



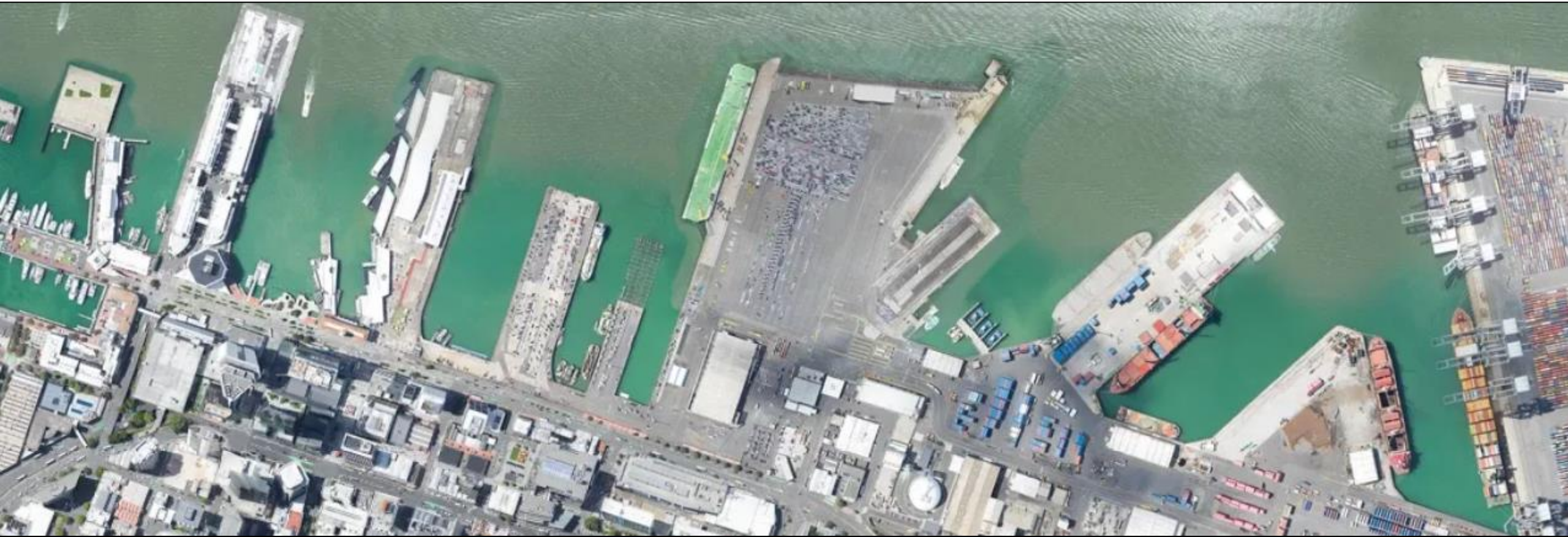
Modelling Group
WATER NEW ZEALAND

Modelling Symposium

How much seawater is in our wastewater networks?

Presented by
Ben Caldwell

Where are we and what's the context?



The Problem

- Want to improve network for future
- Saline samples show tidal ingress
- Would tidal ingress mitigation be a cost-effective solution?

How bad is it?

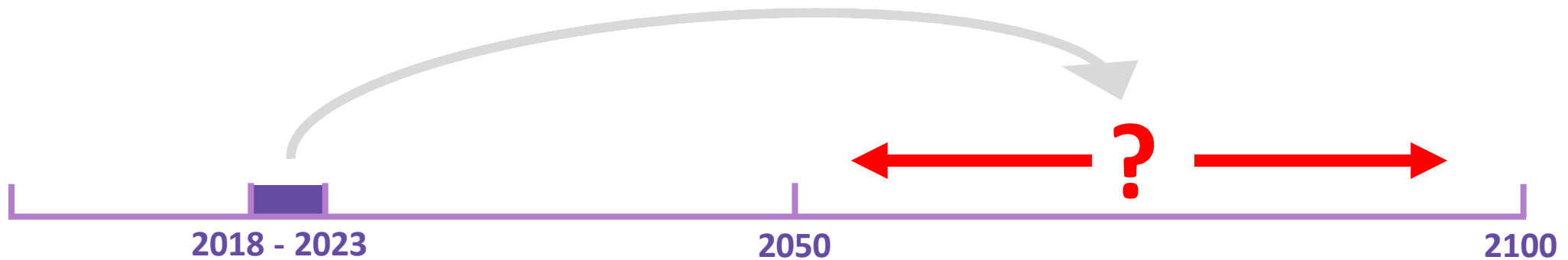
&

How bad will it be?



