

South Bethany 5 Year Water Quality Trend

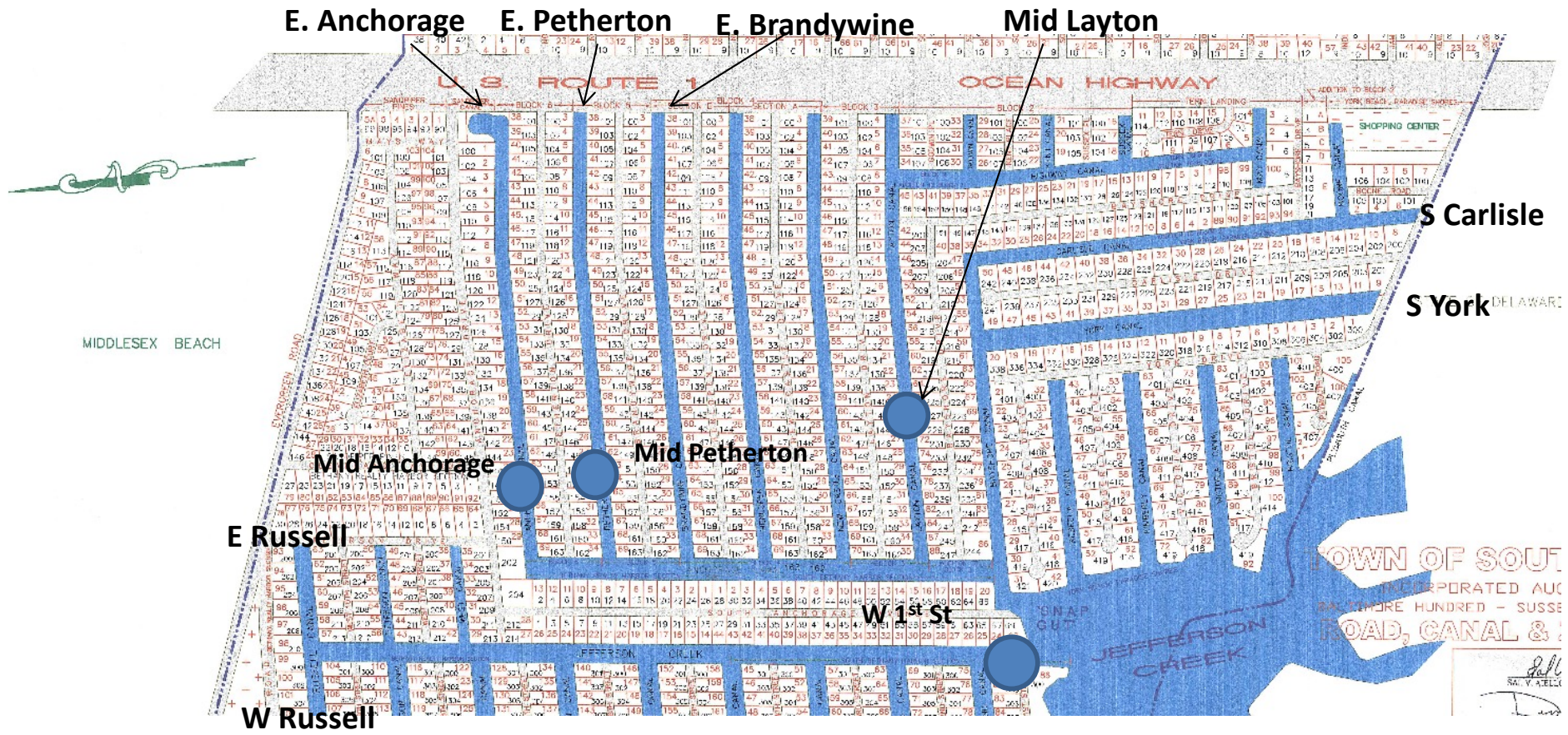
March 27, 2023

Citizen Water Quality Monitoring Program

- Administered by U of Delaware at Lewes for Delaware waterways
 - Data reported to Ed Whereat
- Currently a 5-member team in South Bethany
 - Will Case, Mark Giler, Bill MacLachlan, Jack Whitney, Dave Wilson
- Monitor 11 sites in South Bethany
 - May-Sept once a week
 - October and April twice a month
 - November-March once a month
- Parameters monitored
 - Dissolved oxygen (DO), salinity, air and water temperature measured with a meter
 - Water clarity measured with a secchi disk
 - Water samples collected for bacteria, total and inorganic nitrogen (DIN), total and inorganic phosphorus (DIP), and harmful algae blooms
 - Observations of algae accumulations or fish kills

