DWR Monitoring of Dissolved Oxygen concentrations in the DWSC

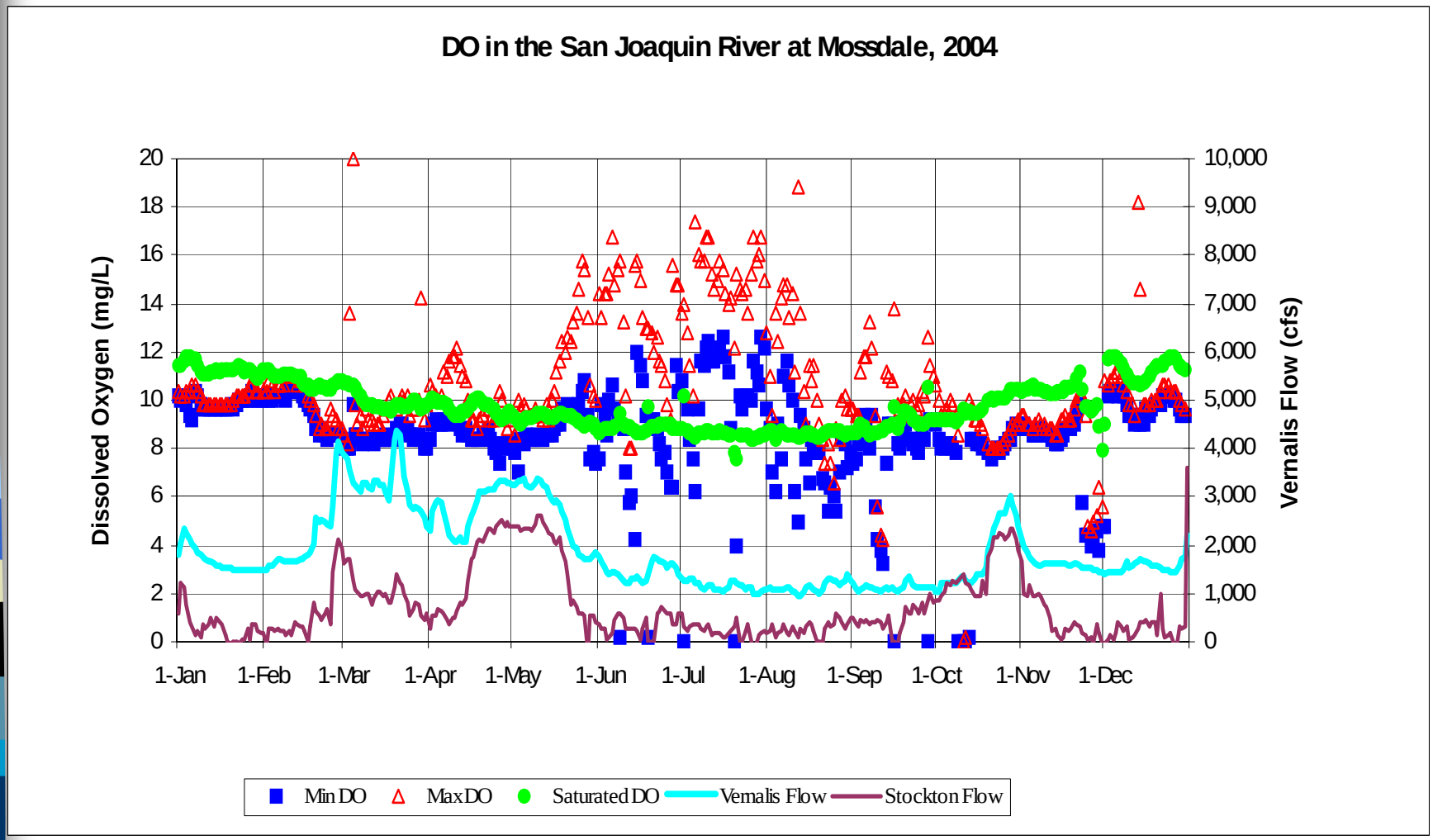
Russ Brown, Jones & Stokes--- presentation

Khalid Ameri, DWR South Delta Branch--- data analysis and display

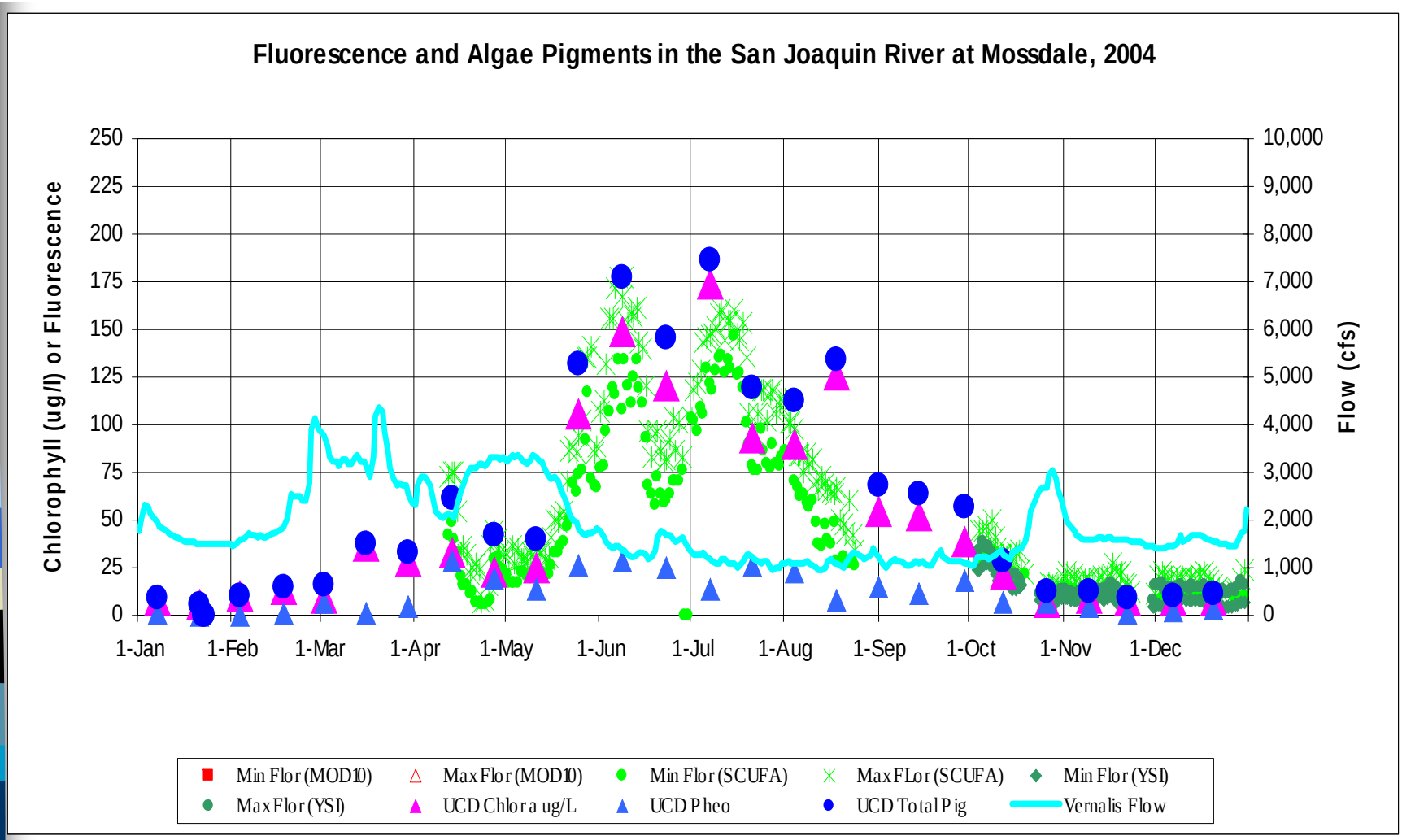
DWR Central District---installation, calibration and data collection