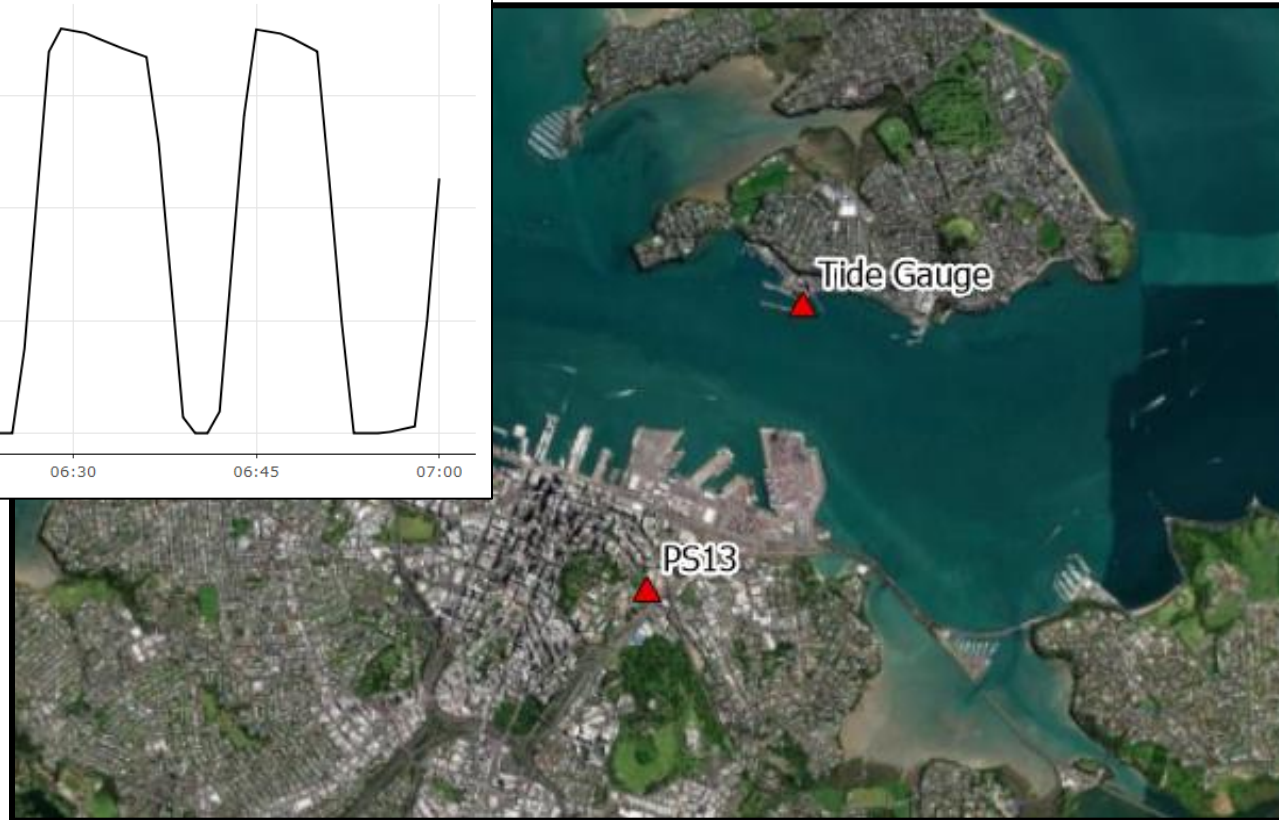
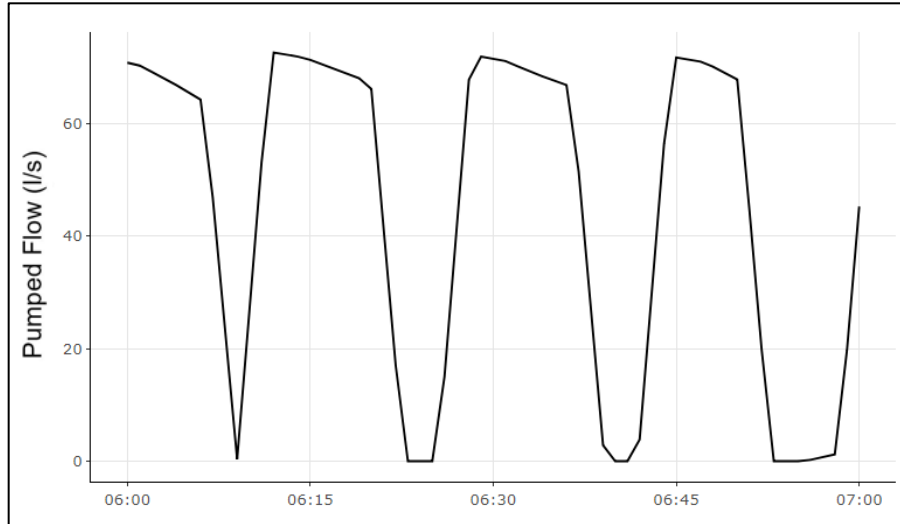
The Second Problem