Eleven Monitoring Sites Include 4 Mid Canal ● and 7 Dead End Locations

Generally, sites furthest from Bay have lowest DO



Dissolved Oxygen Best Indicator of Water Quality

- Minimum standard for healthy water for marine life is 4 mg/l in Delaware
- High DO conditions
 - Water with low temperature, low salinity, good circulation, and remote from storm drainage (mid canal locations away from Rte 1)
- Low DO conditions
 - Water with high temperature, high salinity, poor circulation, and close to storm water drainage (dead ends close to Rte 1 in summer months)
- Factors adversely affecting DO
 - Poor circulation reduces turbulence which promotes mixing with air
 - High water temperature and salinity reduce absorption of oxygen
 - Nutrients promote algae that consume oxygen during decay
 - Reduced sunlight from algae blooms limits underwater plant growth which produces oxygen during photosynthesis

Factors Affecting Water Quality in 2022

- Sea Colony retention pond operational since early July 2020 and Rte 1 drain improvements operational since 2014
 - Road and parking lot runoff partially retained, reducing storm water draining into South Bethany canals
- Extensive algae accumulations in May-June not removed due to harvester unavailability
 - Algae blocks sunlight and inhibits photosynthesis
 - Decaying algae absorb oxygen
- Floating wetlands trimmed in late Fall to reduce nutrients re-entering canal water during off season

Takeaways for 2022

- May-September 2022 cooler and drier than 2021 (Fig. 1)
- Substantially more algae than previous years (Fig. 2)
 - Possibly triggered by several day heat wave in mid April and expanded by warming in May (Fig. 3)
 - Beneficial widgeon grass observed at Petherton, Anchorage, Brandywine, Layton, and Highway canals
- Dissolved oxygen trend is flat over last 3 years (Fig. 4)
 - Average DO for mid canal sites always above State Std (110 samples/yr)
 - Average DO for dead end sites always below State Std (132 samples/yr.)
- Bacteria increased in 2022 at two of three dead end locations (Fig.5)
 - Dead ends well above State Std
 - Mid canal location at State Std
 - Would have expected decrease due to 8" less rain in 2022
- Inorganic nutrients are improving at E end of Anchorage
 - Dissolved inorganic nitrogen at two sites below State Std (Fig.6)
 - Dissolved inorganic phosphorus at two sites below State Std for 2 years in a row (Fig.7)
 - Effect of Rte 1 drain modifications and retention pond at Sea Colony and/or 8" less rain?