Purpose of DWR Monitoring of the DWSC DO concentrations

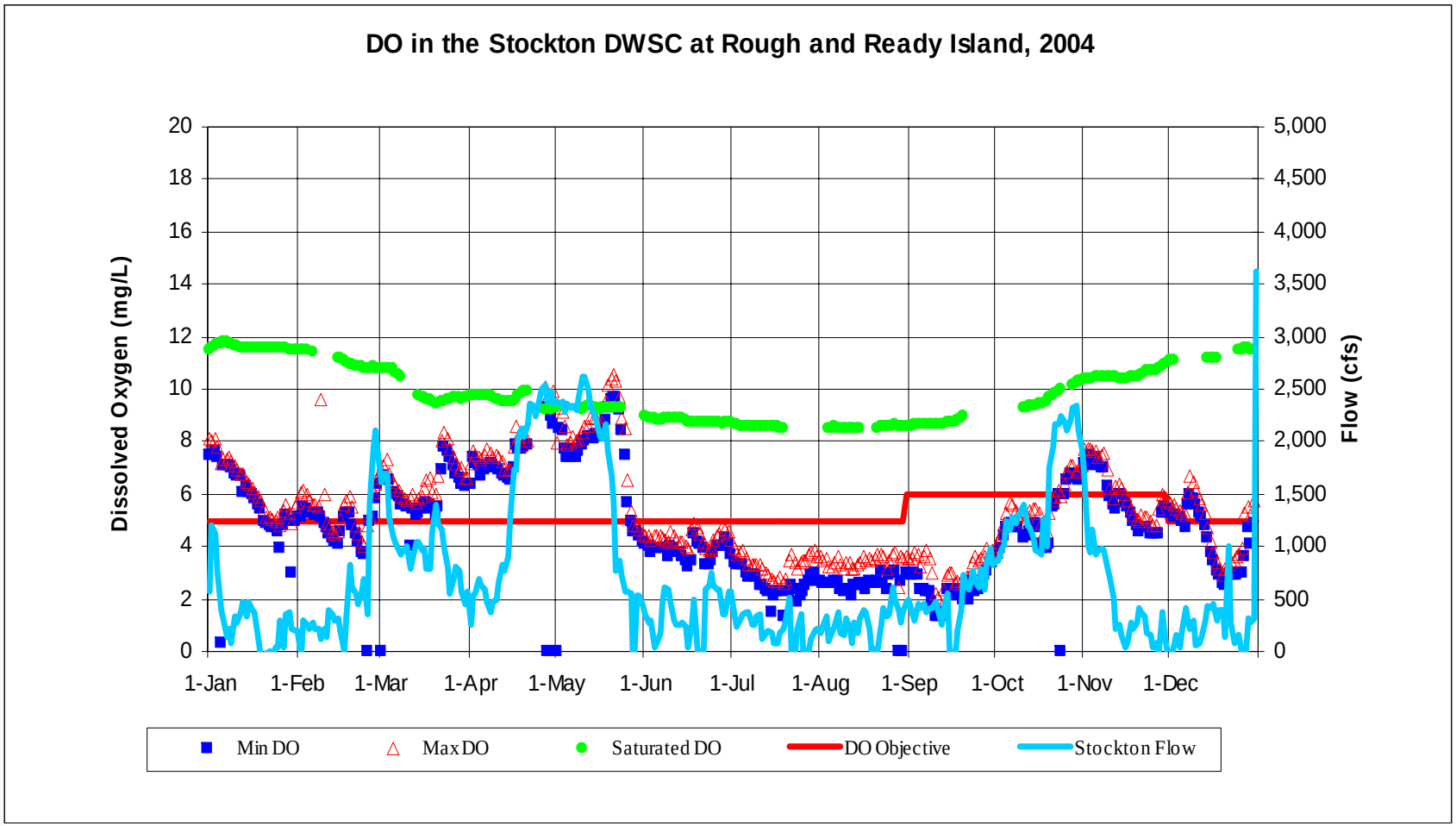
- Confirm RRI monitoring of background DO concentration patterns (without aeration) in the DWSC
- Measure tidal transport and mixing of DO additions (DO diffuser effects)
- Identify DO increments in the DWSC (where does the added DO go? How long does the added DO stay?)
- Estimate what DO concentrations without aeration would have been (during periods of aerator operation).



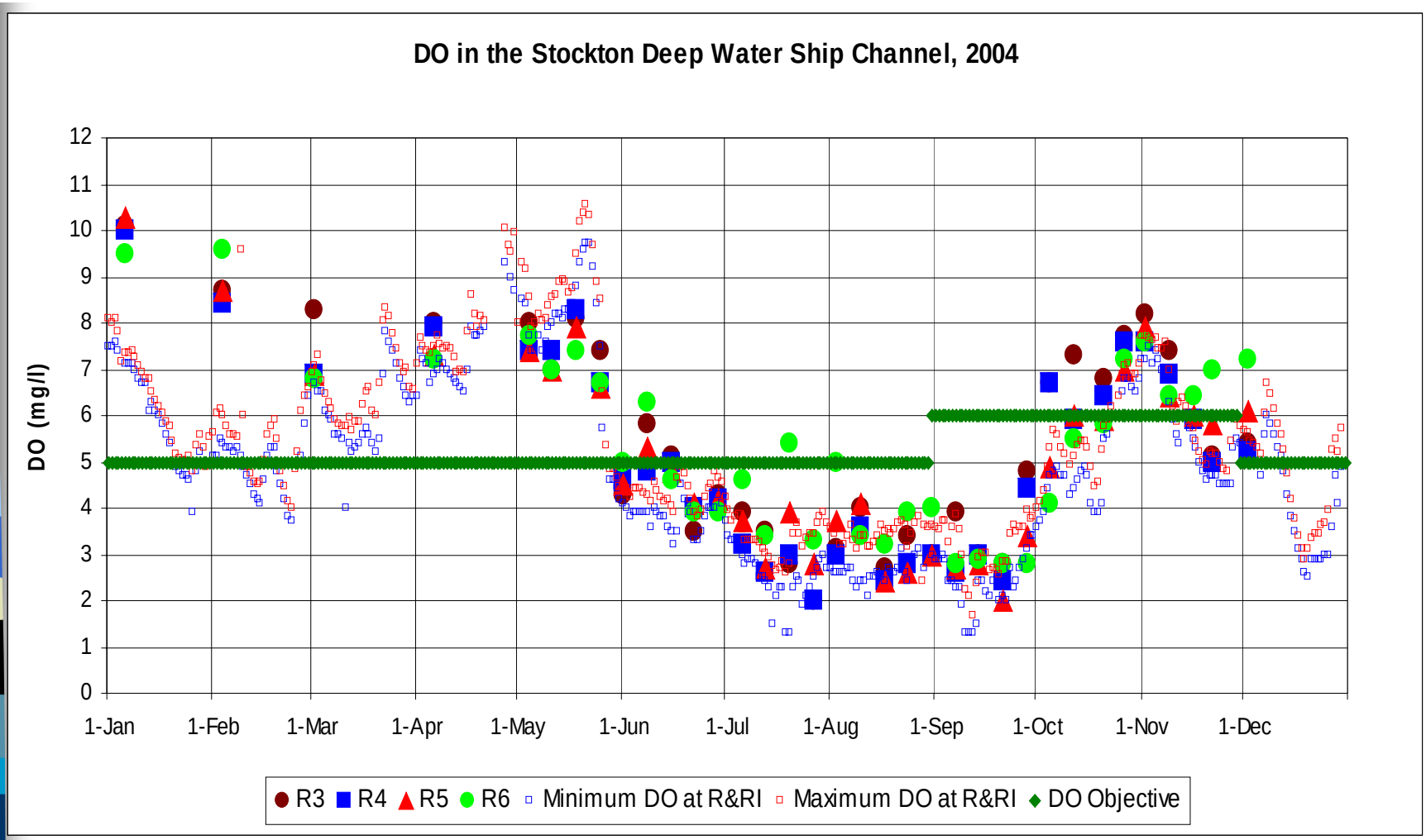
- Lets play the DO guessing game.
- Here is the measured flow and DO at Mossdale for 2004. And the DWSC flow.
- Can you calculate or estimate the RRI DO?



