

Appendix K. Change in Dissolved Oxygen versus Reference Dissolved Oxygen

In order to take a closer look at the impact of different bounding scenarios on DO at specific locations, changes in DO (ΔDO) were evaluated. ΔDO was calculated based on comparing the bounding scenarios minus the reference conditions. This appendix contains plots specific to the following three bounding scenarios:

1. Impact of all anthropogenic sources (existing conditions – reference conditions).
2. Impact of point sources discharging into marine waters (marine point sources – reference conditions).
3. Improvement with biological nitrogen removal (BNR) at all municipal WWTP (BNR at all WWTP – reference conditions).

The table below shows the set of conditions for the watershed inflows and marine point source inflows during reference conditions and for each of the scenarios listed above. Existing conditions are for years 2006 and 2008.

Table K1. Watershed and marine point source inflows for bounding scenarios and reference conditions.

	Watershed Inflows	Marine Point Source Inflows
Reference Conditions	Reference	None
Scenario 1	Existing	Existing
Scenario 2	Reference	Existing
Scenario 3	Existing	BNR

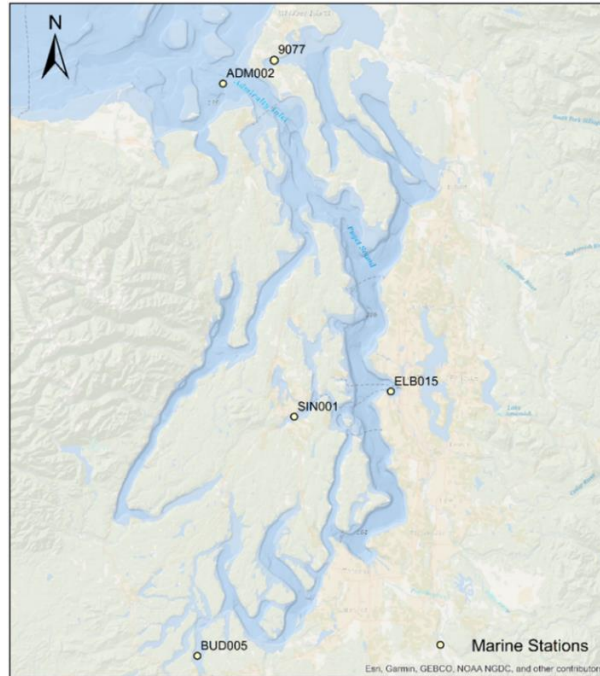


Figure K1. Marine site locations.

The following graphs illustrate the ΔDO on each of the above scenarios when compared with the reference conditions for years 2006 and 2008 at the five marine stations. Negative values for ΔDO indicate that the DO is lower (depleted) relative to reference conditions.

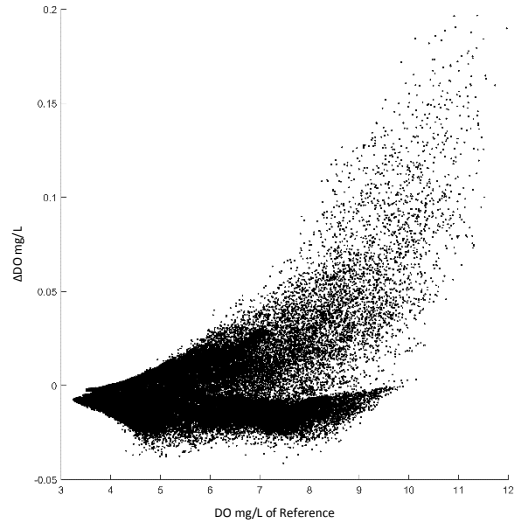
Overall, the largest depletions of DO occurred when evaluating the impacts of human sources from both marine point sources and rivers (scenario 1). Among the five locations chosen for analysis here, Sinclair Inlet, Budd Inlet, and Penn Cove showed the greatest depletion of DO during both years. Marine point sources alone (scenario 2) also results in impacts to DO levels at these locations, exceeding the water quality standard. Note the different pattern at Elliott Bay from the marine point sources compared to the other two scenarios. In this case, at Elliott Bay, with the riverine loads at reference conditions, the impact of the marine point sources is lower. The magnitude of the impact varies non-linearly, and depends on the order in which nutrients are removed from the system.