2022 Cooler and Drier Than Previous 5 Years May-September at BB Boardwalk

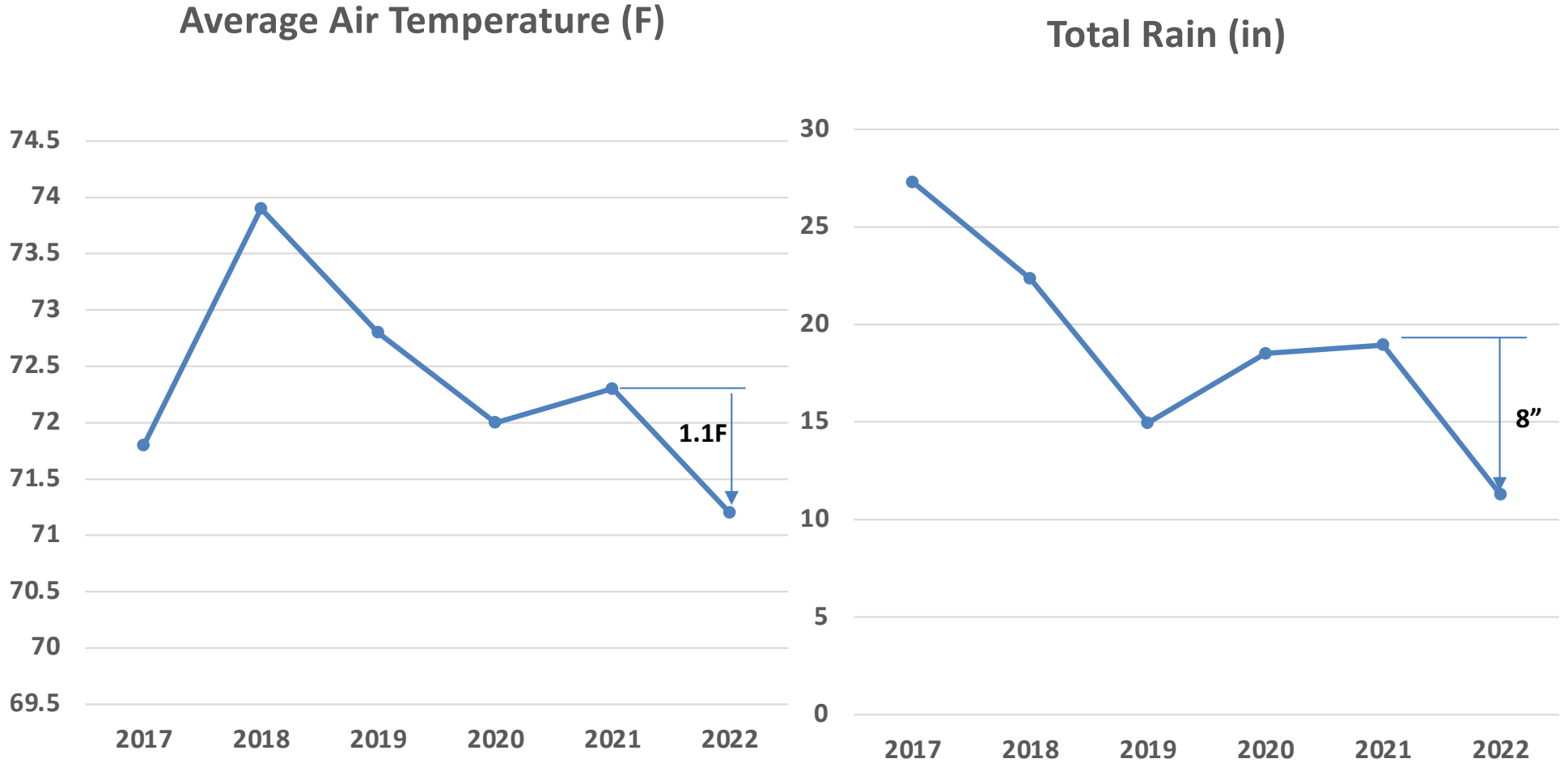


Fig. 1

Substantial Increase in Algae Extent >10ft. In 2022

11 Weekly Monitored Sites

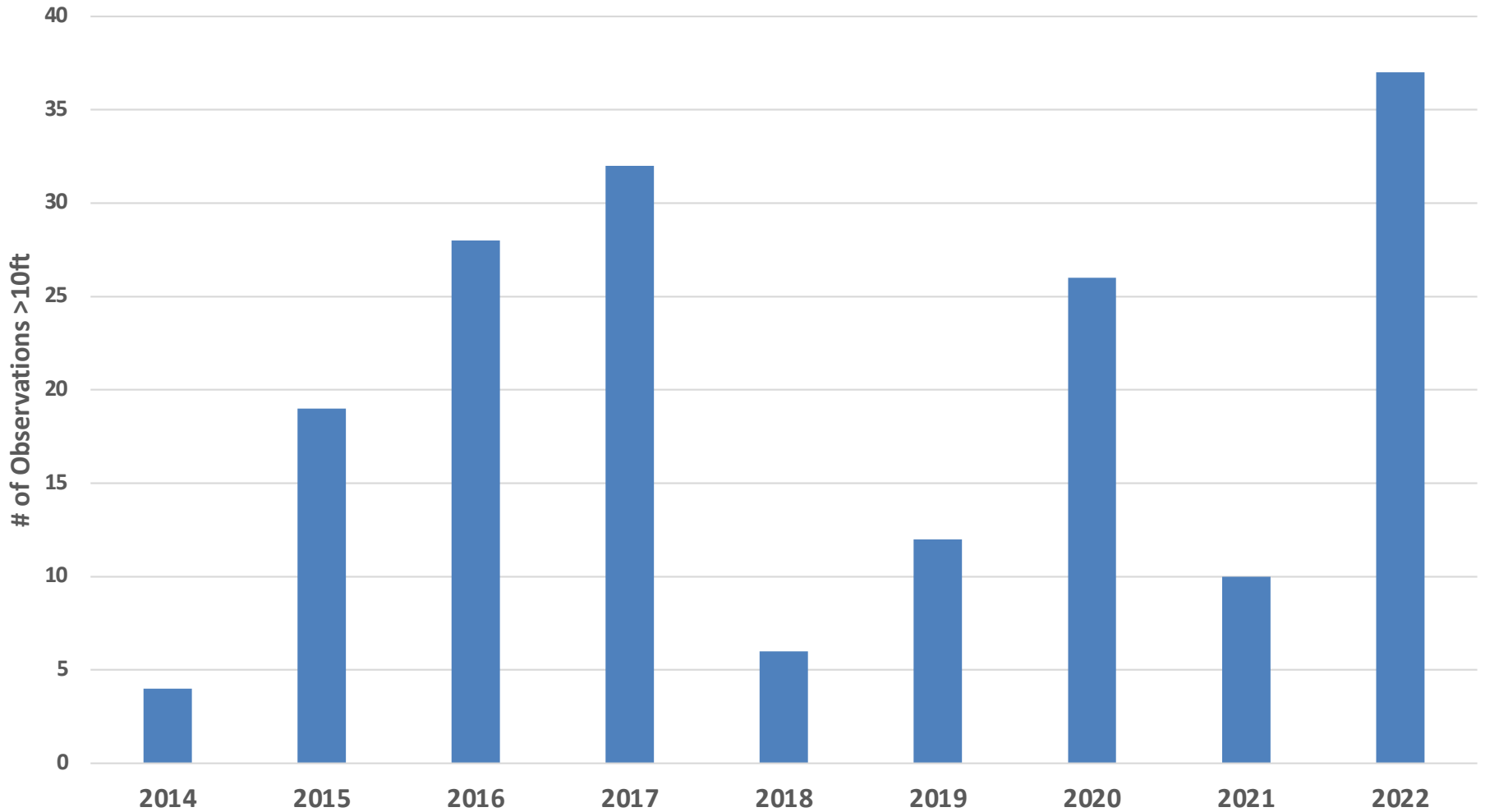


