

The Long and Winding Road of Nutrient Criteria Development



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A Race Between the States



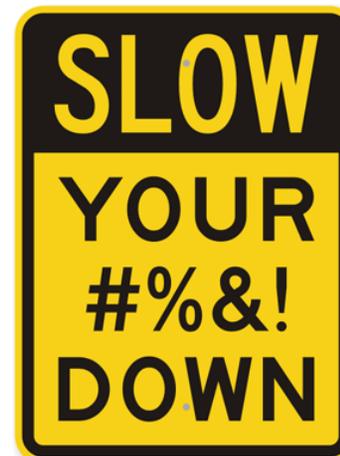
And they're off.....

In 1998, EPA began a nationwide push for states and tribes to develop Numeric Nutrient Criteria to replace their narrative criteria

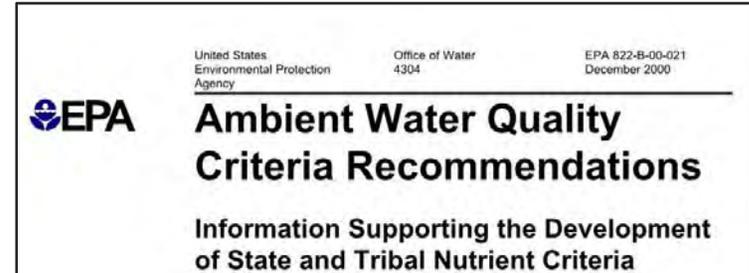
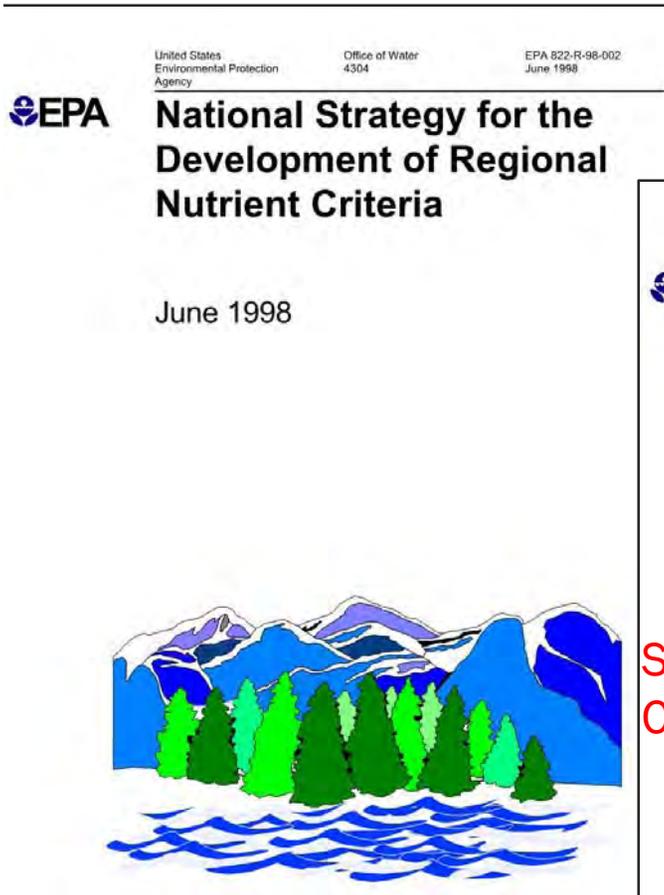
A primary justification was that NNC would make assessment, permitting, compliance and enforcement easier and more defensible



→ is better than →



EPA offered lots of guidance



Which many states largely ignored (or ridiculed)

And the race had a choppy start

Like any good unfunded Federal mandate, the response by states and tribes was not so uniform



So here we are
nearly 20
years later....

Let's look at just a few of the states to check on how the NNC race is going on that long, winding road

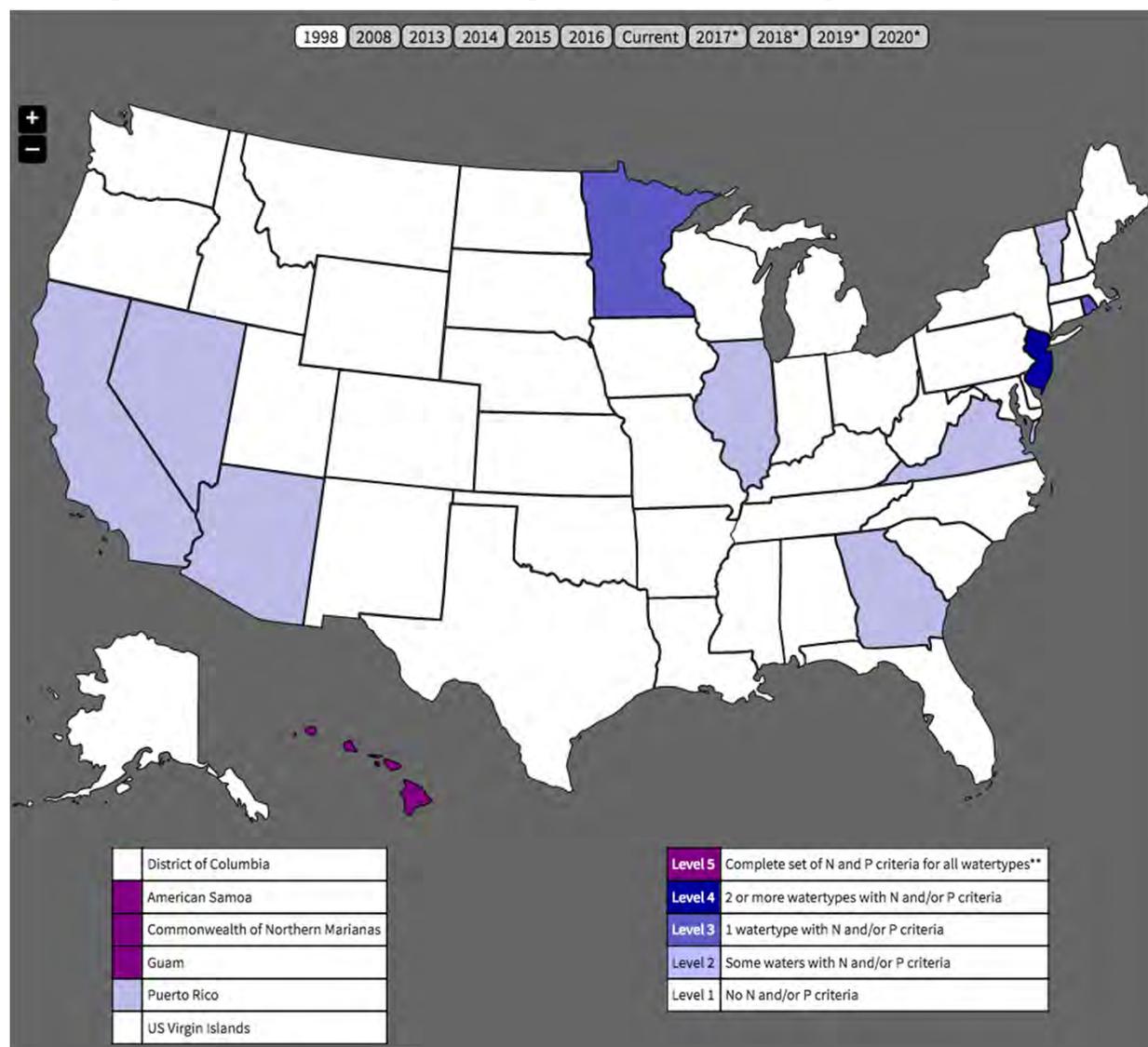
EPA has a groovy interactive map on its NNC website

(<https://www.epa.gov/nutrient-policy-data/state-progress-toward-developing-numeric-nutrient-water-quality-criteria>)

Just click a year and it shows the status of the states toward developing Nitrogen and Phosphorus criteria in that year

Click on any state and it takes you to more information than you could ever want about its N and P standards

Brown and Caldwell



Someone at EPA has good organizational skills...

| State/Territory | Region | N/P Progress at Year End | | Chl-a Progress | Number of Site-Specific Criteria | | | | | |
|-----------------|--------|--------------------------|---------|----------------|----------------------------------|----------------|-----------|---------------|---------------|---------------|
| | | 2008 | Current | | Lakes/Reservoirs | Rivers/Streams | Estuaries | | | |
| Alabama | 4 | Level 1 | ⊕⊕⊕ | Level 1 | ⊕⊕⊕ | Level C2 | ⊕○○ | 37 | 0 | 0 |
| Florida | 4 | Level 1 | ⊕⊕⊕ | Level 4 | ⊕⊕⊕ | Level C4 | ●●● | 3 | 6 | 62 |
| Georgia | 4 | Level 2 | ⊕⊕⊕ | Level 2 | ⊕⊕⊕ | Level C2 | ⊕○○ | 19 | 0 | 0 |
| Kentucky | 4 | Level 1 | ⊕⊕⊗ | Level 1 | ⊕⊕⊗ | Level C1 | ○○⊗ | not available | not available | not available |
| Mississippi | 4 | Level 1 | ⊕⊕⊕ | Level 1 | ⊕⊕⊕ | Level C1 | ○○○ | not available | not available | not available |
| North Carolina | 4 | Level 1 | ⊕⊕⊕ | Level 1 | ⊕⊕⊕ | Level C5 | ○○○ | 4 | 4 | 2 |
| South Carolina | 4 | Level 2 | ⊕⊕⊕ | Level 2 | ⊕⊕⊕ | Level C2 | ⊕○○ | 6 | 2 | 3 |
| Tennessee | 4 | Level 1 | ⊕⊕⊗ | Level 1 | ⊕⊕⊗ | Level C2 | ⊕○○ | 1 | 0 | 0 |

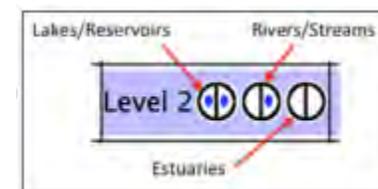
Progress Levels

Nitrogen and Phosphorus Criteria

| | |
|---------|---|
| Level 5 | Complete set of N and P criteria for all watertypes |
| Level 4 | 2 or more watertypes with N and/or P criteria |
| Level 3 | 1 watertype with N and/or P criteria |
| Level 2 | Some waters with N and/or P criteria |
| Level 1 | No N and/or P criteria |

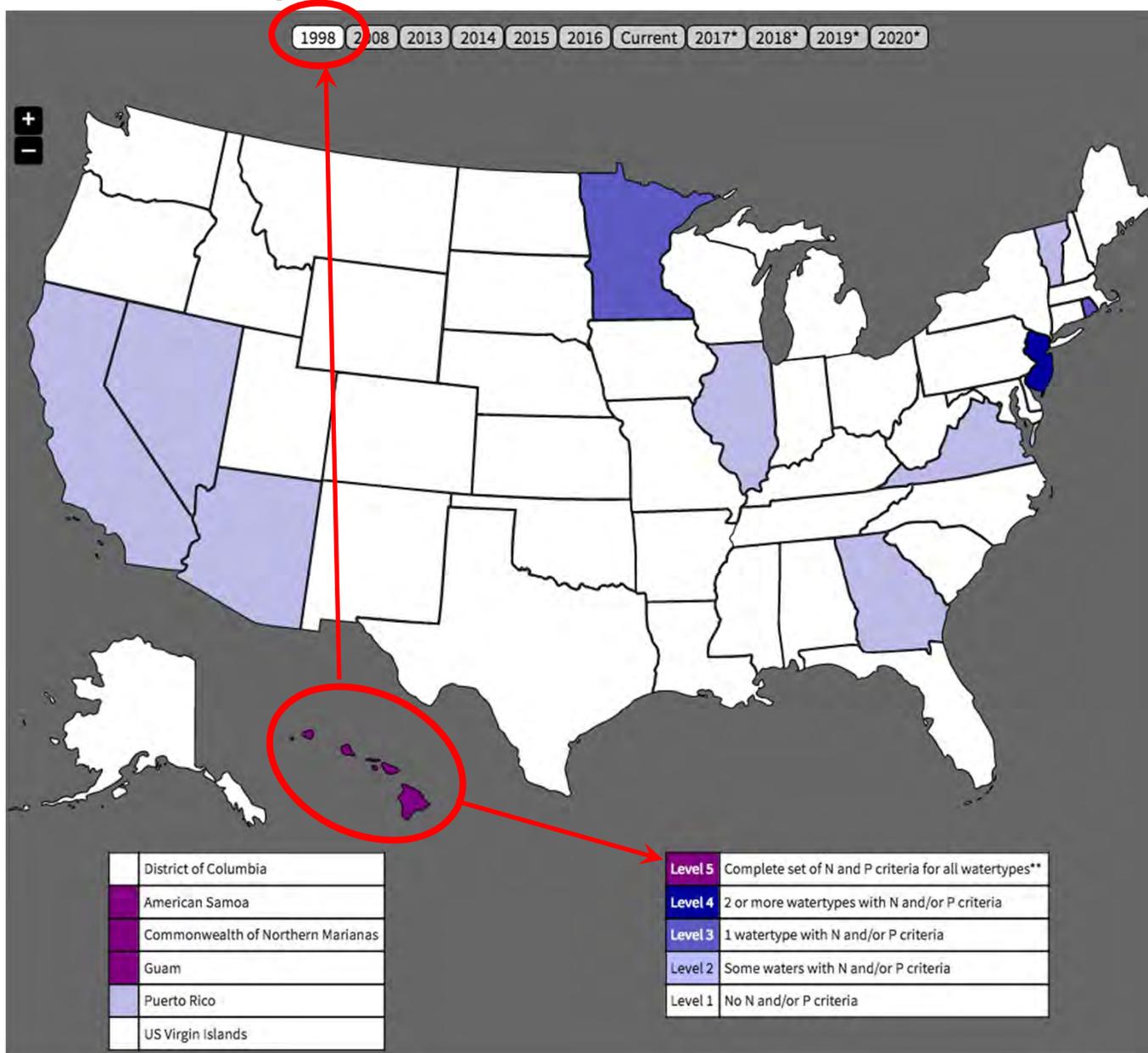
Chlorophyll-a Criteria

| | |
|----------|---|
| Level C5 | Complete set of chlorophyll-a criteria for all watertypes |
| Level C4 | 2 or more watertypes with chlorophyll-a criteria |
| Level C3 | 1 watertype with chlorophyll-a criteria |
| Level C2 | Some waters with chlorophyll-a criteria |
| Level C1 | No chlorophyll-a criteria |



| N | P | Chl-a | |
|---|---|-------|--|
| ⊕ | ⊕ | ● | Statewide criteria |
| ⊕ | ⊕ | ⊕ | Partial criteria (Categorical criteria, site-specific criteria, etc.) |
| ⊕ | ⊕ | ○ | No criteria |
| | ⊗ | | Watertype Not Applicable |

How About a Trip to Hawaii ?!



