Dickinson Bayou

Total Maximum Daily Load for Dissolved Oxygen

December 05, 2007

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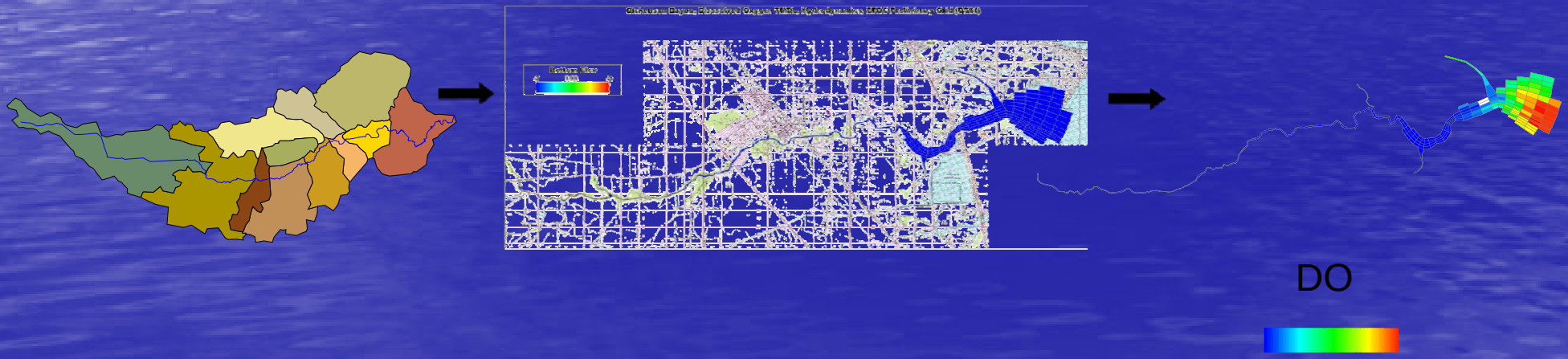
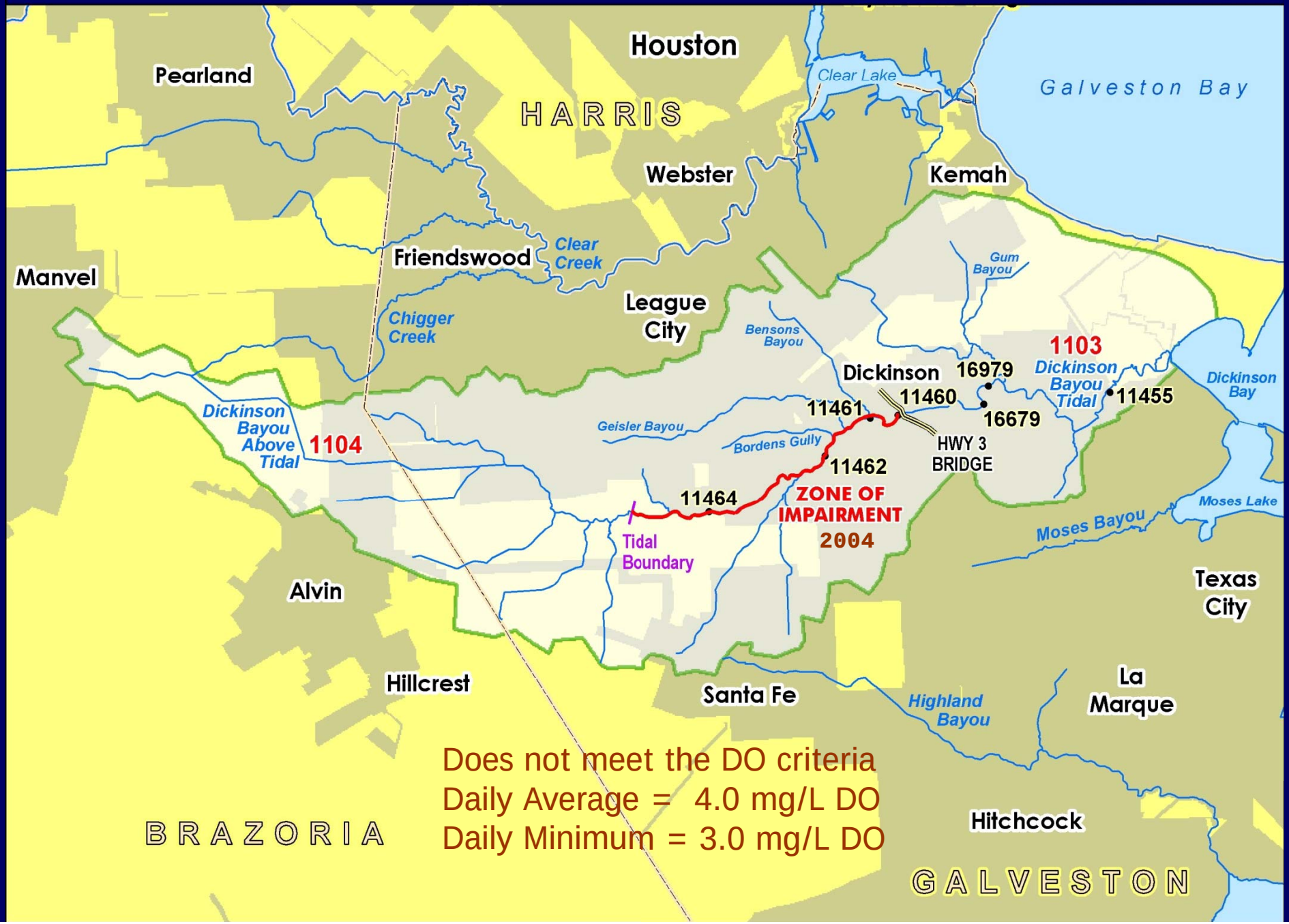
Texas Commission on Environmental Quality

Dickinson Bayou TMDL

- Watershed Model (HSPF)
- Hydrodynamic Model (EFDC)
- In-stream Water Quality Model

