Lovejoy Pond

WATER QUALITY REPORT

2022

30 Mile River Watershed Association
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2022 Lovejoy Pond Water Quality Report

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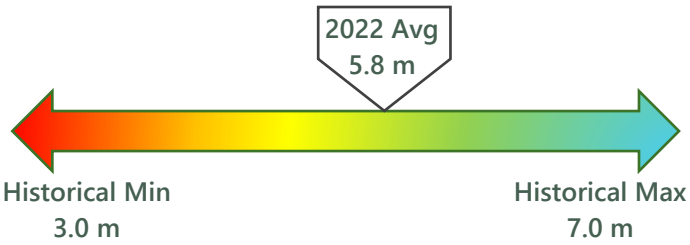
2022 Water Quality Summary[1]

Monitoring on Lovejoy Pond occurred on nine (9) dates between May and September 2022 by Whitney Baker, Silas Mohlar, and Tess Gioia of 30 Mile River Watershed Association (30 Mile) and volunteers from the Lovejoy Pond Improvement Association (LPIA).

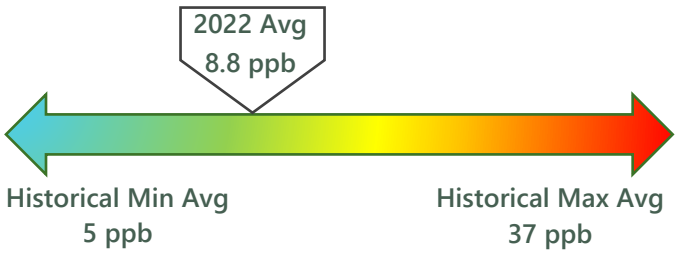
Water clarity readings in 2022 ranged from 5.1 meters (June 24th) to 6.3 meters (June 6th) with an annual average of 5.8 meters. 12 readings were collected in 2022 in total.

Water Clarity (m)	
2022 Water Clarity Average	5.8
Historical SDT Average	5.5
Maine Lakes SDT Average	4.8



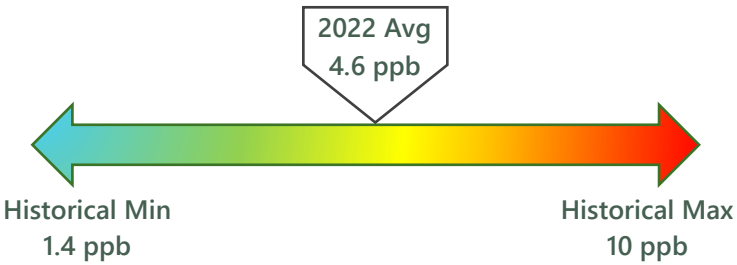
Five (5) samples were collected and analyzed for **Total Phosphorus**. Laboratory results ranged from 7 ppb (parts per billion) to 10 ppb with an average of 8.8 ppb.

Total Phosphorus (ppb)	
2022 TP Average	8.8
Historical TP Average	12
Maine Lakes TP Average	12



Chlorophyll was measured five (5) times in 2022. Results ranged from 2 ppb to 10 ppb with an annual average of 4.6 ppb.

Chlorophyll-a (ppb)	
2022 Chl-a Average	4.6
2022 Peak Chl-a	10
Historical Chl-a Average	3.2
Maine Lakes Chl-a Average	5.4



Nine (9) **Dissolved Oxygen (DO)** profiles were collected in 2022. Anoxia (DO <2 ppm) was documented in only the bottom meter of the pond during the month of August.

[1] Scale bars illustrate the range of data collected for each parameter over the historical monitoring record for general comparison with the 2022 monitoring results. The blue end represents the historical minimum (best), and the red end represents the historical maximum (worst) of all monitoring data collected.

Overview

Lovejoy Pond is located in the towns of Readfield, Fayette, and Wayne in Kennebec County, Maine and has a direct watershed area of approximately 4 square miles. Its indirect, upstream watershed is very large (42 square miles) and includes the upstream drainages of Echo Lake, Taylor Pond, Minnehonk Lake, David Pond, Parker Pond, Flying Pond, and several other smaller ponds and tributaries flowing into each of the above. Lovejoy Pond drains to a single outlet located at the south end of the lake that flows south to Pickerel Pond and Pocasset Lake in Wayne. Lovejoy does not have a public boat launch.