- Only 5-years of data
- Want predictions for next 100-years

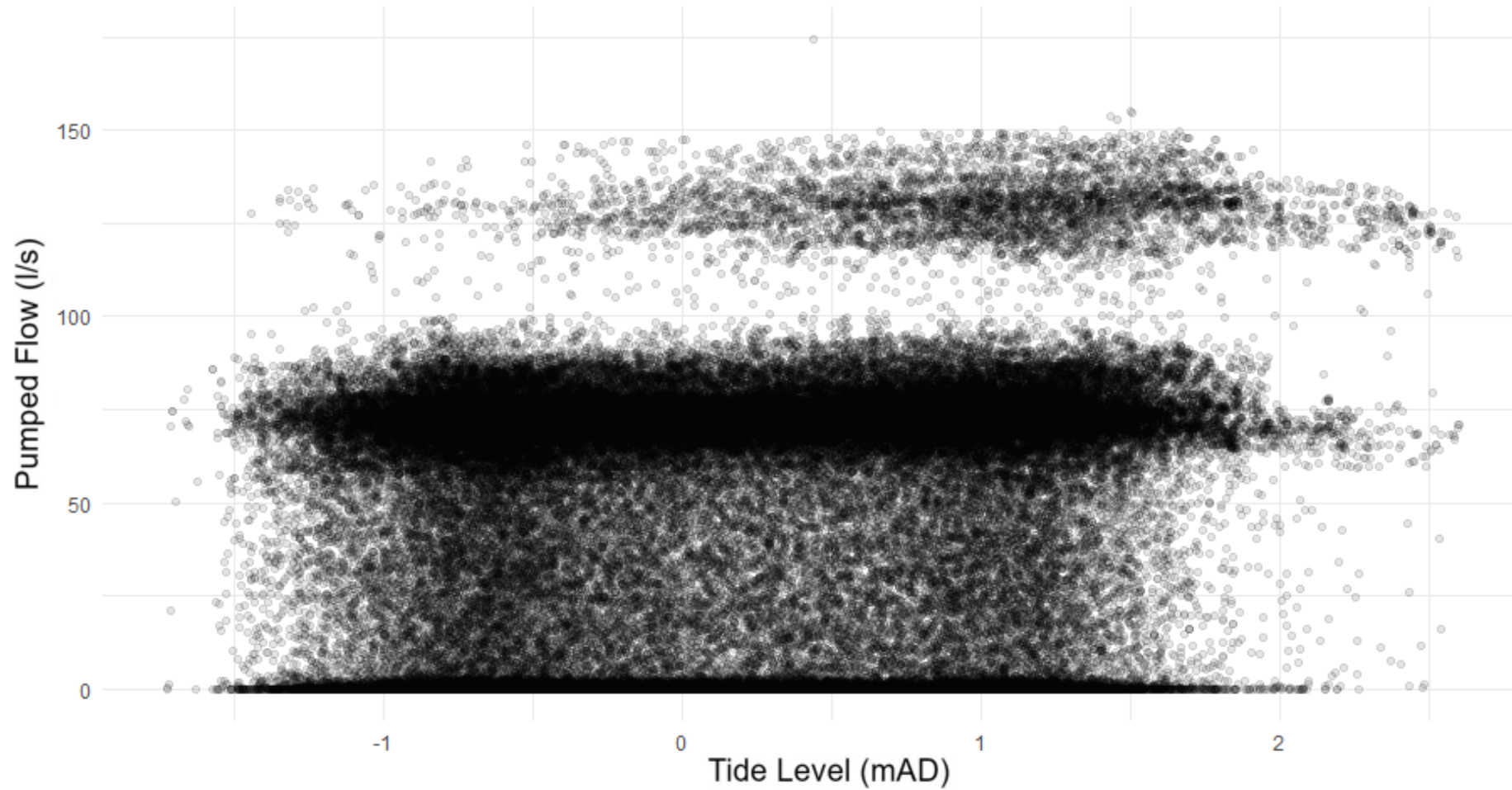


The Third Problem

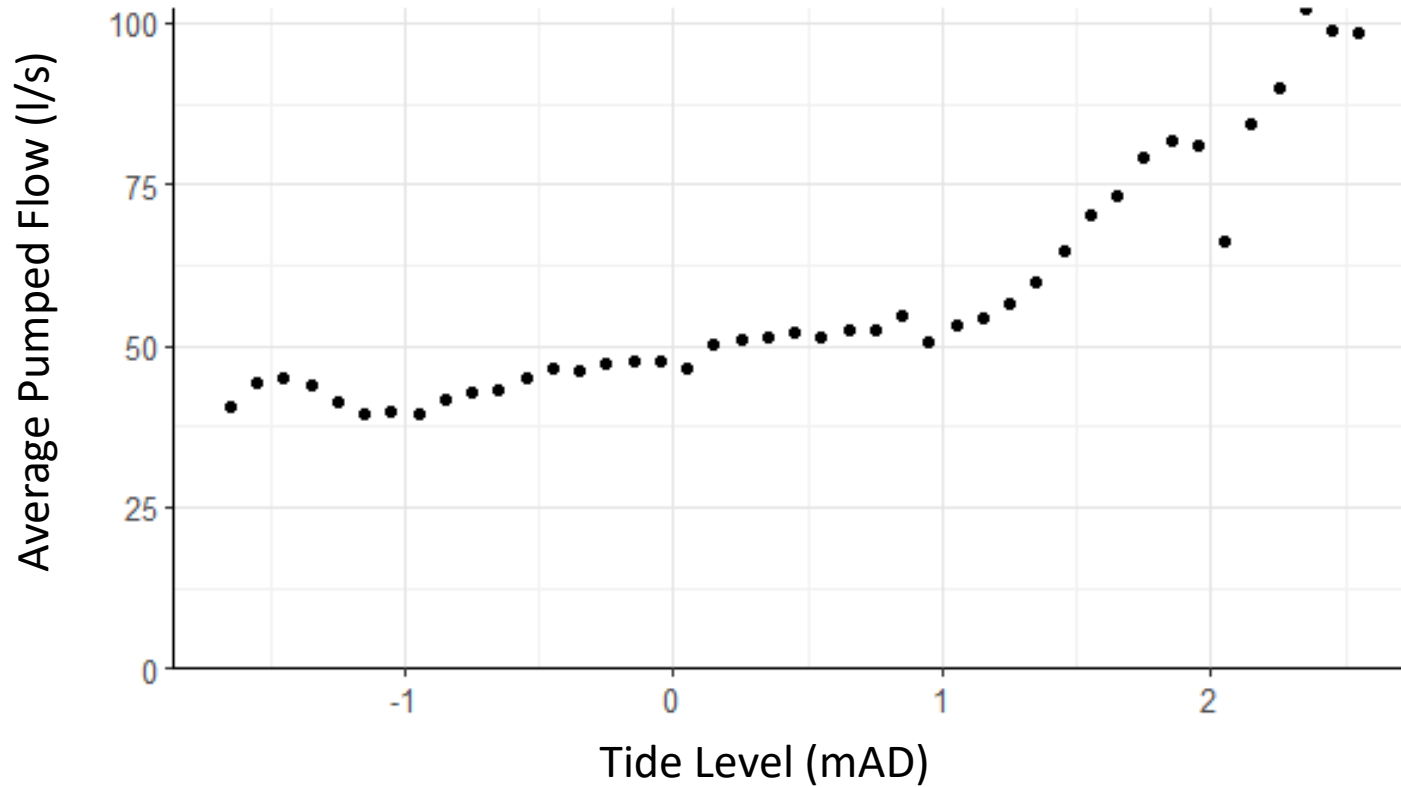
Example of normal DWF operation of PS13, ~75 L/s