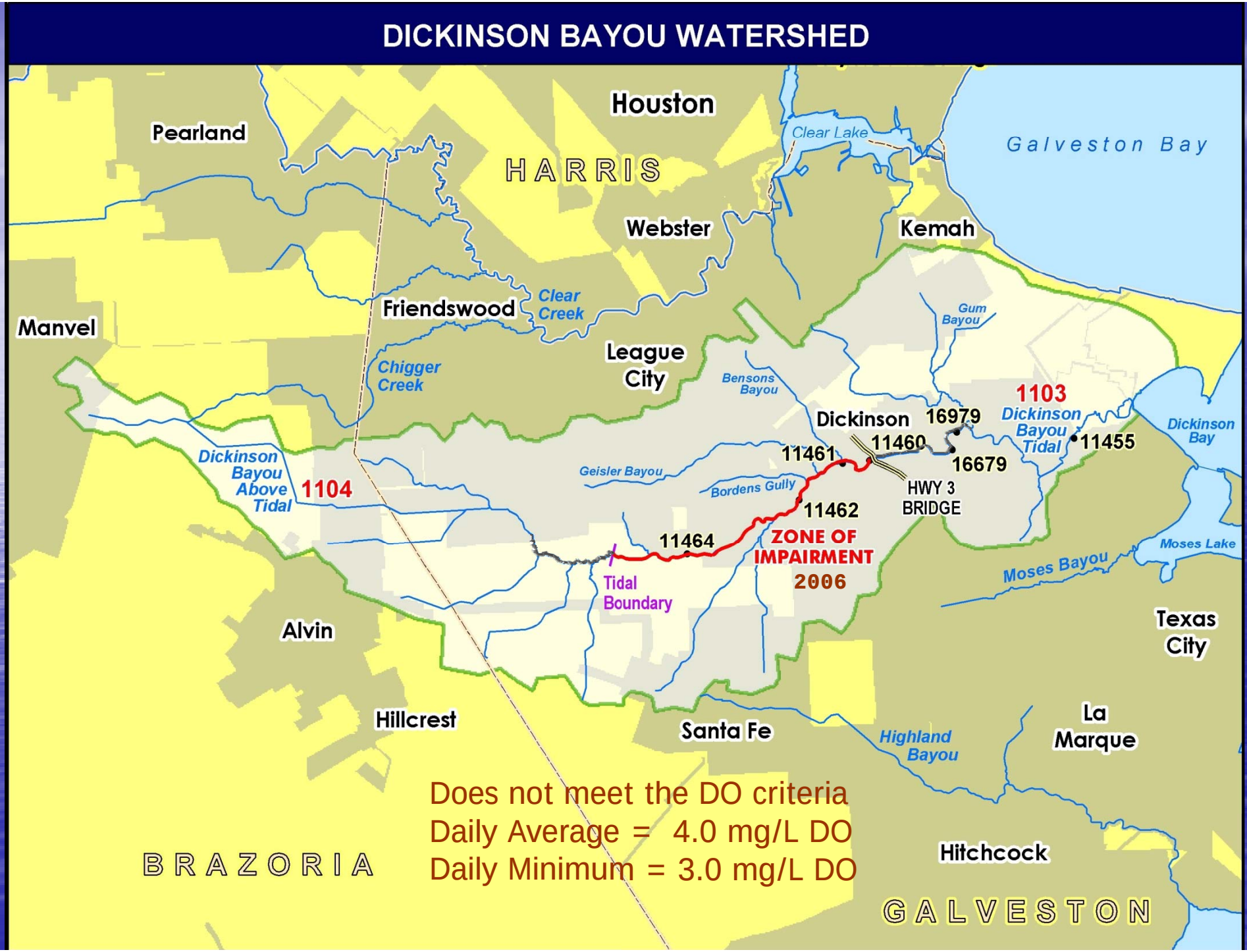


DICKINSON BAYOU WATERSHED

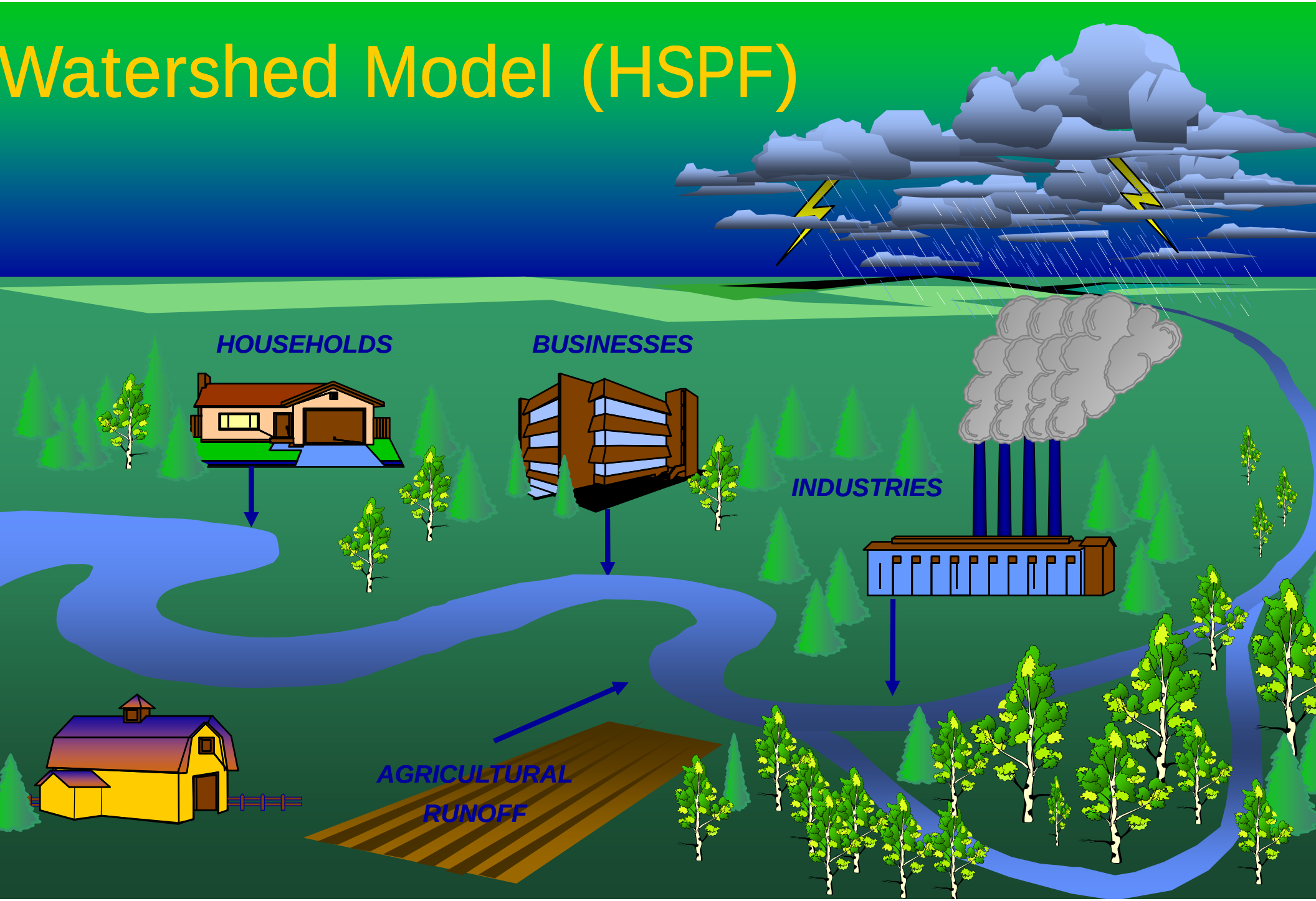


Does not meet the DO criteria
Daily Average = 4.0 mg/L DO
Daily Minimum = 3.0 mg/L DO

DICKINSON BAYOU WATERSHED

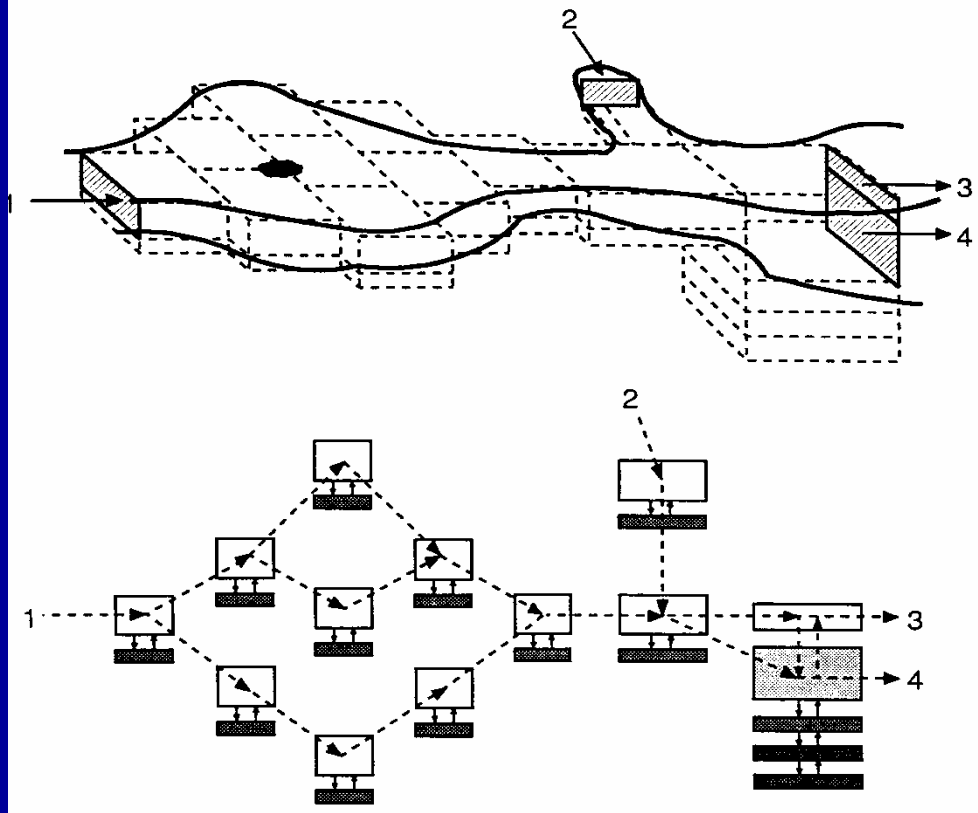


Watershed Model (HSPF)