Hawaii was the first state with a complete set of NNC



And they have a lot of people out testing the water every day...

Interesting side story



Cliff Kaponu (UC San Diego student researcher):

Humans are so often concerned with the impact they're having on the environment – but we should be thinking about it from the opposite angle. When people realize their own recreational environment – the ocean – has a major effect on their health, they will become more motivated to keep the ocean clean for the sake of their own well-being.

Back to NNC...

Even the cover of Hawaii's 305(b) Report looks like a travel brochure !

2014 STATE OF HAWAII WATER QUALITY MONITORING AND ASSESSMENT REPORT:
Integrated Report to the U.S. Environmental Protection Agency and the U.S. Congress
Pursuant to §303(d) and §305(b), Clean Water Act (P.L. 97-117)



The Hawaii Department of Health
Honolulu, Hawaii
April 2014
Draft

But everything is not perfect in this tropical paradise

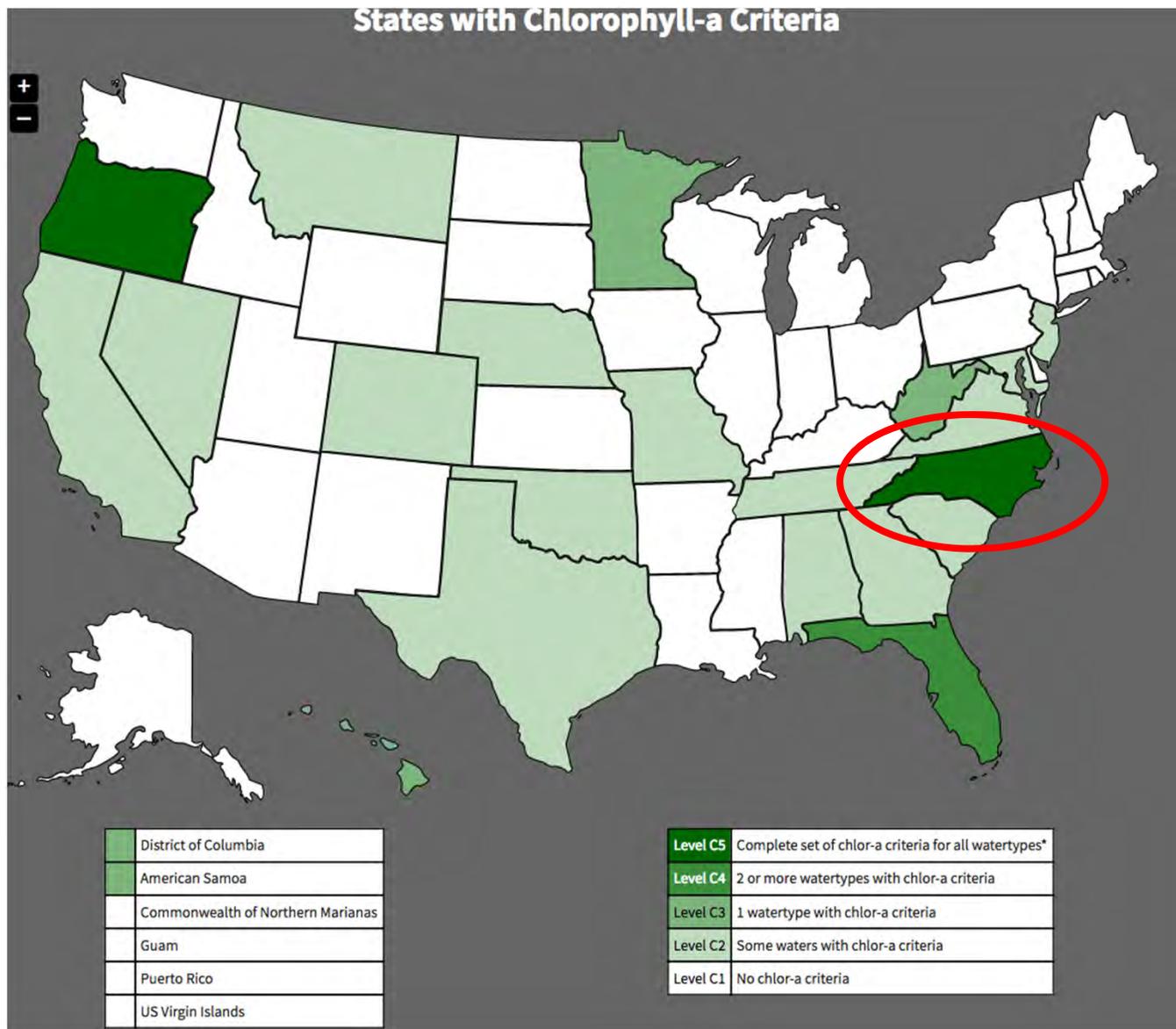
- Full set of NNC in place since at least 1998
- Streams, Embayments, Open Ocean
- No chl a criteria for streams (they are mostly torrential mountain streams)
- They have many water segments impaired for N, P and/or Chl a
- Have only a few approved TMDLs in place
- Many impaired segments are ranked as High priority for TMDL development
- 2014 Integrated Report says only a small proportion of the state's waters can even be assessed with current data

So – a quick start in the NNC race doesn't necessarily get you across the finish line of flawless water quality.

Some NNC things happened way before 1998

The EPA NNC website also has a map showing states' status toward developing Chlorophyll a criteria

North Carolina has had statewide Chl a standards on the books since the Clean Water Act was a baby (late 1970's)

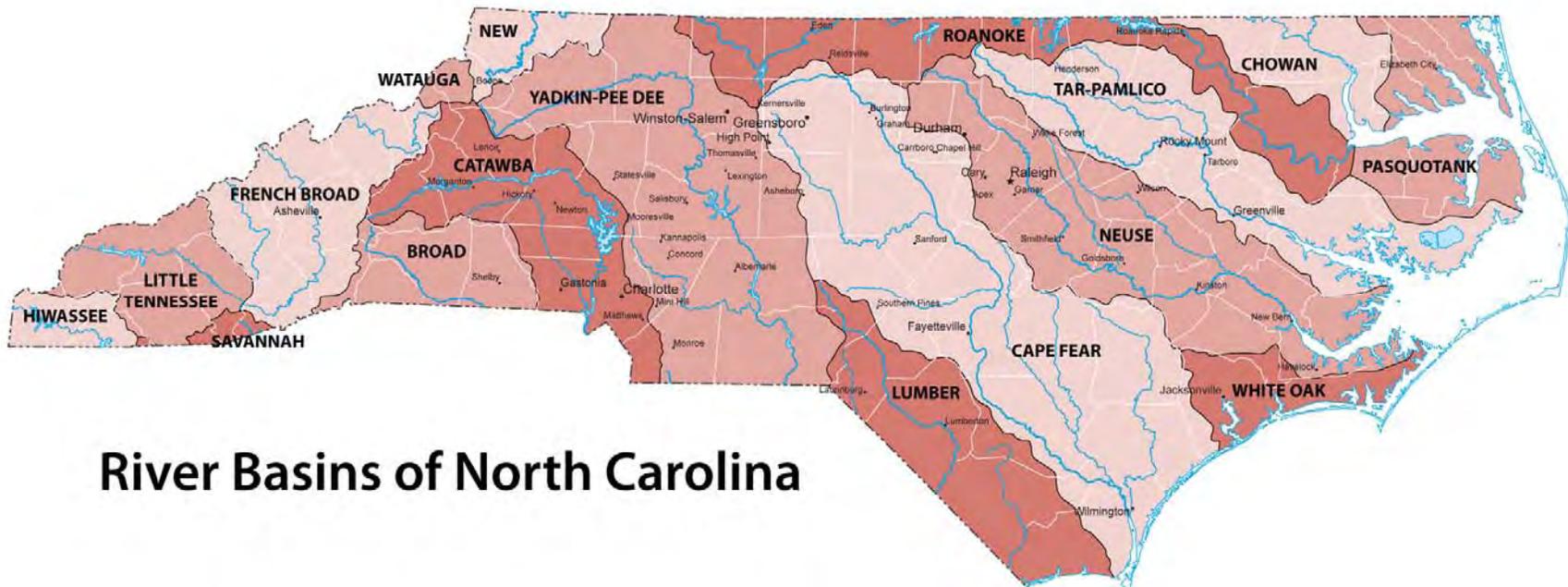


Nothin' Could be Finer than NNC in Carolina

- Chl a criteria were developed from a basic trophic status model
 - 40 ug/L for most lakes, streams and estuaries
 - 15 ug/L for “trout waters” in the mountains
 - The criteria were originally intended to be spatially and temporally-averaged criteria, but are now implemented as “all times, all places” standards
 - MUCH tougher to comply
- May 2012 – NC Forum on Nutrient Over-Enrichment
 - Experts convened from inside and outside NC to present current information and ideas for nutrient regulation and management
- NC’s 2016 305(b) report lists 29 waters with Chl a as a parameter of concern
 - 17 are listed as “exceeding criteria”
 - 12 are listed as “data inconclusive”

Nothin' Could be Finer than NNC in Carolina

- NC has a sub-classification of “Nutrient Sensitive Waters”
- 5 lakes/watersheds have Nutrient Strategies (similar to a TMDL)
 - Most strategies have been in place for 10-20 years now.
 - Each strategy is unique to the water body
 - Each is “managed” independently, with varying degrees of economic and political pressure.
 - There is uncertainty and disagreement over whether the strategies are improving water quality.



River Basins of North Carolina

Nothin' Could be Finer than NNC in Carolina

- NC has no statewide N or P criteria
 - Some see the Chl a standard as supplanting the need for N & P criteria
 - If you regulate Chl a, why the need to regulate N & P?
- NCDEQ recently updated its NNC Development Plan
 - Convened **Scientific Advisory Committee and Criteria Implementation Committee** to review information and offer recommendations.
 - Working toward adopting NNC for a few specific waters
 - High Rock Lake (targeted for NNC adoption in July 2018)
 - Albemarle Sound estuary (Dec 2020)
 - Middle Cape Fear River (Dec 2021)
 - After these three efforts, the plan calls for prioritizing all other lakes, rivers and estuaries
 - NNC adoption dates for that process extend out to 2025.
 - There are those who think these deadlines will never be met.

Nothin' Could be Finer than NNC in Carolina

Politics and budget cuts in NC in recent years have led to far fewer and far less experienced resource managers at NCDEQ, which hampers its ability to lead this process.