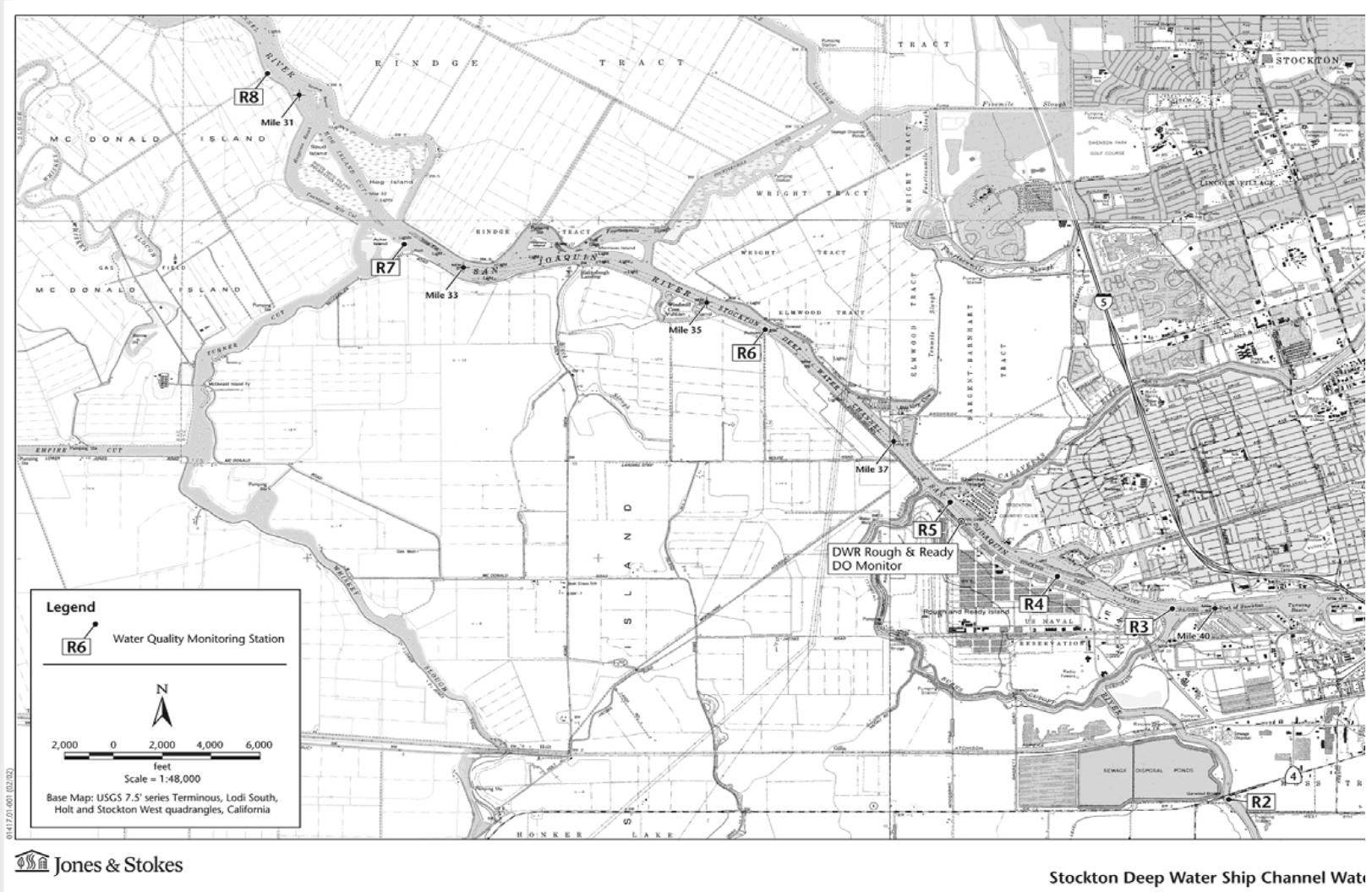
- Here is the measured algal fluorescence (chlorophyll a, biomass) at Mossdale for 2004. What else would help you guess?
- Does this help you estimate the RRI DO?



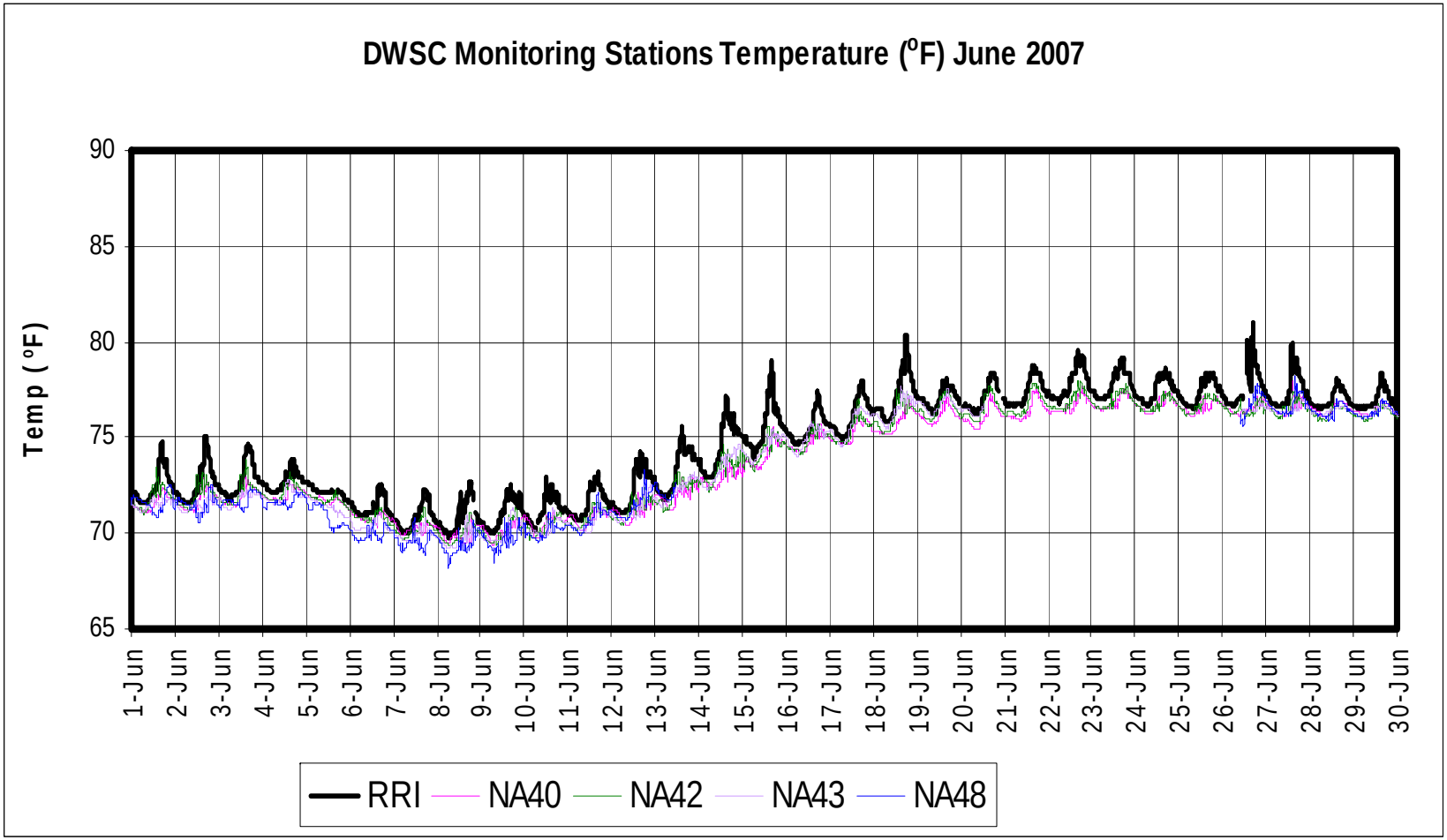
- Here is the measured RRI DO concentrations for 2004. How did you do in guessing DO?
- How can we be sure that this RRI DO pattern was the actual DO conditions?