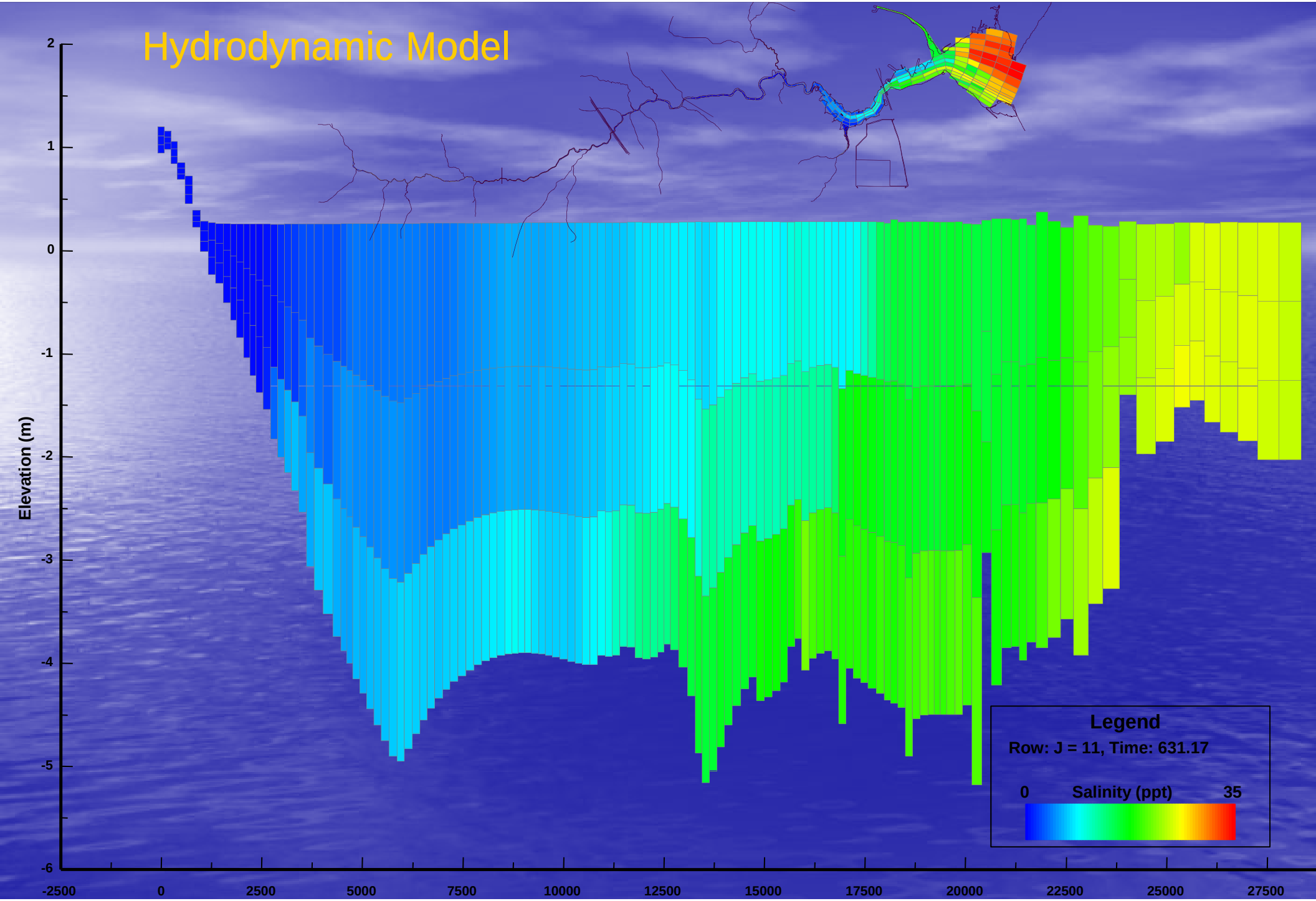


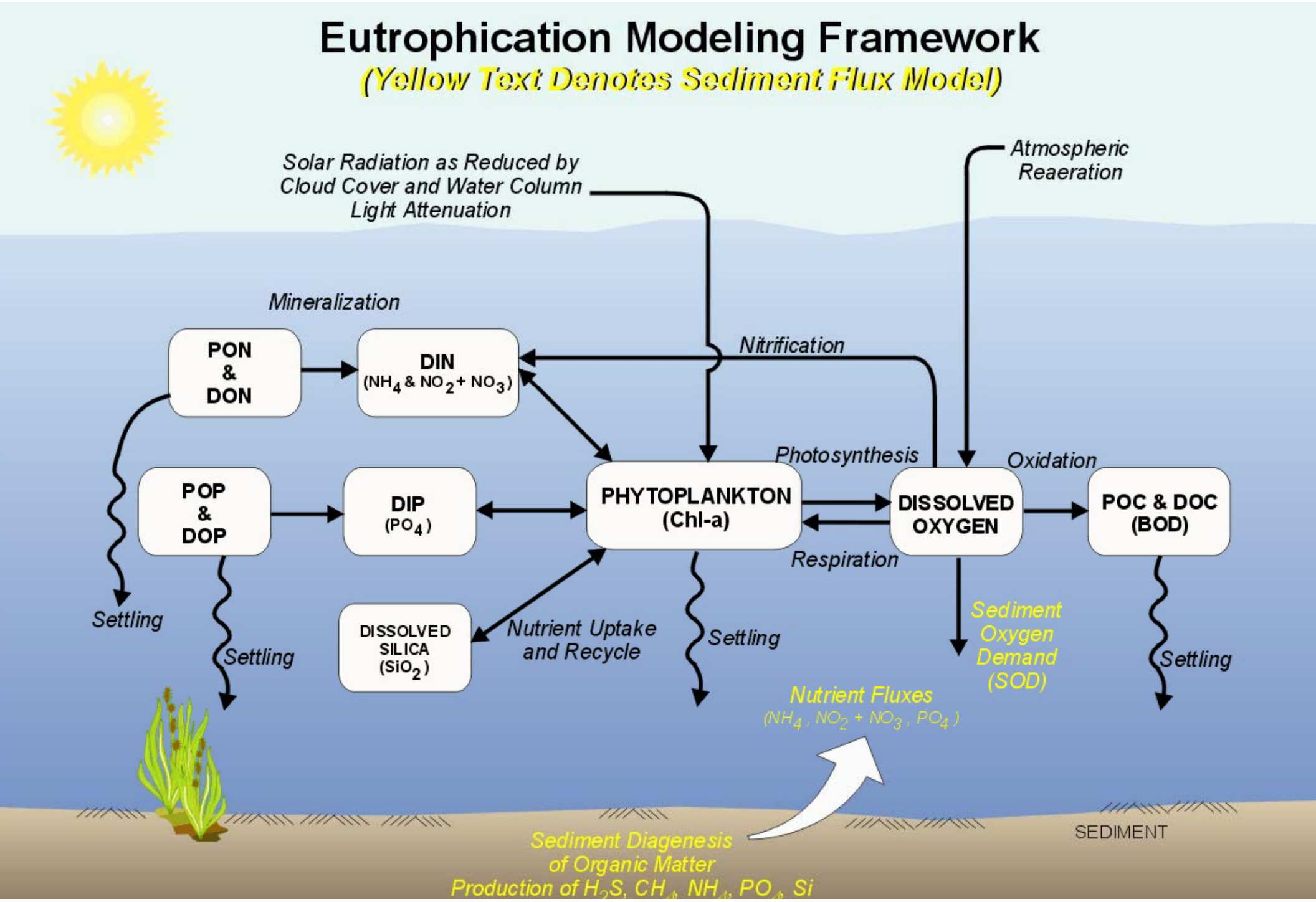
3-D Hydrodynamic and Water Quality Model

A cross-section where water is exchanged (by advection or dispersion) between locations inside and outside the network.



Boundary concentrations, $C_B(t)$ in g/m^3 (mg/L), must be specified for each boundary.


Hydrodynamic Model
Elevation (m)
2
1
0
-1
-2
-3
-4
-5
-6
-2500
0
2500
5000
7500
10000
12500
15000
17500
20000
22500
25000
27500
Legend
Row: J = 11, Time: 631.17
0
Salinity (ppt)
35

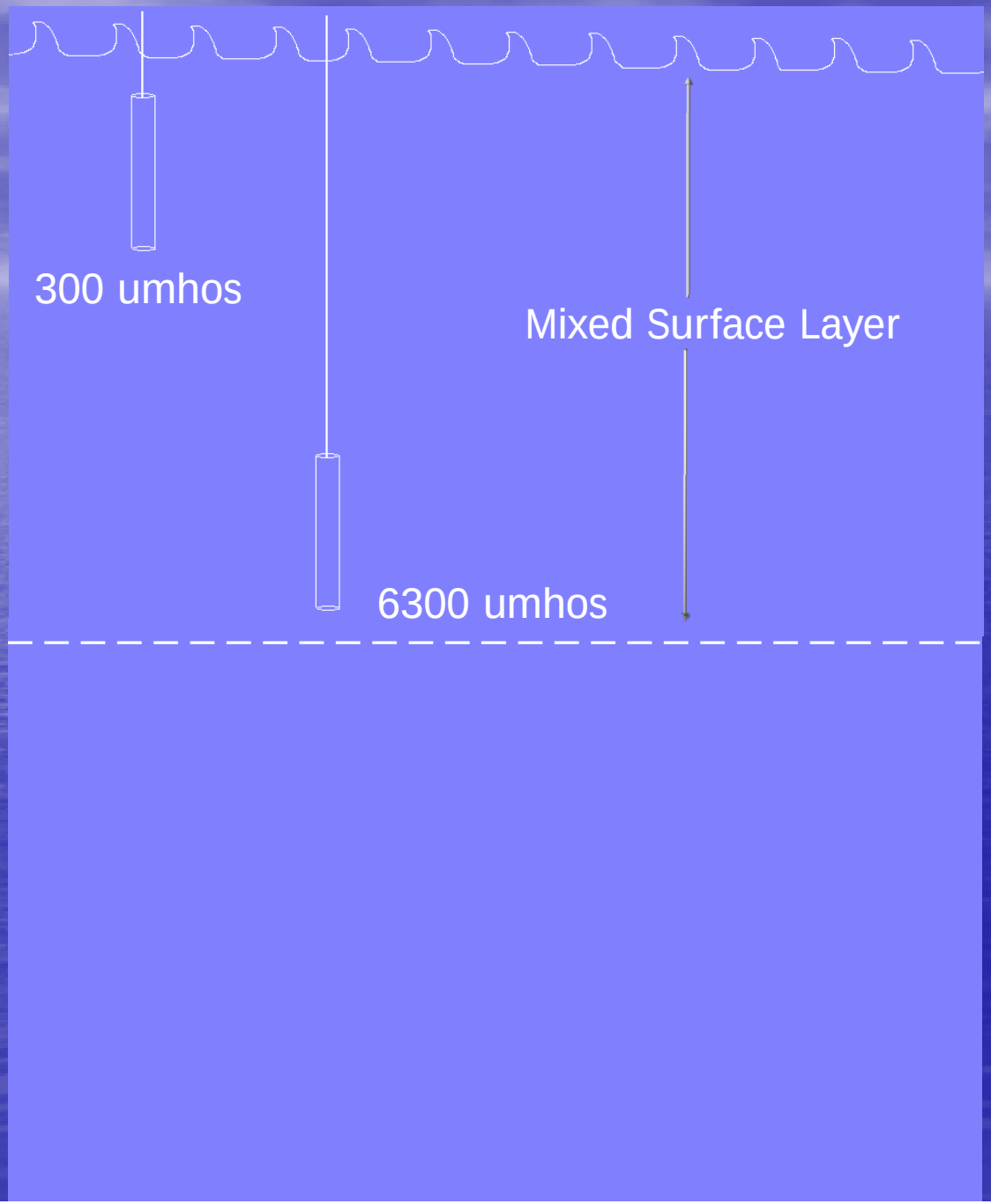

Eutrophication Modeling Framework
(Yellow Text Denotes Sediment Flux Model)
Solar Radiation as Reduced by Cloud Cover and Water Column Light Attenuation
Atmospheric Reaeration
Mineralization
PON & DON
DIN (NH4 & NO2+ NO3)
Nitrification
Photosynthesis
Oxidation
POP & DOP
DIP (PO4)
PHYTOPLANKTON (Chl-a)
DISSOLVED OXYGEN
POC & DOC (BOD)
Respiration
Settling
Settling
DISSOLVED SILICA (SiO2)
Nutrient Uptake and Recycle
Settling
Sediment Oxygen Demand (SOD)
Settling
Nutrient Fluxes
(NH4 , NO2 + NO3 , PO4)
SEDIMENT
Sediment Diagenesis of Organic Matter
Production of H2S, CH4, NH4, PO4, Si