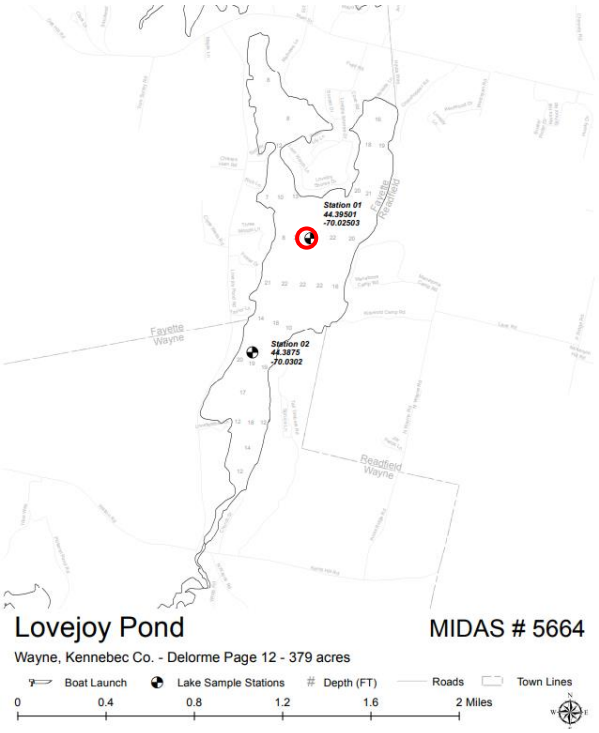


Figure 1. Lovejoy Pond Monitoring Stations.

Water Quality Monitoring in 2022

Water quality monitoring on Lovejoy Pond takes place at the deepest spot in the lake (Maine DEP Station 1), also known as the "deep spot." Station 1 is 7 meters (22 ft) deep (Figure 1). Monitoring in 2022 was completed by Whitney Baker, Silas Mohlar, and Tess Gioia of 30 Mile River Watershed Association (30 Mile) and volunteers from the Lovejoy Pond Improvement Association (LPIA). A special thanks to the 2022 volunteers:

2022 water quality volunteer, Deb Aseltine.

Deb Aseltine
Ted & Mary Becker

Water quality data was collected on nine dates between May and September. Parameters include Secchi disk transparency, dissolved oxygen and temperature, phosphorus, chlorophyll, and advanced chemistry parameters (pH, Alkalinity, Color, and Conductivity).

Secchi Disk Transparency (Water Clarity)

Secchi disk transparency (SDT) is an indicator of water clarity. To measure water clarity, a black and white disk is lowered into the water and the reading is taken at the depth at which it is no longer visible. Factors that affect water clarity include algal growth, zooplankton densities, natural water color, and suspended silt or sediment particles.

Water Clarity (m)	
2022 Water Clarity Average	5.8
Historical SDT Average	5.5
Maine Lakes SDT Average	4.8

Water readings in 2022 ranged from 5.1 meters (June 24th) to 6.3 meters (June 6th) with an annual average of 5.8 meters. 12 readings were collected over nine monitoring days in 2022 (Figure 2).

