Comparison of P6 Bay Model and CESR Estimated attainment

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Water quality indicator based on observation

Criteria assessment based on 3-year rolling CFD in space and time

m=attained DU segments
n=total DU segments
A=area of a DU segment

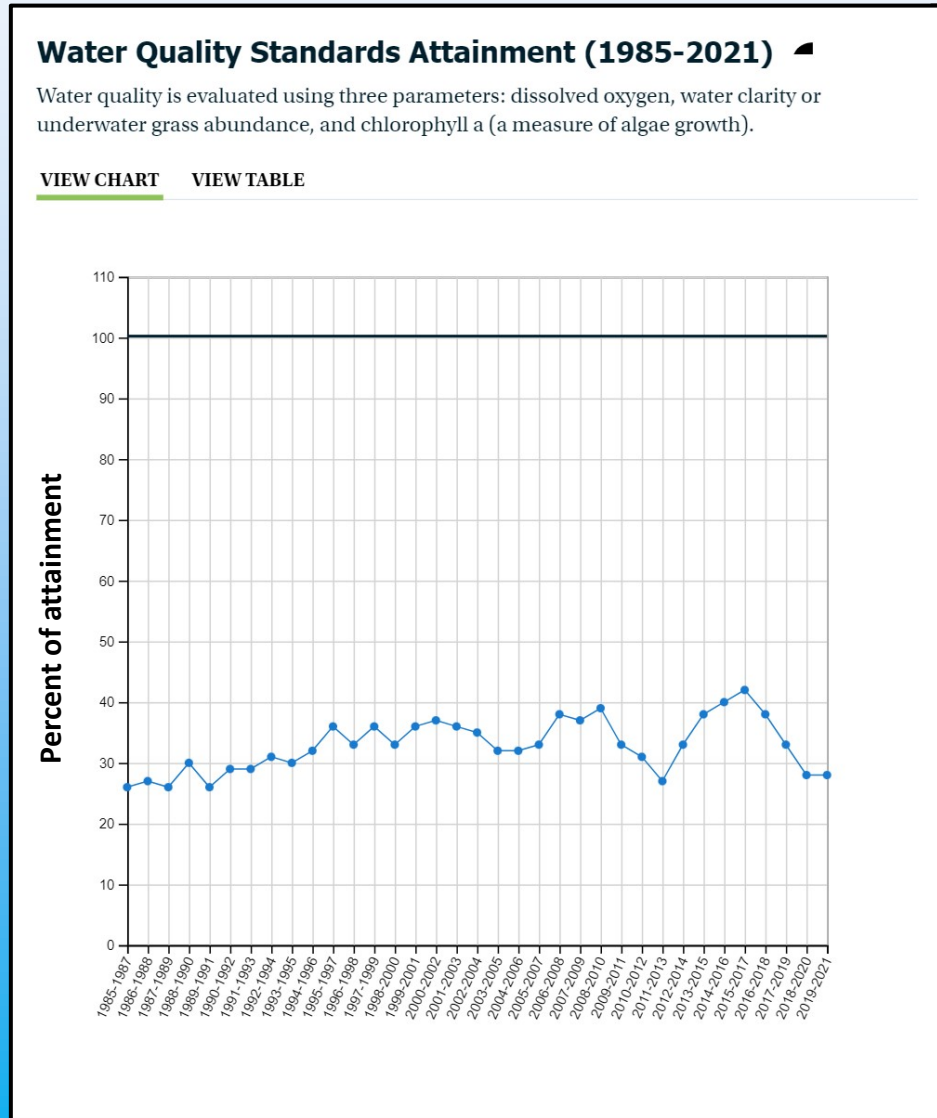
Indicator y:

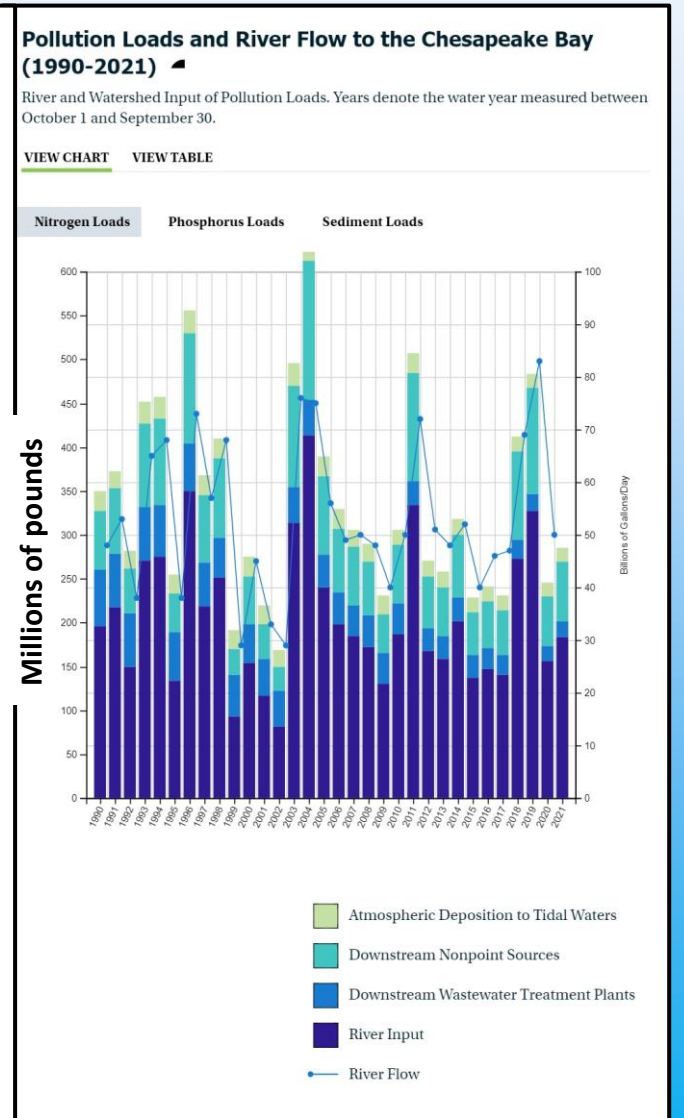
$$y = \sum_{i=1}^{m} A_i : \sum_{j=1}^{n} A_j$$