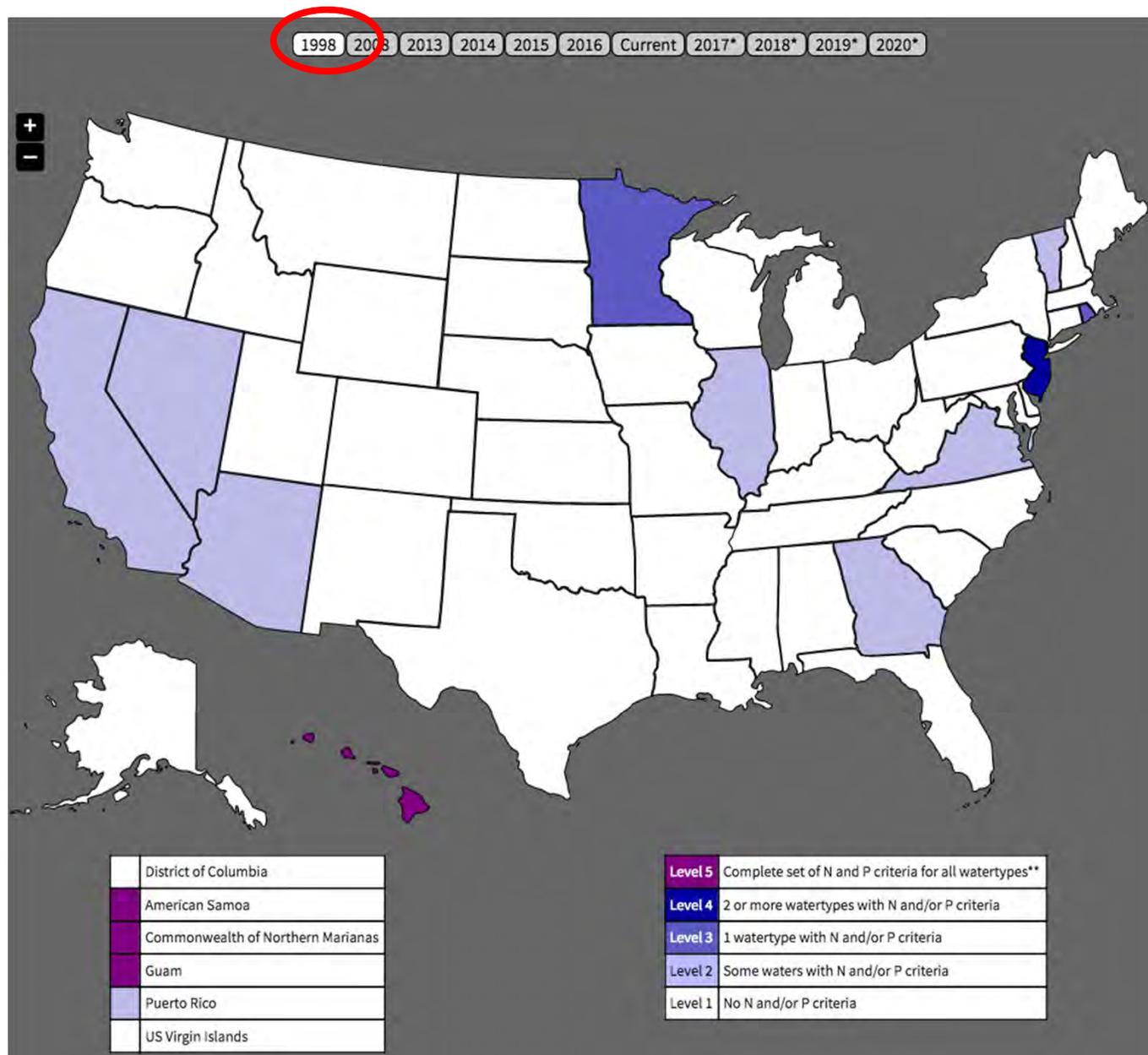
So – even if your state got a long head start before the NNC race officially began in 1998, you may still be far from the finish line.

And now, back to N and P

Zooming ahead
on the time-travel
NNC map...

But first – look at
1998 again, to
appreciate the
difference that
15 years made
nationally

[Here is 1998 →](#)

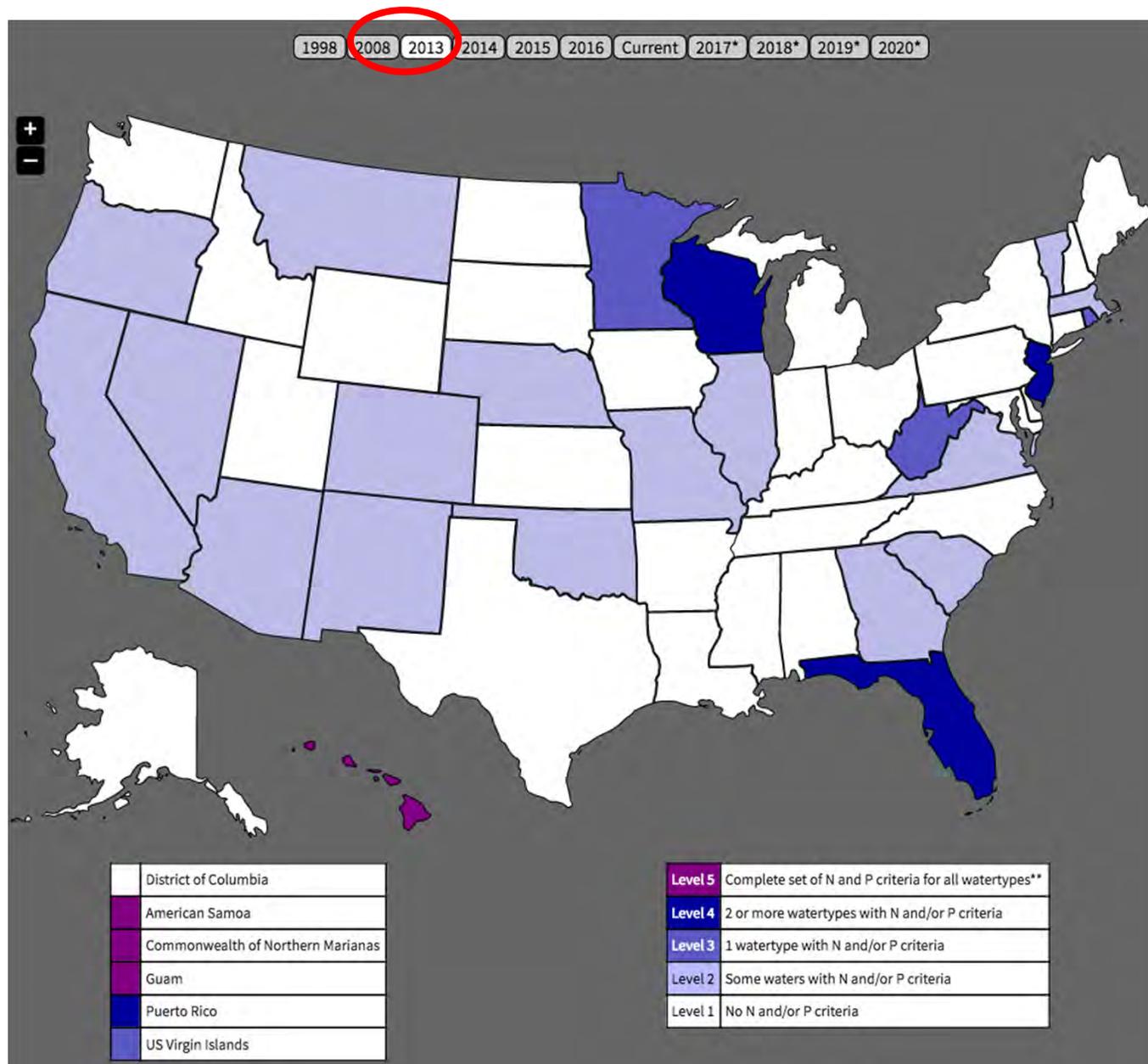


And now, back to N and P

[And here is 2013](#) →

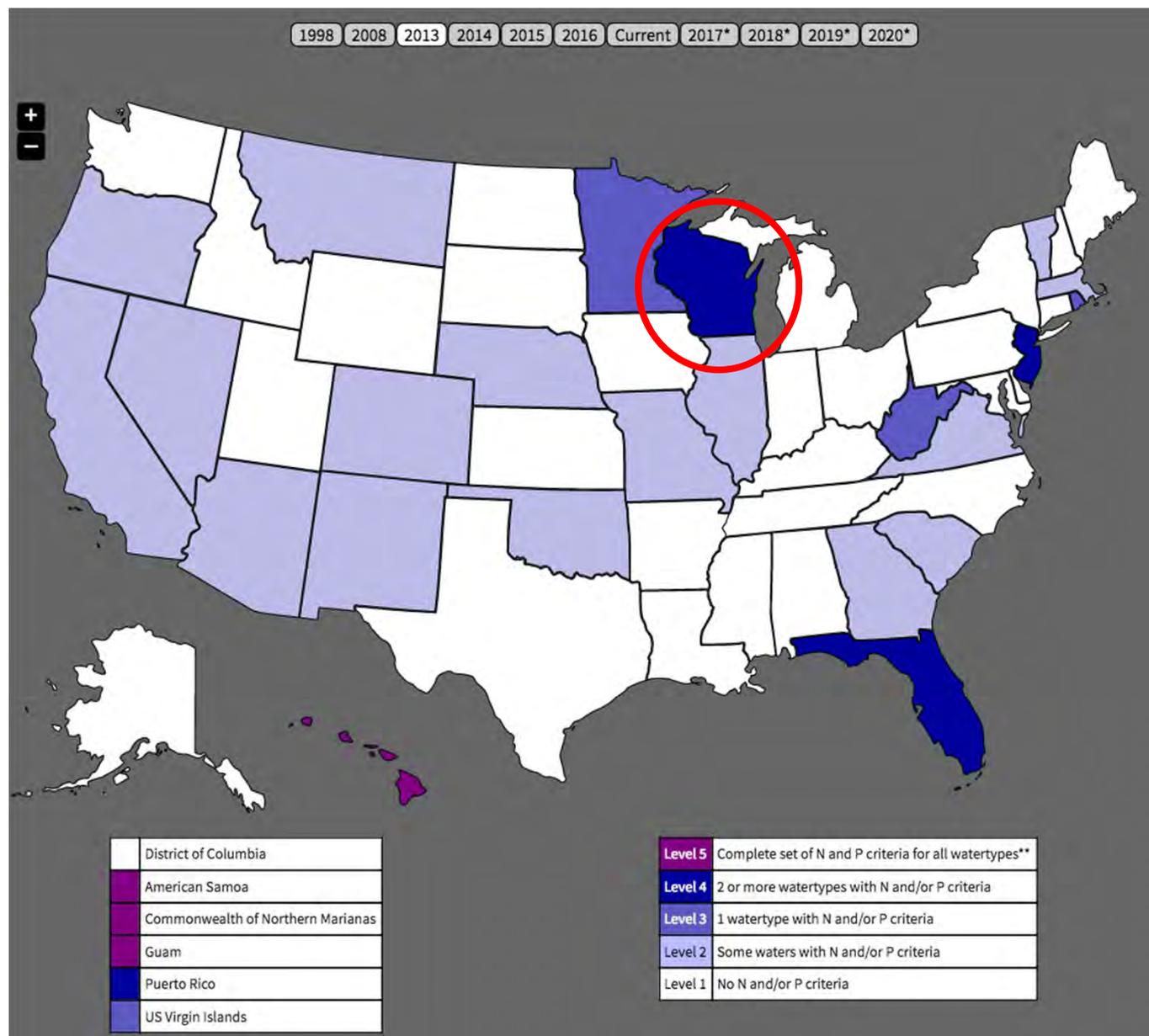
So, 10 states went from “*nothing*” to “*a little bit*”

And, 2 states went from “*nothing*” to “*pretty good*”



A Look at Wisconsin

In 2010, Wisconsin adopted – and EPA approved – numeric phosphorus criteria for rivers and streams, lakes and reservoirs, and nearshore and open waters of the Great Lakes.



Wisconsin

In fact, WI adopted a lot of numeric phosphorus criteria :

Phosphorus Criteria:

Most rivers: 100 $\mu\text{g/L}$

All other streams: 75 $\mu\text{g/L}$

Stratified reservoirs: 30 $\mu\text{g/L}$

Non-stratified reservoirs: 40 $\mu\text{g/L}$

Stratified “two-story” fishery lakes: 15 $\mu\text{g/L}$

Stratified drainage lakes: 30 $\mu\text{g/L}$

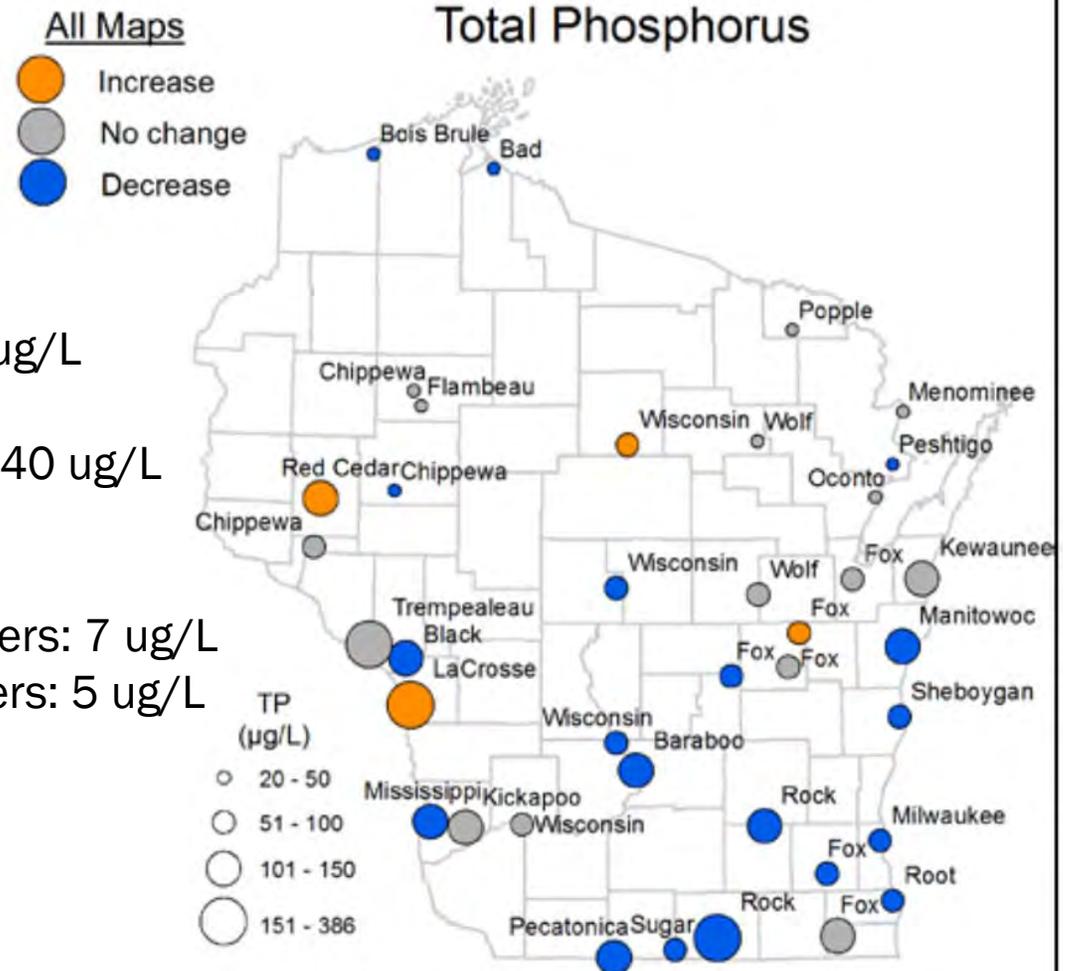
Non-stratified (shallow) drainage lakes: 40 $\mu\text{g/L}$

Stratified seepage lakes: 20 $\mu\text{g/L}$

Non-stratified (shallow) lakes: 40 $\mu\text{g/L}$

Lake Michigan open and nearshore waters: 7 $\mu\text{g/L}$

Lake Superior open and nearshore waters: 5 $\mu\text{g/L}$



Wisconsin

More than seven years after adopting its phosphorus criteria, nearly half of the state's water quality impairments reported are for . . .