DO Simulation Animation

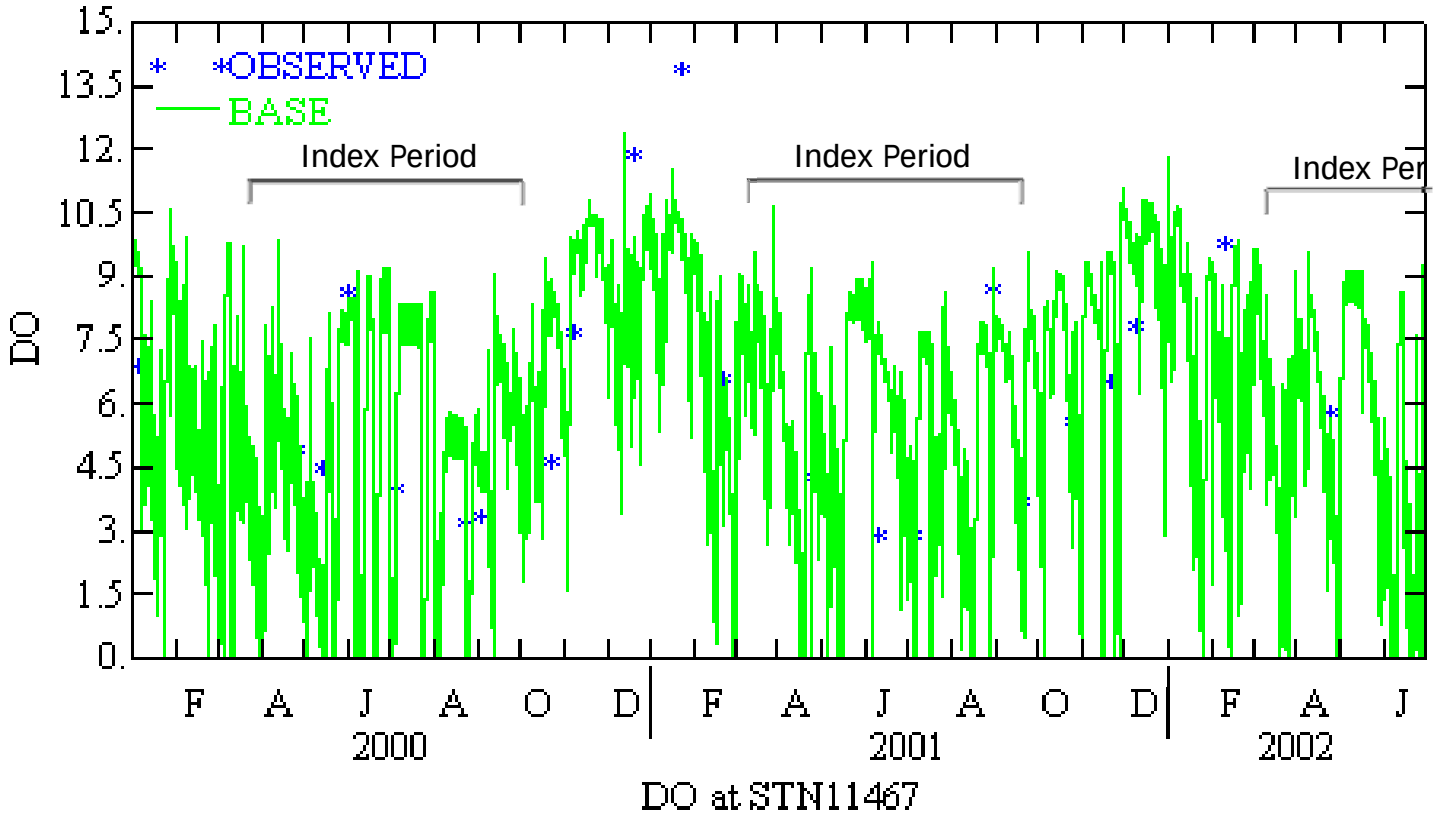
Standards Compliance and Assessment Criteria

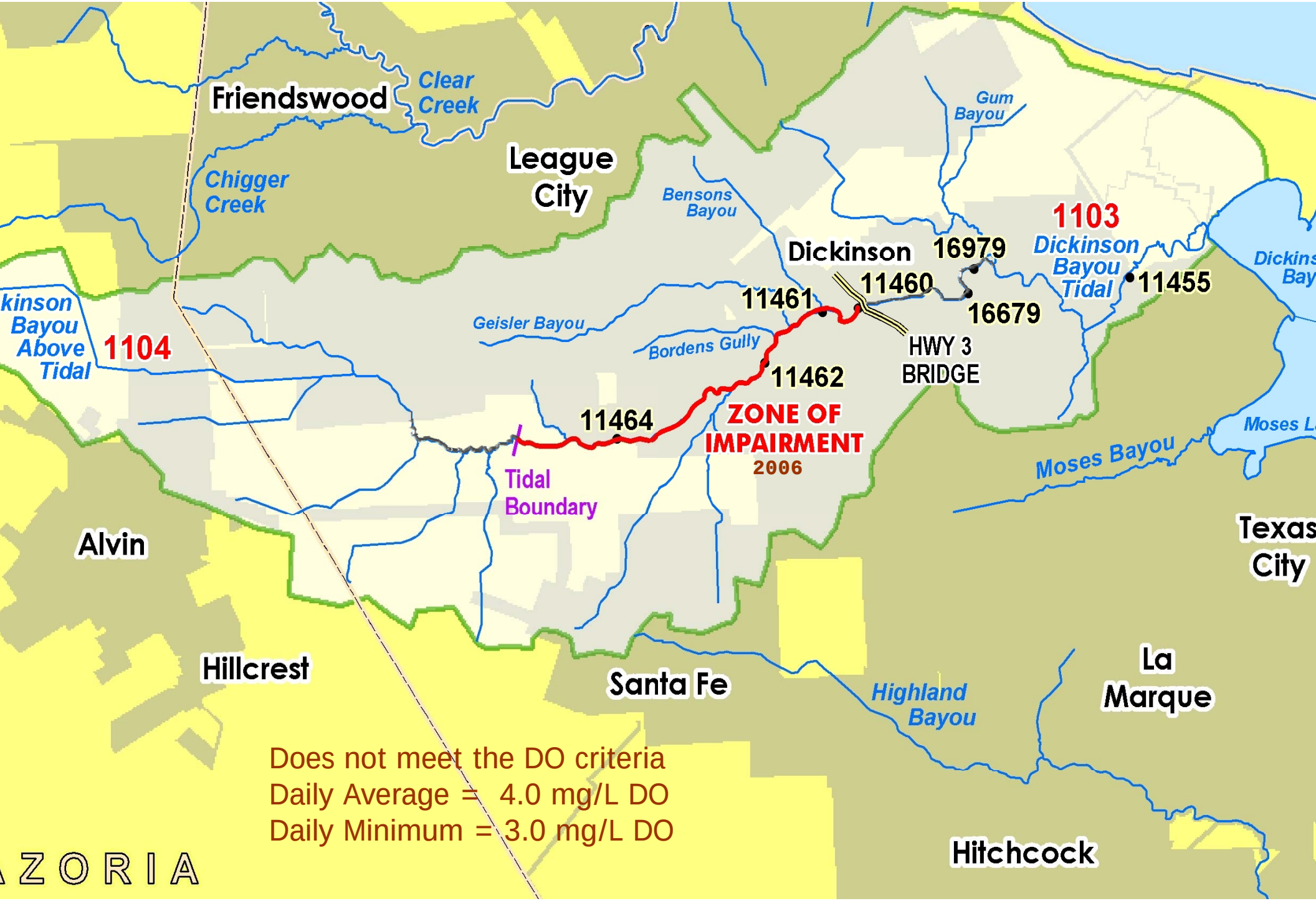
- Mixed Surface Layer (Surface to +6000 umhos)
- Index Period (March-October)
- Zone of Impairment
- 90% Compliance with DO Criteria (Avg. and Min.)