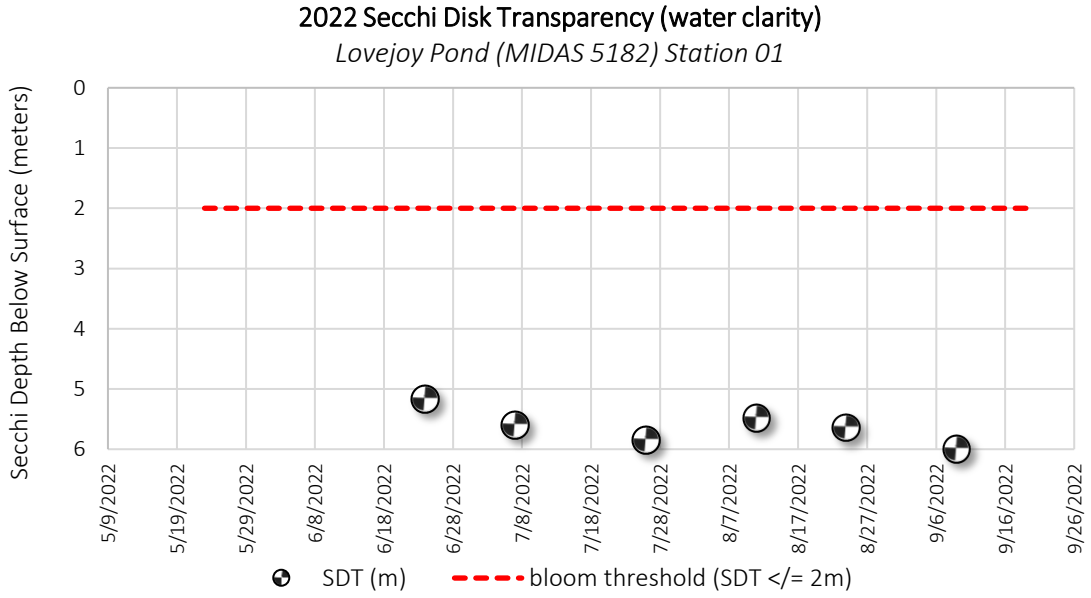


Figure 2. 2022 Secchi Disk Transparency, Station 1

SDT data has been collected during 35 years throughout the historical monitoring period spanning the past 46 years. SDT readings in Lovejoy Pond have ranged from 3.0 m (1984) to 7.0 m (2020) with an average annual reading of 5.5 m (Figure 3). It is important to note that water clarity readings in Lovejoy Pond can sometimes be physically restricted by the depth of the lake. Ocassionally, the Secchi disk will touch the bottom of the lake while still visible.

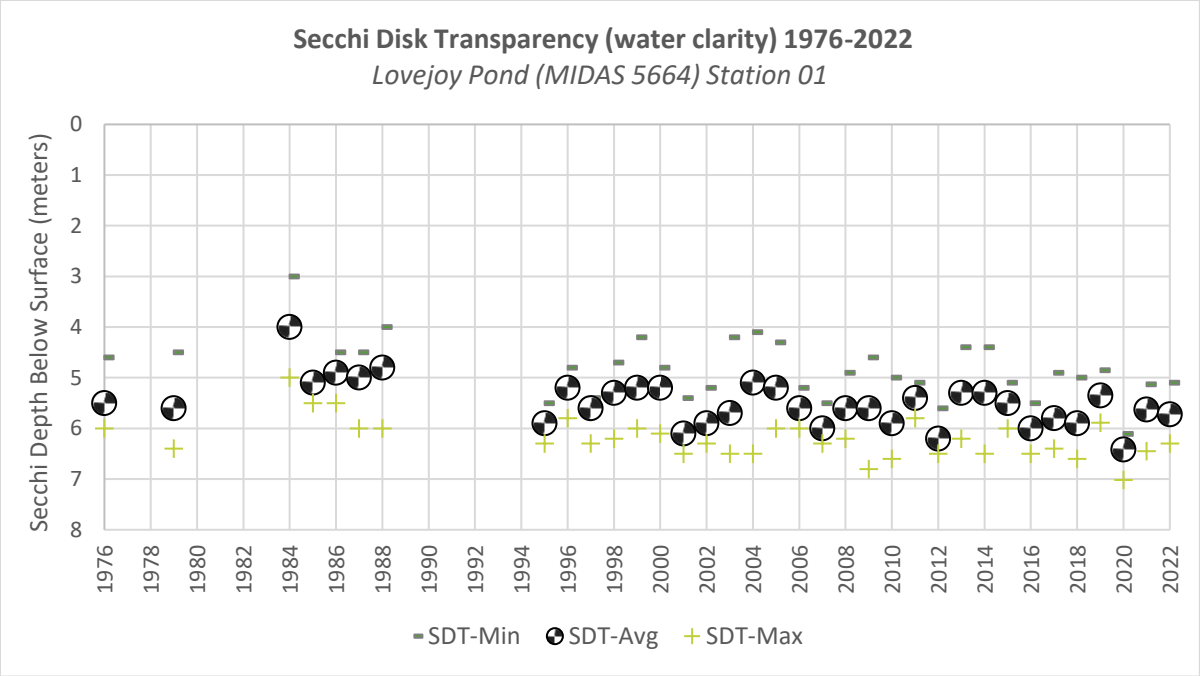


Figure 3. Average Annual Secchi Disk Transparency (water clarity), Station 1, 1976-2022