Or

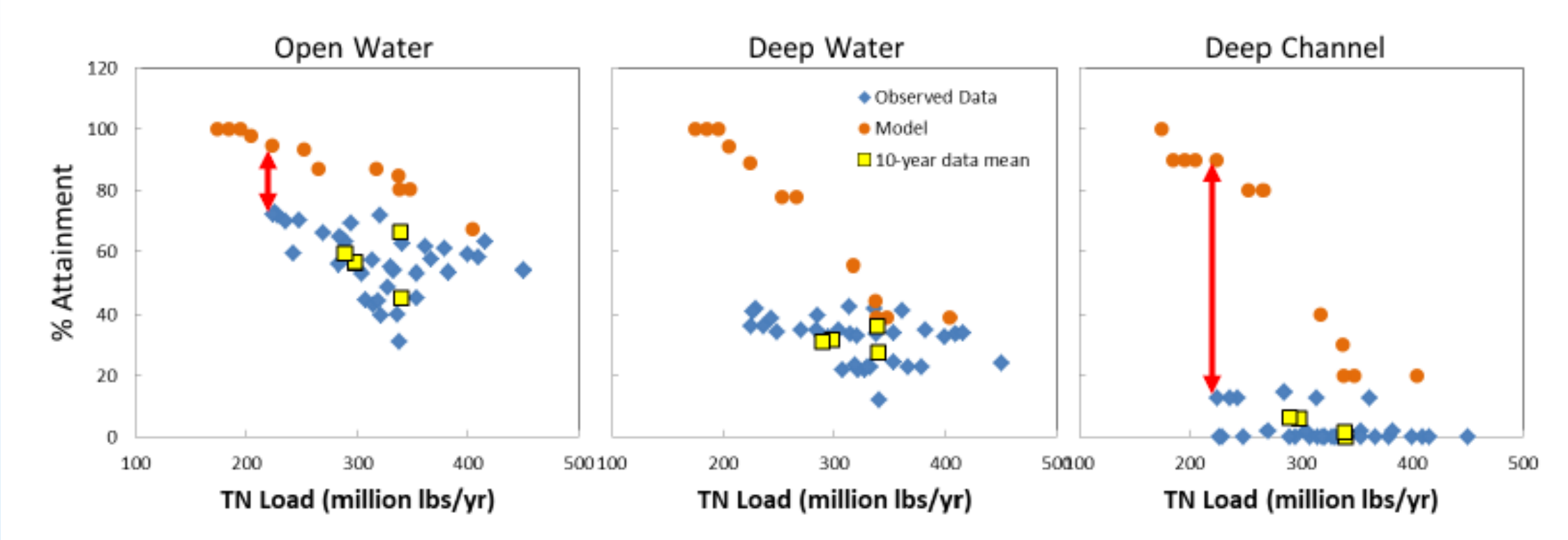
$$y = m : n$$

https://www.chesapeakeprogress.com/clean-water/water-quality





CESR report (Fig. 4.9)



Two challenges:

(1) Large discrepancy between model prediction and observation.

(2) Lack of sensitivity of attainment to nutrient loads for observed data.

Not really apple to apple comparison

Model

1. Same hydrology 1993-1995
2. Same current 1993-1995
3. Constant temperature 1993-1995
4. Same stratification 1993-1995
5. Spin up for 13 years with reduced nutrient loads
6. Always 1993-1995 criteria assessment
7. Segment count weighted
8. N and P reduction simultaneously

Data

1. Hydrology timeseries
2. Interannual variations
3. Climate warming and variability
4. Varies with river discharge, warming and wind
5. Instantaneous nutrient load
6. Three-year rolling assessment
7. Segment surface area weighted
8. N and P loads may vary differently

Can we ask the model to produce an apple?

Model simulation and analysis to compare with the data

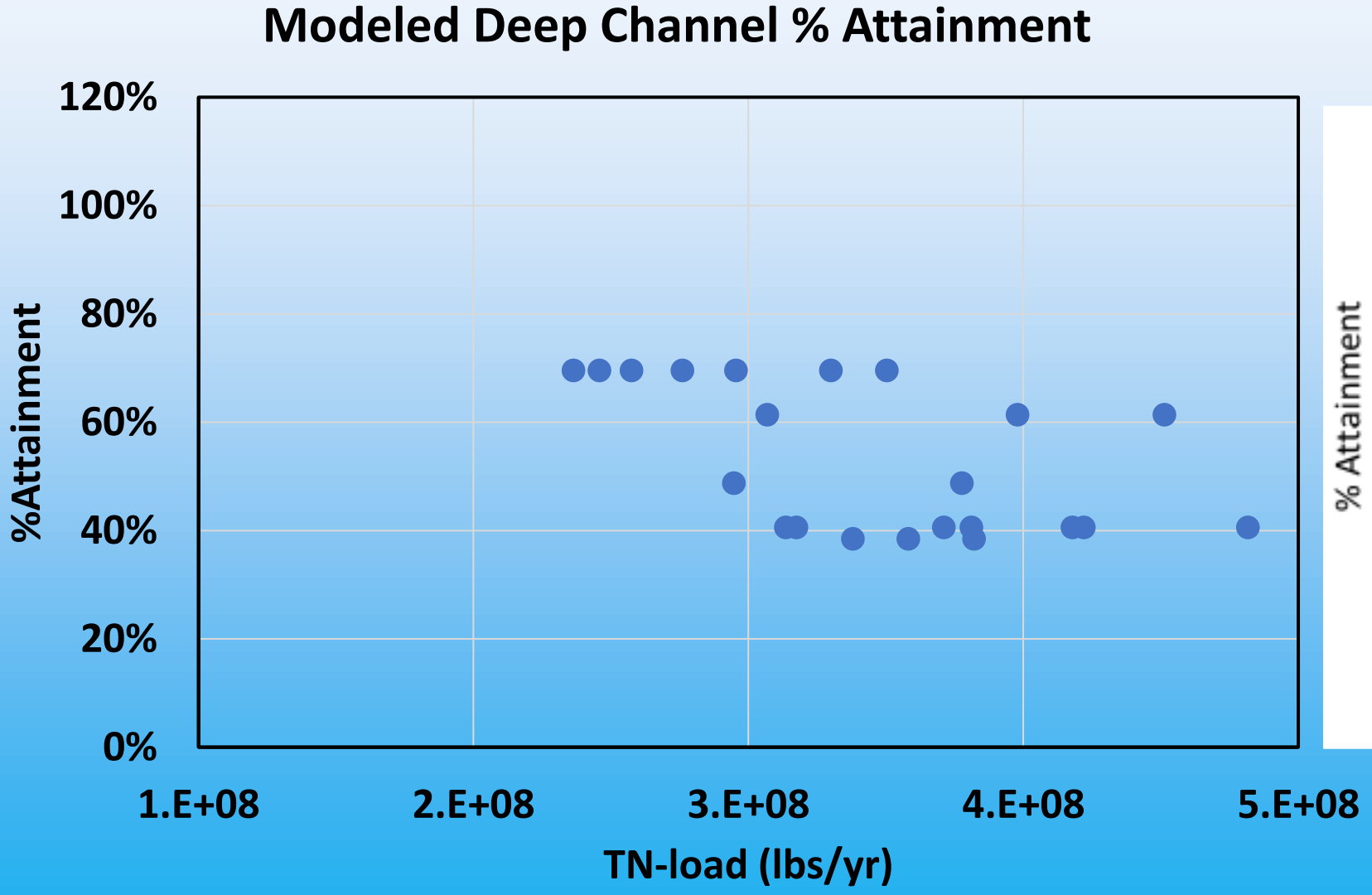
- Long-term run for 24 years (1991-2014).
- Model results were pulled out at the same time and location of the observations.
- The same assessment procedure of observations was applied to the modeled data set.