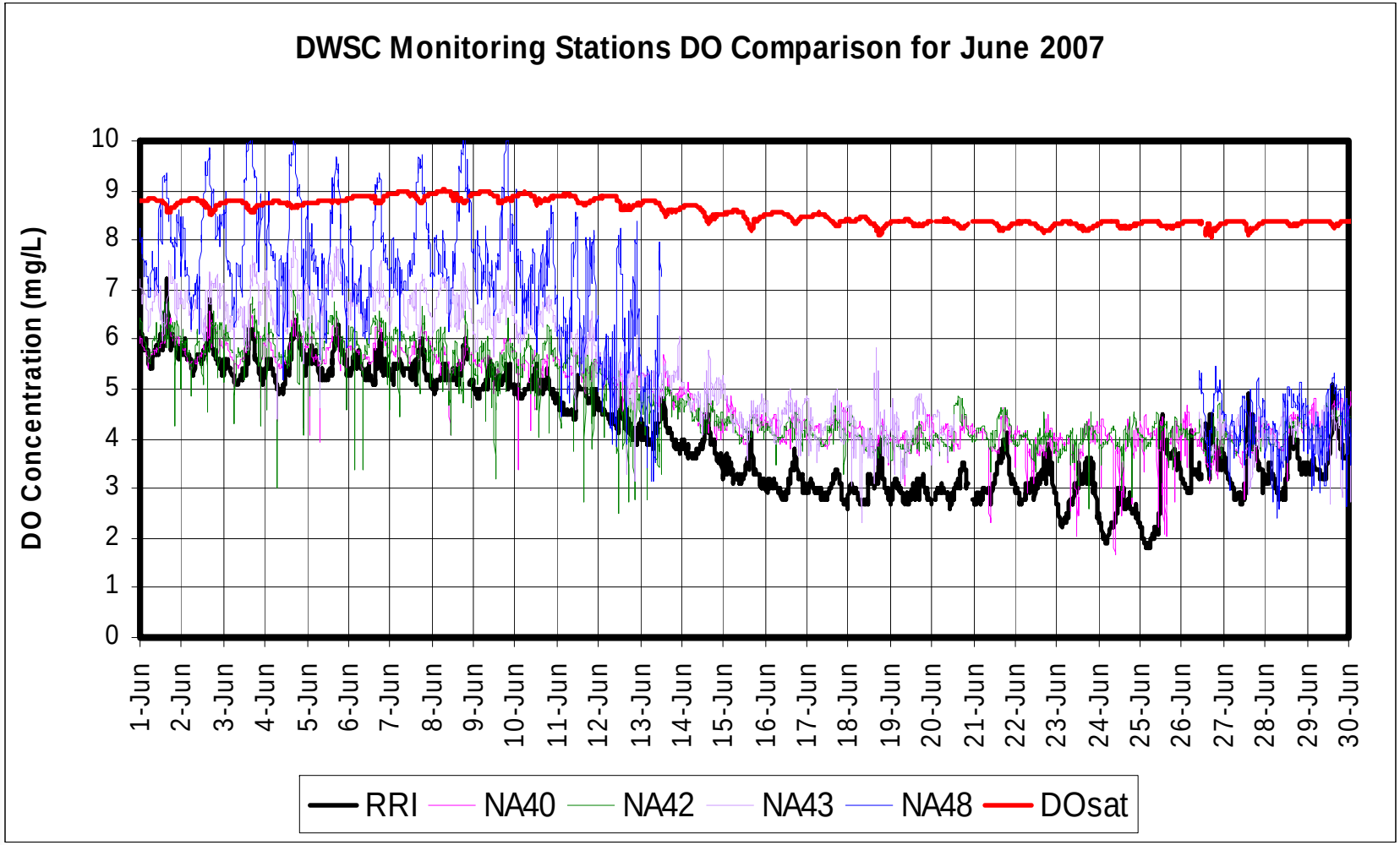
- Two independent measurements (replicates) can either confirm or challenge each other.
- Where in the DWSC is the DO the lowest?