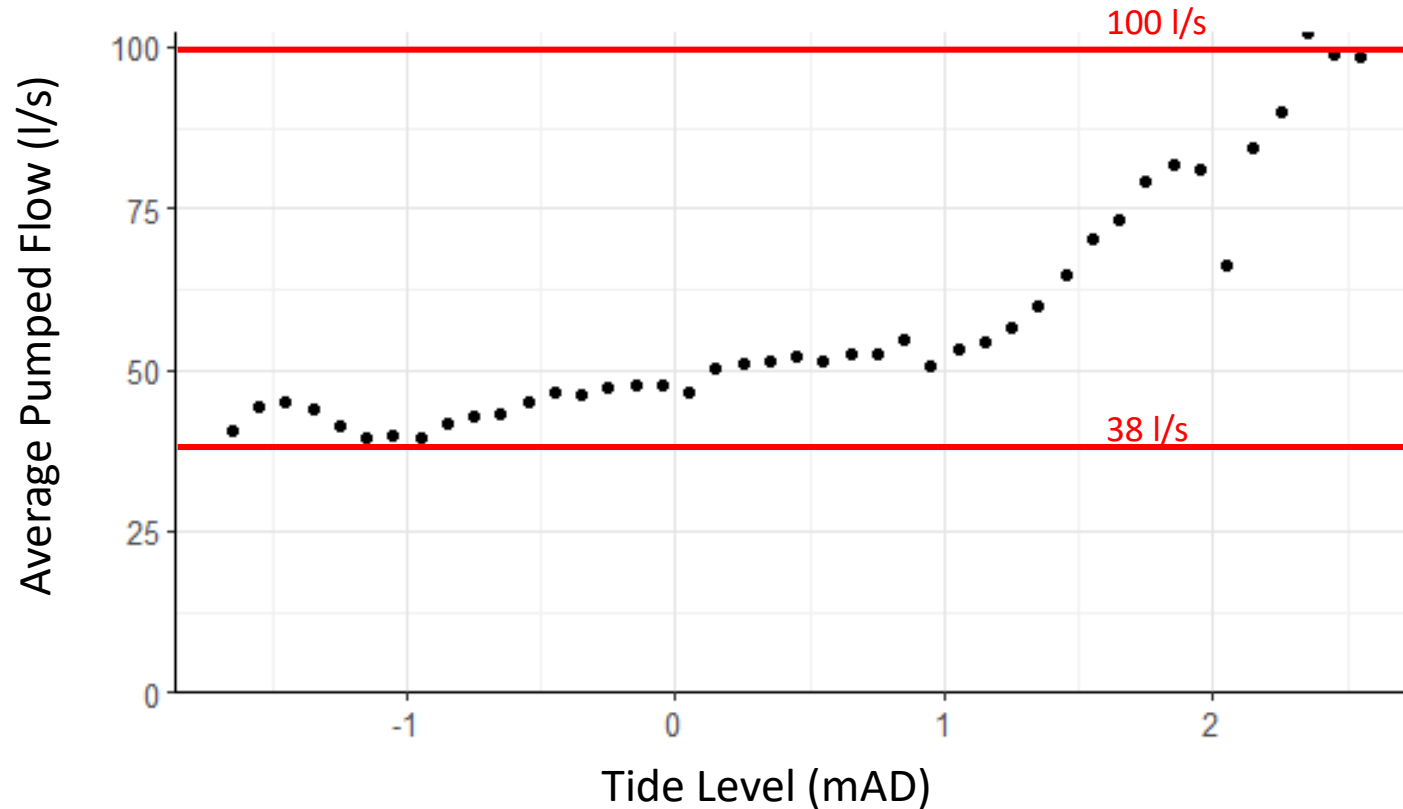
First look at the data



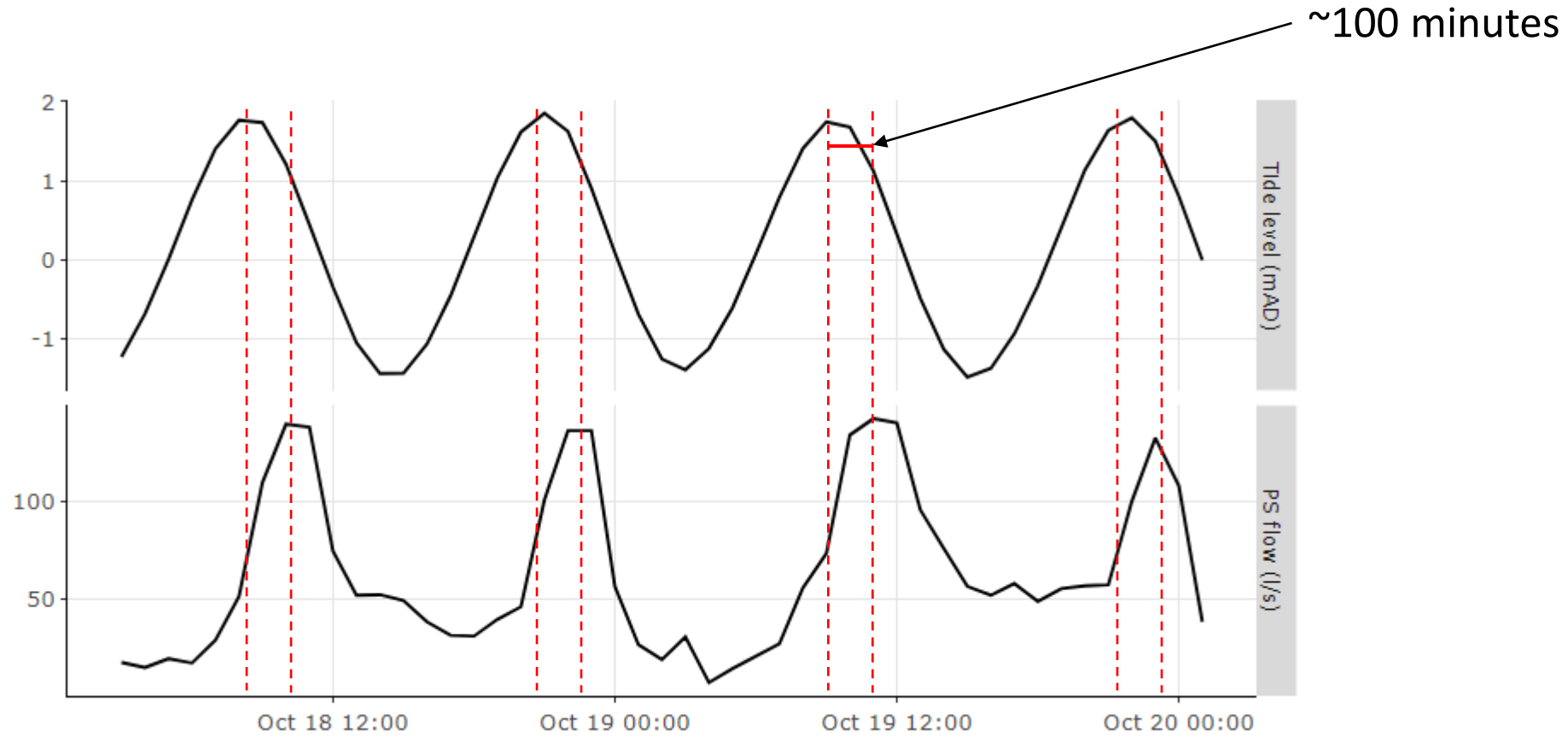
Average flow for tide levels