Yep, phosphorus exceedances

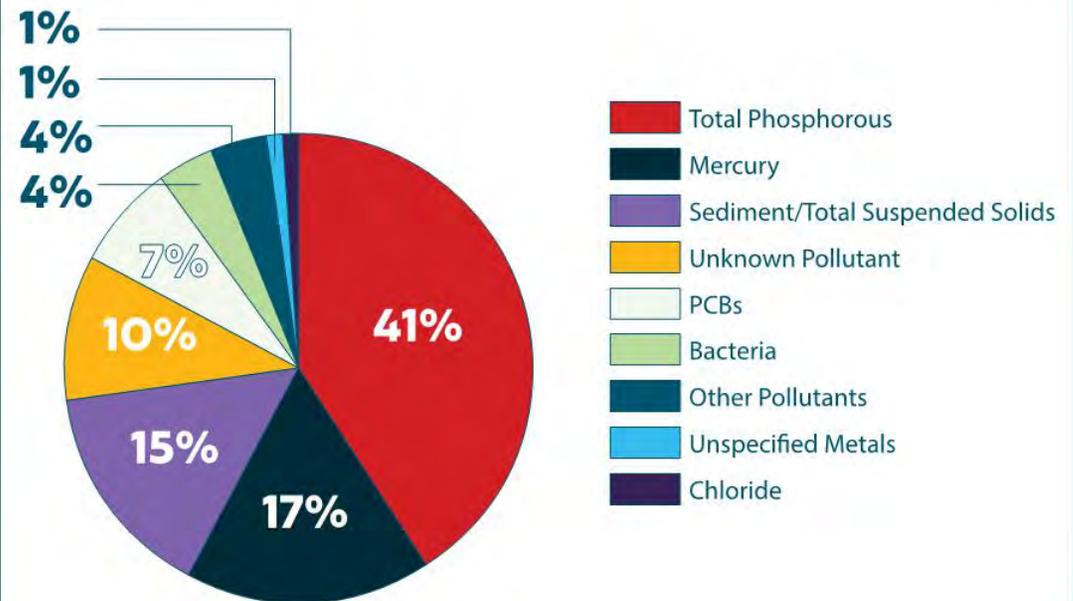


Wisconsin's Nutrient
Reduction Strategy
2015 — 2016

Implementation Progress

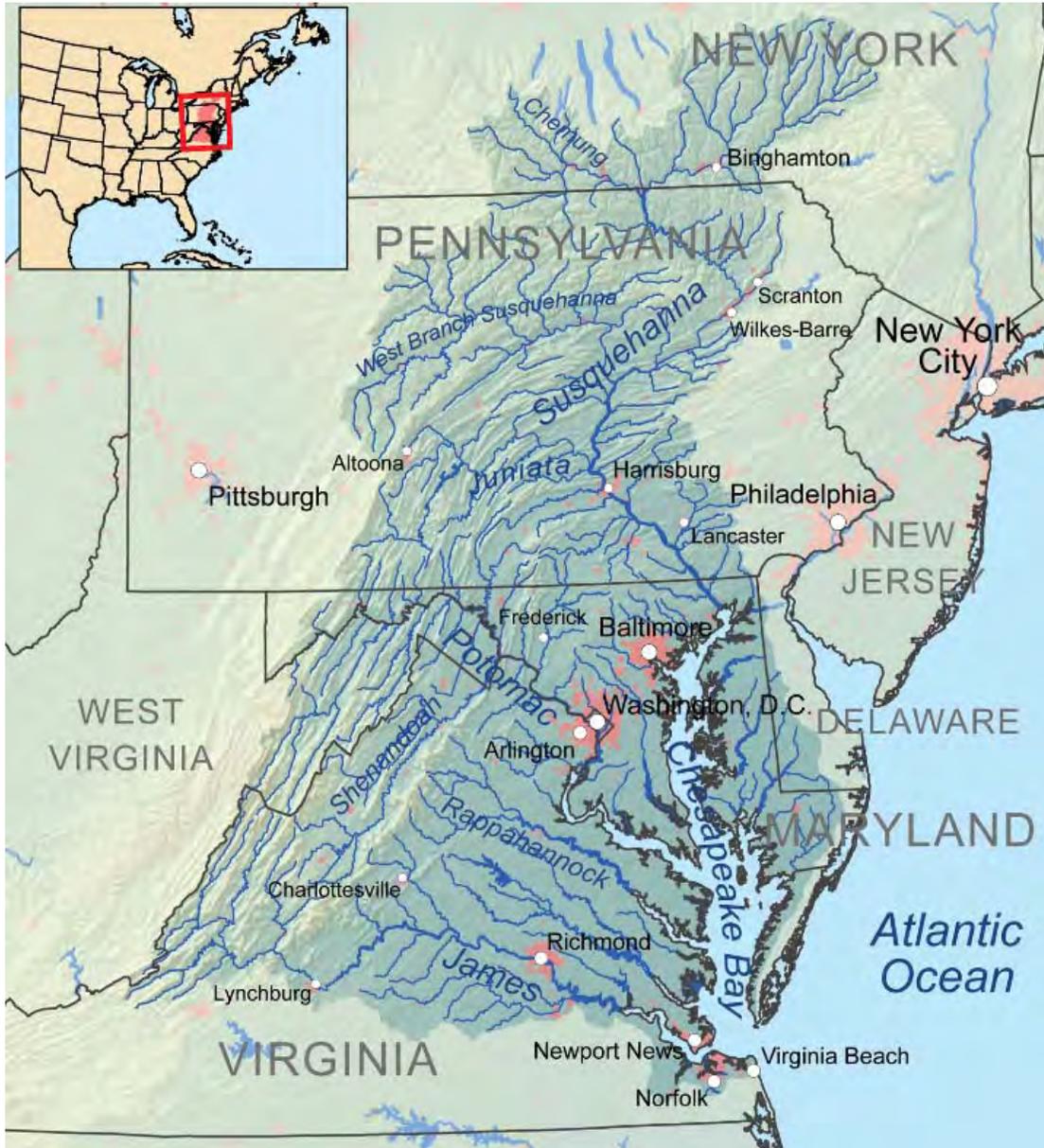
June 2017
EGAD # 3200-2017-25
Environmental Management
Wisconsin DNR

Figure 3: Impairment Pollutants



You are what you measure....?

NNC Sidebar: Let's swing by Chesapeake Bay



After a decade of work, a TMDL was finalized by EPA at the end of 2010

Largest TMDL footprint ever established – 64,000 square miles

Includes parts of Delaware, Maryland, New York, Pennsylvania, Virginia, West Virginia and the District of Columbia

Identifies pollution reduction needs for nitrogen, phosphorus and sediment.

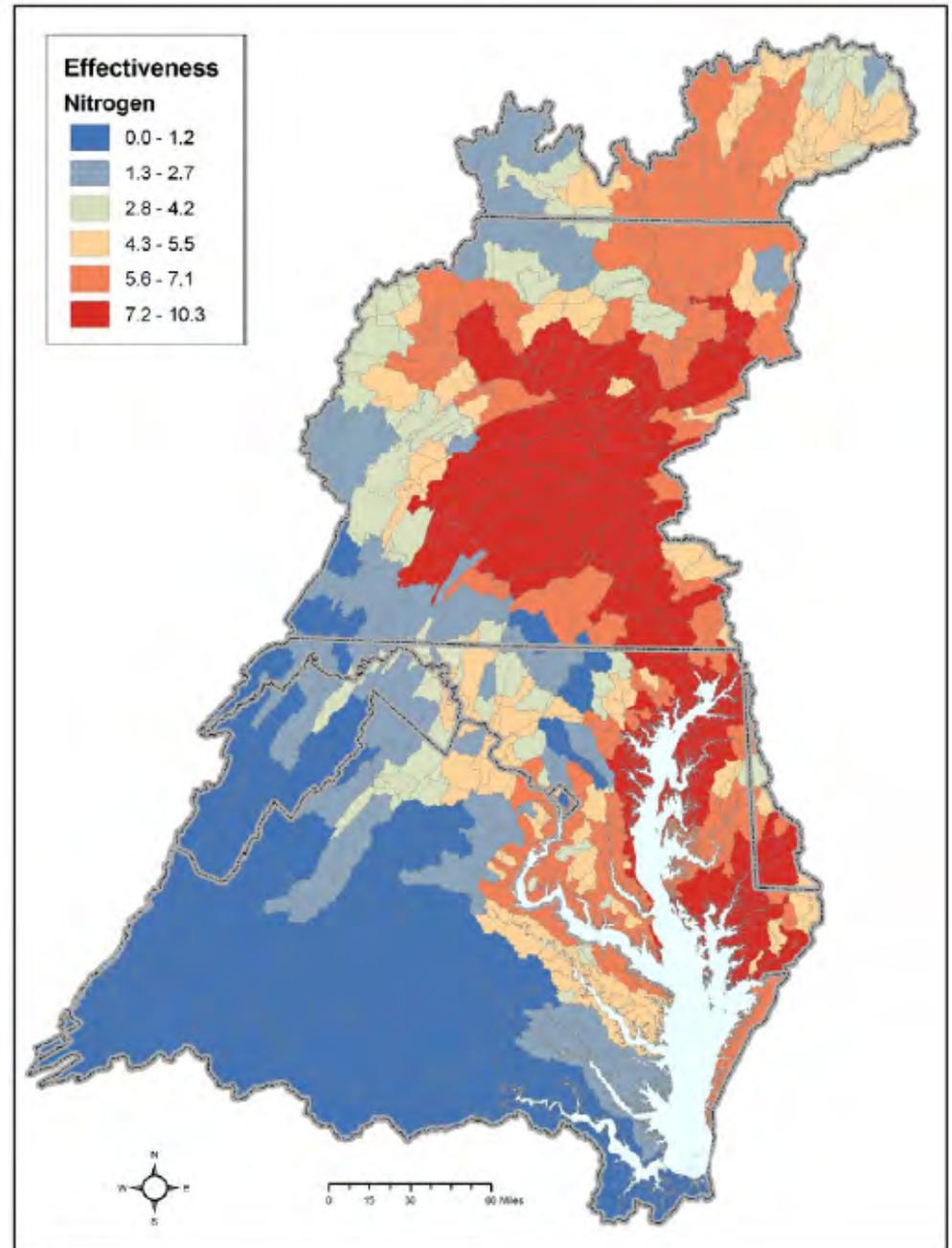
Chesapeake Bay

Individual reduction requirements for 92 watershed segments

Load reductions were developed using models to determine when Chl a, dissolved oxygen, seagrass and water clarity targets would be met

TMDL goal is to have all reduction measures in place by 2025, with 60% in place by 2017

Each jurisdiction has 2-year milestones to demonstrate load reductions



Chesapeake Bay



Brown and Caldwell

EPA's 2017 bi-annual evaluations metrics just came out this summer

Every jurisdiction was found to be “off track” for at least one parameter:

DE - N

DC - N and sediment

MD - N

NY - N and sediment

PA - N, P and sediment

VA - sediment

WV - P

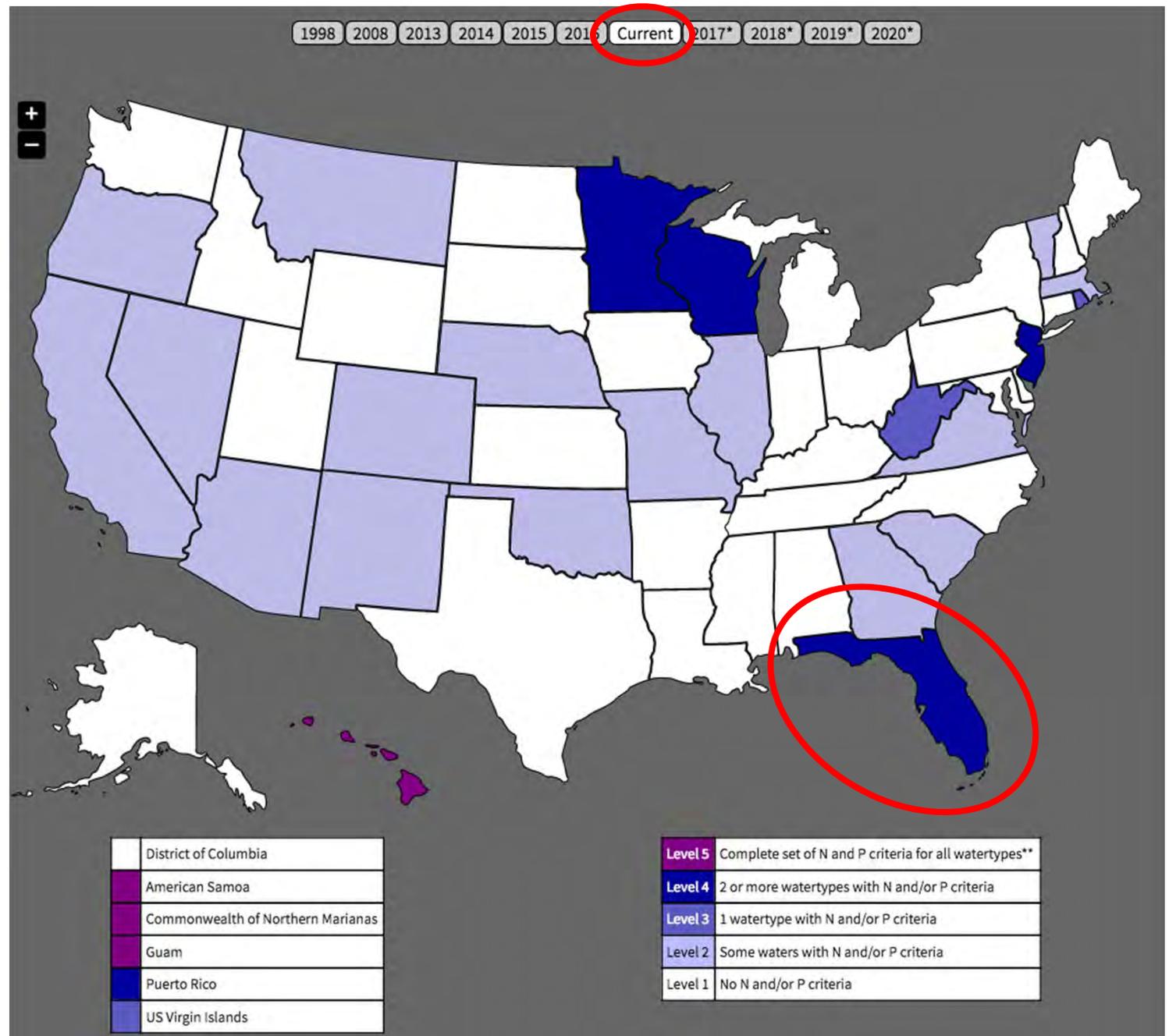
But then – they didn't start out by establishing NNC, so what did they expect, right?

Florida: NNC Goes to Court

Florida started the NNC race in earnest in 2001, entering into an agreement with EPA in 2002 to work together

Then, EPA got sued in 2008, and Florida became NNC litigation Exhibit A....

Brown and Caldwell



Florida



The pace of the race got kicked up a notch in early 2009, when EPA made an official determination that NNC were necessary to protect Florida waters



Florida



About five years later (2014), after a ton of data, a dose of science, dozens of lawyers, a few hundred meetings, and more than 20 million dollars, Florida had adopted – and EPA approved – comprehensive statewide NNC

In a creative attempt to maintain some flexibility in implementation, FL declared that its NNC are “*numerical interpretations of the narrative standard*”

And everyone lived happily ever after! (not really)

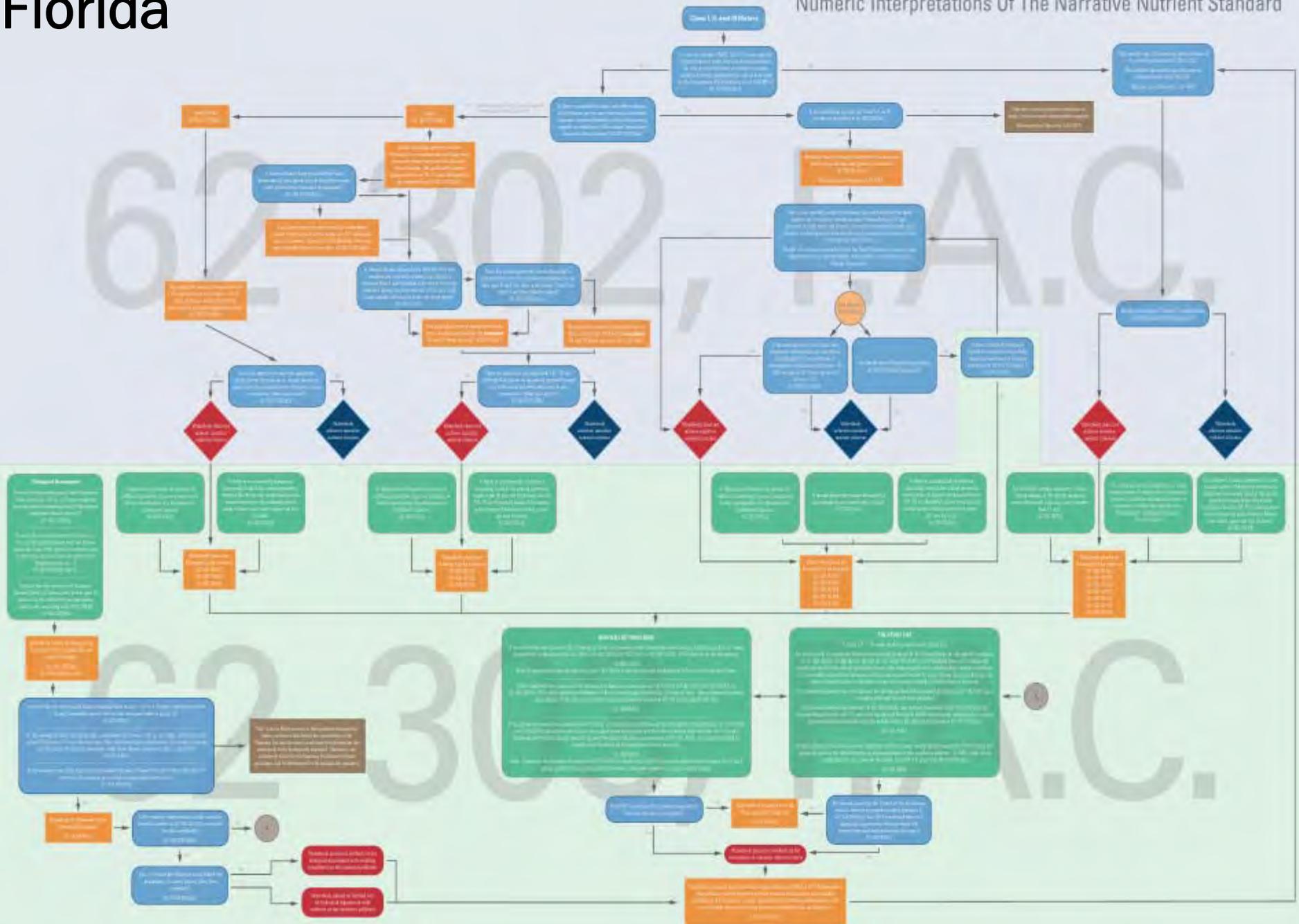
Florida

Just having NNC doesn't mean the race is over!

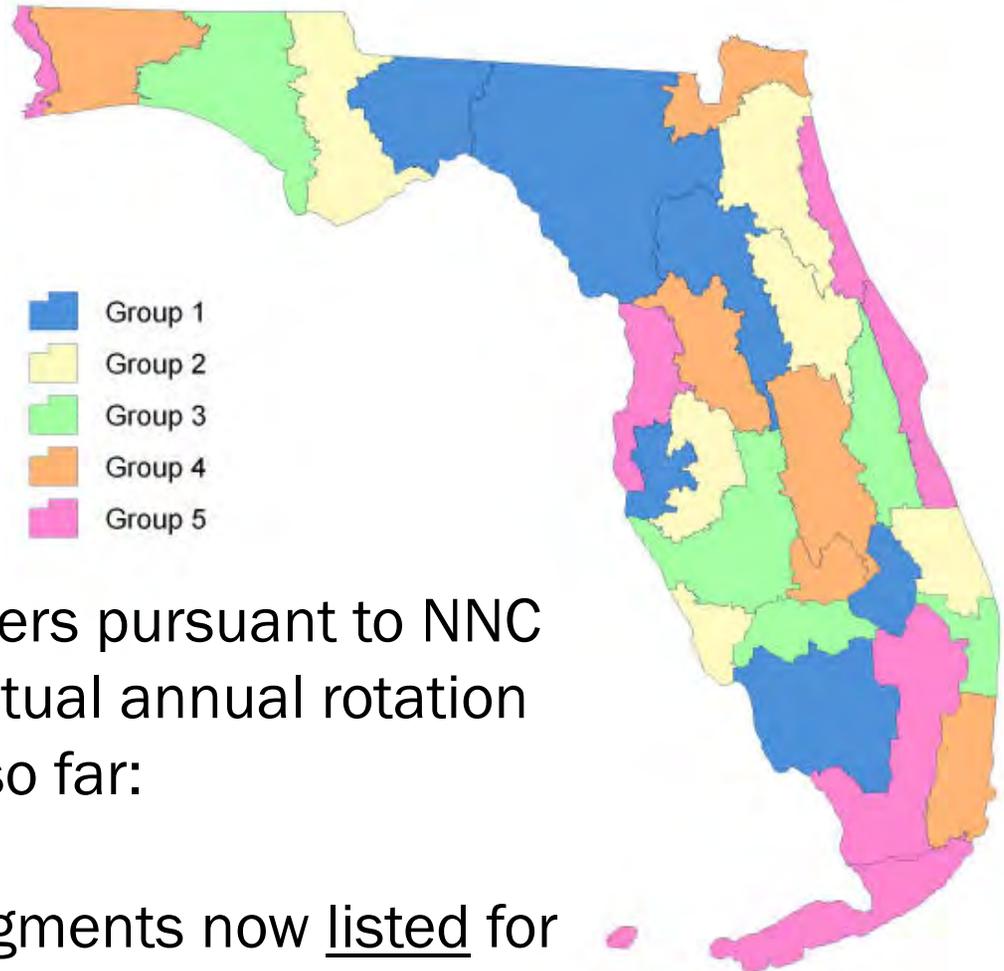
- Remember, EPA pushed for NNC to make assessment, permitting, compliance and enforcement easier
 - But EPA acknowledged that the CWA only has jurisdiction over permitted outfalls, and most nutrient loading in the U.S. is from non-point sources
 - NNC must be “implemented” into every applicable permit as part of the 5-year renewal cycle
 - Florida’s NNC rely heavily on biological data, and there was suddenly a dearth of data to make NNC impairment determinations (or at least to solidly support them)
 - Application of the NNC rule was inconsistent with prior determinations of nutrient impairment