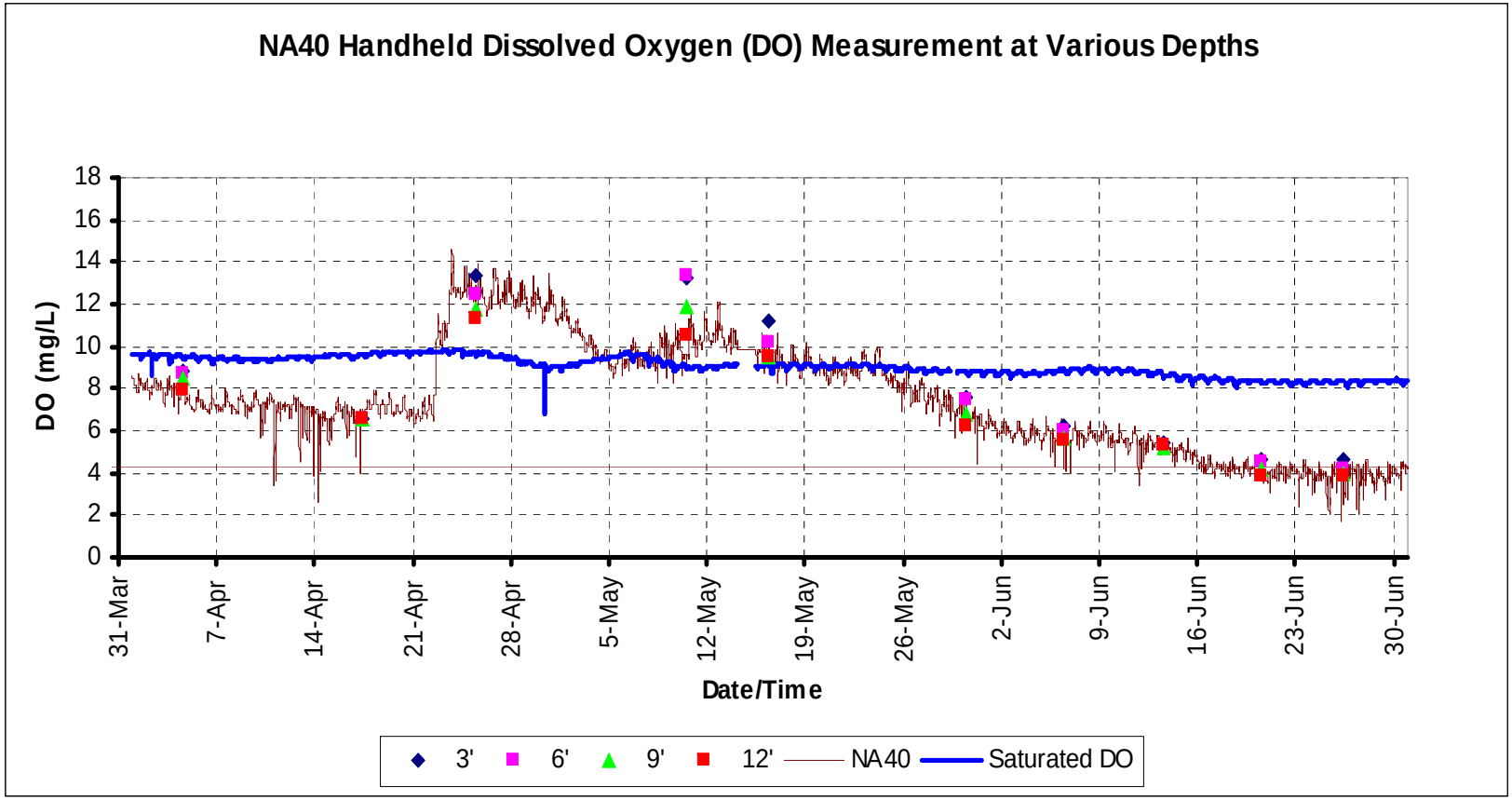
DWR station are located at: Light 40 at RM 35.5 (-2.5), Light 42 at RM 37 (-0.5), [RRI is at RM 37.8 (-0.2), DO Diffuser is at RM 38], Light 43 at RM 38.5 (+0.5), Light 48 at RM 39.4 (+1.4). The City of Stockton stations R3, R4, R5, and R6 are located in the vicinity of these DWR stations (2 downstream and 2 upstream).



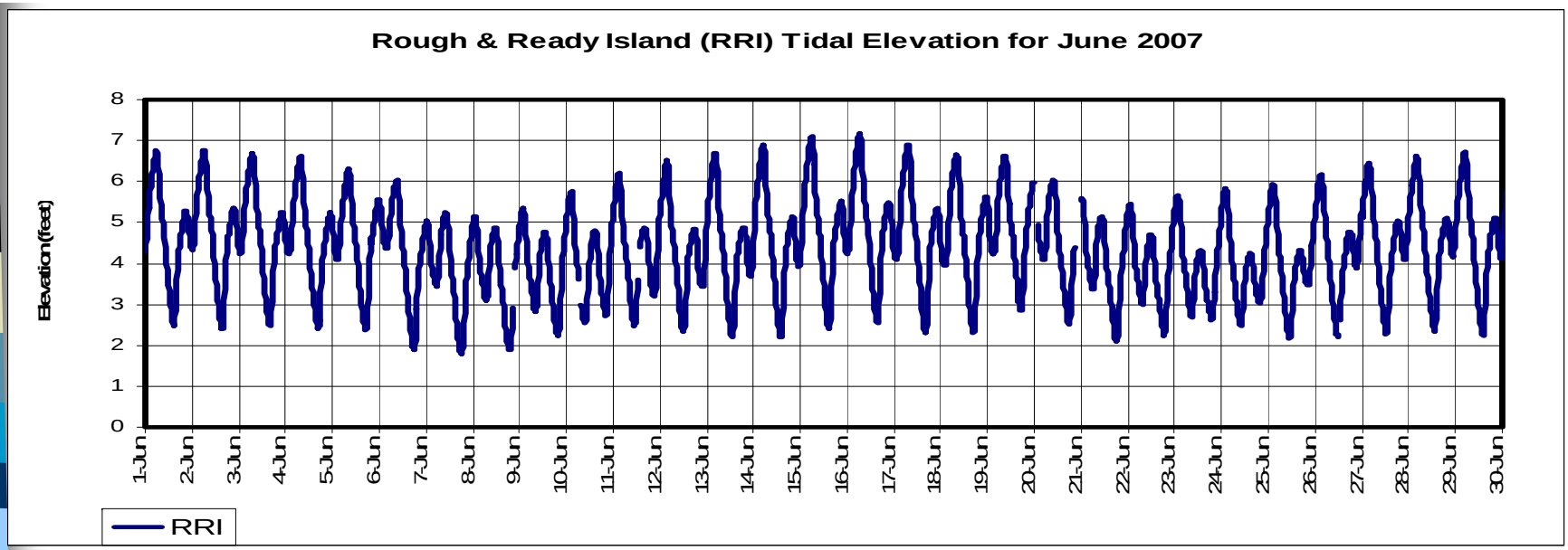
- DWR stations are located at navigation lights 40 and 42 (downstream) and at lights 43 and 48 (upstream) at a depth of –12 feet msl
- The RRI station pumps water from a depth of about 3 feet inside a perforated stilling well.

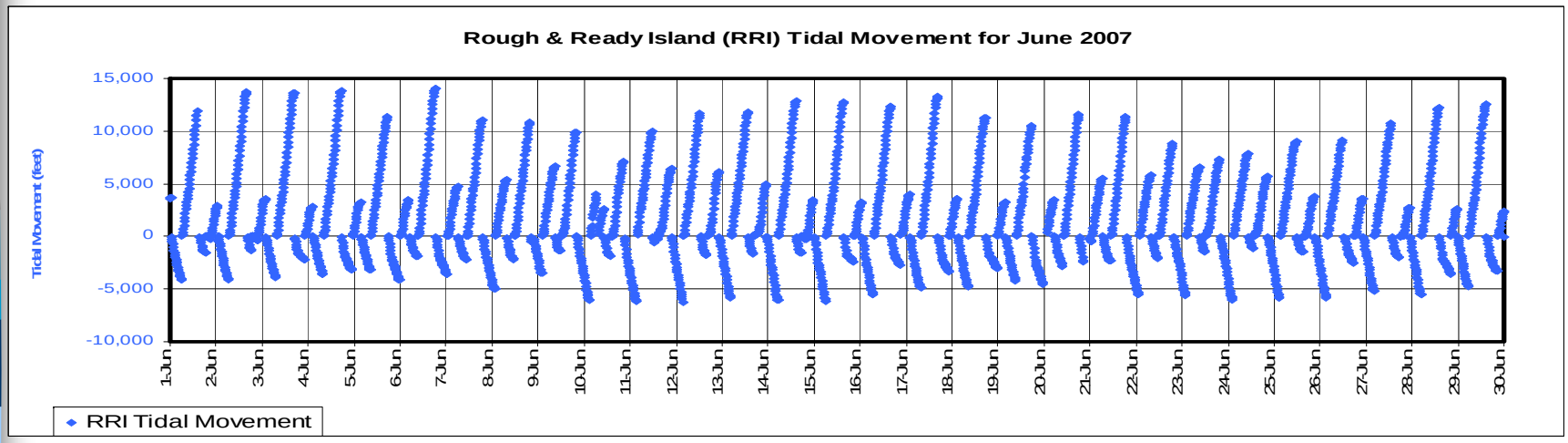


- In early June 2007 there was a DO decline from upstream N48 to N43 to N42 to N40.
- RRI DO was often about 1 mg/l lower than the DO measured at N43 and N42.