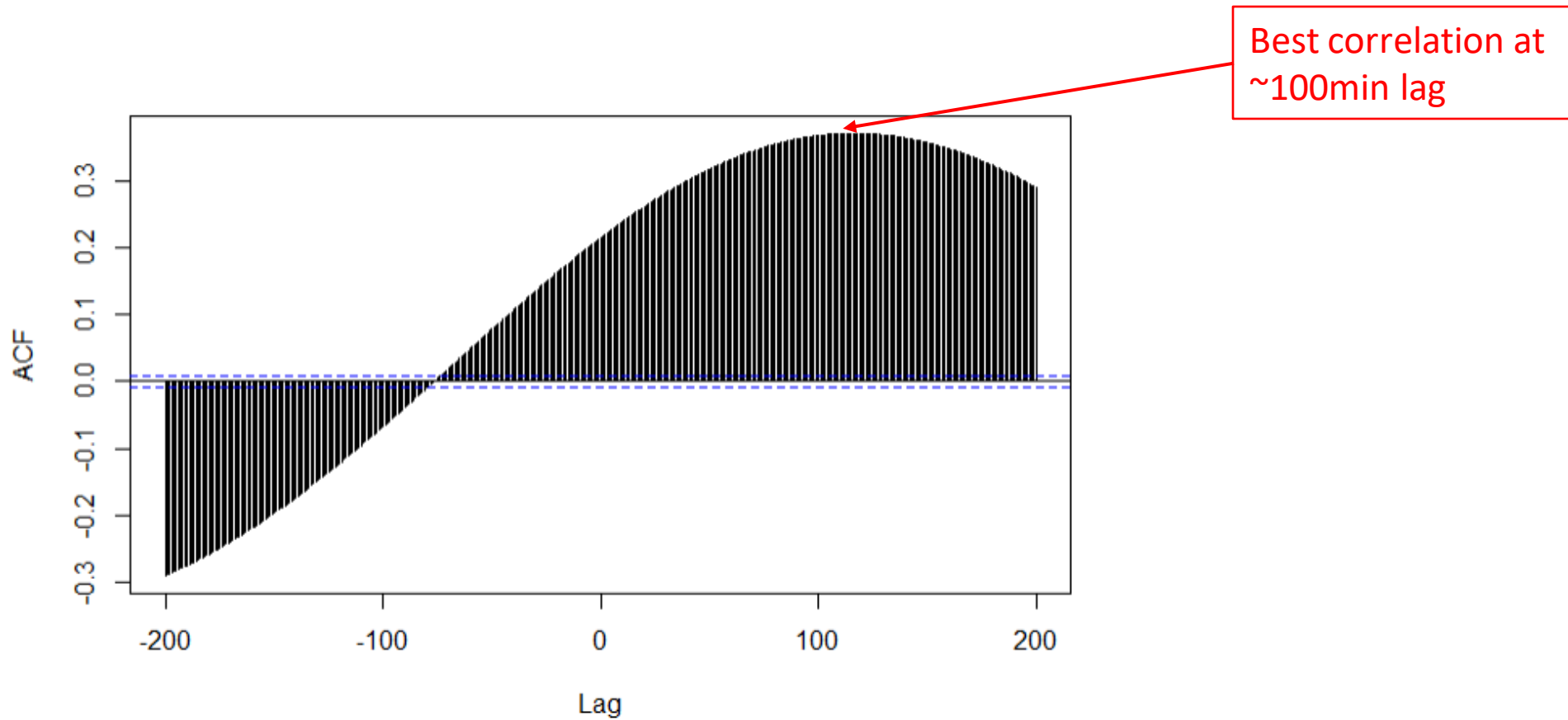
Average flow for tide levels



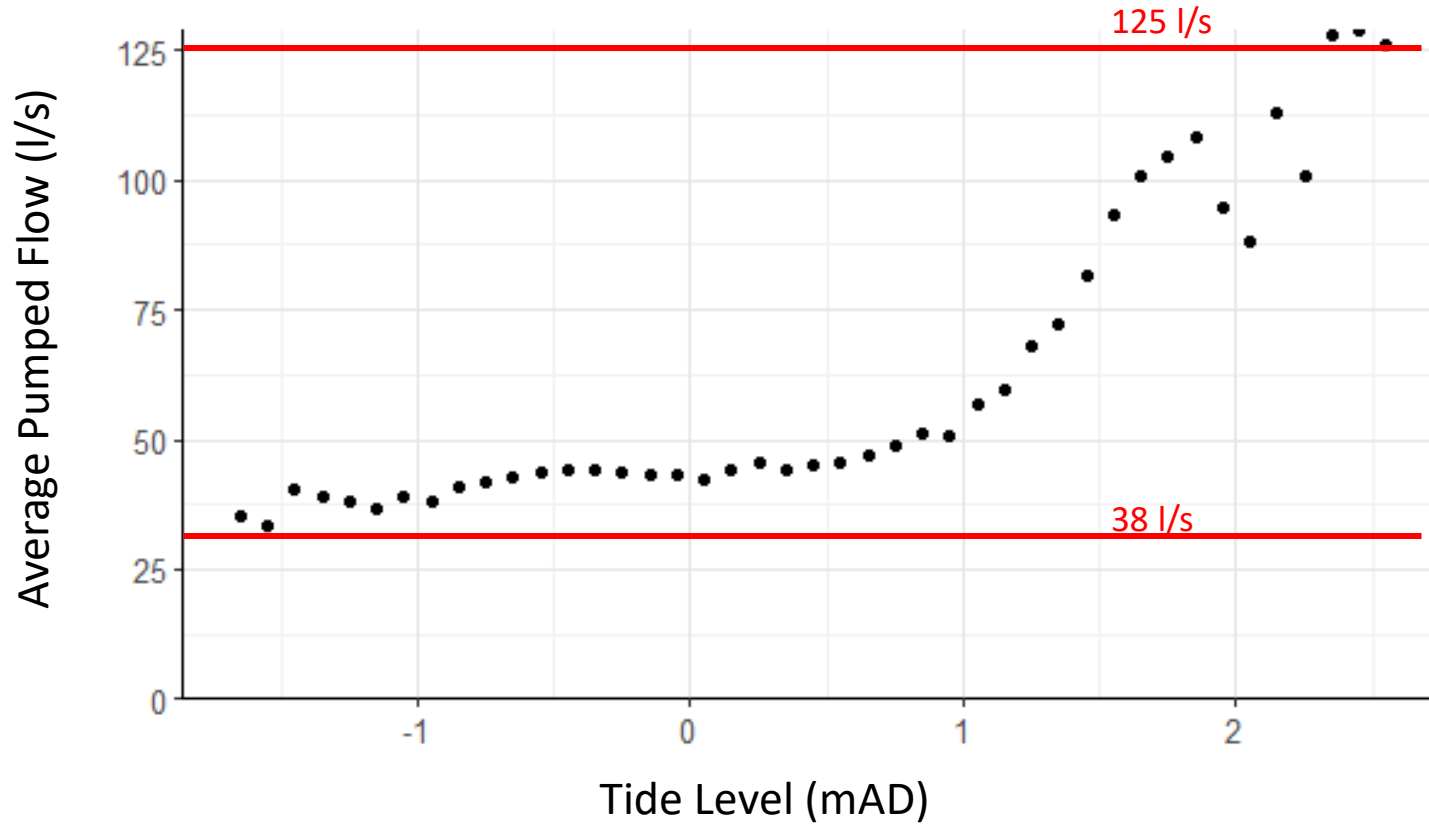