Florida

Numeric Interpretations Of The Narrative Nutrient Standard

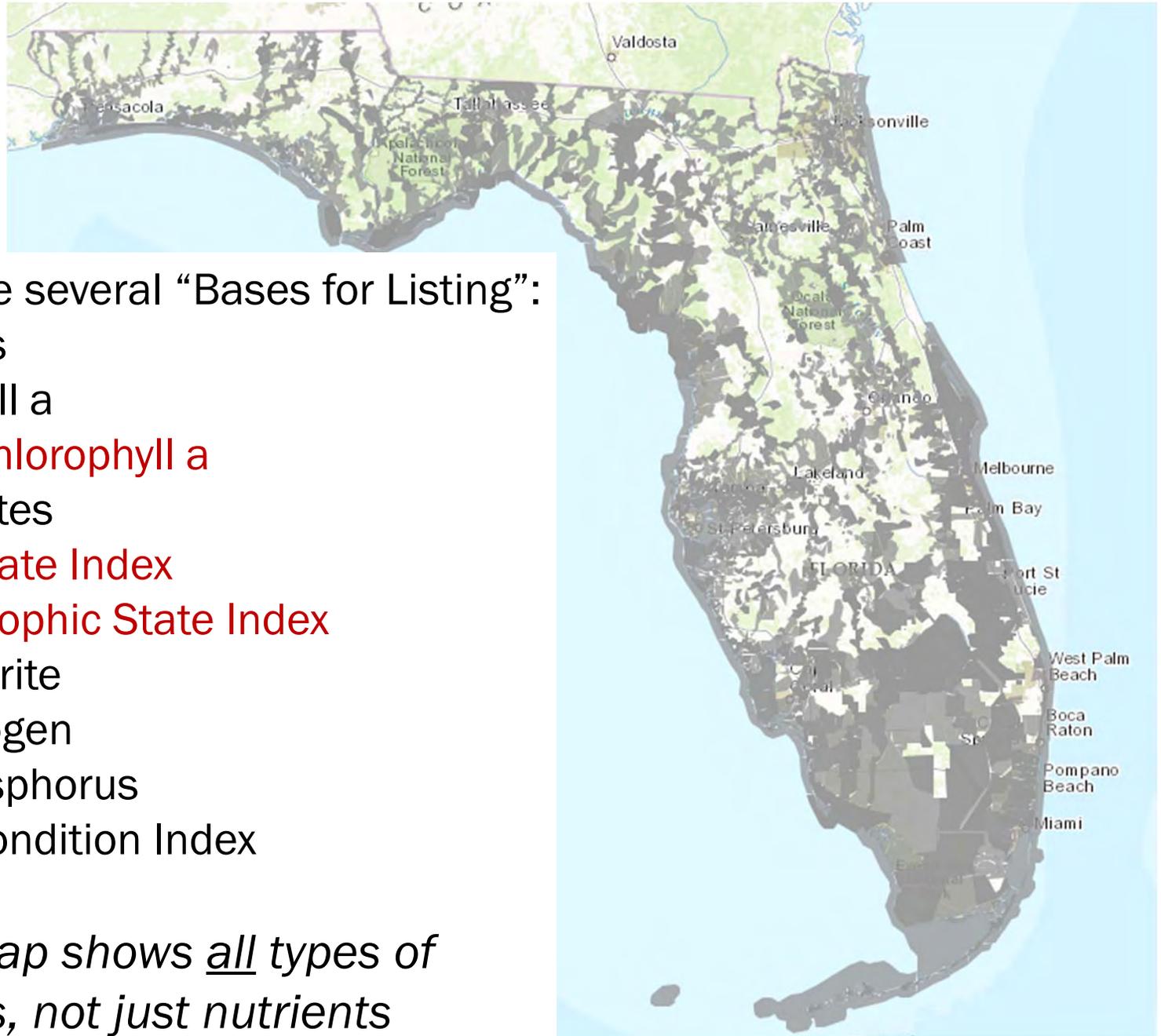


Florida Nutrient Impairments



- Florida must re-assess its waters pursuant to NNC
- Done in five groups in a perpetual annual rotation
 - Only 3 groups completed so far:
 - **Groups 2, 3, and 4**
 - 383 water body segments now listed for nutrient impairment
 - 358 formerly impaired waters delisted
- So NNC could be generating a few more impairment listings

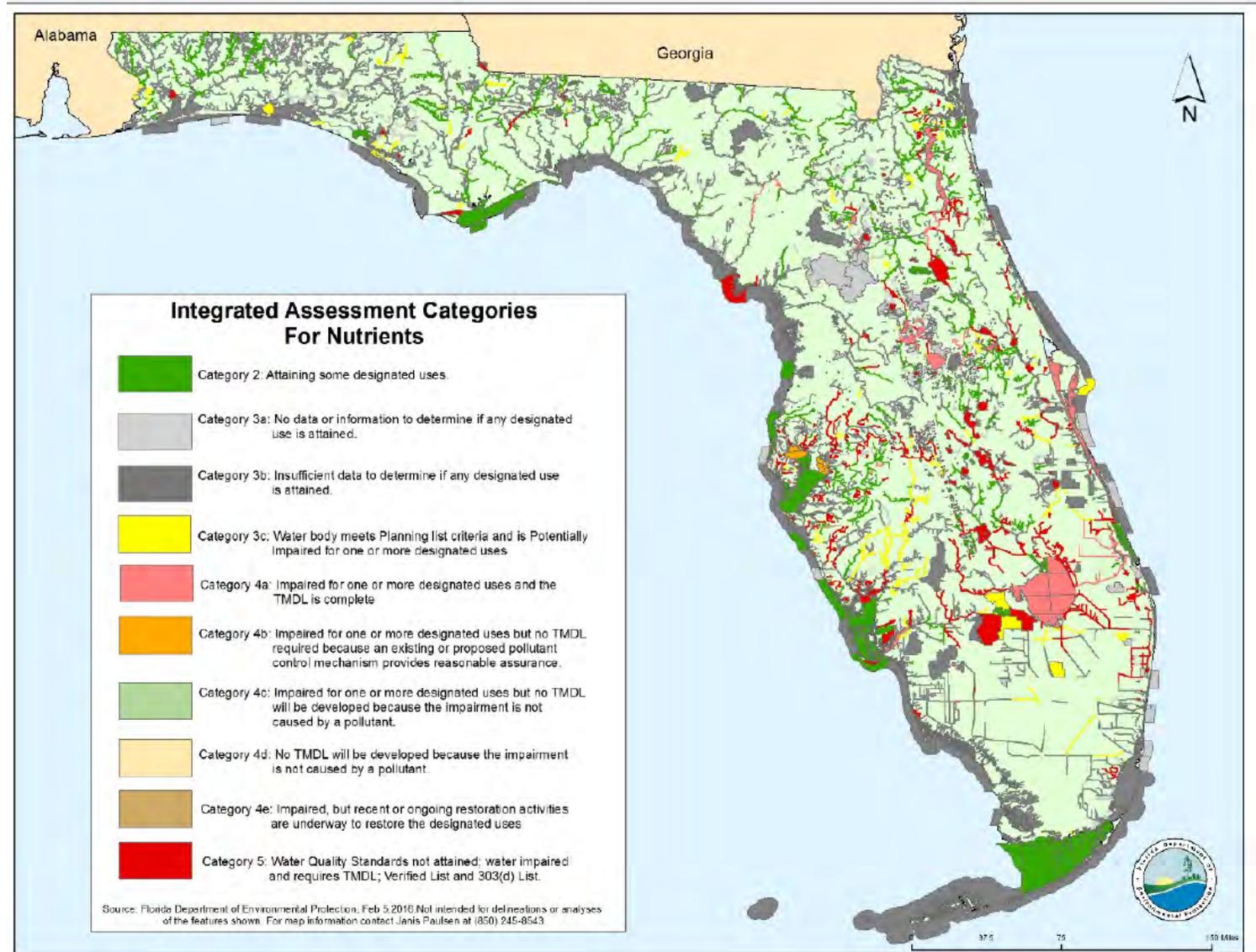
Florida Impaired Waters



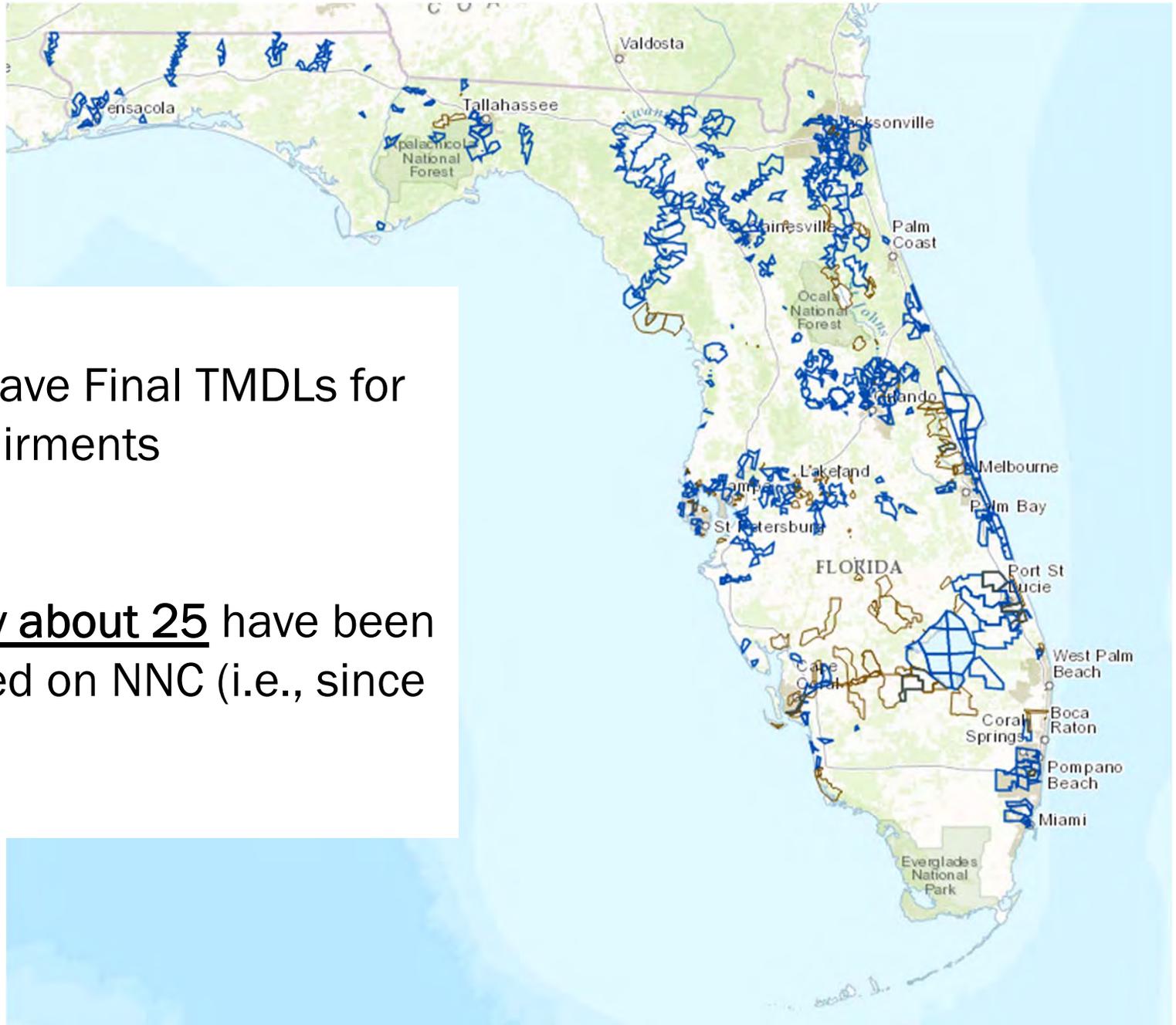
- Nutrients have several “Bases for Listing”:
 - Algal mats
 - Chlorophyll a
 - **Historic Chlorophyll a**
 - Macrophytes
 - **Trophic State Index**
 - **Historic Trophic State Index**
 - Nitrate-nitrite
 - Total Nitrogen
 - Total Phosphorus
 - Stream Condition Index
 - Other
- *Note: this map shows all types of impairments, not just nutrients*

Florida Impaired Waters

And there are ten different assessment categories for nutrient impairment



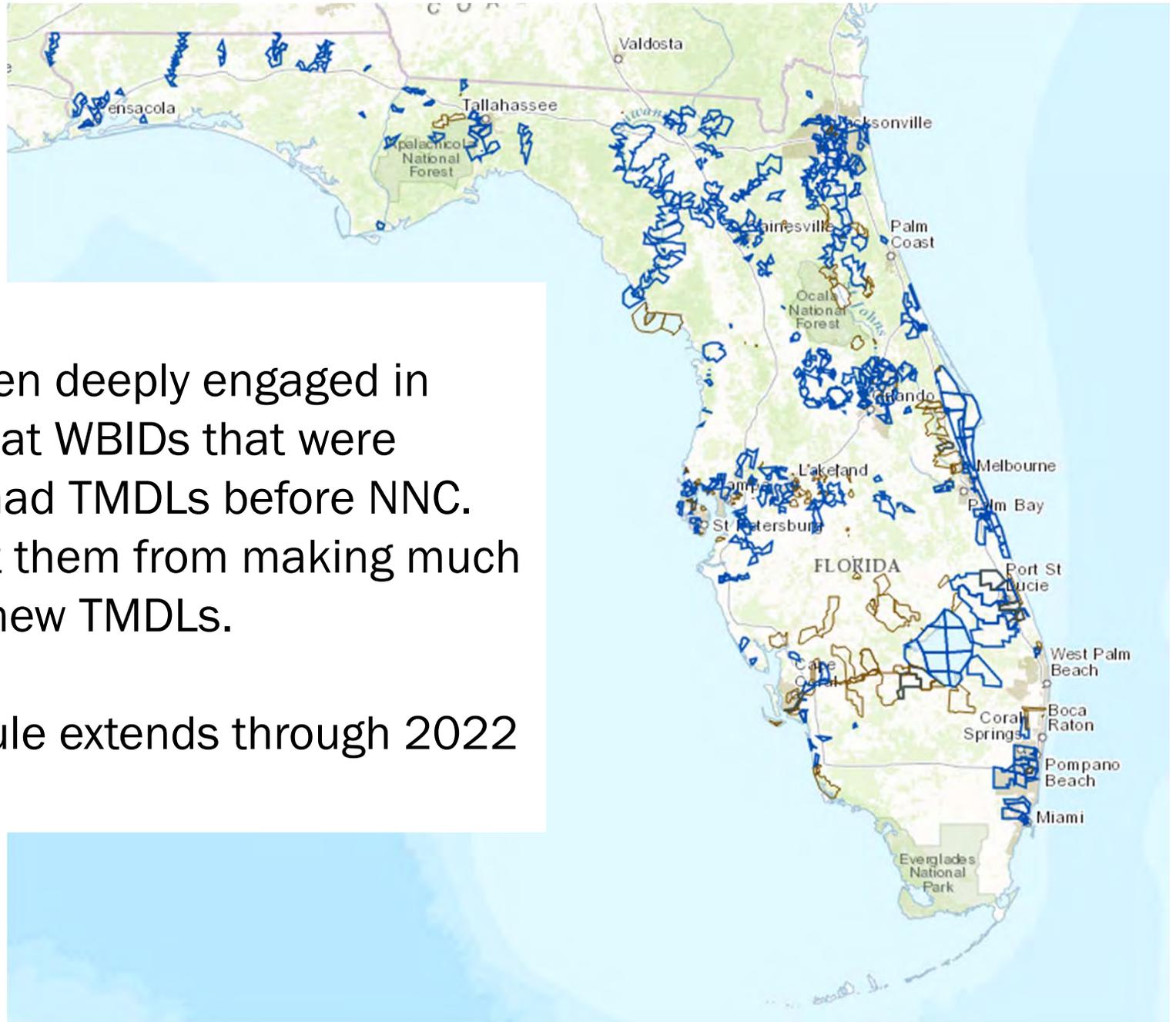
Florida TMDLs



353 WBIDs have Final TMDLs for nutrient impairments

Of those, only about 25 have been adopted based on NNC (i.e., since late 2014).