Fig. 2

Algae Blooms Increased with Temperature After 5 Day Nor'easter

11 Sites Monitored Weekly

May 2022

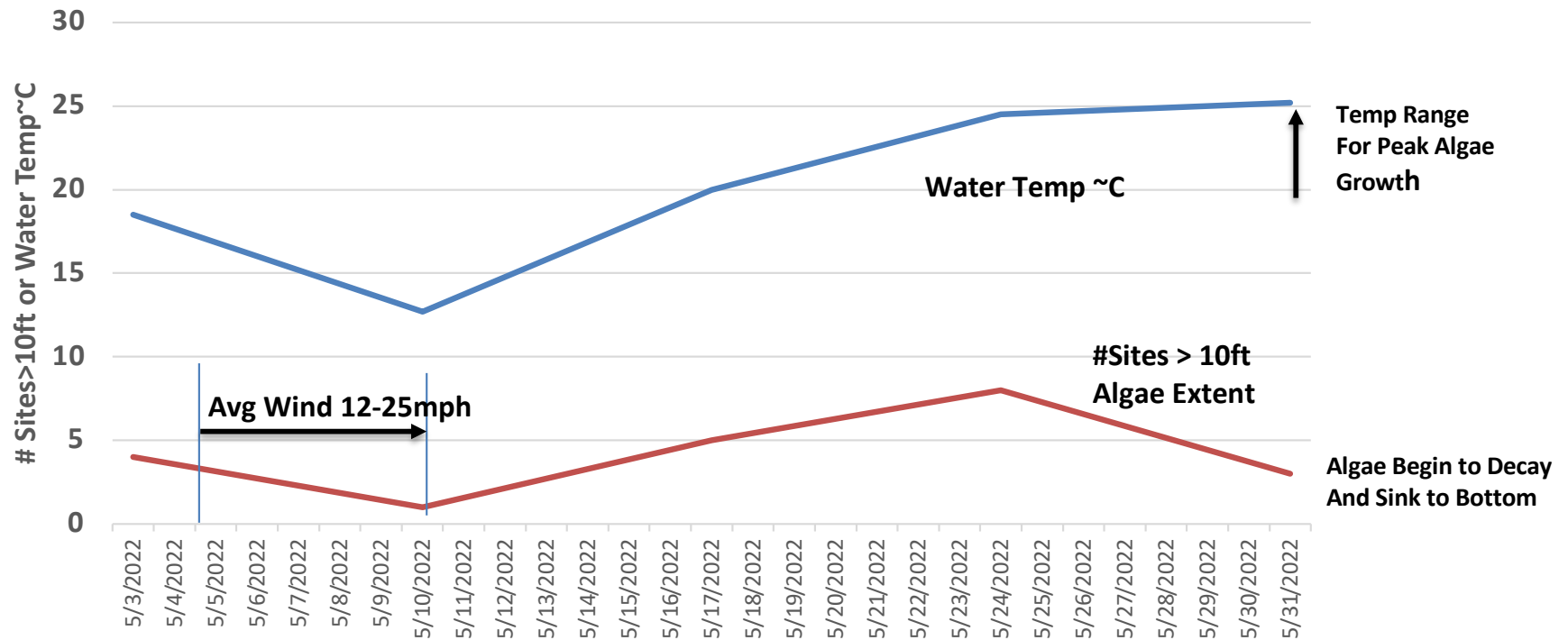


Fig. 3

Average Dissolved Oxygen at Dead Ends Below State Std May-September 11 Sites Monitored Weekly