Mixed Surface Layer



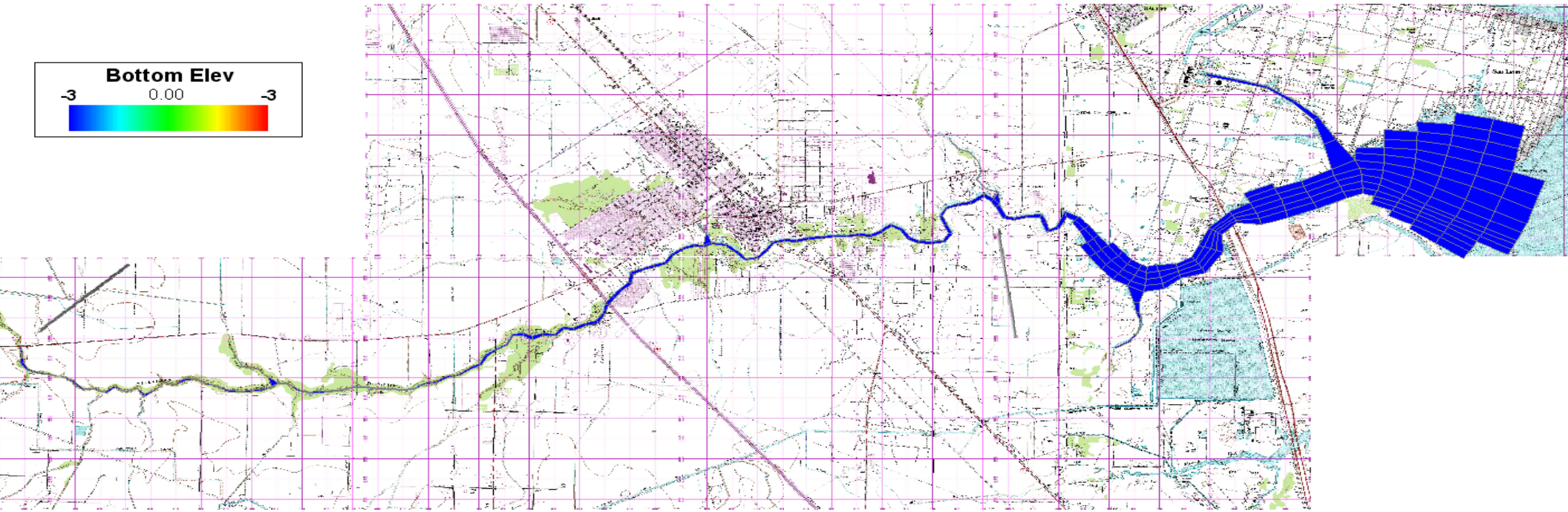
Index Period = March 15 – September 30



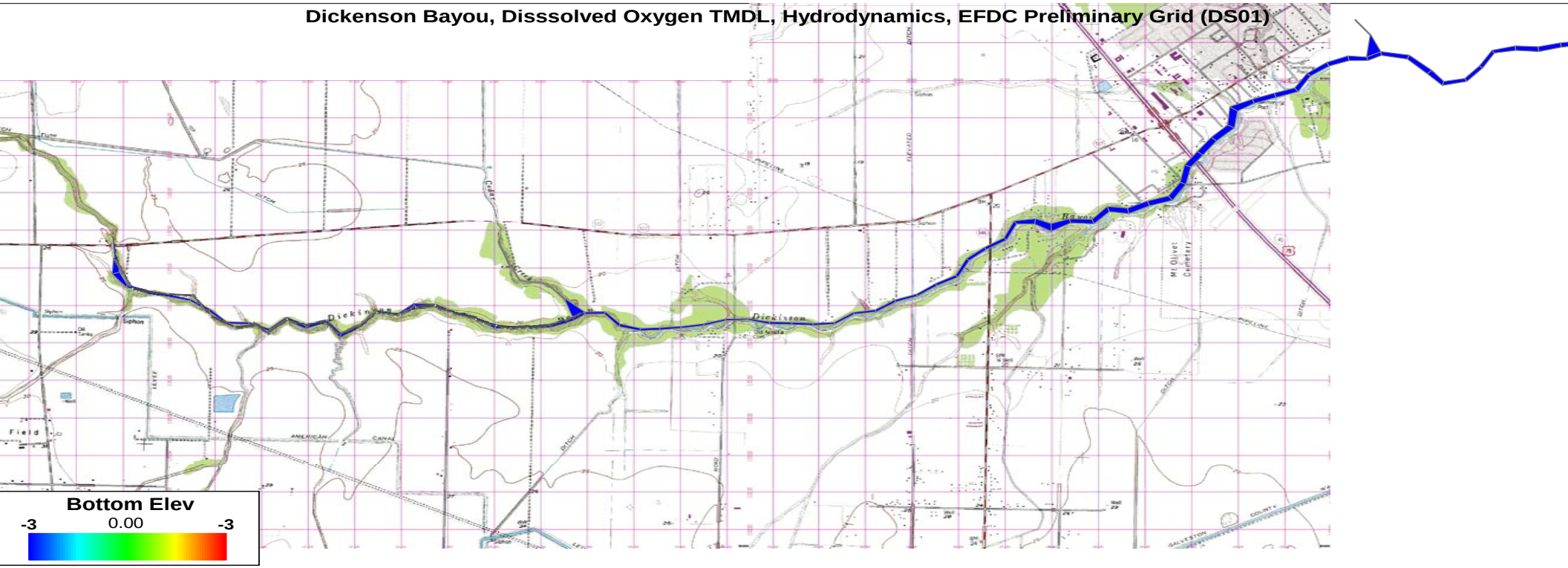

Friendswood
Clear Creek
Chigger Creek
League City
Bensons Bayou
Gum Bayou
1103
Dickinson Bayou Tidal
Dickinson
16979
11460
11455
11461
16679
HWY 3 BRIDGE
Geisler Bayou
Bordens Gully
1104
Above Tidal
11462
11464
ZONE OF IMPAIRMENT
2006
Tidal Boundary
Moses Bayou
Alvin
Texas City
Hillcrest
Santa Fe
Highland Bayou
La Marque
Hitchcock
Does not meet the DO criteria
Daily Average = 4.0 mg/L DO
Daily Minimum = 3.0 mg/L DO

Whole Domain

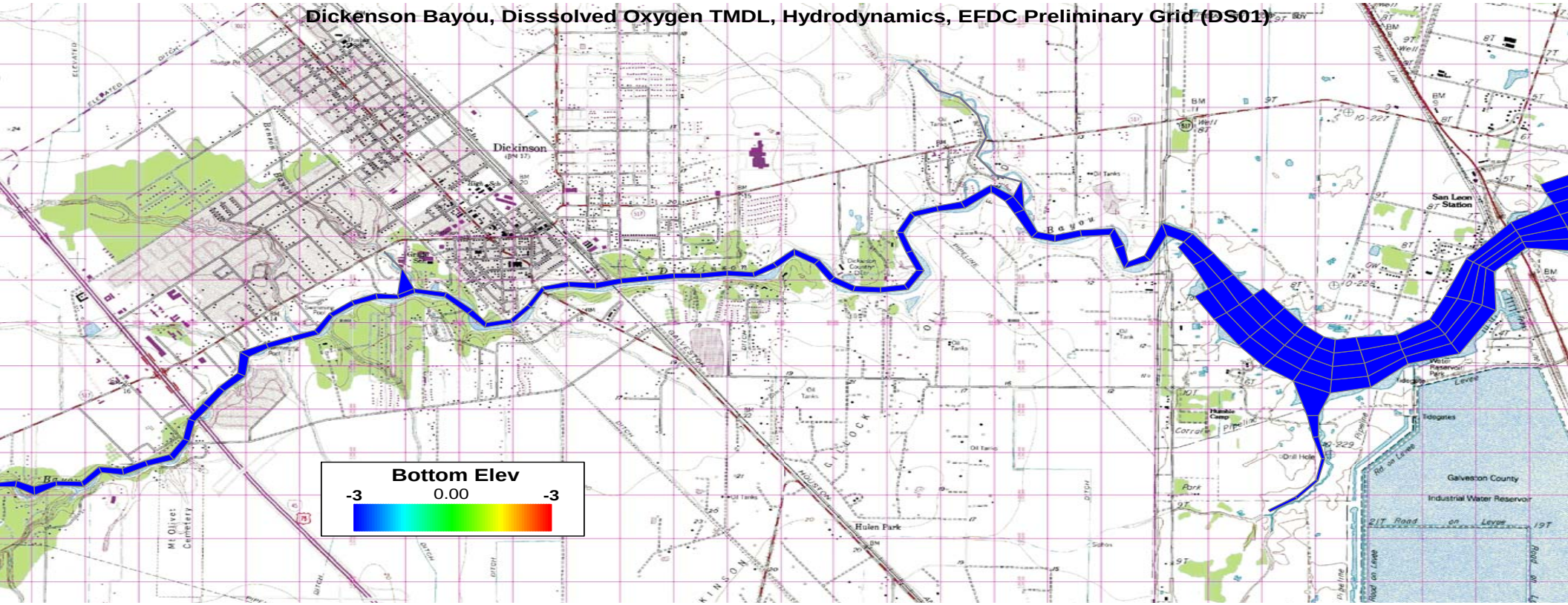
Dickenson Bayou, Disssolved Oxygen TMDL, Hydrodynamics, EFDC Preliminary Grid (DS01)