DO depletions are generally smaller with BNR at all WWTP (scenario 3) when compared with the impact of all anthropogenic sources (scenario 1). Larger differences in ΔDO between scenario 3 and scenario 1 are predicted at some locations compared to others. Among the five sites examined here, Sinclair Inlet site (SIN001) predictions reveal the largest difference in ΔDO between scenarios 3 and 1 during both 2006 and 2008.

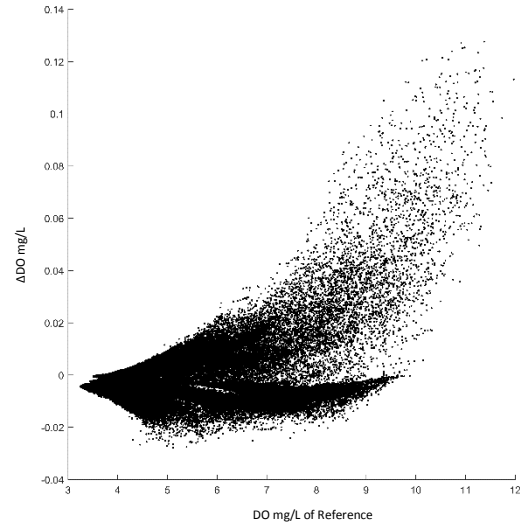
Year - 2006

1. Anthropogenic Sources
 Δ DO (mg/L) of Existing – Reference

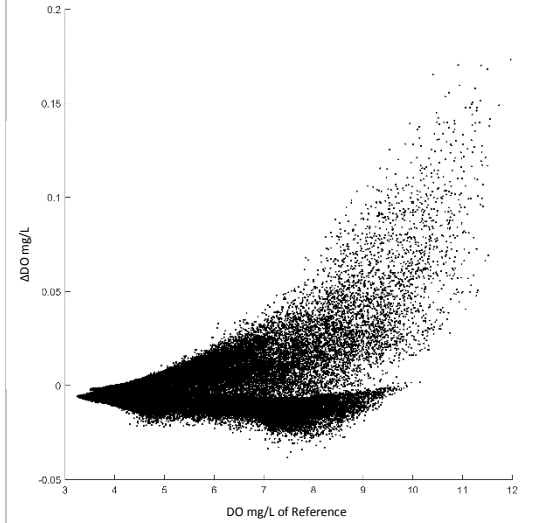
Admiralty Inlet
(ADM002)