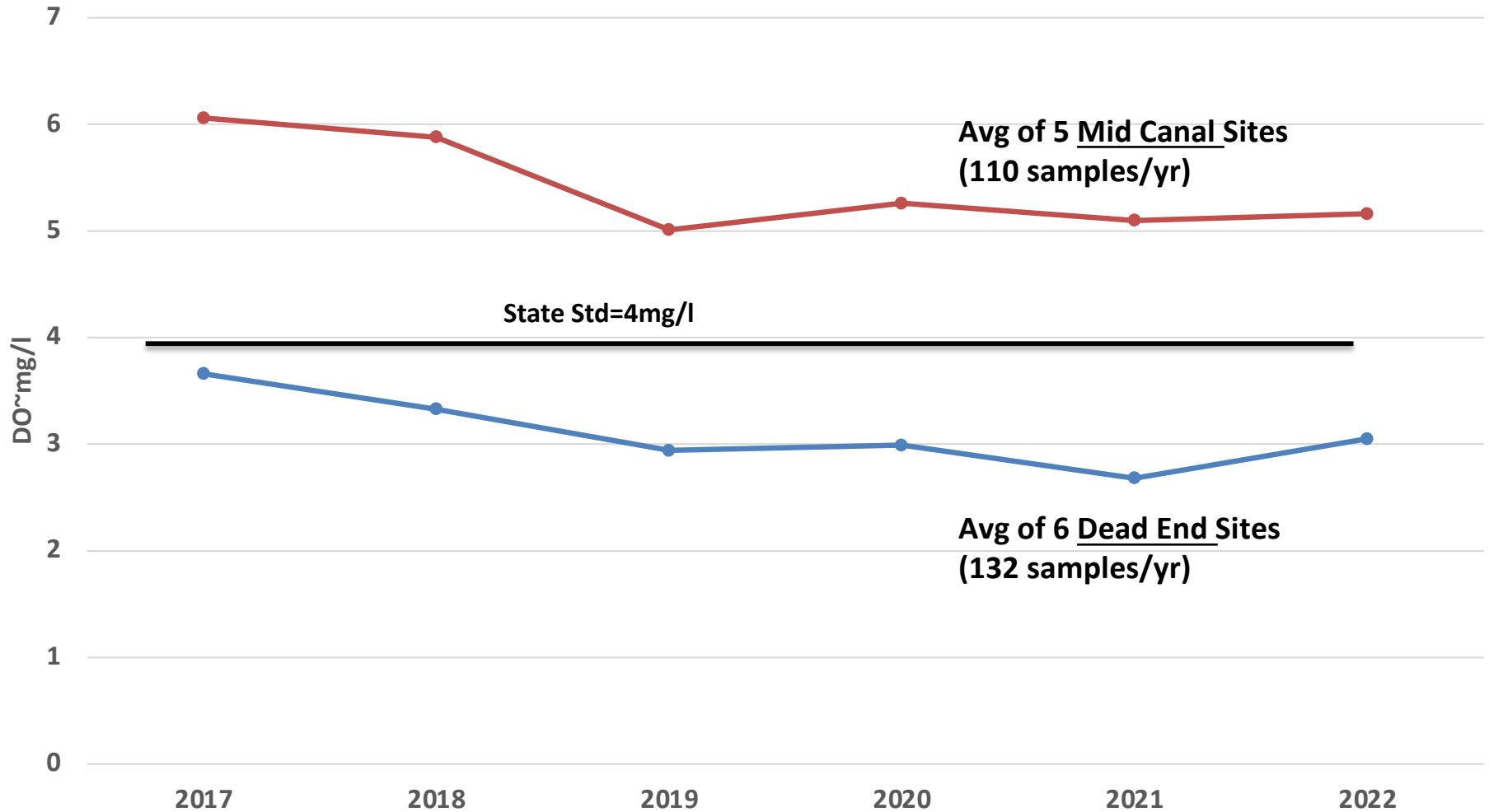


Fig. 4

2022 Bacteria Increased for E Anchorage and E Petherton

Geometric Mean for 10 Samples

Apr-Mid September

4 Sites Monitored Twice/Month