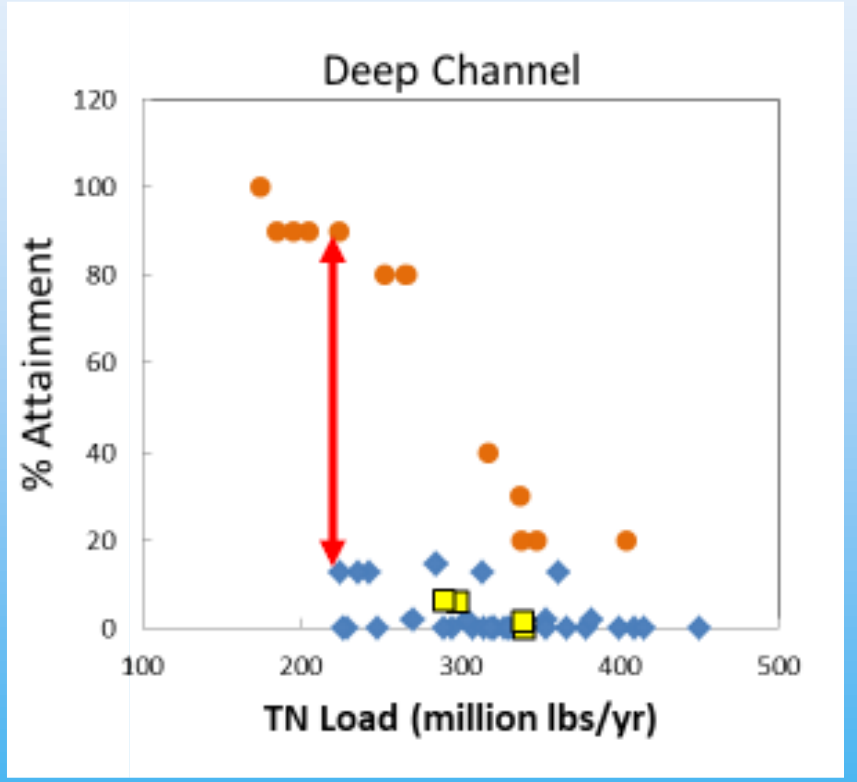
Deep channel comparison

Plot in CSER report

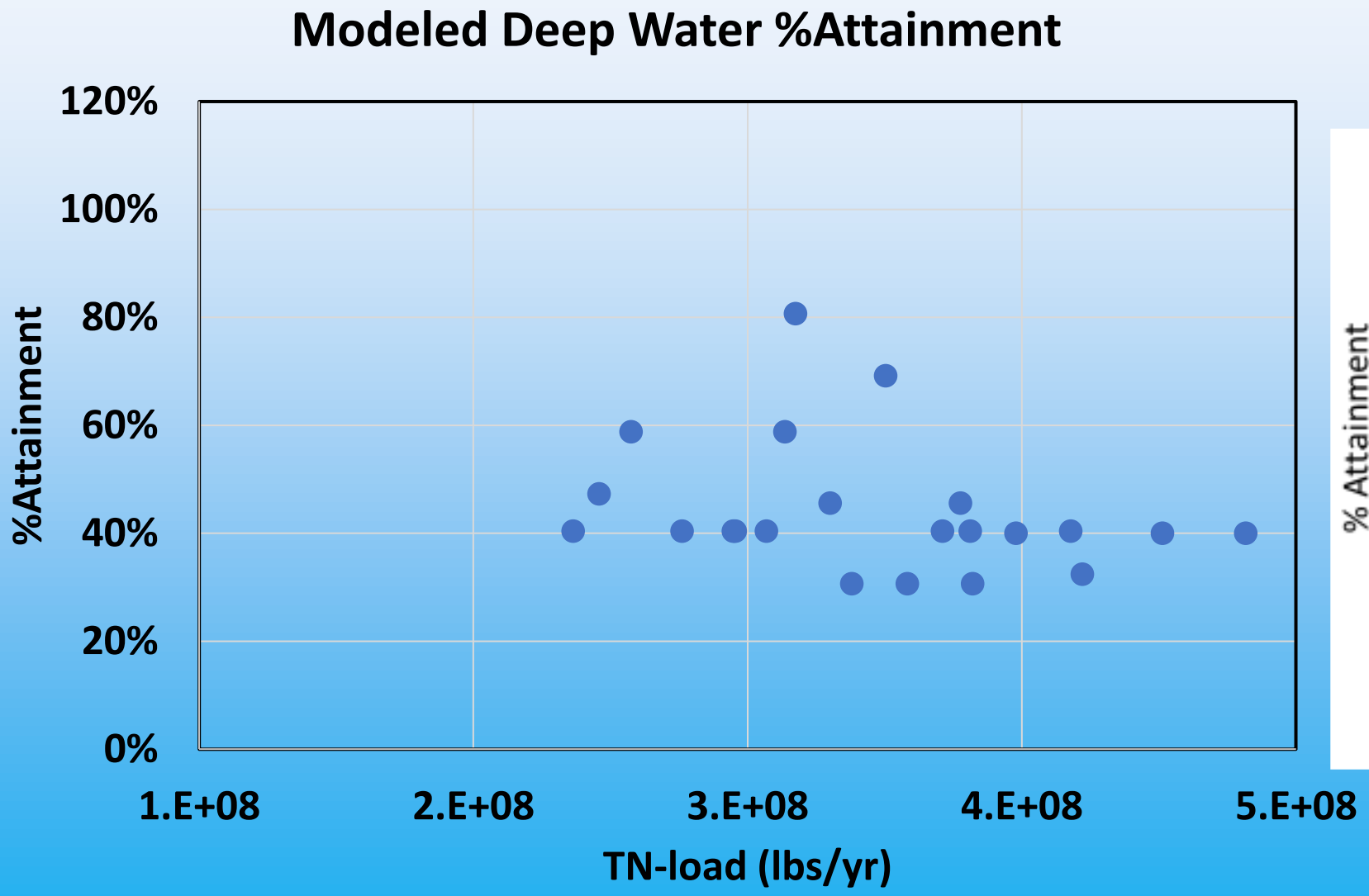
Orange = mode

Blue = observations





Deep water comparison



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