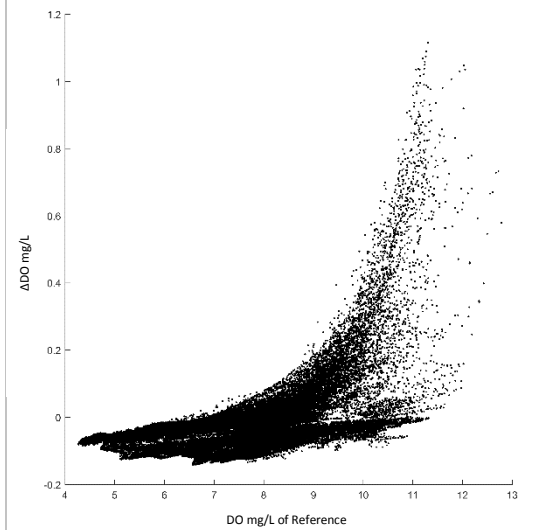
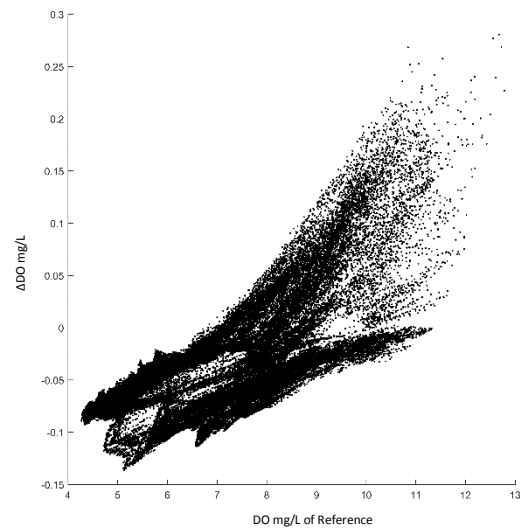
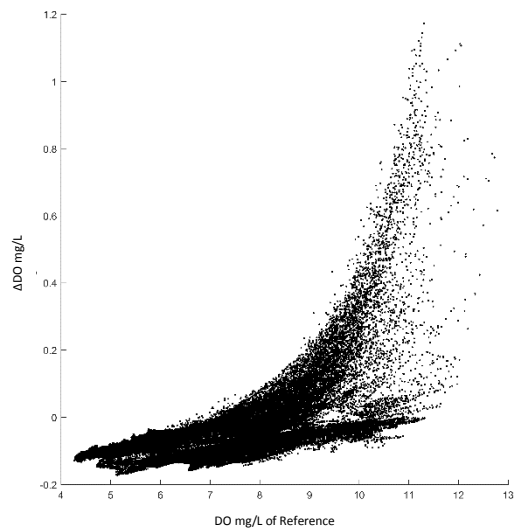
2. Marine Point Sources
 Δ DO (mg/L) of WWTP – Reference



3. Improvements with BNR at WWTP
 Δ DO (mg/L) of BNR at all WWTP – Reference



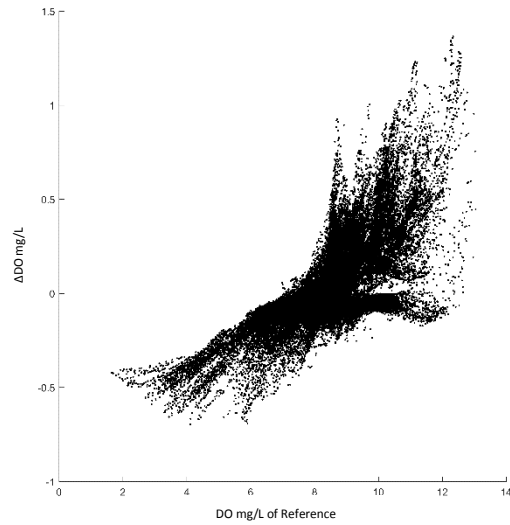
Elliott Bay
(ELB015)



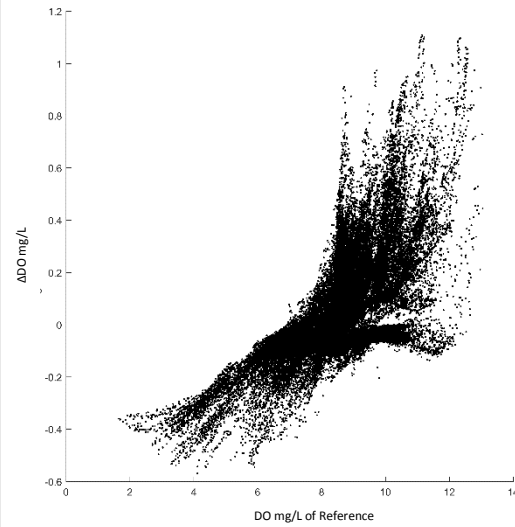
Year - 2006

1. Anthropogenic Sources
 ΔDO (mg/L) of Existing – Reference

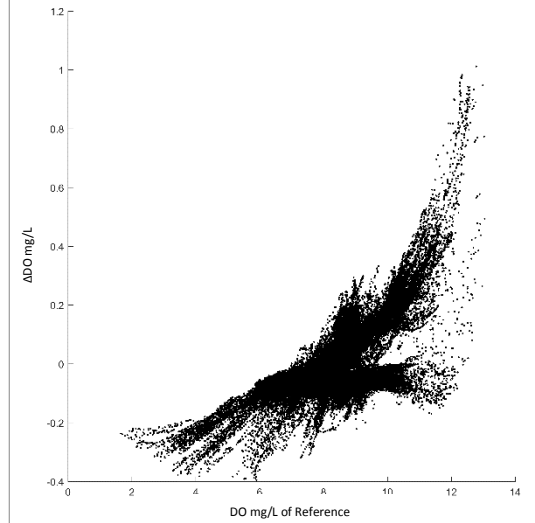
Sinclair Inlet
(SIN001)