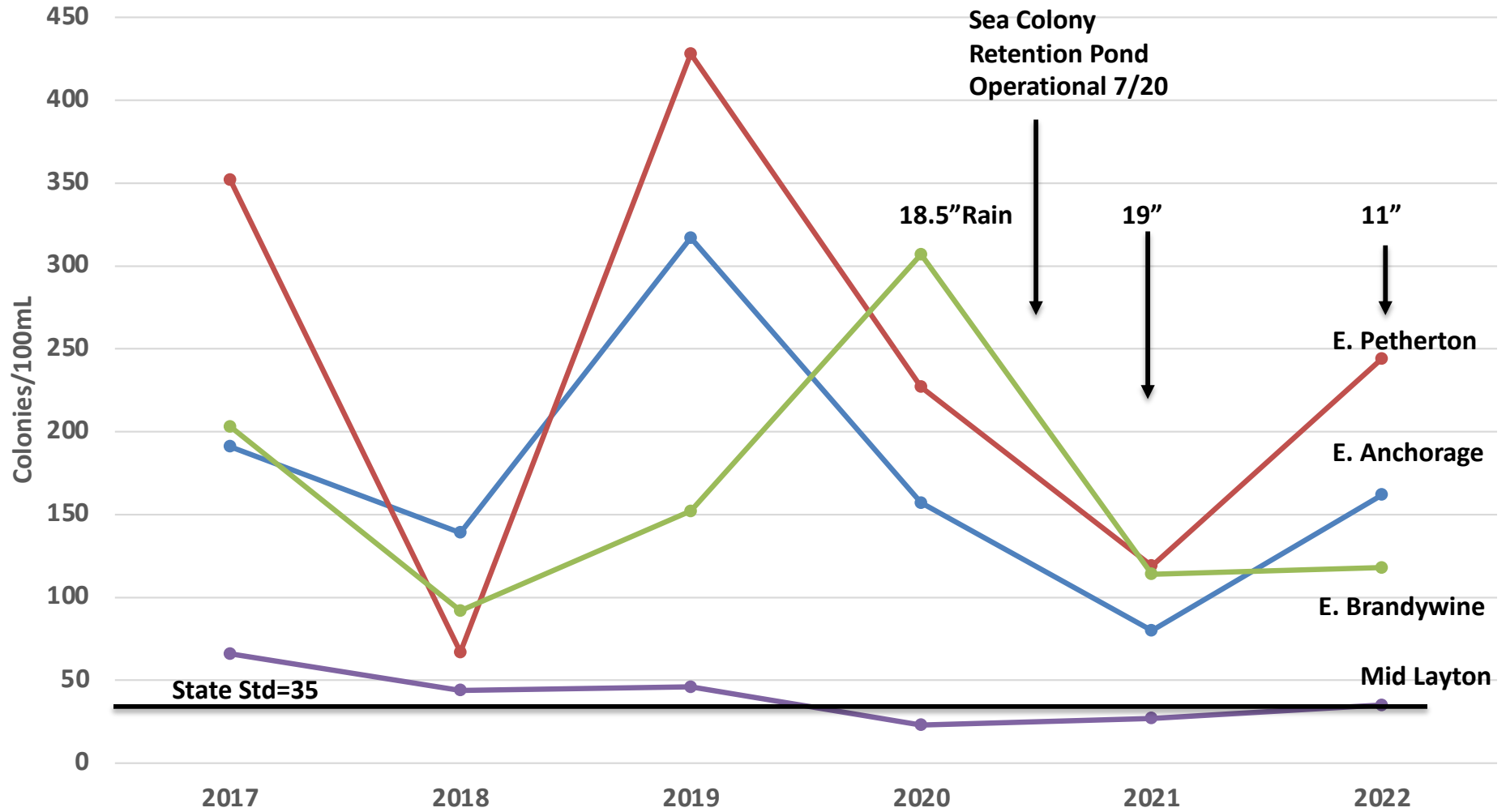


Fig. 5

Average Dissolved Inorganic Nitrogen Below State Std for 2022

February-August (11 Samples from 2 Sites)

2020 Omitted: No Apr-May Data