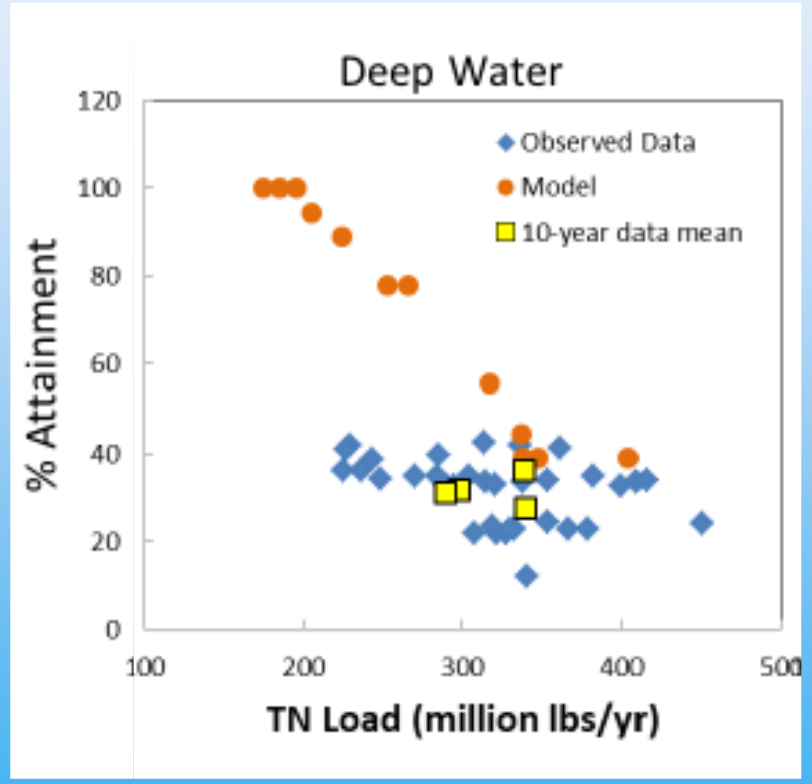
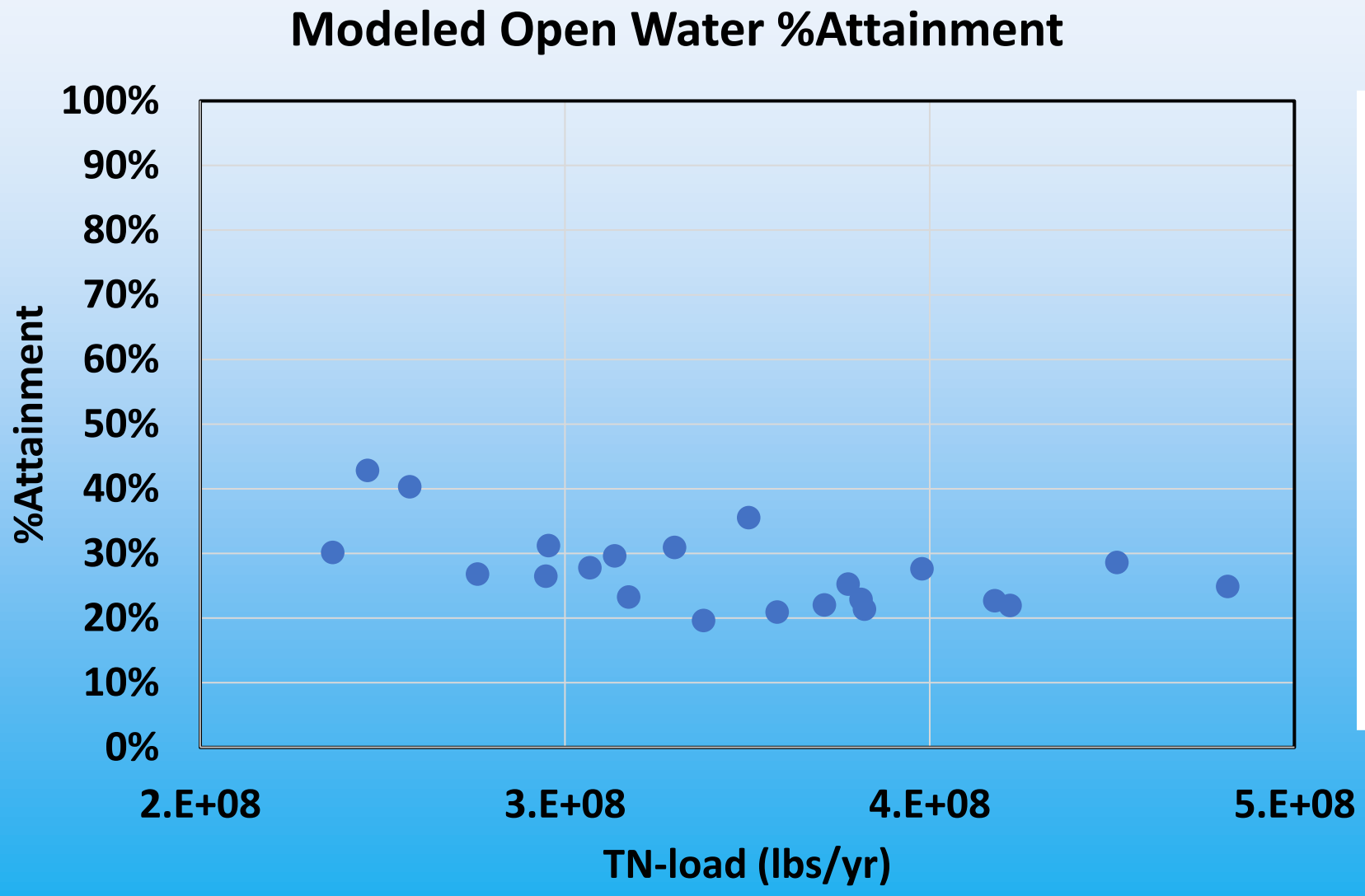


Open water comparison



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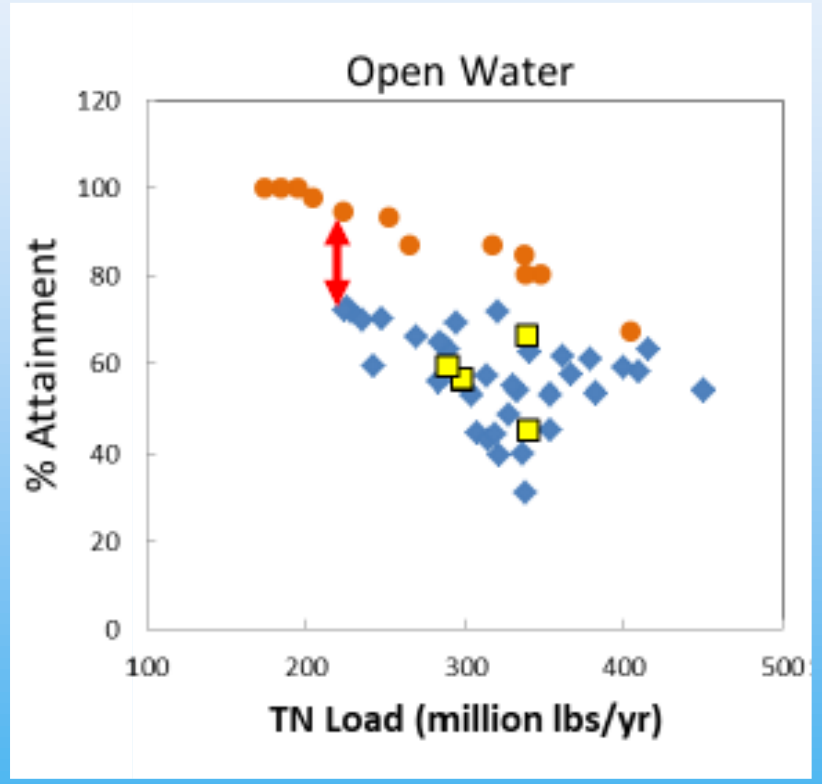
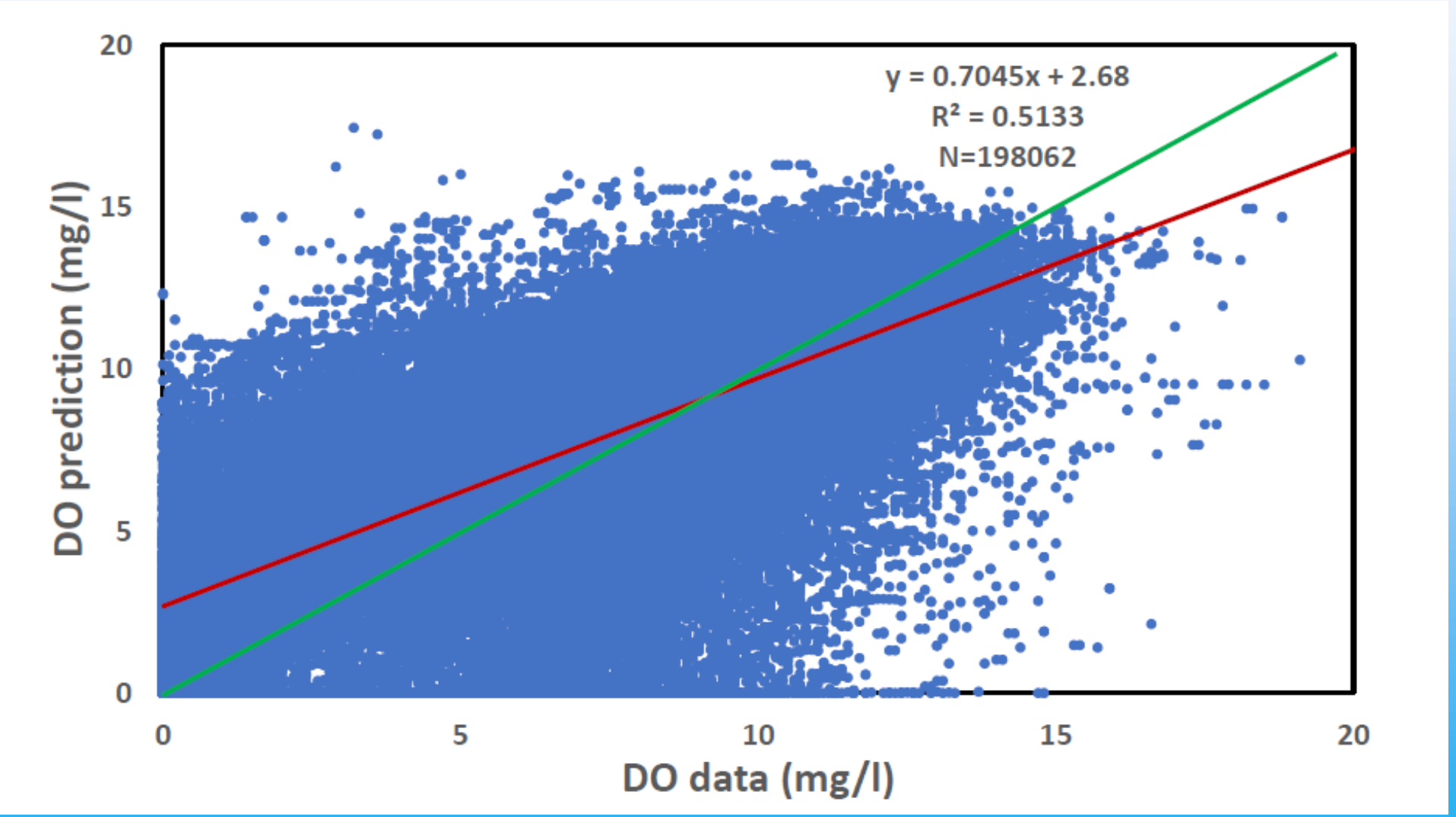