Dissolved Oxygen and Temperature

Dissolved oxygen (DO) is a critical indicator of the health of the lake system. DO is produced through photosynthesis, consumed during respiration and decomposition, and is influenced by wind, wave action, weather events, and lake productivity. A good supply of oxygen is essential for fish and other aquatic species, with most fish species requiring a DO concentration of 5 ppm (parts per million) or more. As lakes become more biologically productive in the summer, oxygen can decline as decomposition occurs in deep areas of the lake. Loss of oxygen may indicate a stressed and changing ecosystem. Understanding the pattern and extent of oxygen loss in deep areas of the lake is important to understanding changes between the years and through a single season and is particular concerning for Lovejoy Pond because it may be more vulnerable for internal phosphorus loading due to its unique sediment chemistry.[2]

As lake water is warmed during the summer, deep lakes will thermally stratify to form three distinct temperature layers. There is a warm layer at the surface (epilimnion), a thin transitional layer (metalimnion), and a deep cold layer (hypolimnion) that becomes isolated from the surface and oxygen resupply. Shallow lakes may experience brief or periodic occurrences of thermal stratification throughout the open water season, but most often shallow lakes are homothermous,

[2]Lovejoy Pond appears on Maine DEP's list of "Threatened Lakes" on the NPS Priority Watersheds List (https://www.maine.gov/dep/land/watershed/nps_priority_list/NPS%20Priority%20List%20-%20Lakes20.pdf) due to its sediment chemistry. Sediment results suggest that the lake is more vulnerable to internal phosphorus loading, a phenomenon that can occur when deep waters become anoxic (DO loss <2 ppm) resulting in phosphorus release from the bottom sediments exposed to anoxic waters.

with consistent temperature and dissolved oxygen levels from the lake surface to the lake bottom. Pocasset Lake is considered a homothermous lake, which is typical of lakes of similar depth as wind events can facilitate water mixing and easily disrupt thermal stratification. However, Lovejoy Pond does occasionally stratify in the summer, and low levels of DO were documented in recent years with DO <5 ppm in 2017, 2018, 2019, 2020, 2021, and 2022. DO <2 ppm (anoxia) was documented in 2019, 2021, and 2022. Continued and consistent monitoring will provide greater understanding of DO trends in Lovejoy Pond.

Nine (9) DO and temperature profiles were collected in 2022. DO <5 ppm was documented in profiles collected in early July through August, in only the bottom-most meter of the Pond. DO <2 ppm (anoxia) was documented in the bottom-most meter of the pond during the month of August (Figure 4).