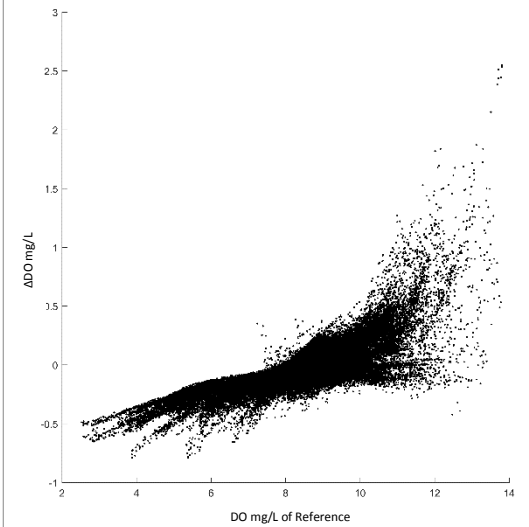
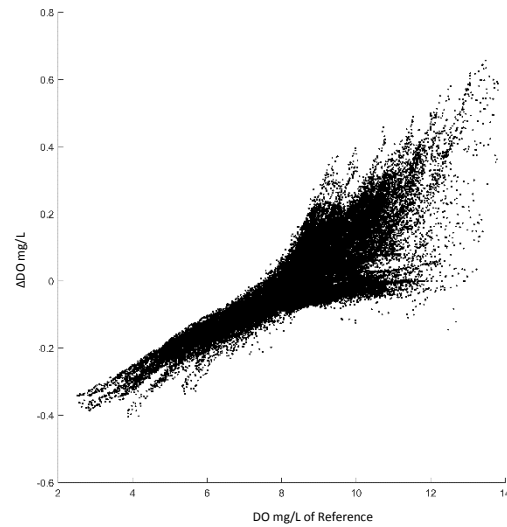
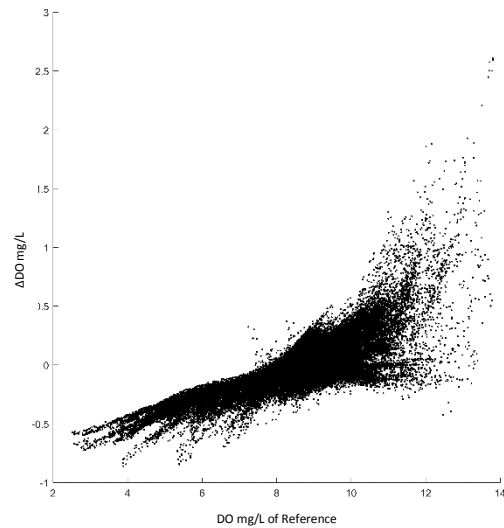
2. Marine Point Sources
 ΔDO (mg/L) of WWTP – Reference



3. Improvements with BNR at WWTP
 ΔDO (mg/L) of BNR at all WWTP – Reference



Budd Inlet
(BUD005)