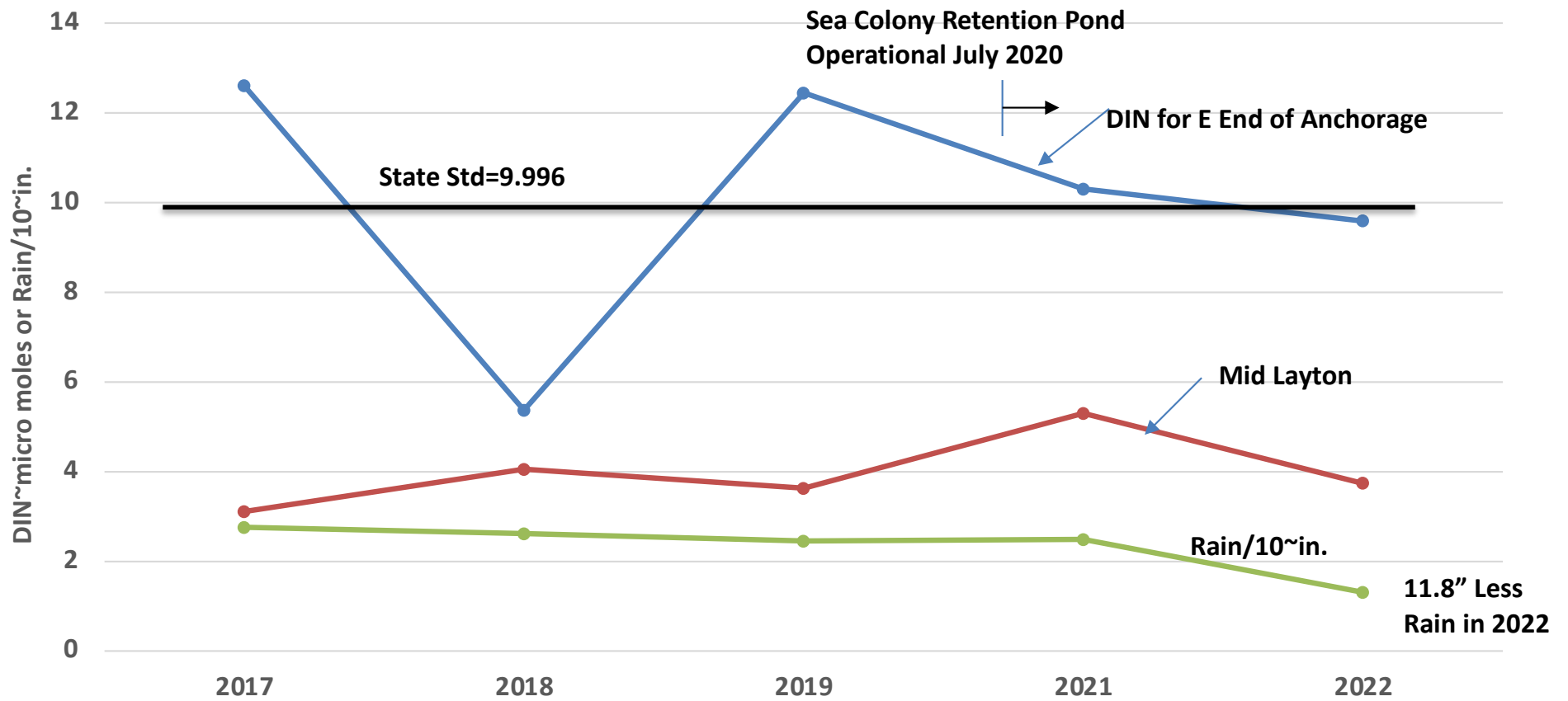


Fig. 6

Average Dissolved Inorganic Phosphorus Below State Std for 2 Years February-August (11 Samples from 2 Sites) 2020 Omitted: No April-May Data