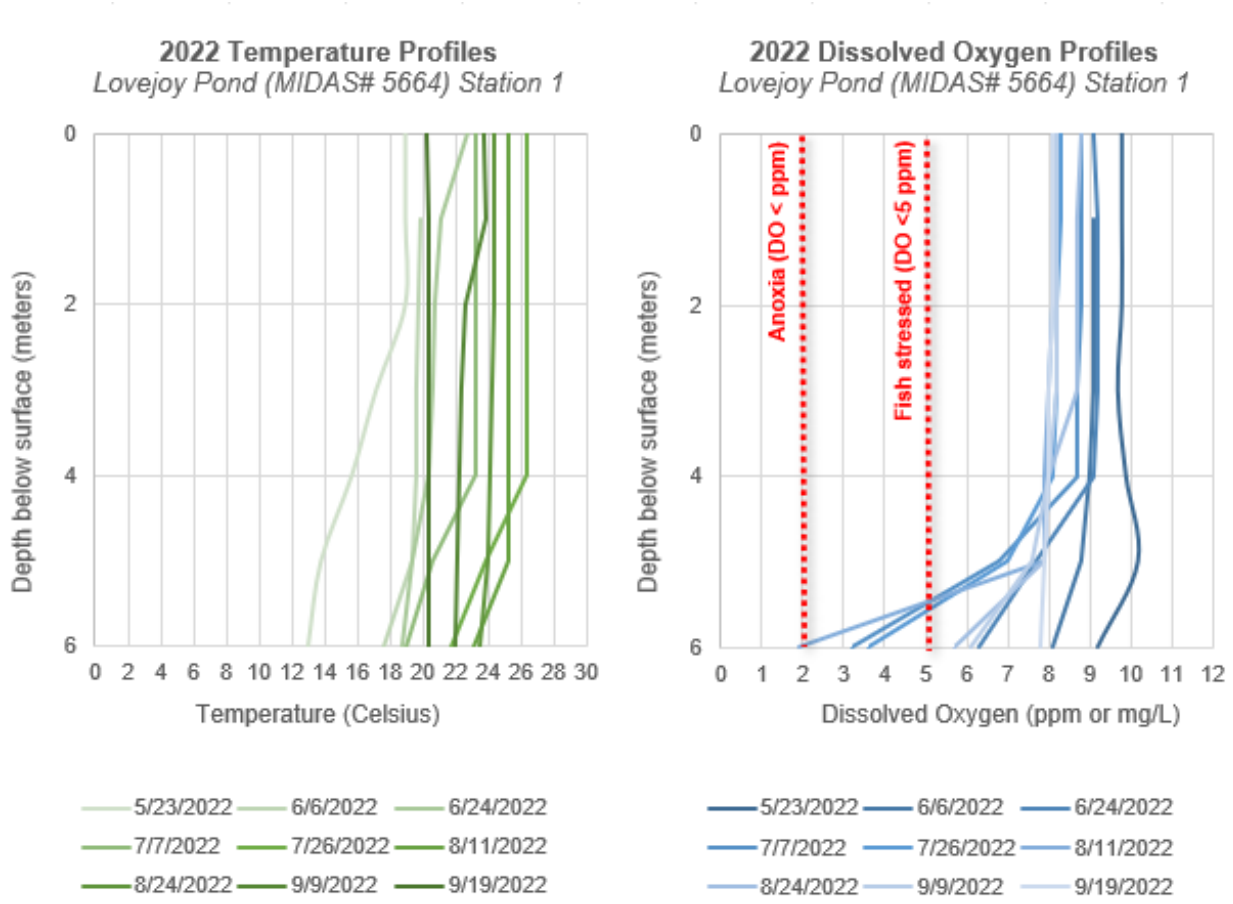


Figure 4. 2022 Dissolved Oxygen and Temperature Profiles, Station 1

Water surface temperatures through the monitoring season ranged from 19.0 C (66.2 F) to 26.4 C (79.5 F) with an average surface water temperature of 22.8 C (73 F) between May and September. Continued collection of bi-weekly DO and temperature profiles will identify trends and changes

occurring in Lovejoy Pond in order to better understand variations in thermal stratification and the extent and severity of the low DO and anoxic zones throughout the monitoring season.

Total Phosphorus (TP)

Total Phosphorus (ppb)	
2022 TP Average	8.8
Historical TP Average	12
Maine Lakes TP Average	12

Phosphorus is the nutrient that most influences the growth of algae in lakes. Because its natural occurrence in lakes is very small, phosphorus "limits" the growth of algae in lake ecosystems. Small increases in phosphorus in lake water can cause substantial increases in algal growth, hindering lake health as well as the economic, recreational, and aesthetic value of the lake. Tracking in-lake phosphorus levels over time is another way of monitoring change in lake water quality trends.

Five (5) Total Phosphorus (TP) samples were collected monthly between June and September from the pond's surface using an integrated core sampler and are referred to as "epilimnetic core samples". Laboratory results ranged from 7 ppb to 10 ppb with an annual average of 8.8 ppb.

Generally speaking, in-lake phosphorus concentrations (epilimnetic samples) less than 10-12 ppb are ideal. Lakes with in-lake phosphorus concentrations of 13 ppb or more are able to sustain algal blooms, and blooms become frequent as in-lake average concentrations approach 20 ppb.