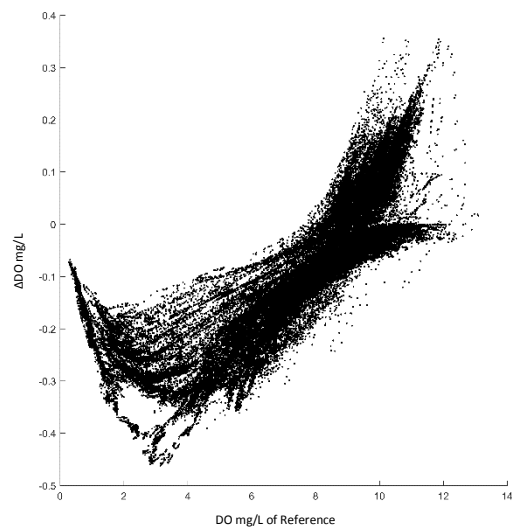


Year - 2006

1. Anthropogenic Sources

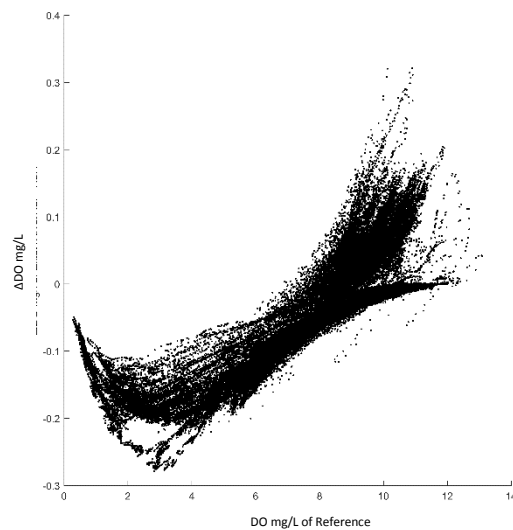
Δ DO (mg/L) of Existing – Reference

Penn Cove
(9077)



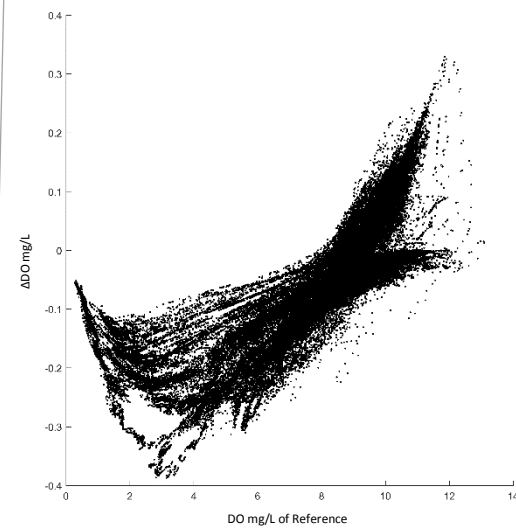
2. Marine Point Sources

Δ DO (mg/L) of WWTP – Reference



3. Improvements with BNR at WWTP

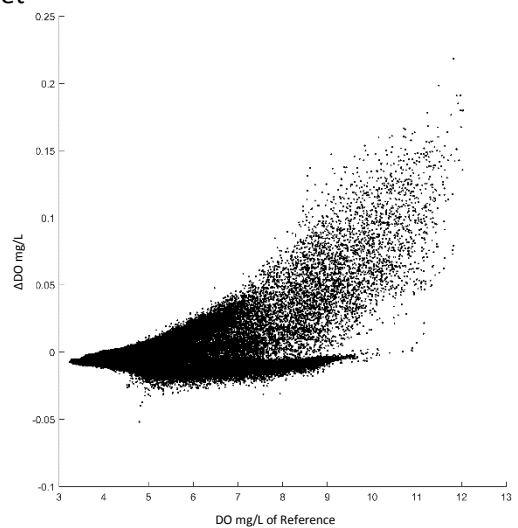
Δ DO (mg/L) of BNR at all WWTP – Reference



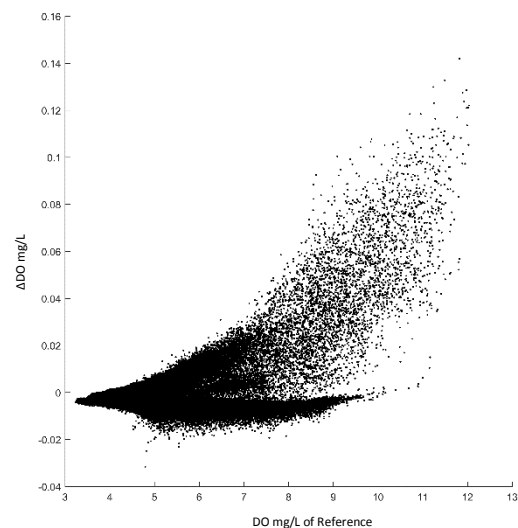
Year - 2008

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 ΔDO (mg/L) of Existing – Reference