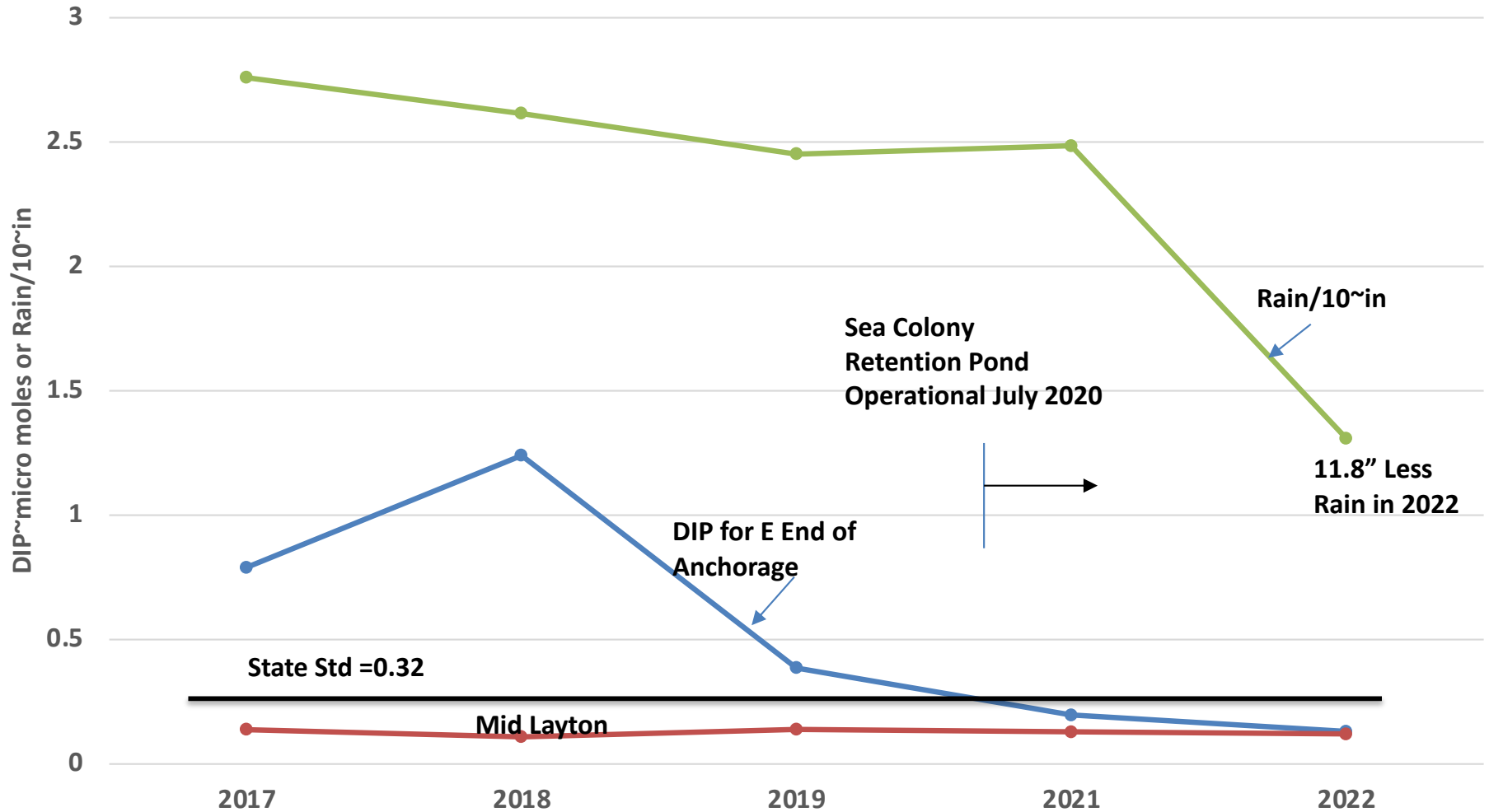


Fig. 7