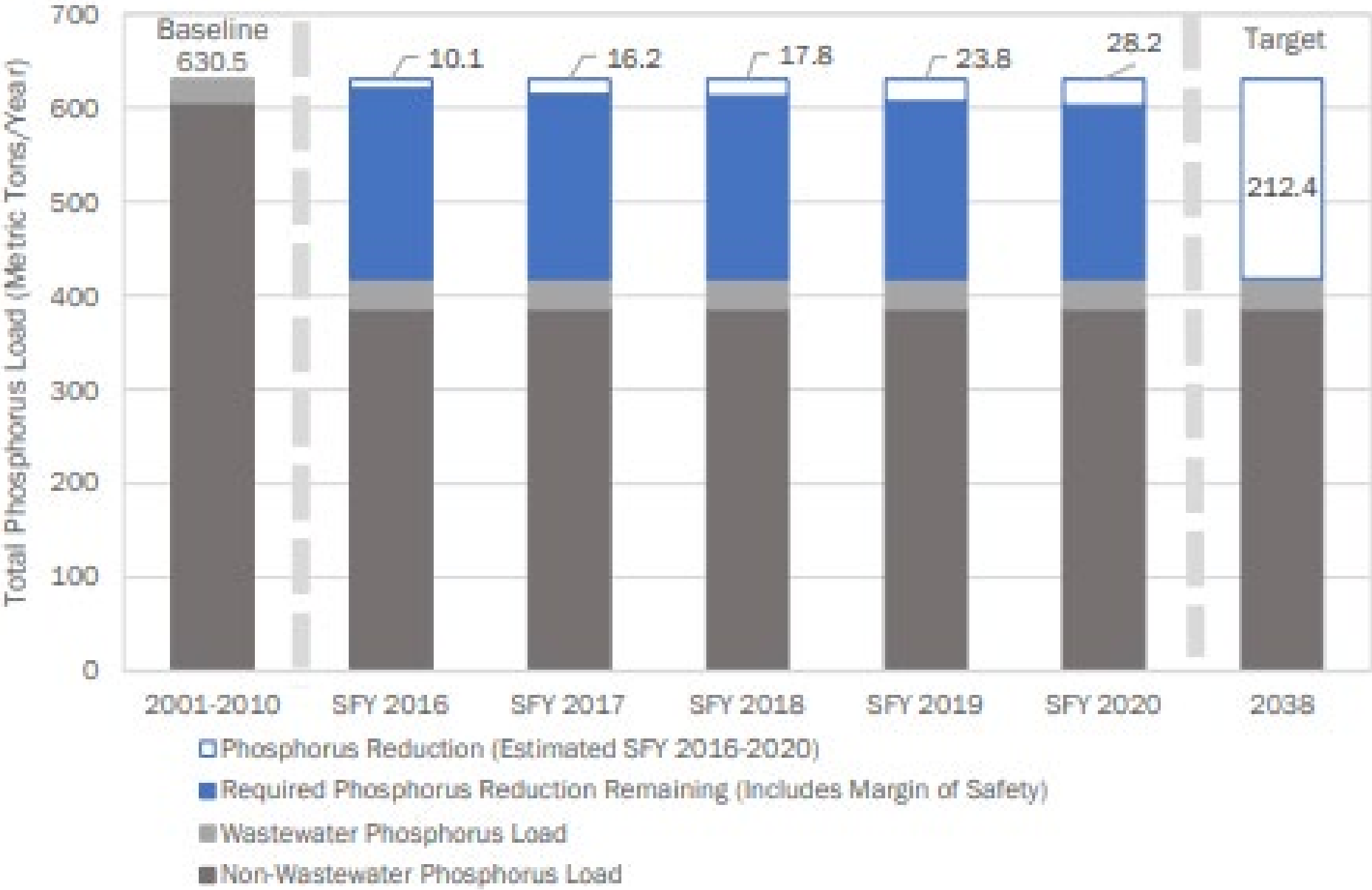


AGENCY OF ADMINISTRATION
AGENCY OF AGRICULTURE, FOOD & MARKETS
AGENCY OF COMMERCE & COMMUNITY DEVELOPMENT
AGENCY OF NATURAL RESOURCES
AGENCY OF TRANSPORTATION

Estimated TP Load Reductions Achieved



Estimated TP Load Reductions against TMDL Targets



Looking Forward

- Clean Water Service Delivery implementation:
 - Launch of P Load Allocation formulas for road, shoreland, wetlands & NR
 - Implement new pollution reduction formula to determine which projects will have the greatest potential to reduce phosphorus.
 - Support establishment of Clean Water Service Providers and implement P reduction projects
- Increased Protections for High Quality Waters
 - Reclassification & Lake Watershed Action Plans
- Monitor and address Contaminants of Emerging Concern
 - Statewide PFAS monitoring underway
- Continue to work towards achieving TMDL Targets
 - Focus on deteriorating trends in NE Arm (St Albans Bay)
 - Use ARPA and CWIP Funds to achieve goals





Thanks for your attention!