Model bias: Overestimation at the low-end underestimation at the high-end



Model bias was handled by using the delta approach

Plot in CSER report

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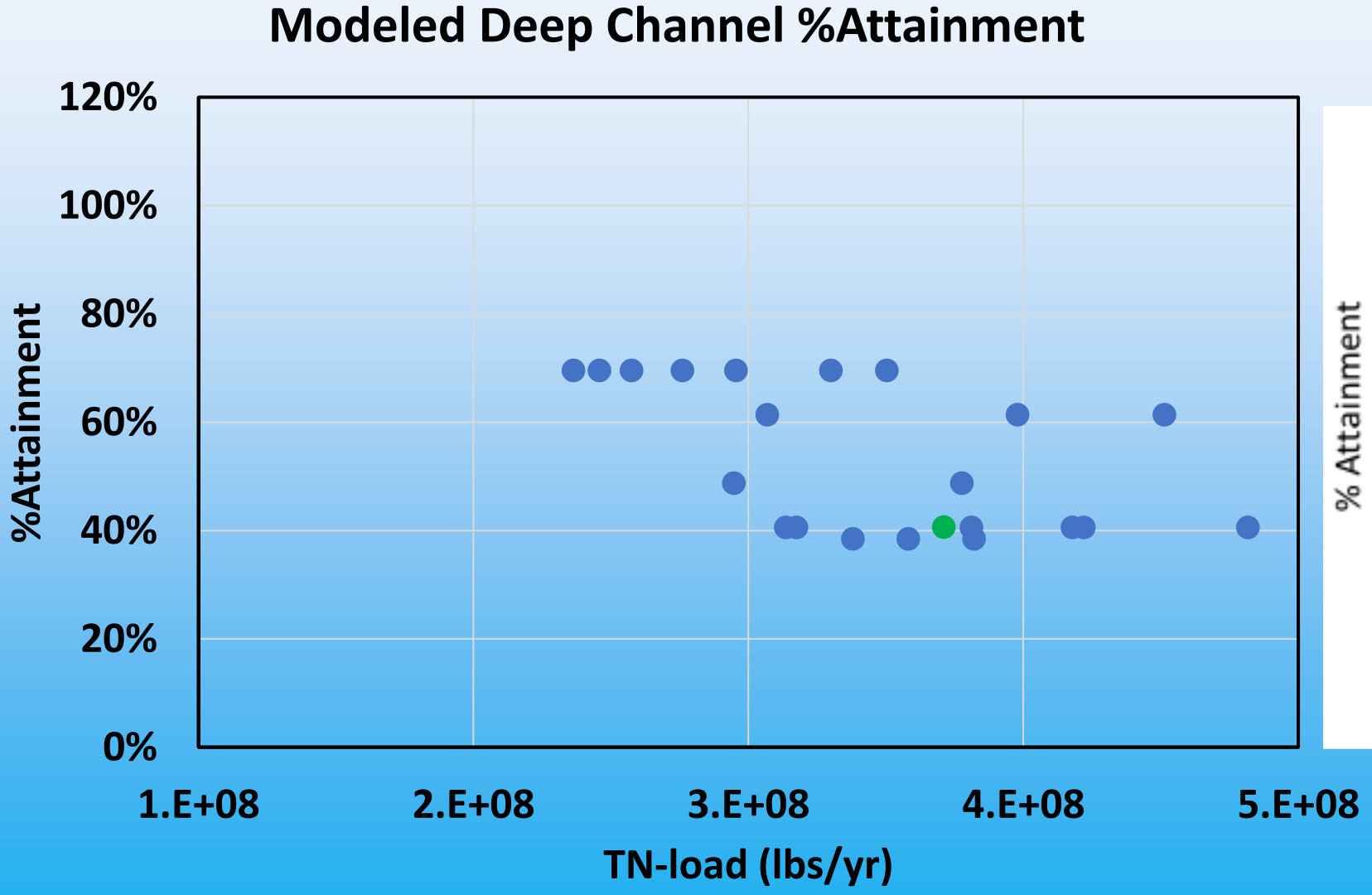
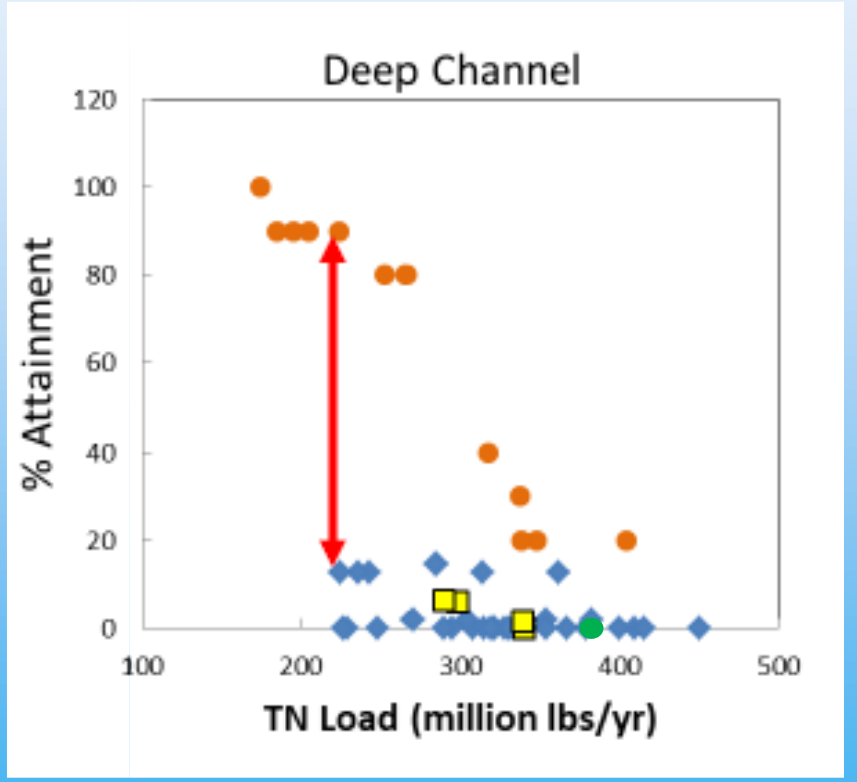
Blue = observations