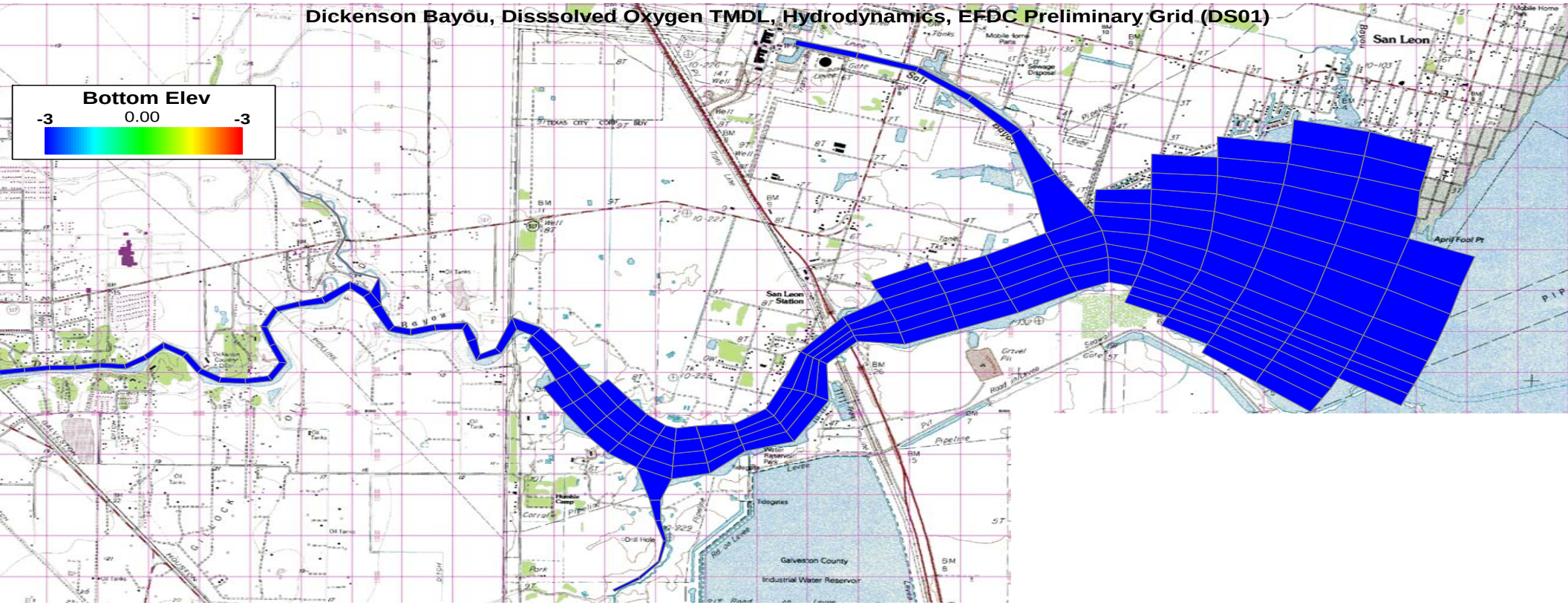
Grid Section 1 of 3



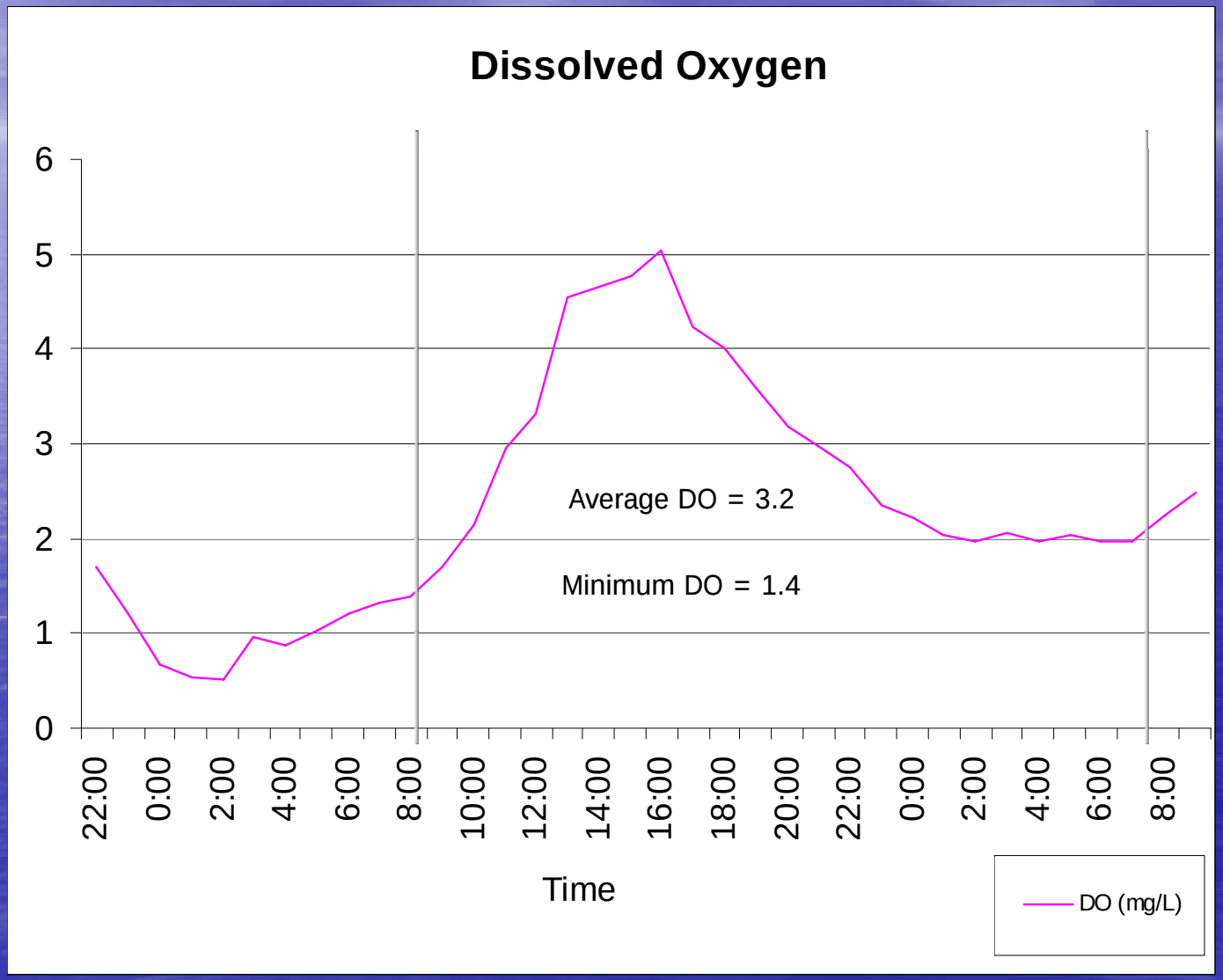
Grid Section 2 of 3



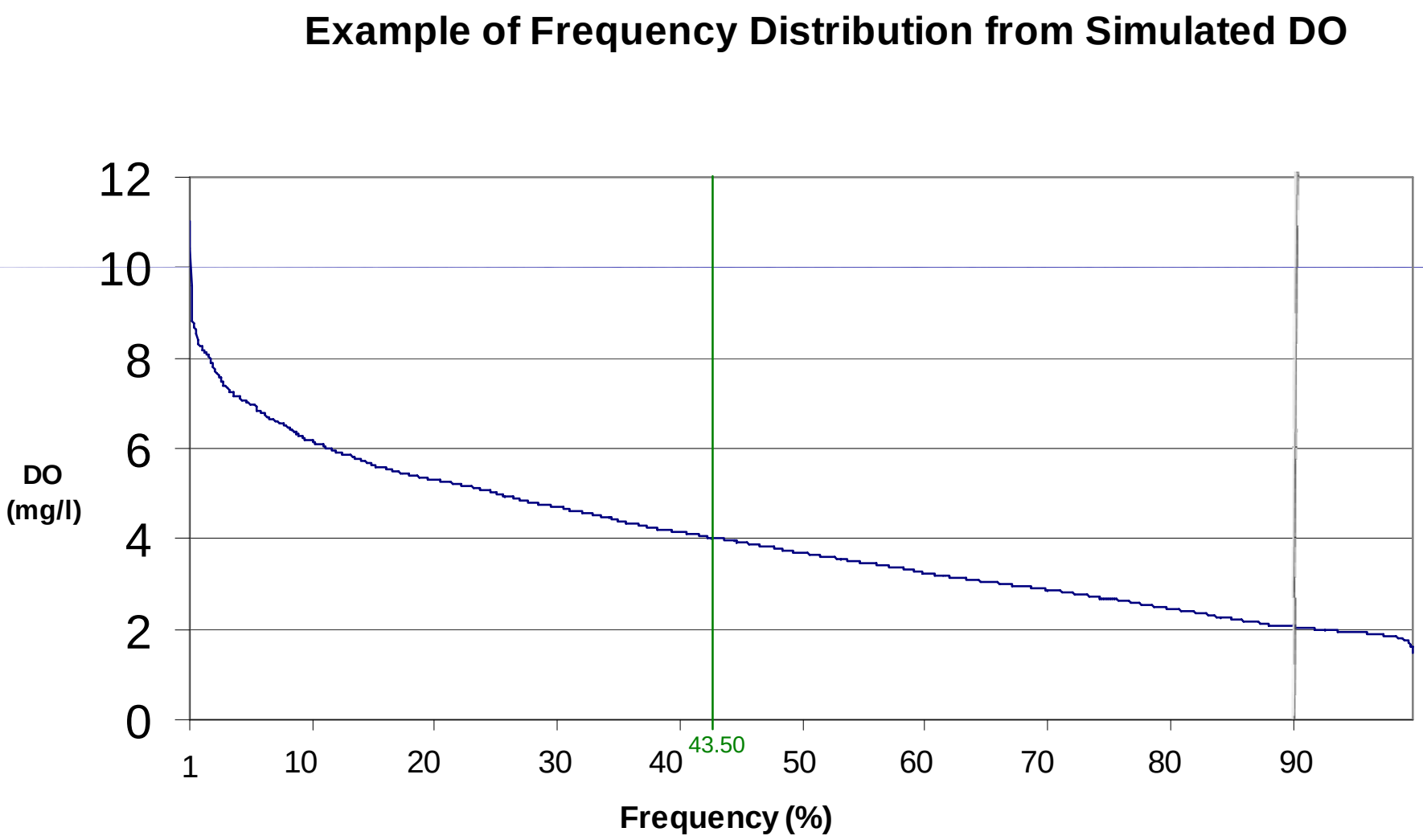
Grid Section 3 of 3



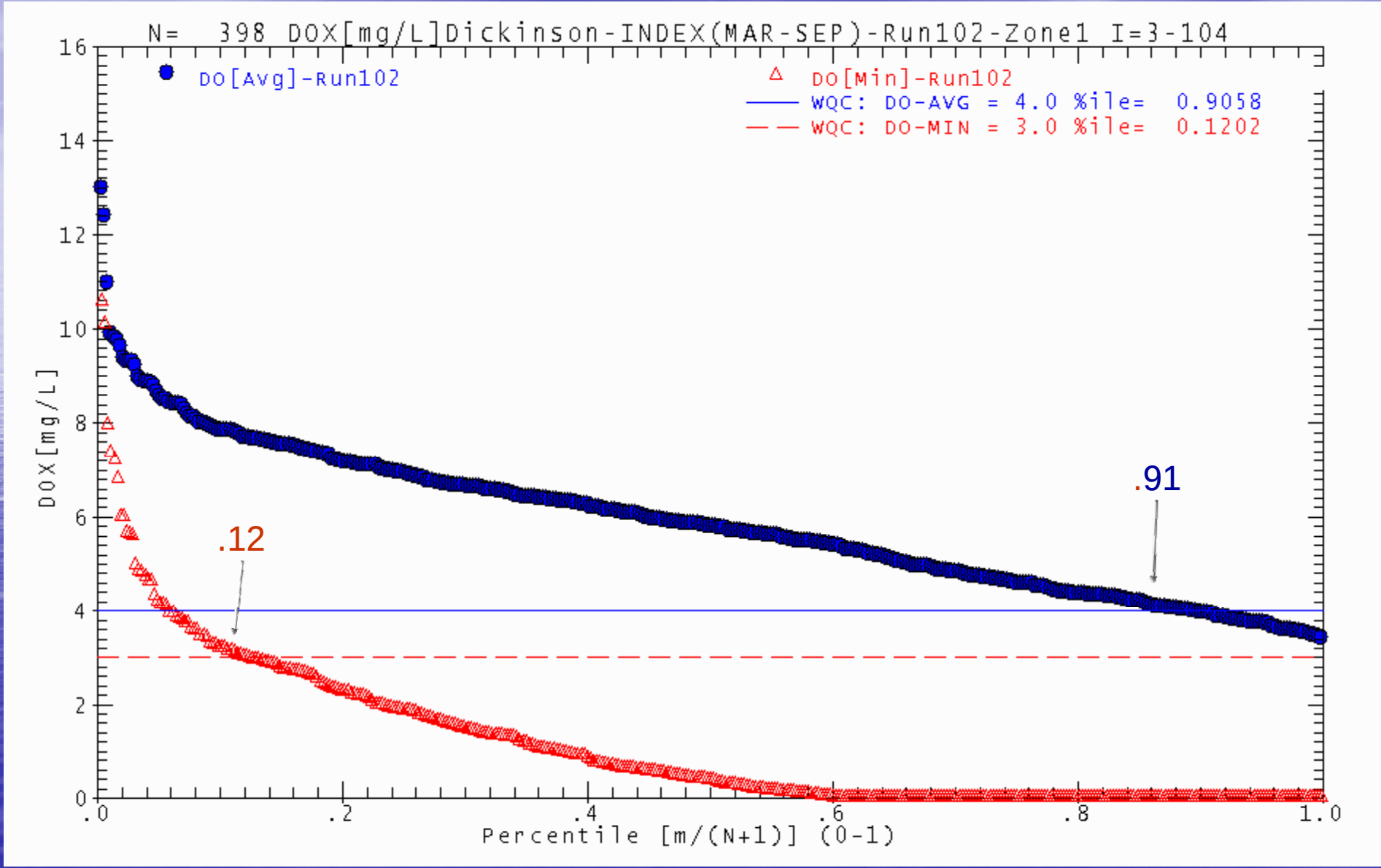
24-hr Average and Minimum Criteria



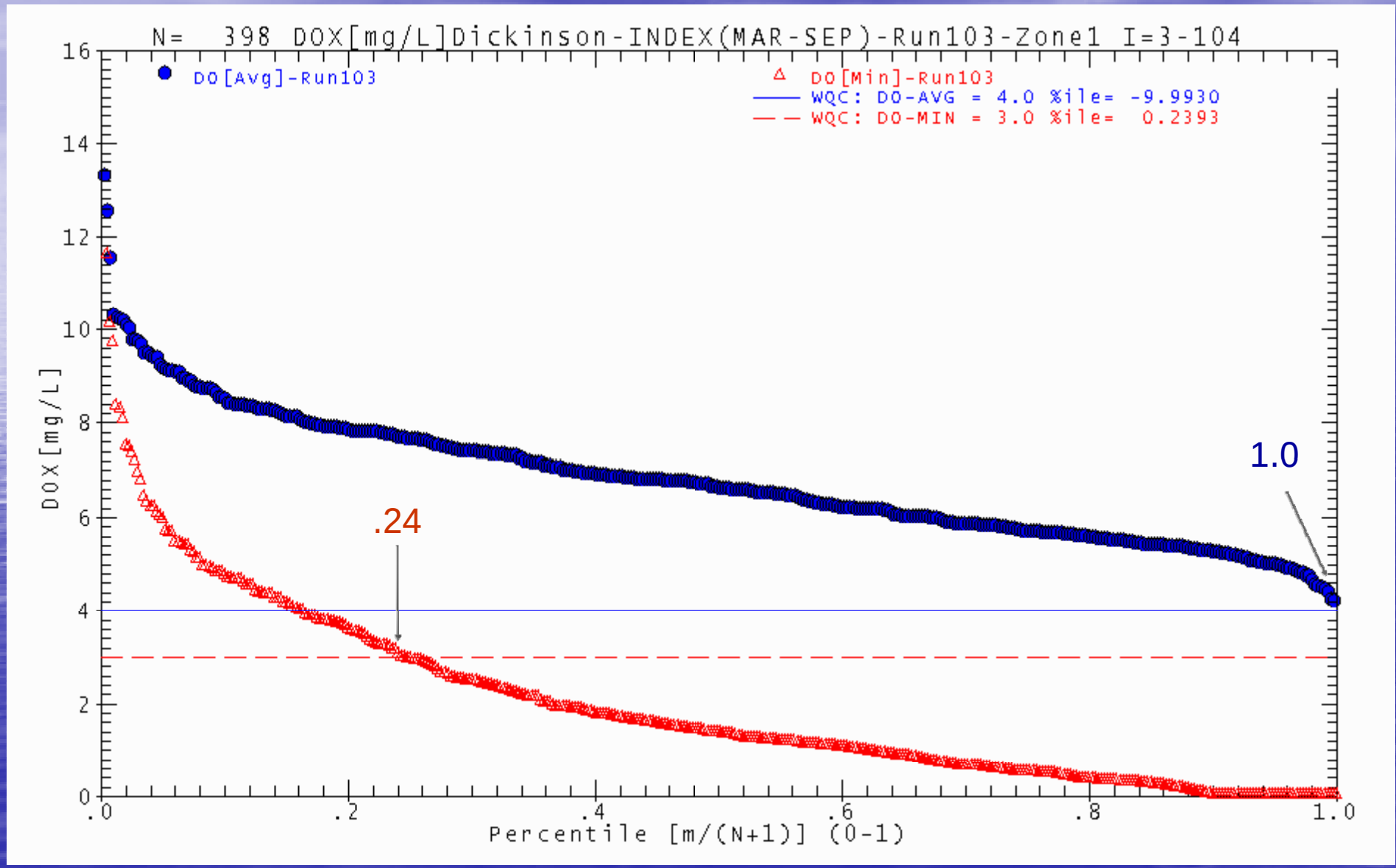
Frequency Distributions



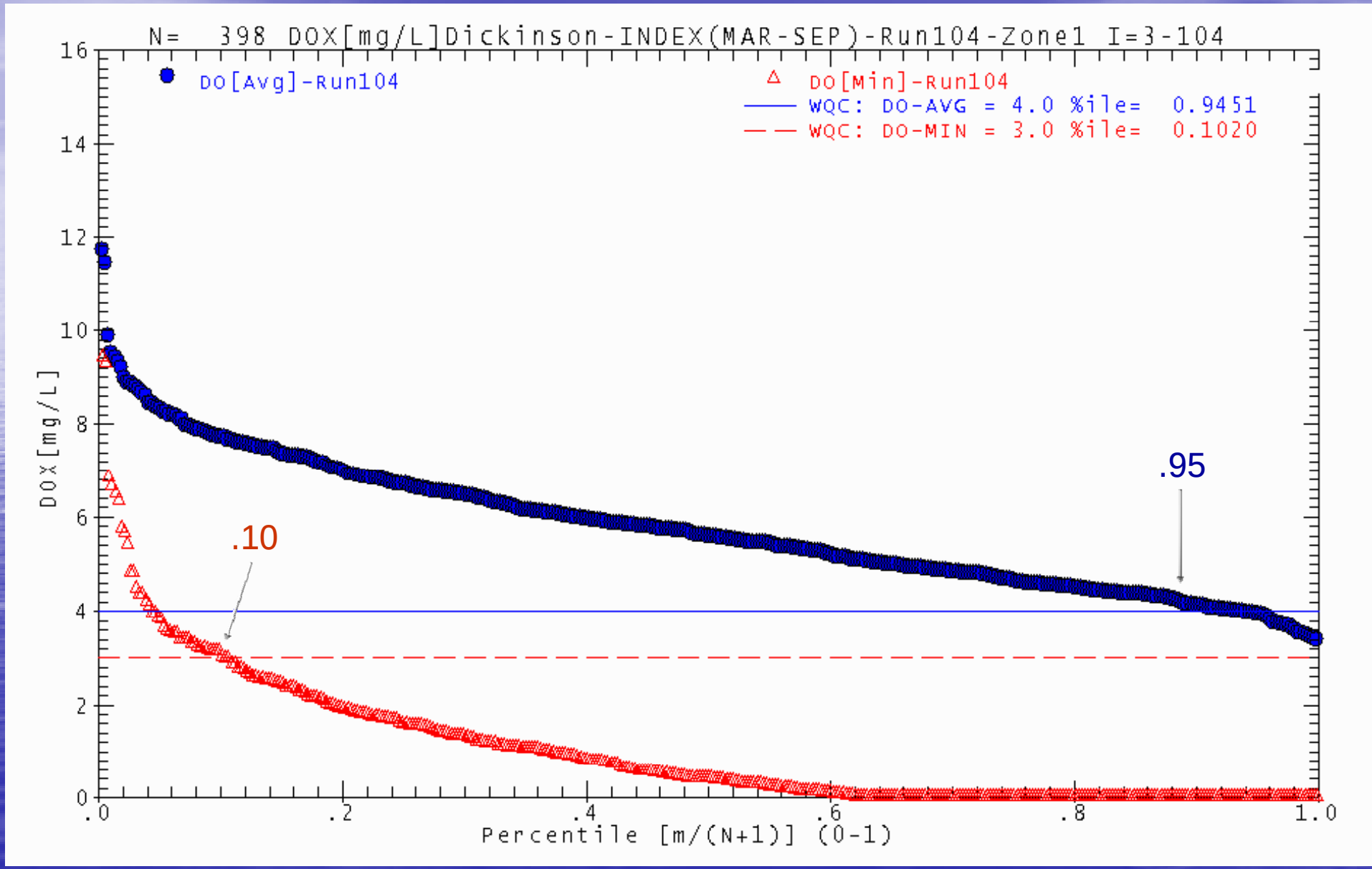
Dickinson Bayou (Calibration Run)



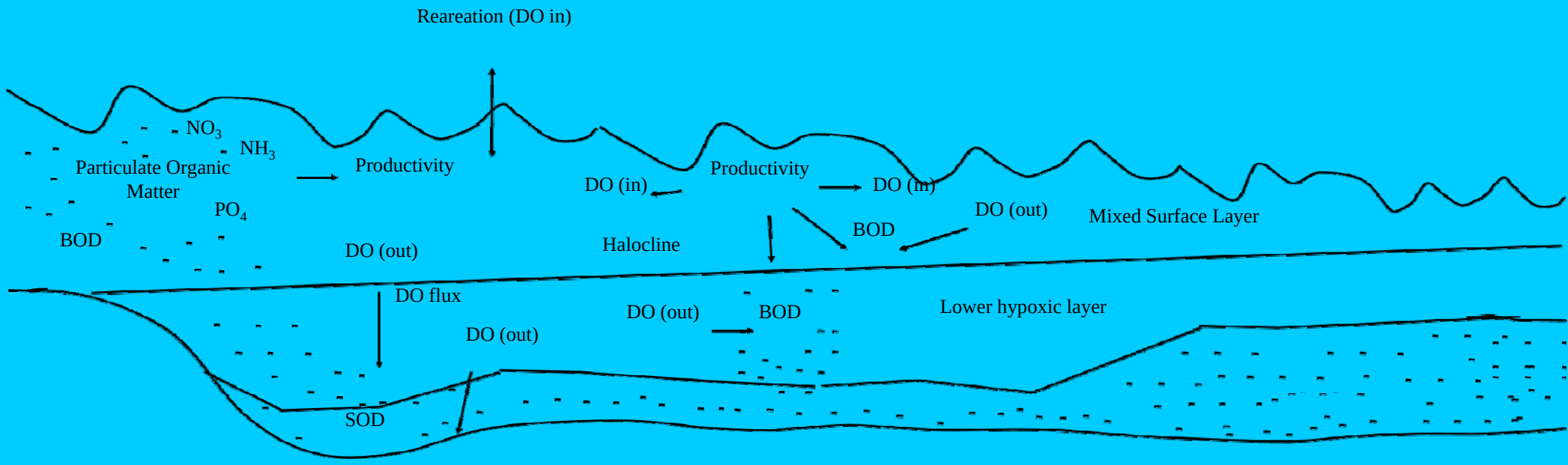
Dickinson Bayou 95% Load Reduction



Dickinson Bayou Natural loadings



Schematic of Problem



5b? or Load Allocation?

5b - Conclusions

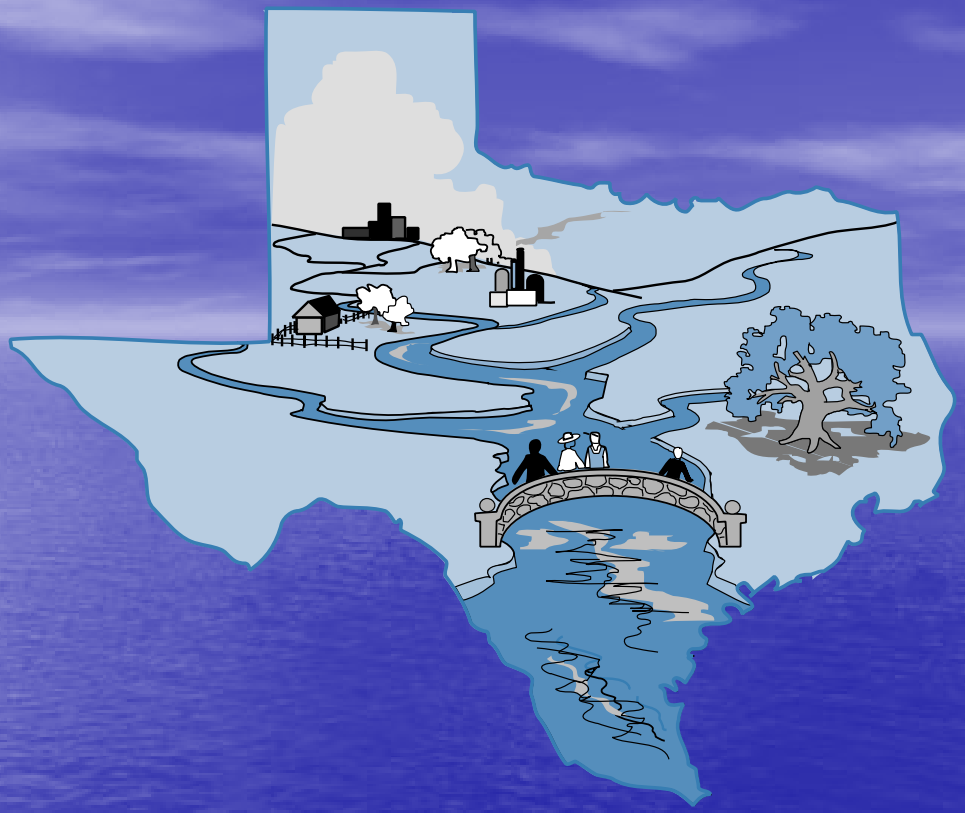
- The DO criteria applied to Dickinson Bayou are not achievable under natural loading conditions
- Aquatic life studies show a high aquatic life use is attained under the modeled conditions
- Additional data will be collected for a UAA
- Pending the results of the UAA, aquatic life use and DO criteria may be de-coupled
- Assesment methodology may be changed
- Site-specific DO criteria will be developed for Dickinson Bayou
- If still necessary, a TMDL will be developed based on the new criteria

Load Allocation

- Under natural conditions the Daily Average DO Criteria is met 95% of the time and the minimum is met 10% of the time in the ZOI; the TMDL and load allocations could be based on these compliance frequencies
- TMDL could be based solely on DO Avg. criteria
- Additional data will be collected for a UAA
- The TMDL will be adjusted in accordance with the criteria set by the UAA.

What remains to be done?

- Gather stakeholder feedback
- Write technical report
- Initiate UAA
- Seek EPA consultation on TMDL scenarios and/or change in assessment methodology
- Allow WPP to conclude
- Follow WPP implementation while UAA is developed



http://www.tceq.state.tx.us/implementation/water/tmdl/17-dickinson.html

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