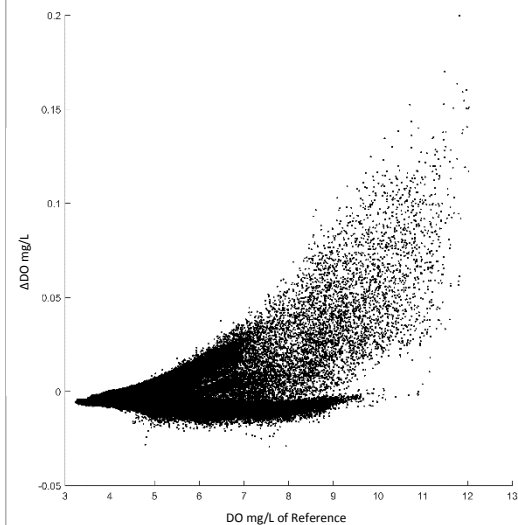
Admiralty Inlet
(ADM002)



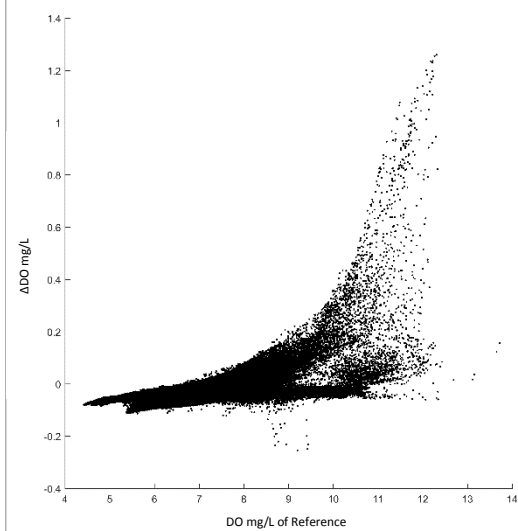
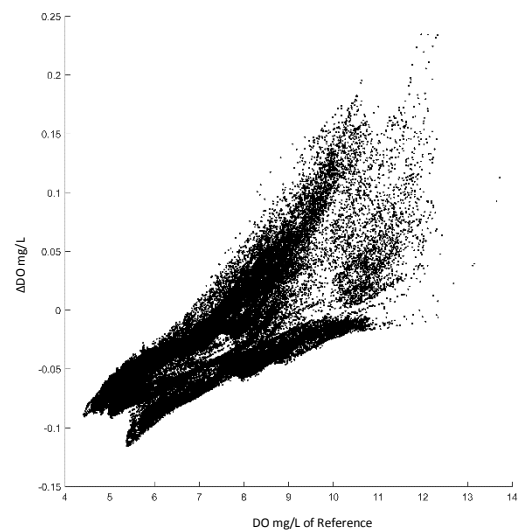
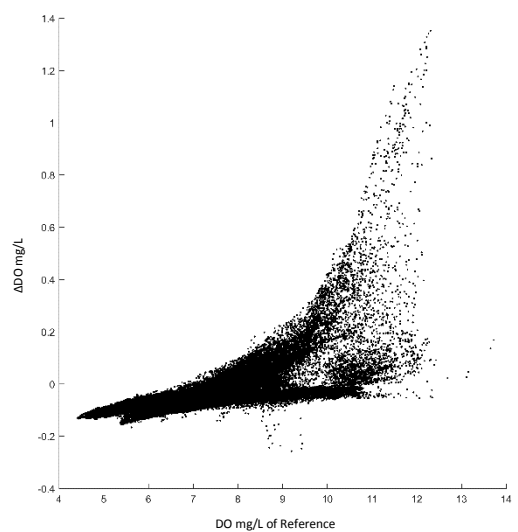
2. Marine Point Sources
 ΔDO (mg/L) of WWTP – Reference