Time to enter network



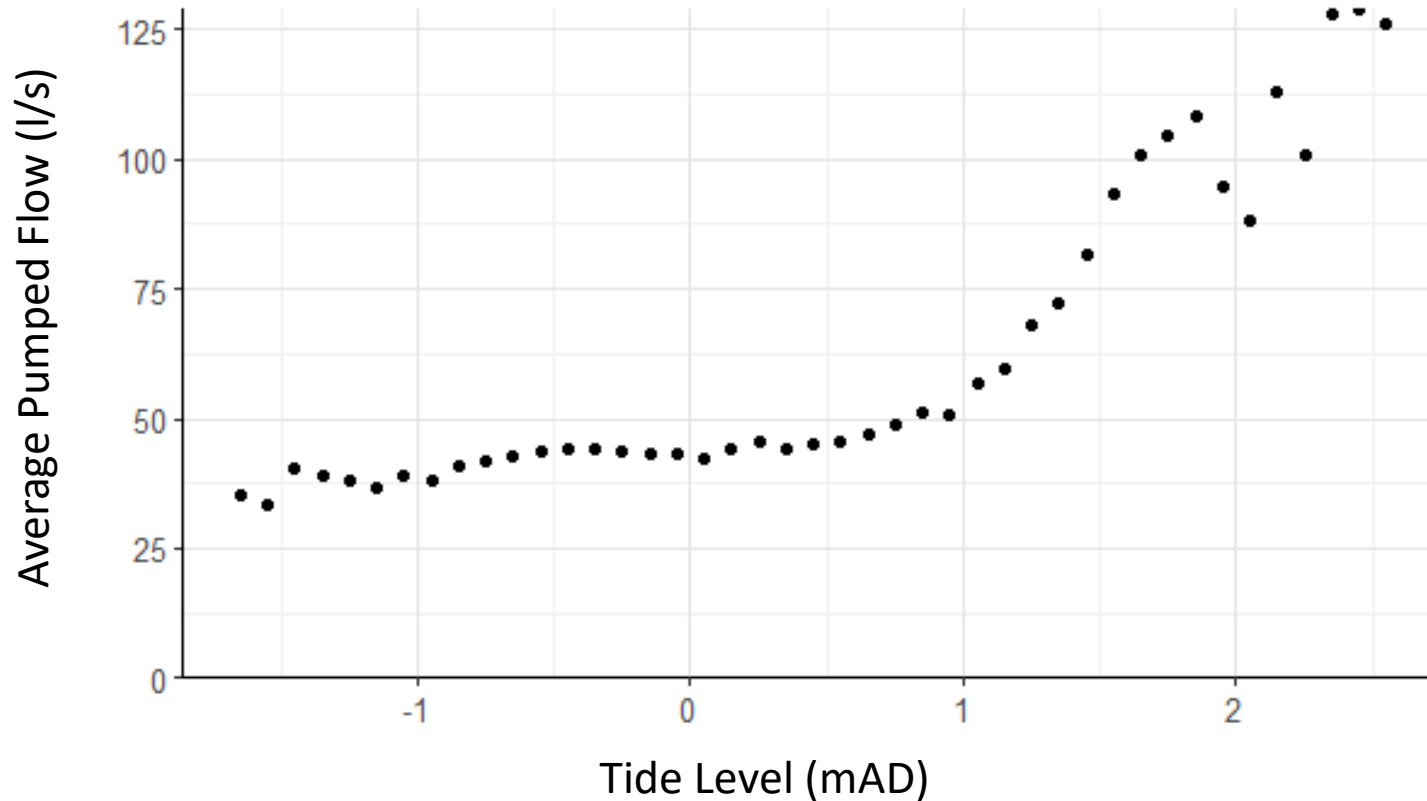
Time to enter network



With shifted tide levels



What do we know?