- Vertical DO measurements are collected when the monitors are exchanged each week
- These measurements indicate vertical gradients (stratification) and confirm the 15-minute data

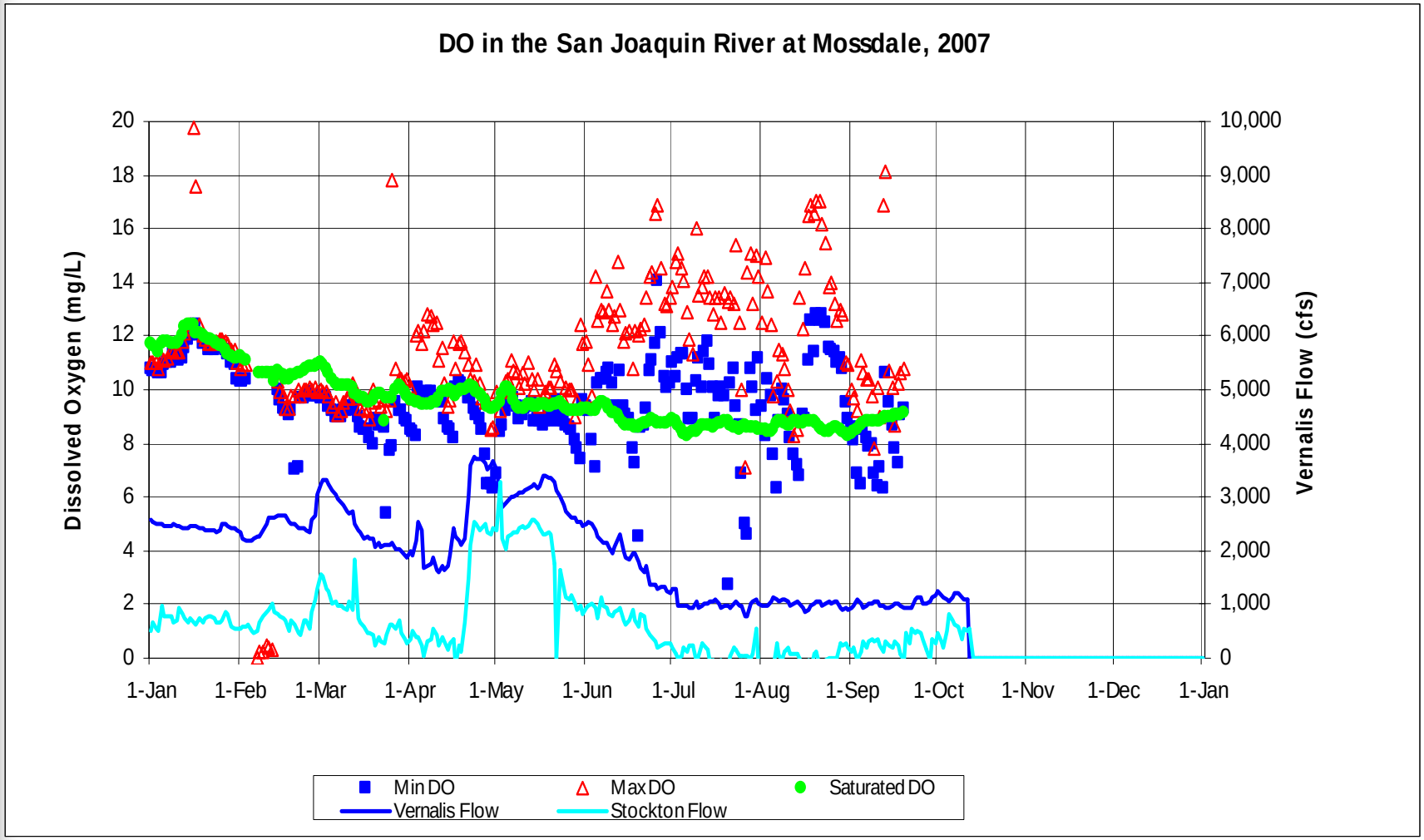




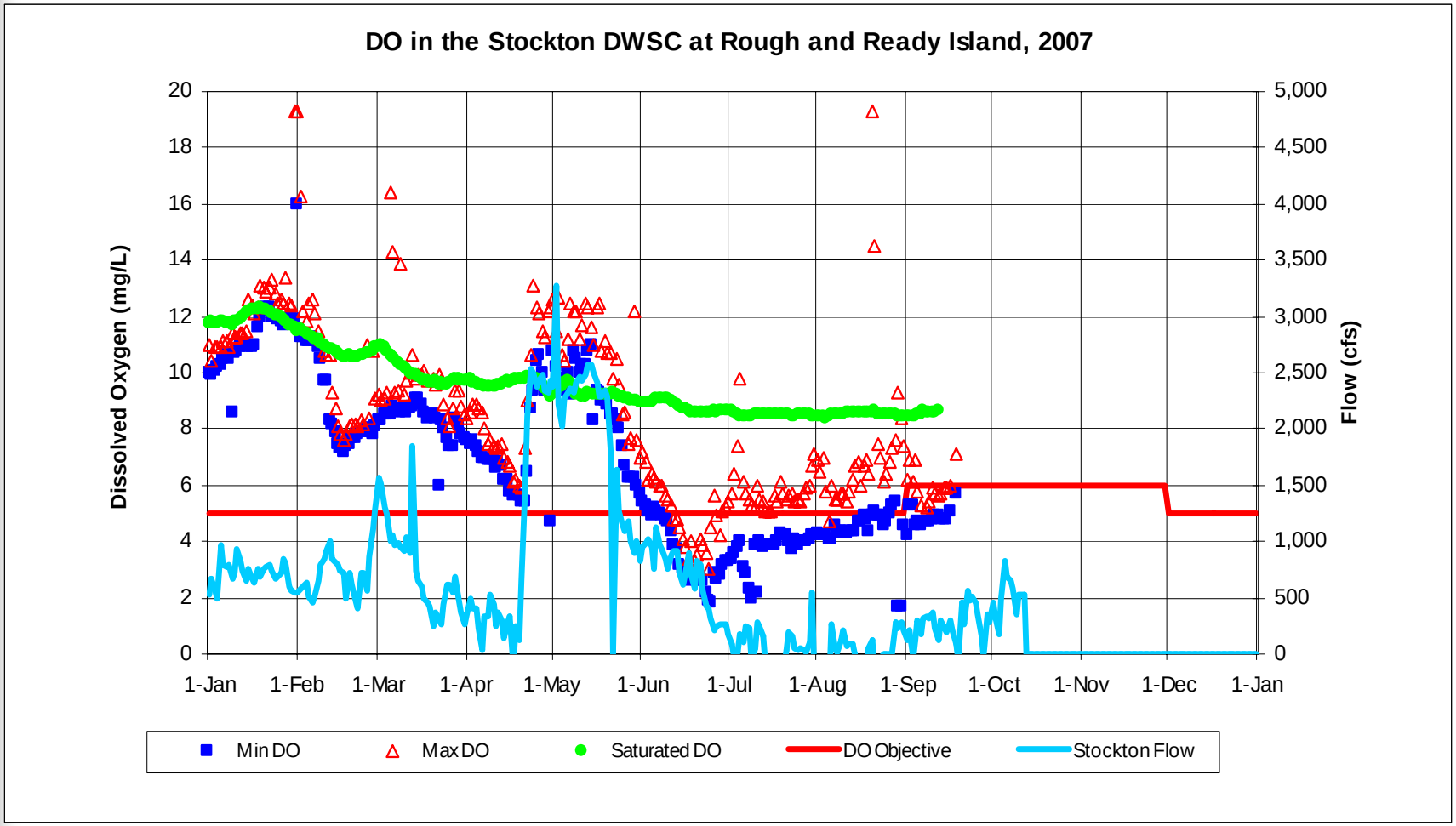
- The movement of the DO diffuser plume can be tracked by the upstream and downstream velocity at the RRI station.
- Upstream movement occurs during rising (flood tide), downstream movement occurs during falling (ebb) tide.