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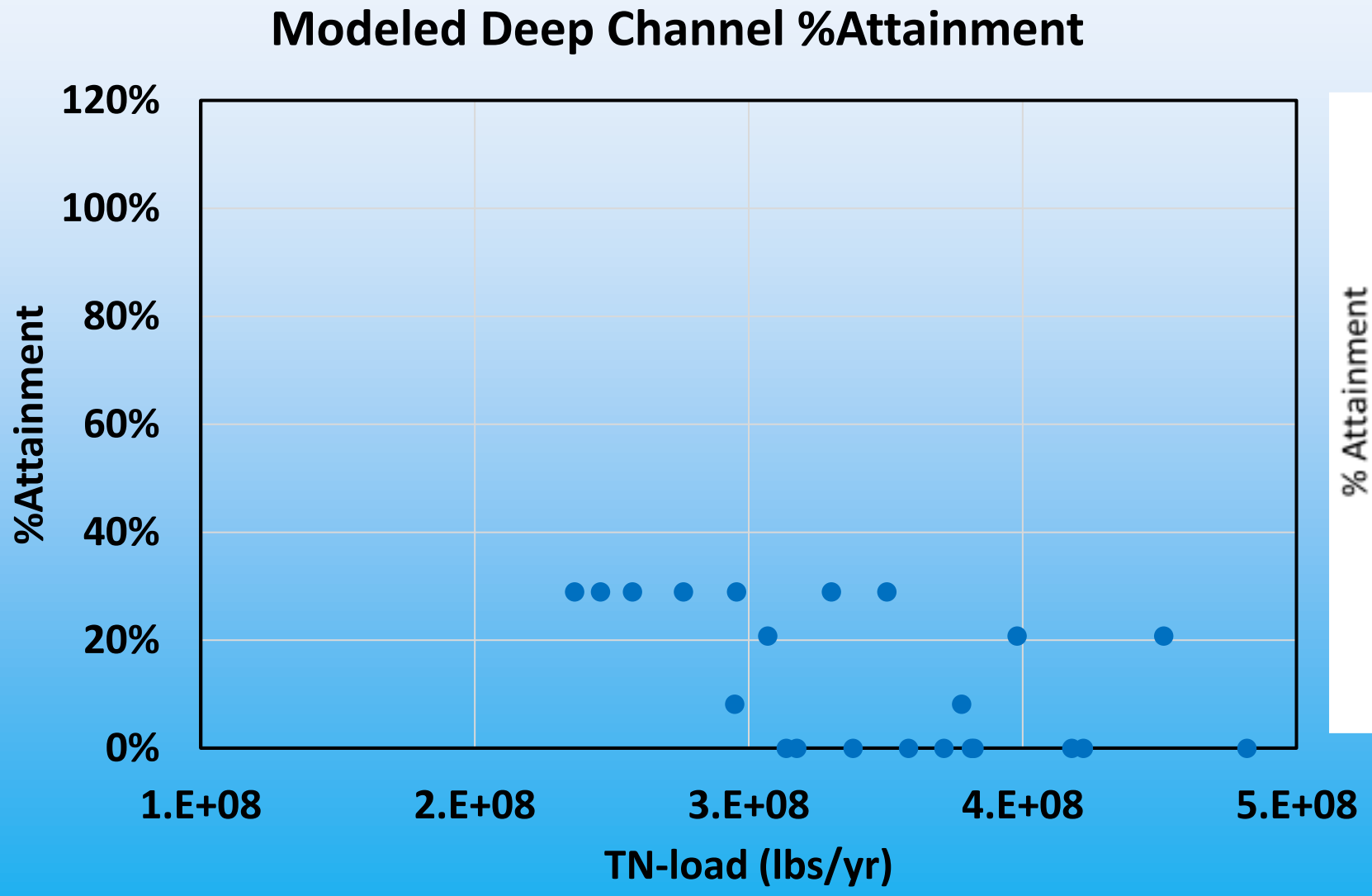
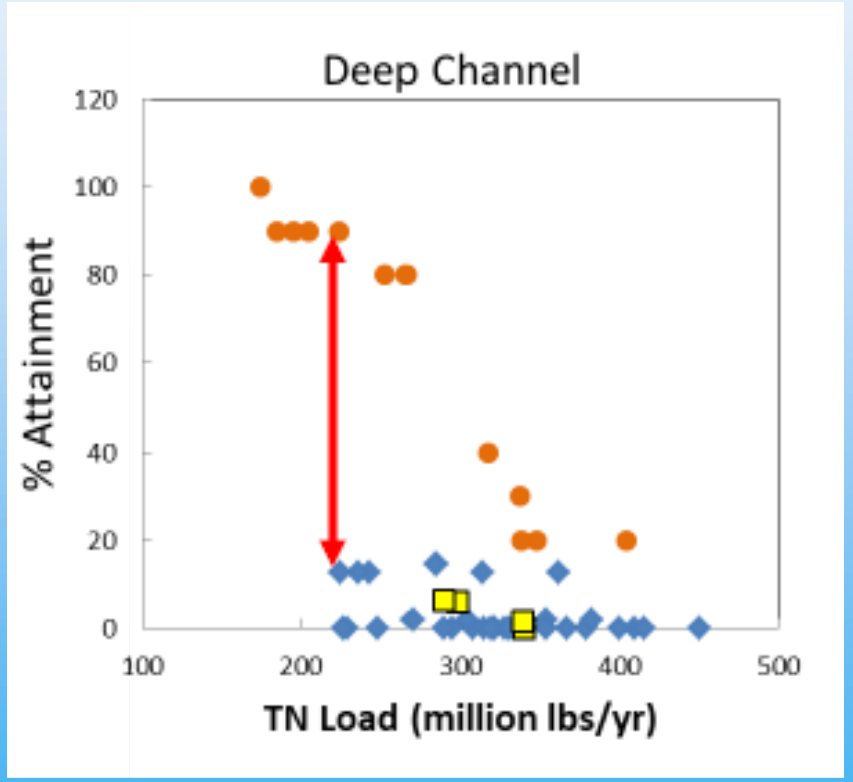
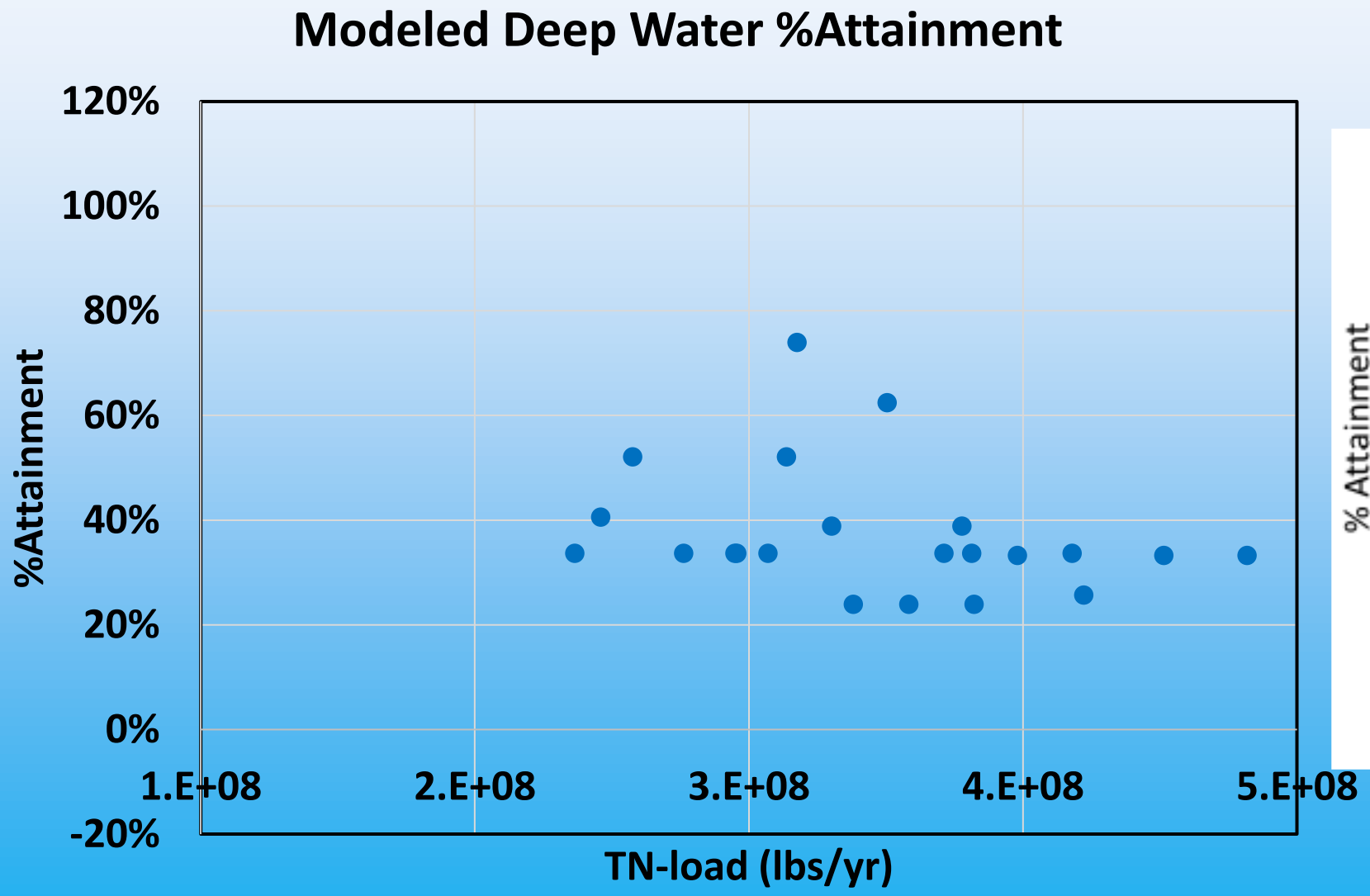