1

Flow goes up as tide goes up

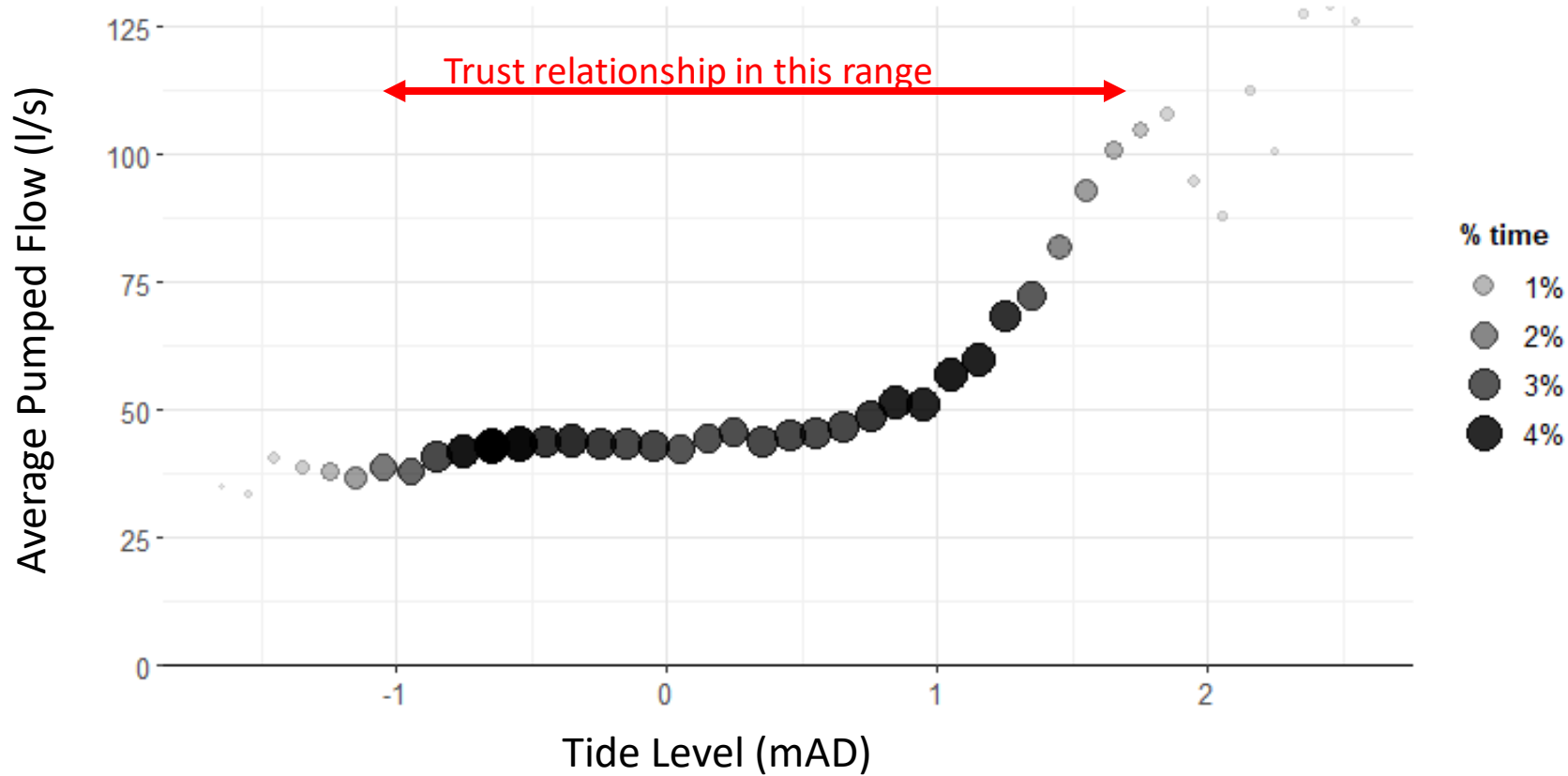
2

Rapid continuous increase >1m tide

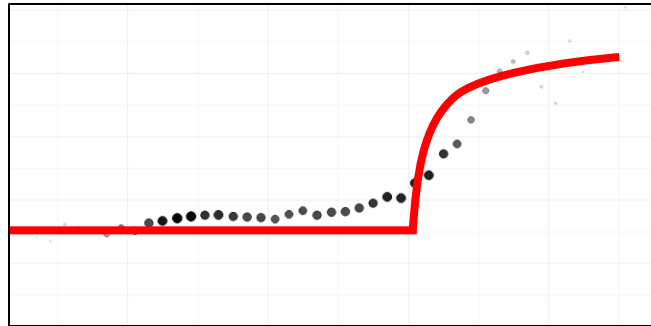
3

High variation at high tide

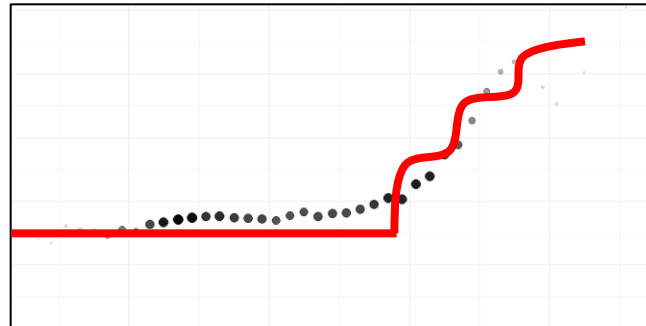
Why does it look like this?



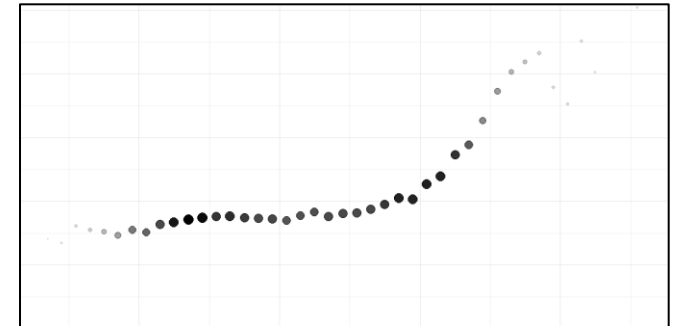
Why does it look like this?



Single point source

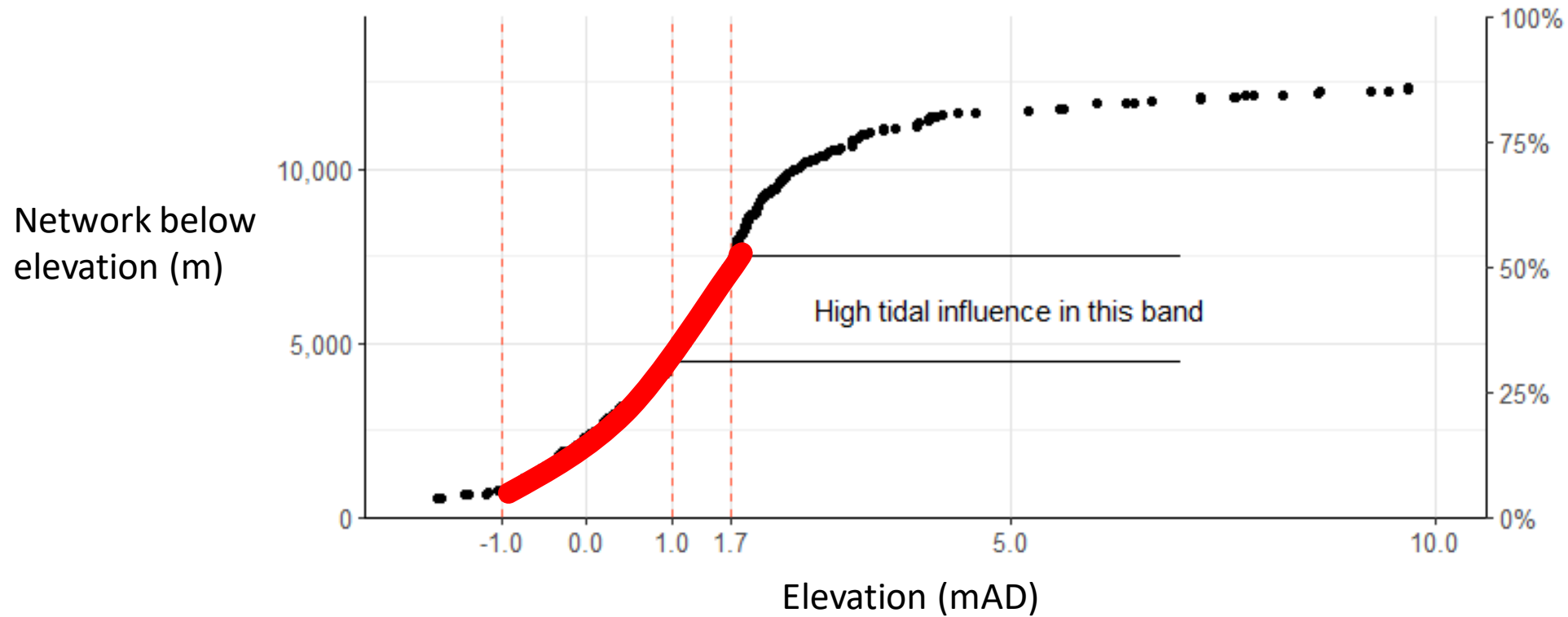


Multiple point sources

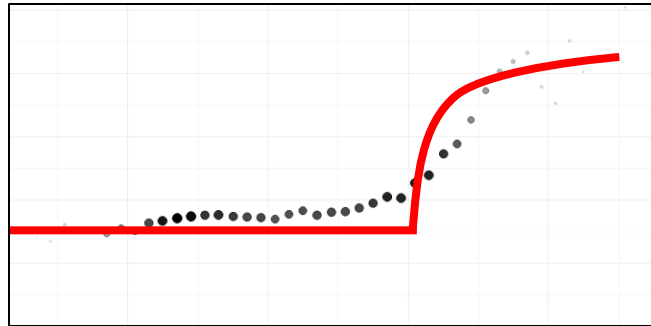


All throughout the network

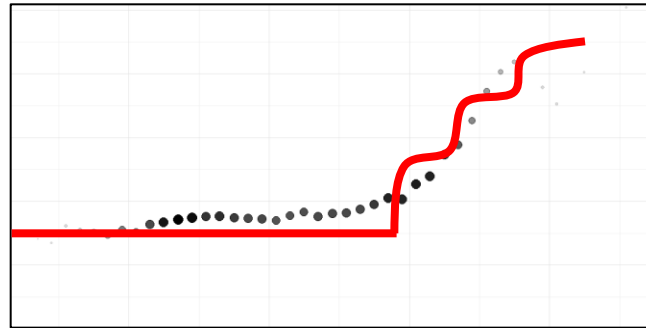
Why does it look like this?