3. Improvements with BNR at WWTP
 ΔDO (mg/L) of BNR at all WWTP – Reference



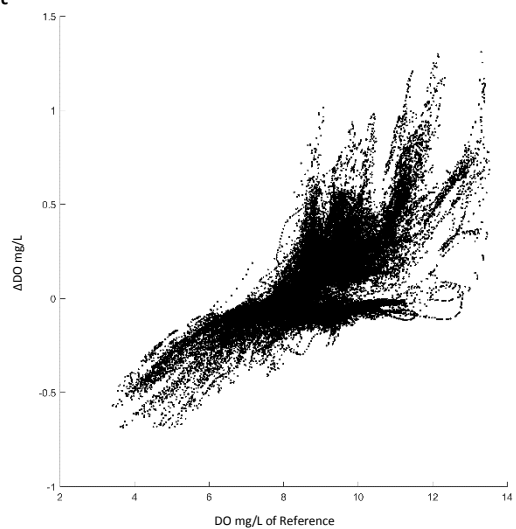
Elliott Bay
(ELB015)



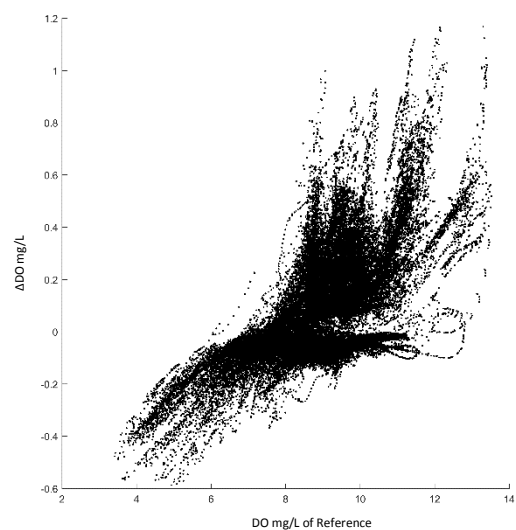
Year - 2008

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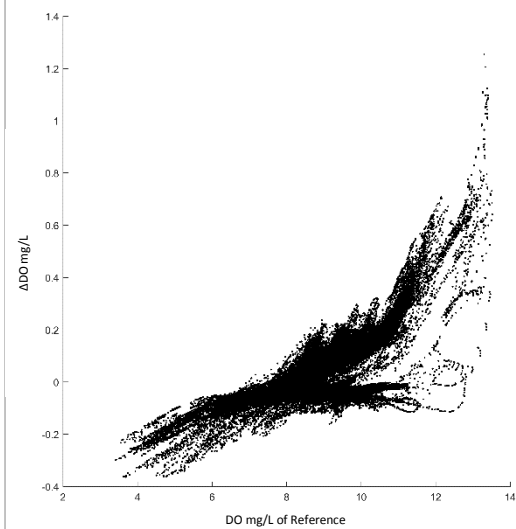
Sinclair Inlet
(SIN001)