Evaluation of the DO increment in the DWSC from the oxygenation device- an important but an impossible task?

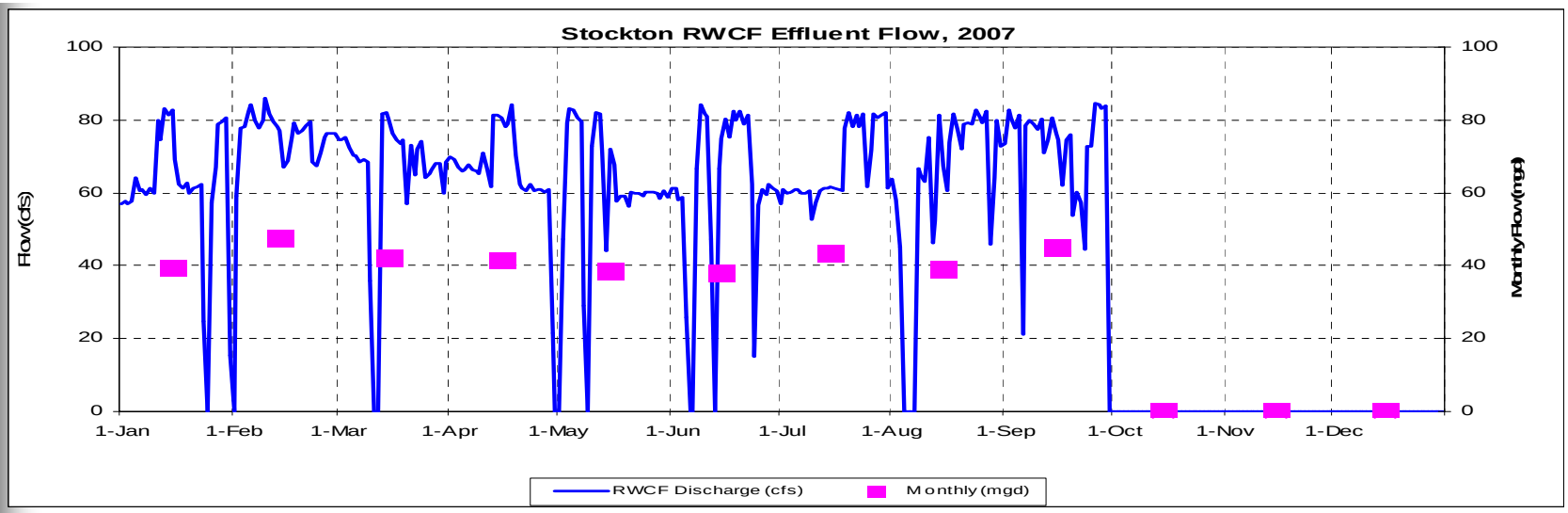
- The oxygenation device capacity (10,000 lb/day) should raise the DO by 1.5 mg/l per day (increment) within the 2,500 af tidal mixing volume (1.5 mile tidal movement for a 3-feet tide change).
- The DWSC net flow will “ratchet” this tidal mixing volume downstream by about 0.1 miles per day for each 100 cfs.
- The oxygenation device will be operated for 2-4 days to increase the DWSC DO and then turned off for 3-5 days to let the baseline DO conditions (without aeration) to re-establish in the DWSC.
- A simple DWSC model with tidal movement and DO sources and sinks may be useful for data interpretation.

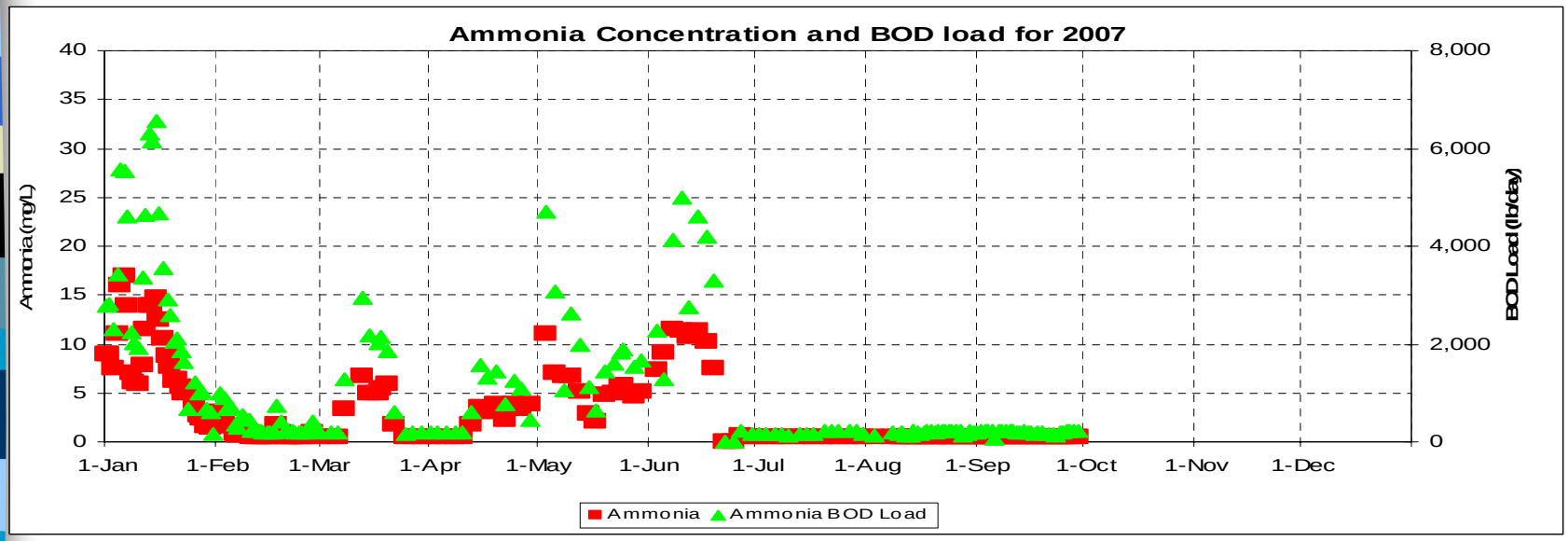


- What would the 2007 oxygenation device operations have looked like?
- Can you predict the DWSC 2007 DO?