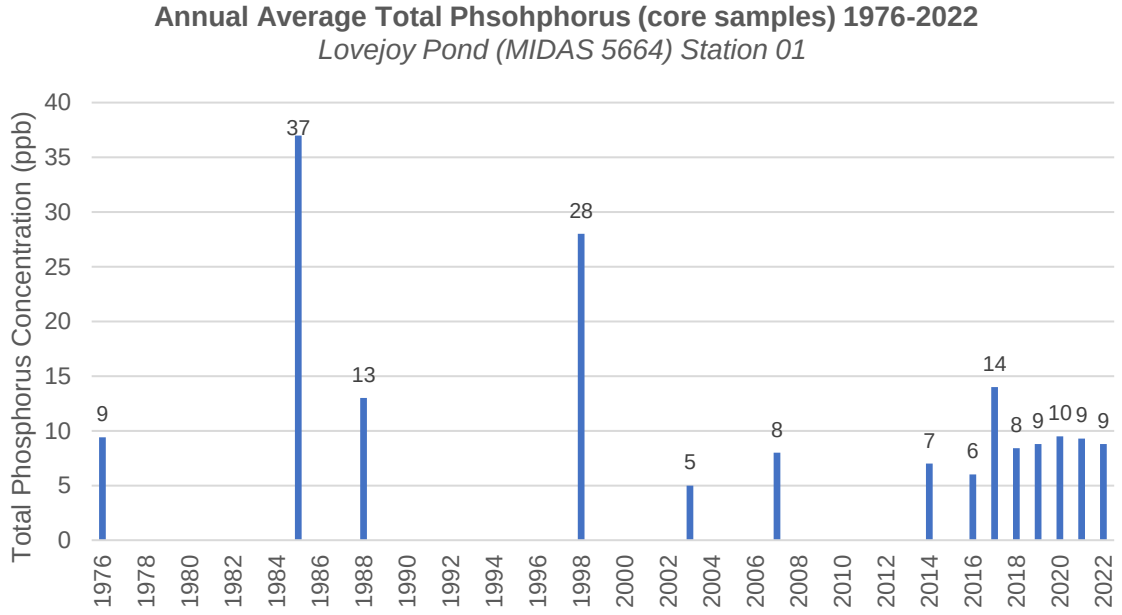


Figure 5. Annual Average Total Phosphorus data (epilimnetic core samples) collected 1976-2022, Station 1.

Historically, the annual average in-lake phosphorus concentration in Lovejoy Pond ranges from 5 ppb (2003) to 37 ppb (1985) with a historical annual average of 13 ppb (Figure 5).

Chlorophyll (Chl-a)

Chl-a (ppb)	
2022 Chl-a Average	4.6
2022 Peak Chl-a	5.1
Historical Chl-a Average	3.2
Maine Lakes Chl-a Average	5.4

Chlorophyll is found in plants (including algae) and is used to convert sunlight into energy. Measuring the concentration of Chlorophyll in lake water helps us estimate the algae population in the lake.

Chlorophyll was measured five (5) times in 2022. Results ranged from 2 ppb to 10 ppb, with a 2022 annual average of 4.6 ppb. Historical monitoring data collected during 11 years between 1976-2022 ranged from 1.4 ppb (2017) to 10 ppb (2022) with a historical annual average of 3.1 ppb (Figure 6).

Discussion

2022 was 30 Mile's seventh year of monitoring Lovejoy Pond. Historical data presented in this report includes all monitoring data collected through 2018, submitted by volunteer monitors, 30 Mile staff, and other state agencies, that has undergone a thorough QA/QC process at Maine DEP. 2019, 2020, 2021, and 2022 data included in this report is data collected by 30 Mile only, and annual averages will be updated in next year's water quality report if Maine DEP has published the full dataset by the time of the report.

Five years of consecutive data collection for any given parameter will provide the baseline condition for water quality. 10 years of consecutive data collection is needed to meet the minimum data thresholds for determining trends over time. 30 Mile's monitoring program will continue to develop a robust dataset that can help our community identify and address water quality concerns in Lovejoy Pond.

Near real-time data for Lovejoy Pond's clarity (Secchi depth), and dissolved oxygen and temperature profiles can be found online at https://30mileriver.org/lovejoy-pond/, along with a link to the historical dataset and depth map.

Next Steps

1. Continue bi-weekly baseline monitoring between May and October each year to monitor seasonal and annual variability across all parameters, and better document changes and trends over time.

2. Develop a LakeSmart Team on Lovejoy Pond, providing education to shorefront property owners about polluted stormwater runoff, phosphorus, and the effects that watershed development can have on lake water quality.

3. Work with 30 Mile to review the list of priority sites identified during the 2020 watershed survey and determine next steps to address remaining sites through LakeSmart, 30 Mile's YCC, and Technical Assistance programs.