Deep water delta attainment



Plot in CSER report

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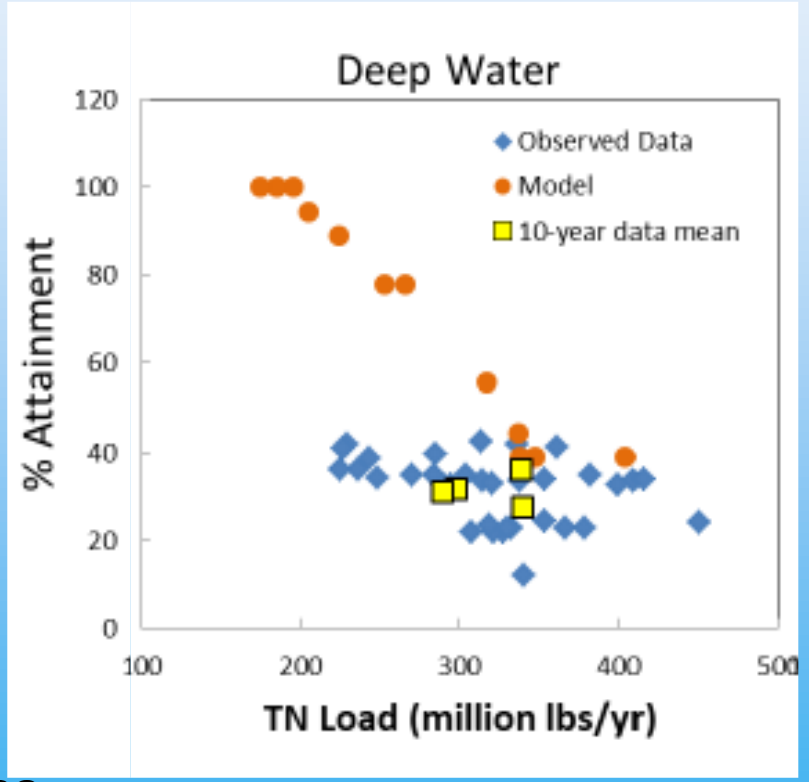