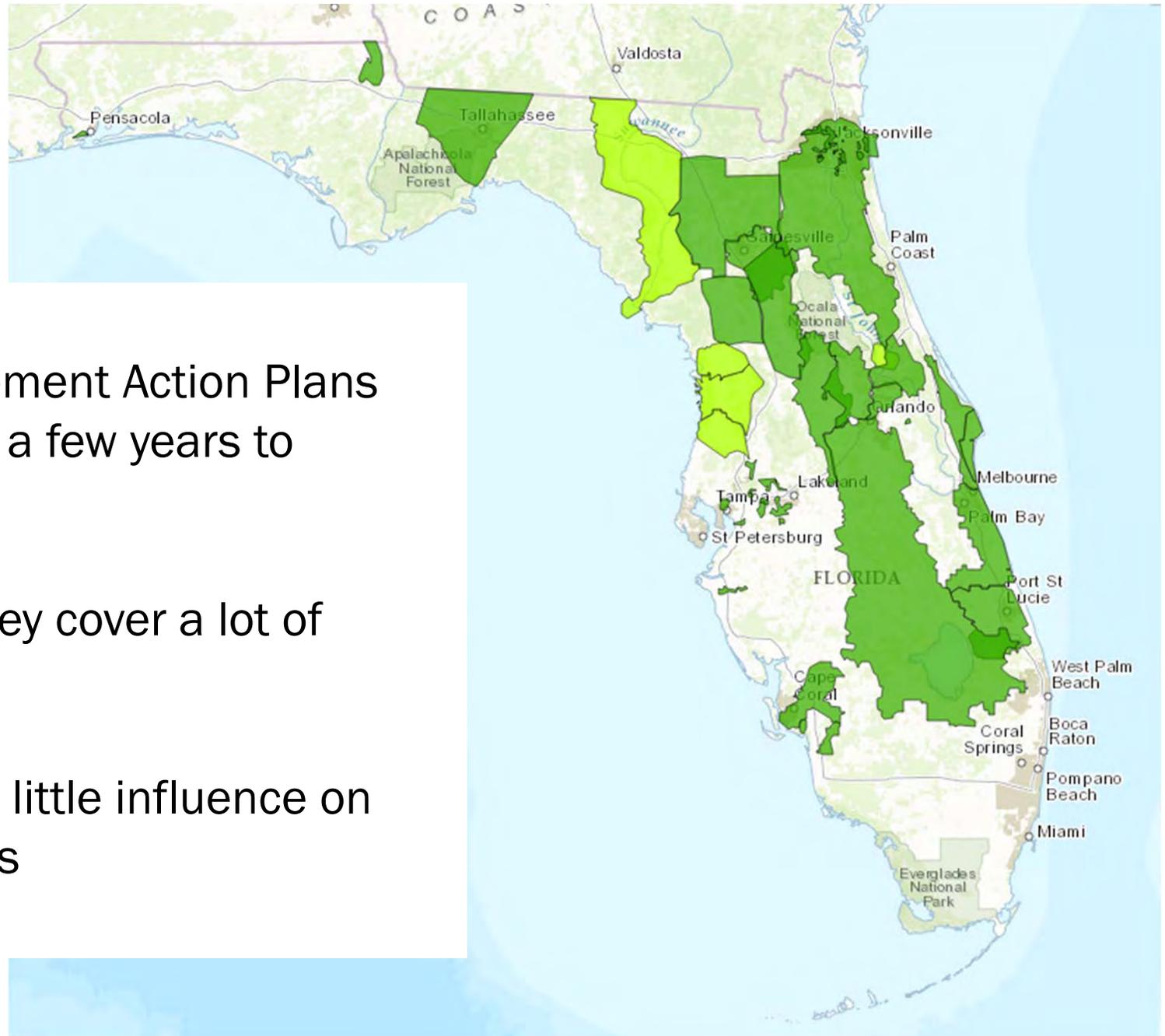
Florida TMDLs



FDEP has been deeply engaged in looking back at WBIDs that were Impaired or had TMDLs before NNC. This has kept them from making much progress on new TMDLs.

TMDL schedule extends through 2022

Florida BMAPs



Basin Management Action Plans generally take a few years to develop

But at least they cover a lot of territory !

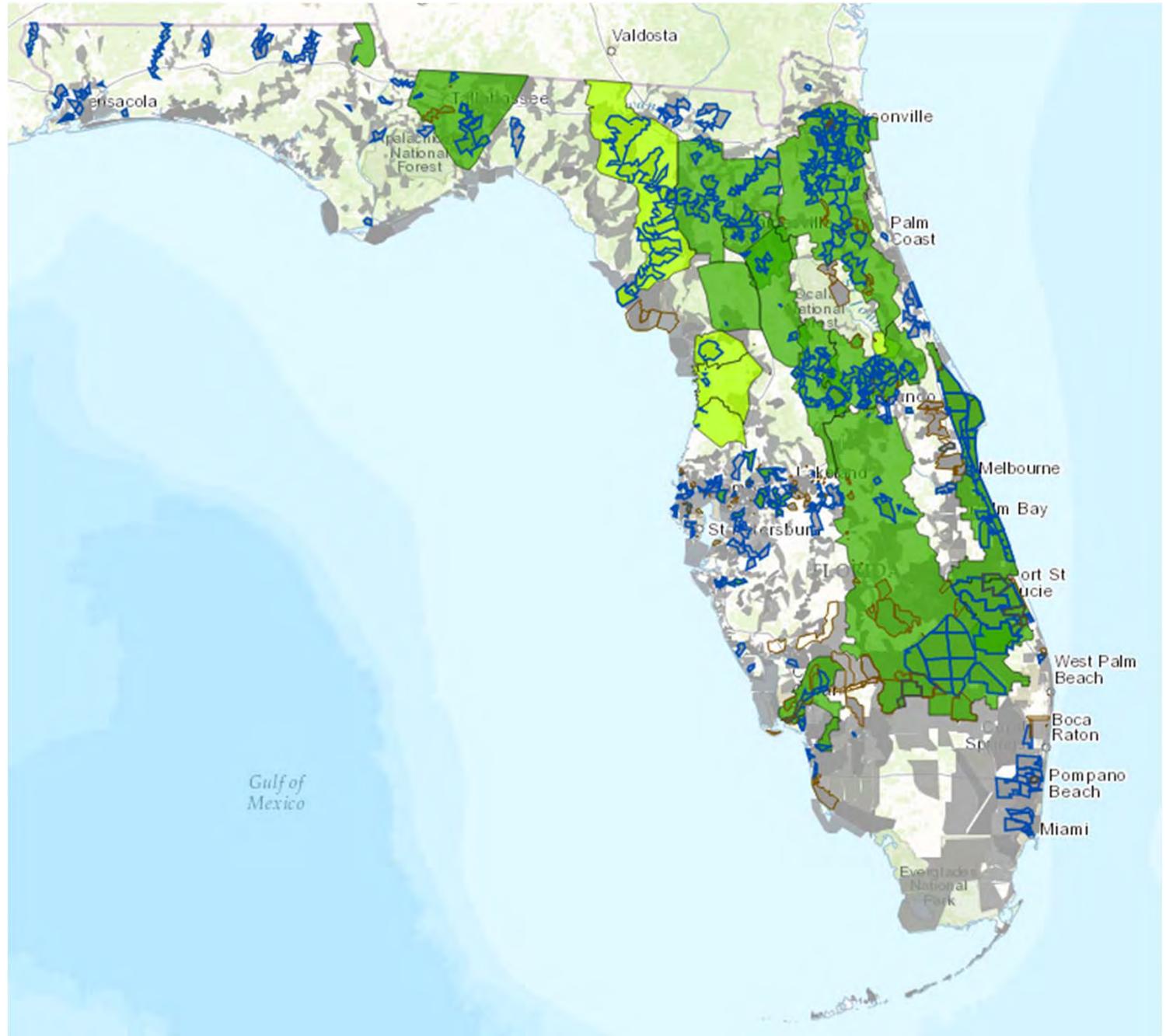
NNC have had little influence on existing BMAPs

Impaired
Waters,

TMDLs,

BMAPs...

*Are we
done yet?*

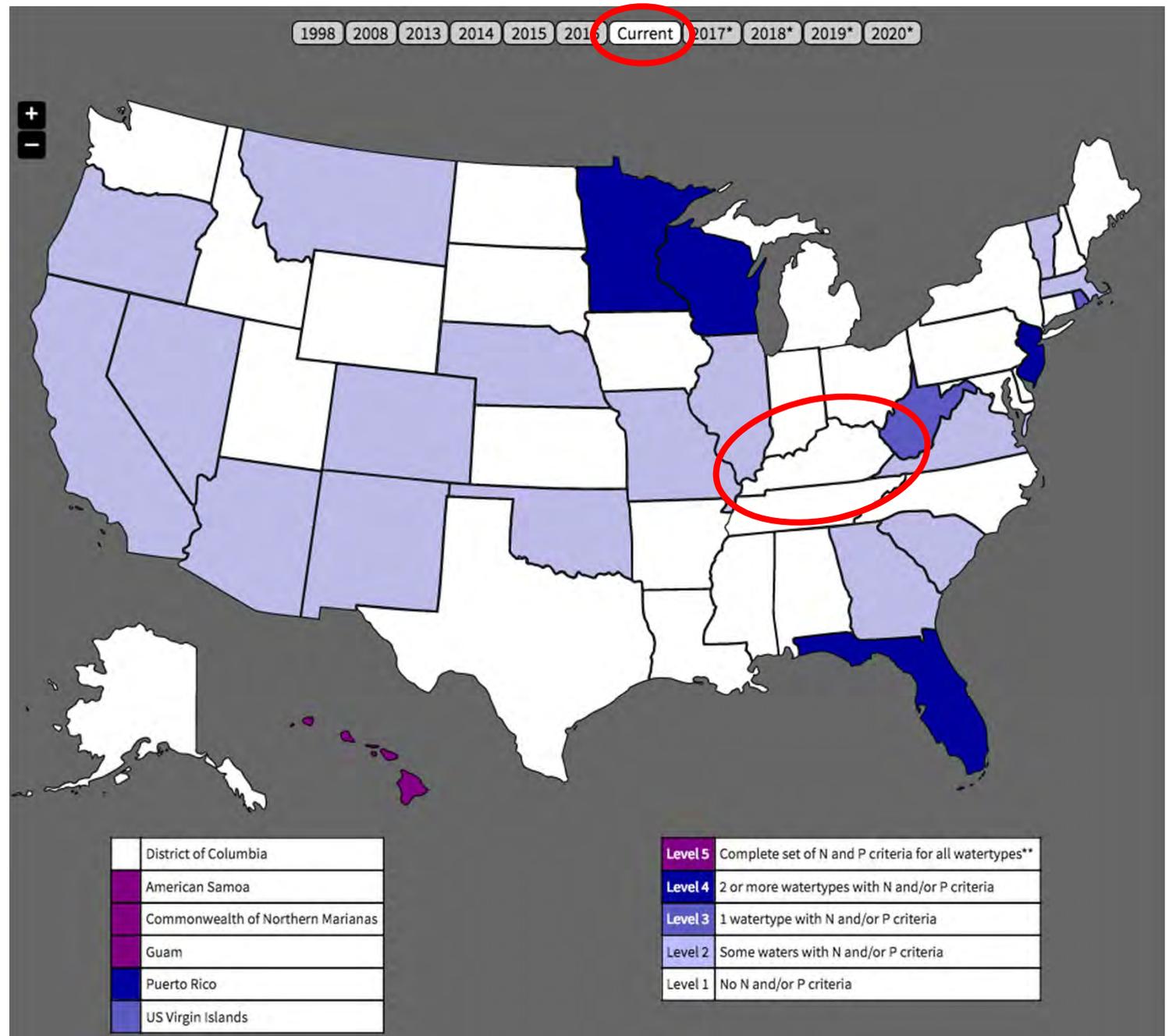


And finally
back to

Kentucky

*The Sun Shines
Bright on My Old
Kentucky
Home...*

No shading
doesn't have to
mean no NNC
progress!