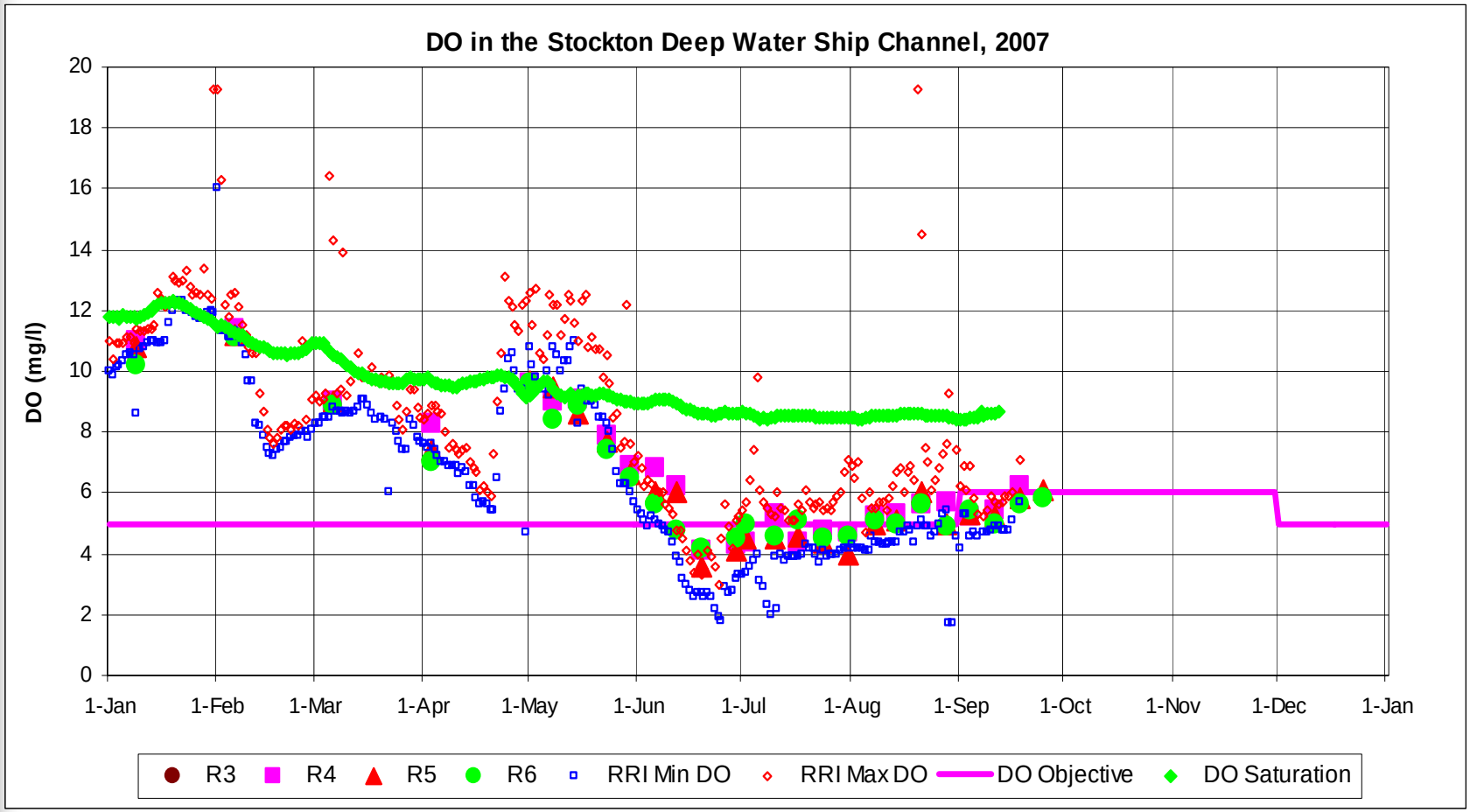


- Low flows in July, August, and September reduced the river algae (BOD) loading
- Low flows reduced the dilution of the Stockton Regional Wastewater Control Facility discharge
- Nitrification reduced the RWCF ammonia discharge

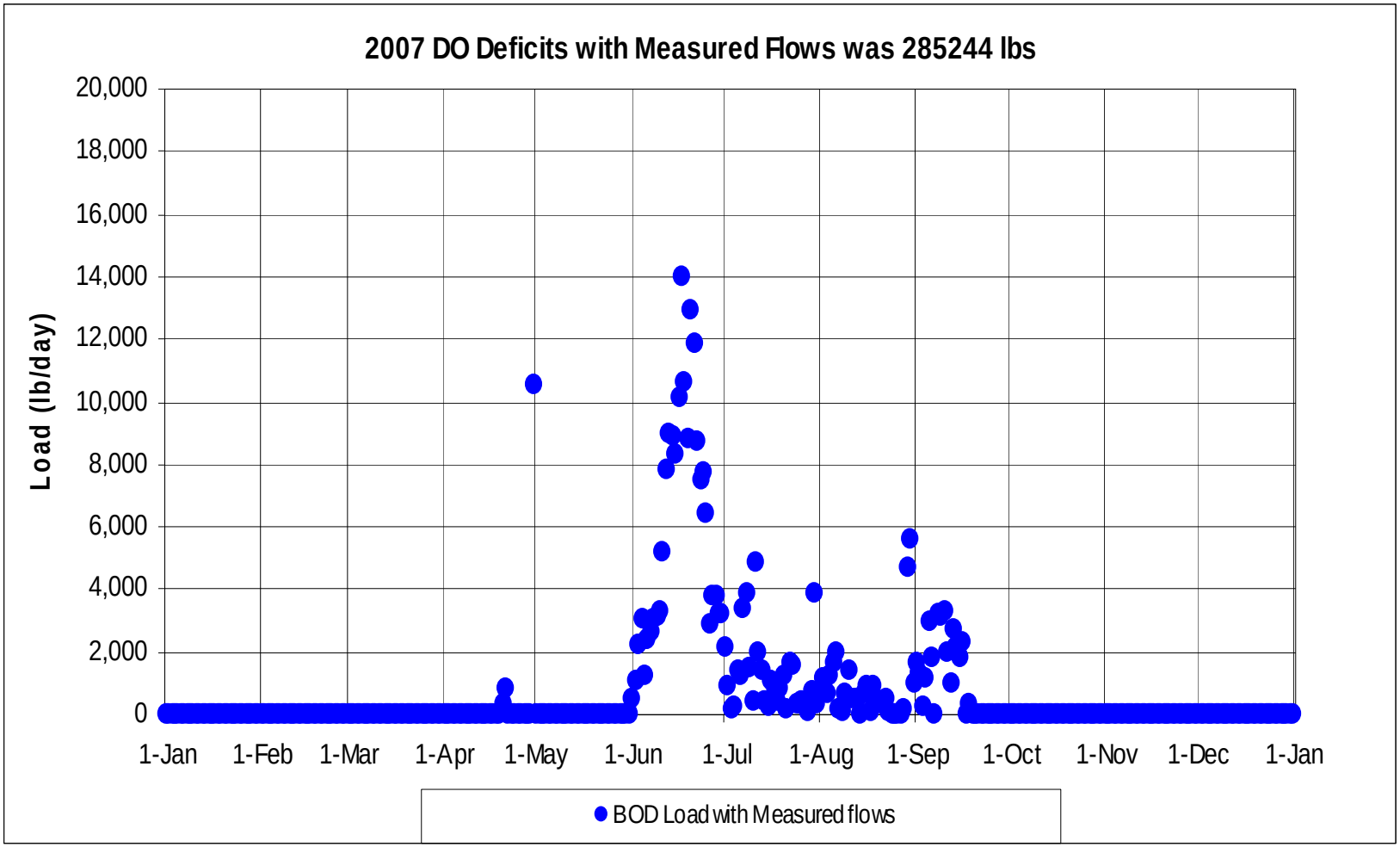




- The Stockton RWCF Ammonia Discharge was low during 2007 because of the new nitrification facility



- The City of Stockton DO measurements confirm the moderately low DO in June-September.
- The City data were about 1 mg/l higher than RRI minimum DO.
- The RRI DO in April-May VAMP period was above the DO saturation, while the City data were not above saturation.



- Oxygenation device would have operated from June through September with a maximum capacity of 10,000 lb/day in most of June and reduced capacity for remainder of summer.