Open water delta attainment

Plot in CSER report

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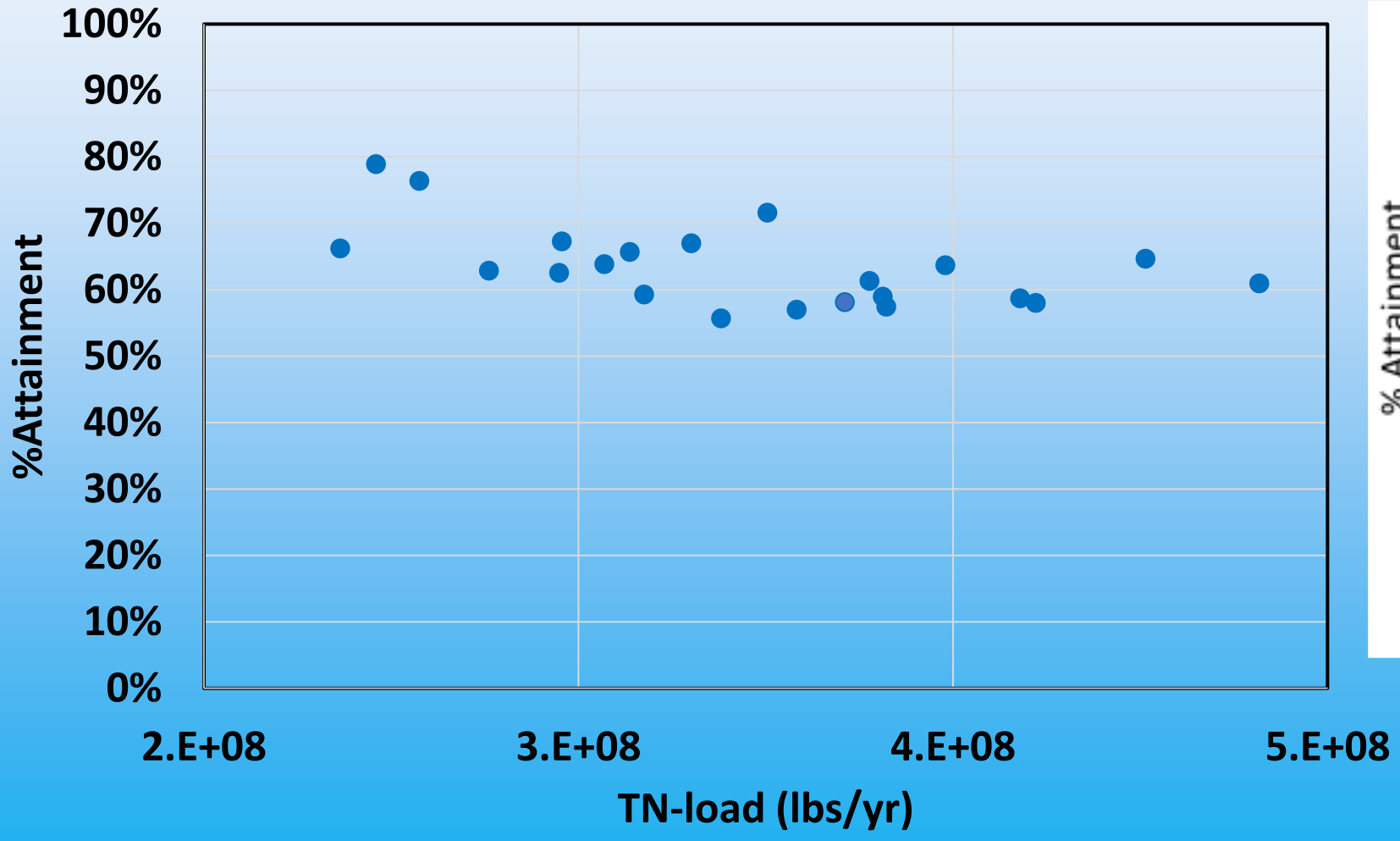
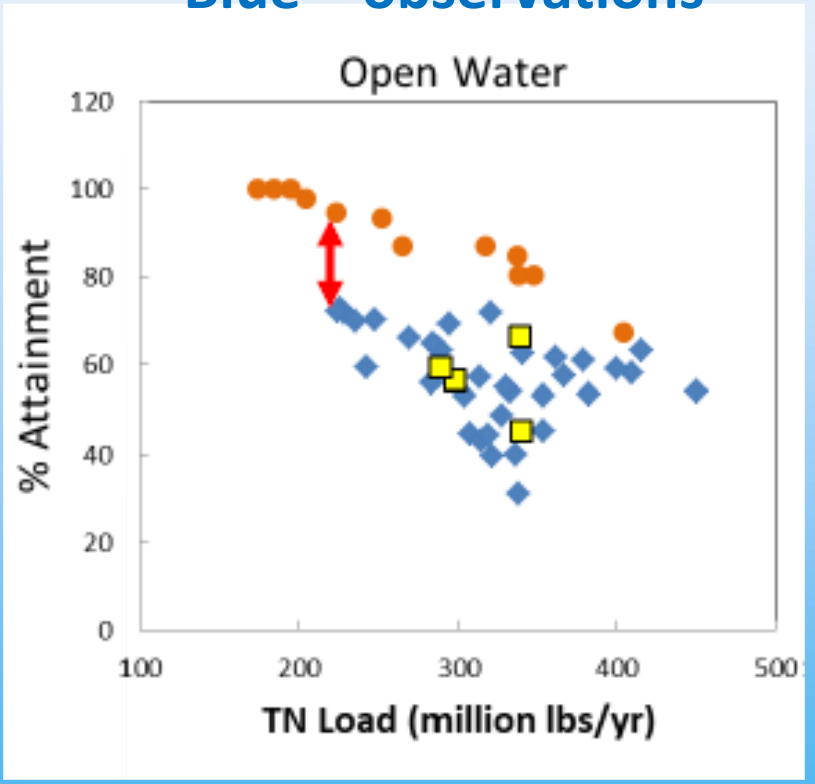
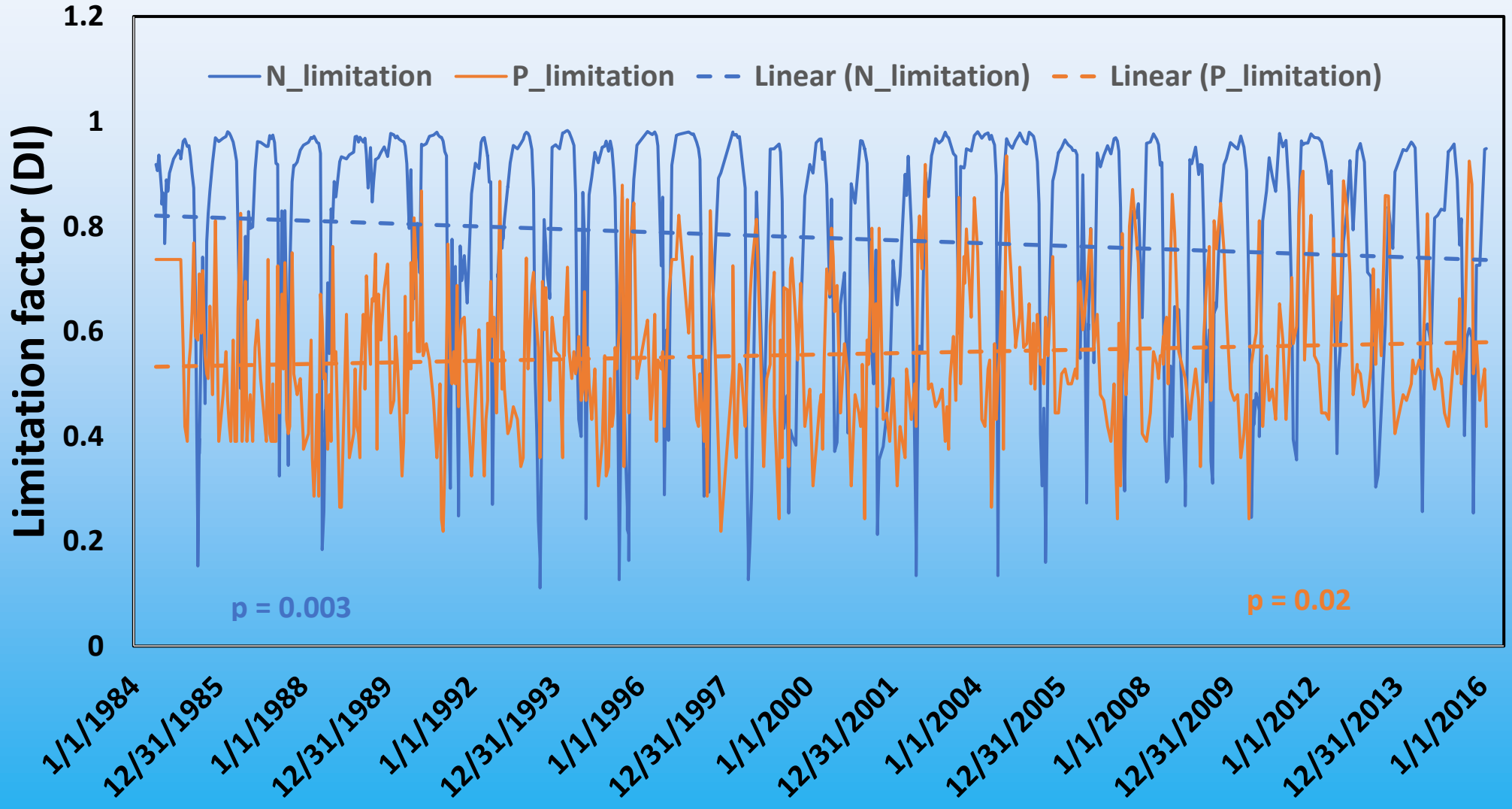




Nutrient limitation based on observation at CB4.2C



We are pretty far away from needed nutrient load reduction for attainment

	Realized reductions from 1995	Reductions needed to meet WQS
Nitrogen	84.1	145.1
Phosphorus	1.9	9.3

Slide from Gary Shenk

Message

- **The model tends to overestimate DO in the deep channel and underestimate DO in the open water, but the bias was corrected to certain extent by using the delta approach.**
- **The model predicted water quality attainment is less contrast to observation than we thought.**
- **Continue the effort to manage nutrient loads and better days are ahead.**