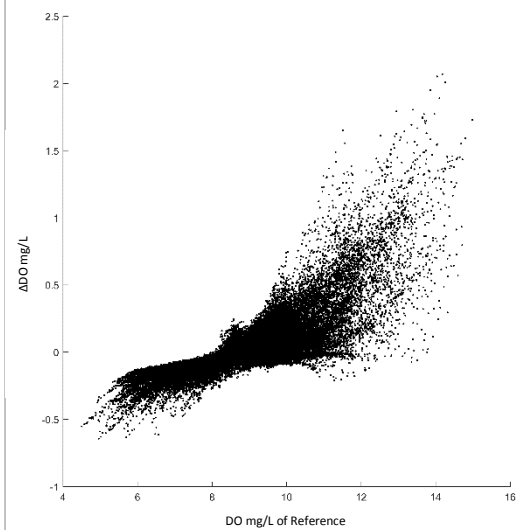
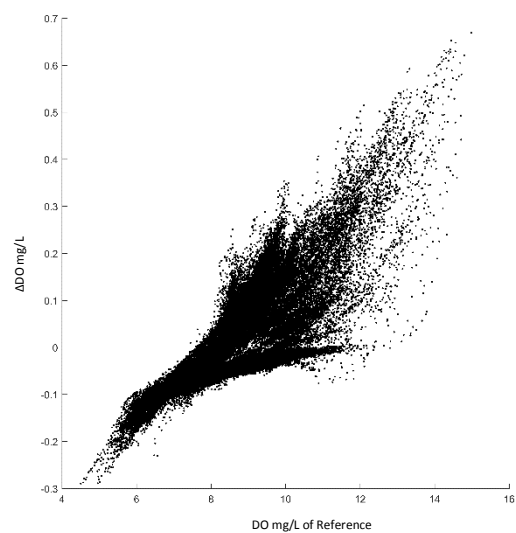
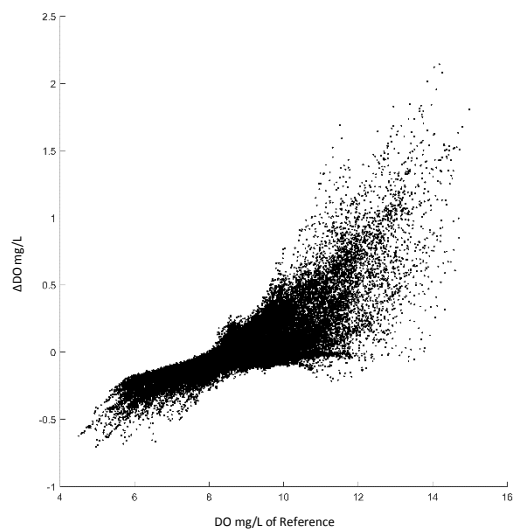
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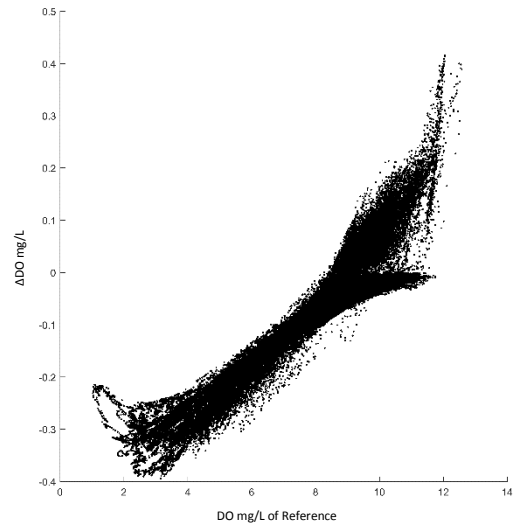
Budd Inlet
(BUD005)



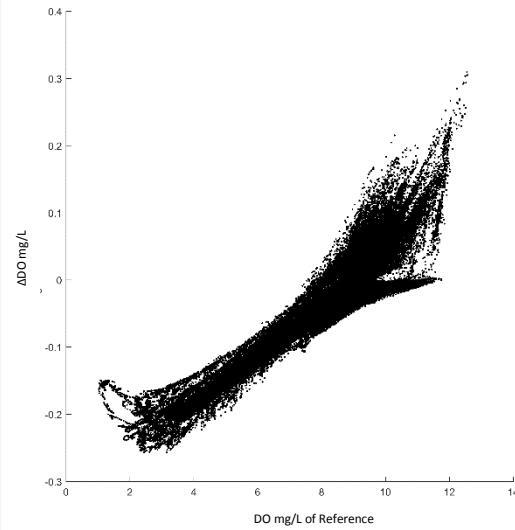
Year - 2008

1. Anthropogenic Sources ΔDO (mg/L) of Existing – Reference

Penn Cove
(9077)



2. Marine Point Sources ΔDO (mg/L) of WWTP – Reference



3. Improvements with BNR at WWTP ΔDO (mg/L) of BNR at all WWTP – Reference