Kentucky has a plan.

Recently updated even!

Commonwealth of Kentucky's Nutrient Criteria Development Plan

Kentucky Department for Environmental Protection
Division of Water
May 2016



Peter Goodmann, Director
Kentucky Division of Water

May 24, 2016

Date

Kentucky – NNC Development Progress

| Update Date | Type/ SubType | Nitrogen or Phosphorus | 1. Planning for Criteria Development | 2. Collection of Information & Data | 3. Analysis of Information & Data | 4. Proposal of Criteria | 5. Adoption of Criteria by EPA |
|-------------|--------------------------------|------------------------|--------------------------------------|-------------------------------------|-----------------------------------|-------------------------|--------------------------------|
| 8/9/2017 | Lakes/ Reservoirs - All | N | completed | No Date Provided | No Date Provided | No Date Provided | No Date Provided |
| 8/9/2017 | Lakes/ Reservoirs - All | P | completed | No Date Provided | No Date Provided | No Date Provided | No Date Provided |
| 8/9/2017 | Rivers/ Streams - Non-Wadeable | N | completed | Collection Underway | No Date Provided | No Date Provided | No Date Provided |
| 8/9/2017 | Rivers/ Streams - Non-Wadeable | P | completed | Collection Underway | No Date Provided | No Date Provided | No Date Provided |
| 8/9/2017 | Rivers/ Streams - Wadeable | N | completed | Collection Underway | No Date Provided | No Date Provided | No Date Provided |
| 8/9/2017 | Rivers/ Streams - Wadeable | P | completed | Collection Underway | No Date Provided | No Date Provided | No Date Provided |

Kentucky – Next Steps

| | | |
|------------------|--|--|
| 2018 | Finalize stream classes and parameters to be prioritized for criteria development. | |
| | Finalize lake and reservoir classes and parameters to be prioritized for criteria development. | |
| | If available, consider for adoption the ORSANCO nutrient criteria recommendations for the Ohio River. | |
| | Evaluate progress made on wetlands management strategy and criteria development (including nutrient criteria). | |
| 2019-2020 | Begin stakeholder outreach and education on nutrient criteria. | |
| | Complete technical work for criteria development for priority stream classes and submit for agency review. | |
| | Complete technical work for criteria development for priority lake and reservoir classes and submit for agency review. | |
| 2021-2022 | Propose for adoption criteria for priority intrastate stream classes in triennial review of water quality standards | |

Kentucky – The good news?

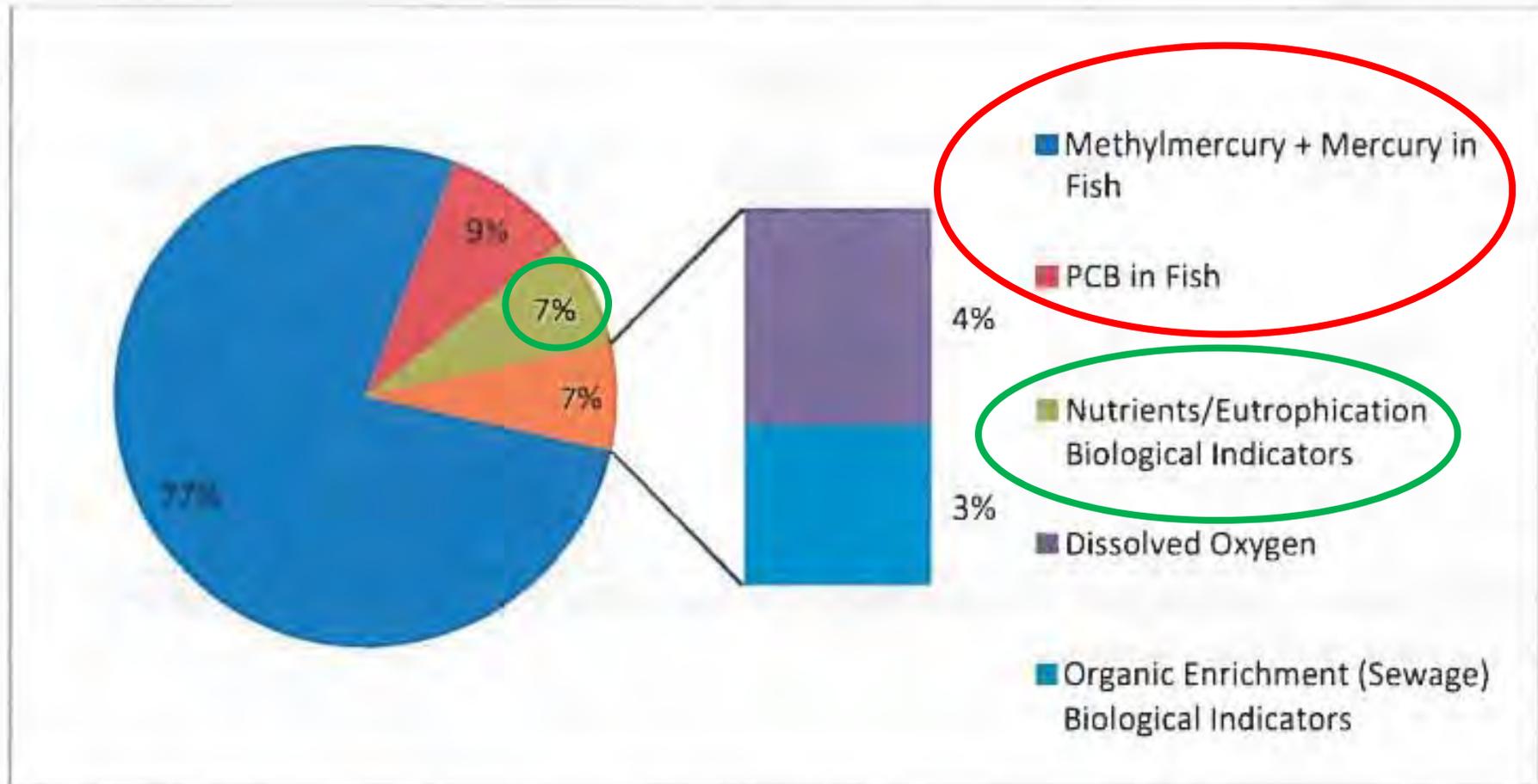


Figure 2. Percentages of causes (pollutants) impacting monitored and assessed lake and reservoir acreage in Kentucky (Kentucky Division of Water, 2015).

Maybe go with the chicken at dinner....

Observations

- It takes a lot of time, data, effort and money to establish defensible NNC, and implementation is complicated too
- Establishing NNC early on doesn't seem to mean nutrient impairments are brought under control sooner
- NNC *might* result in identifying more waters as Impaired
 - Wisconsin now has a lot of P-impaired waters
 - Florida's 1998 303(d) list had 540 WBIDs listed for nutrients
 - Current list has 585 (8% increase)
- Even with NNC, TMDLs and NPDES permits cannot force nutrient reductions from non-point sources, which are seen as the predominant contributors of nutrients in most watersheds

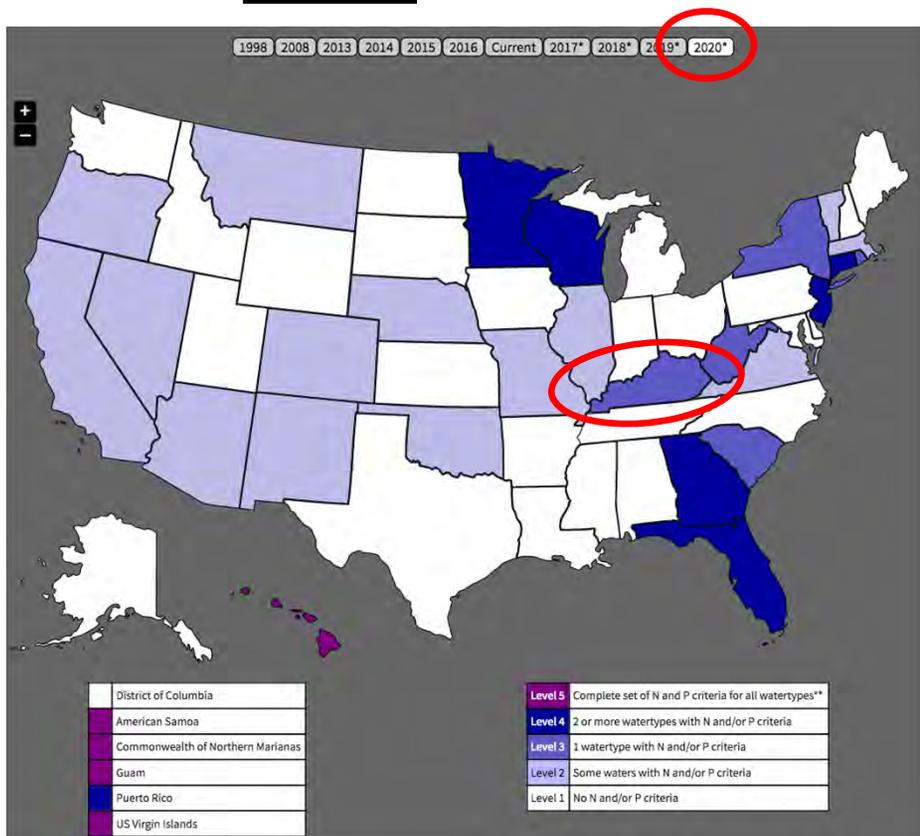
Observations

- Having NNC does not necessarily make it *easier* to determine when a water body is in compliance
 - e.g., Florida uses several biological indicators to determine whether nutrient impairment exists, and has 10 different assessment categories for assigning impairment status
- EPA generally stays engaged with states during NNC development, but hasn't shown much interest or ability in ending up with uniform NNC values or policies among the states
- In some cases, NNC requires looking backward as much as forward (i.e., to bring prior assessments and plans up to date)
- Politics and economics can be at least as important as science in the establishment and the implementation of NNC

Observations

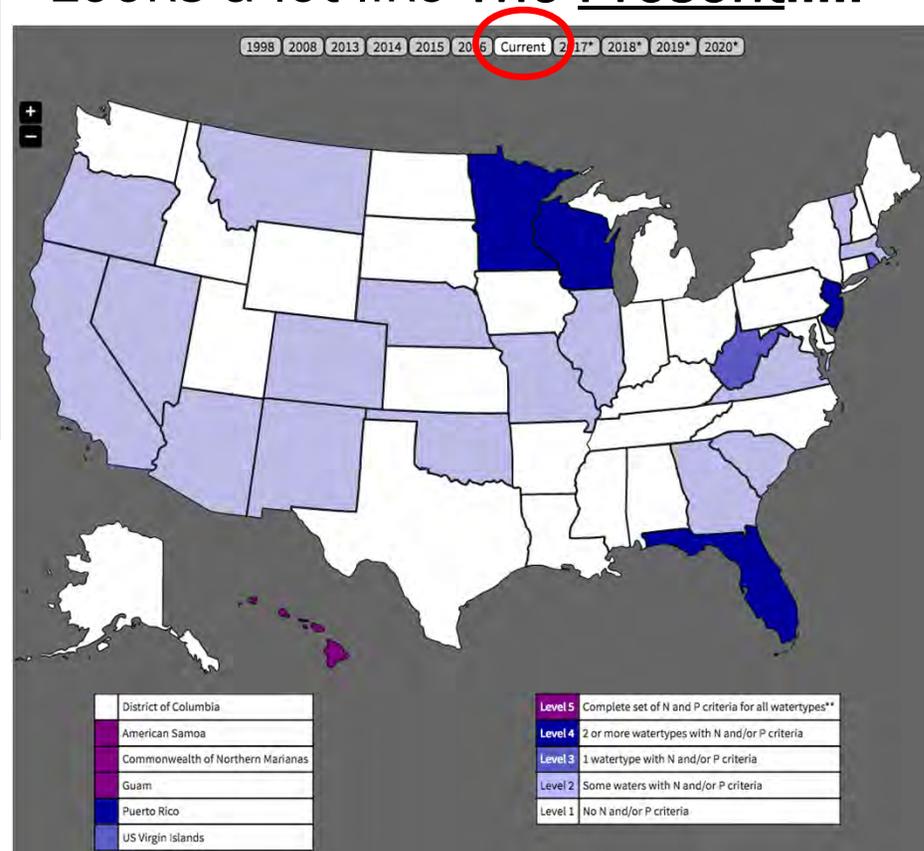
- It may be difficult to see the effect of having NNC in many cases, because so many other programs and projects have already been addressing water quality improvement.
 - Continued tightening of individual NPDES permits (independent of including NNC limits)
 - Refinements to MS4 permits and stormwater management actions by local governments
 - Improved agricultural technologies that reduce nutrient losses to waterways
 - Grants from EPA and others to fund projects in various watersheds
 - Springs and watershed protection programs
 - Septic-to-sewer conversions
 - Land conversion from agriculture to developed, with requirements for quantity and quality management
 - Fertilizer and water management ordinances at the local level

And The Future....



Watch Kentucky Go!!

Looks a lot like The Present....



And the race goes on.....

Brown AND
Caldwell