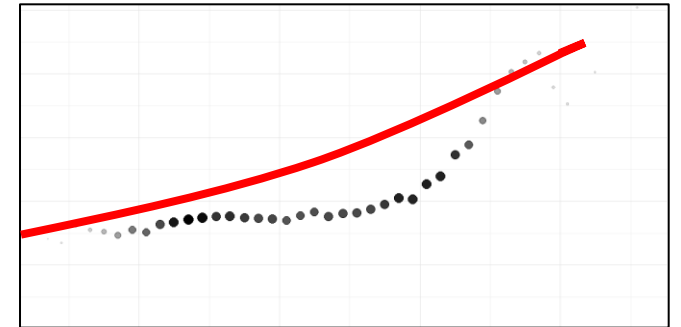
Why does it look like this?



Single point source



Multiple point sources

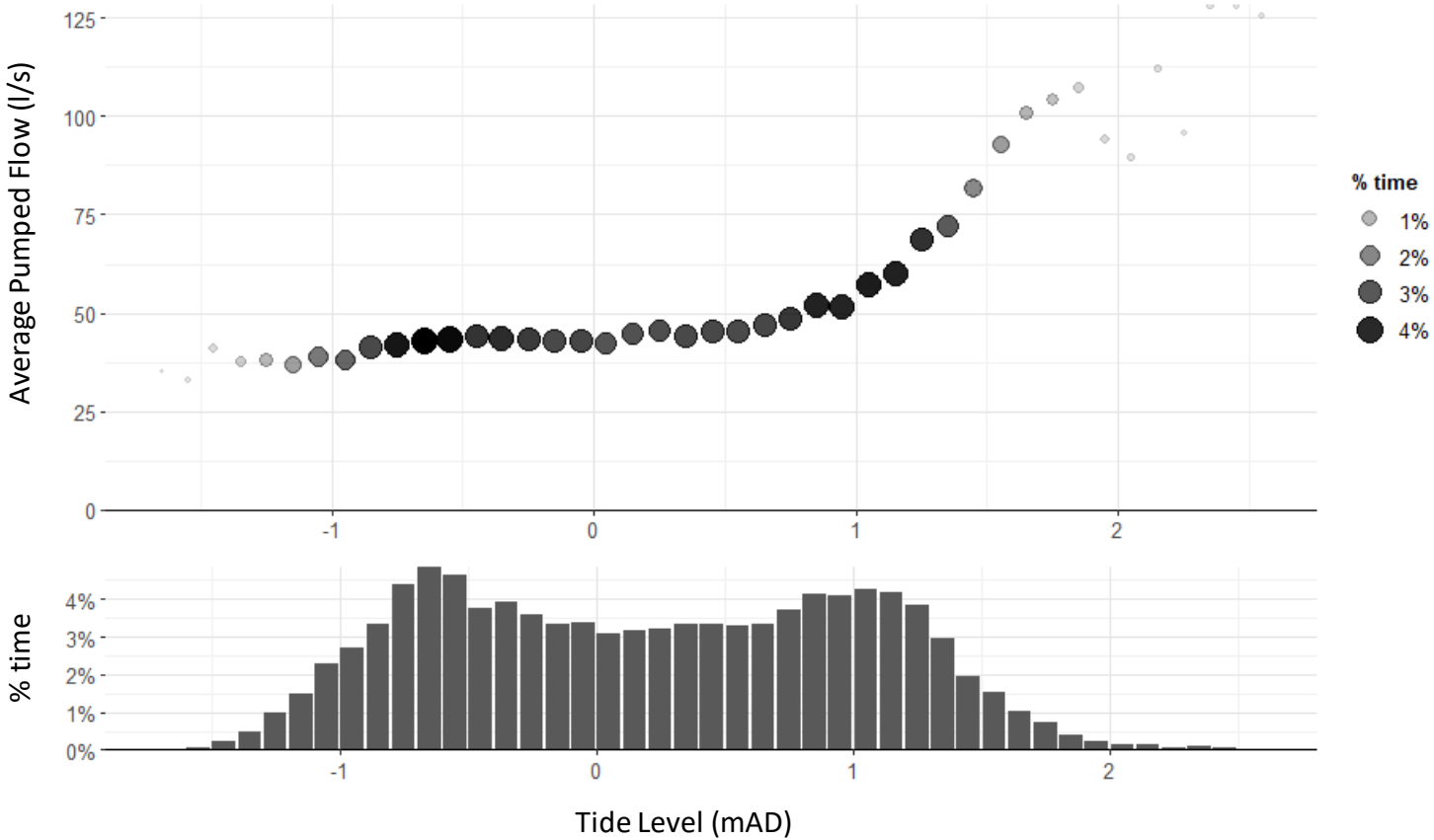


All throughout the network

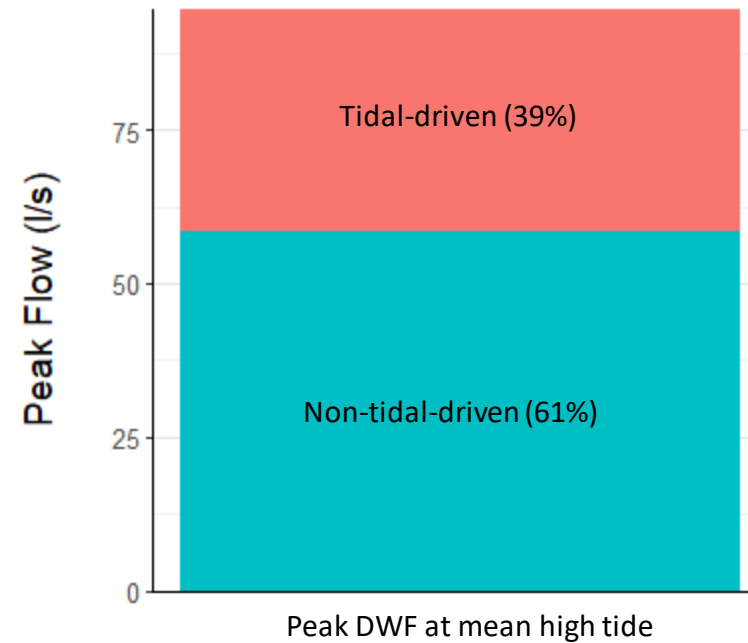
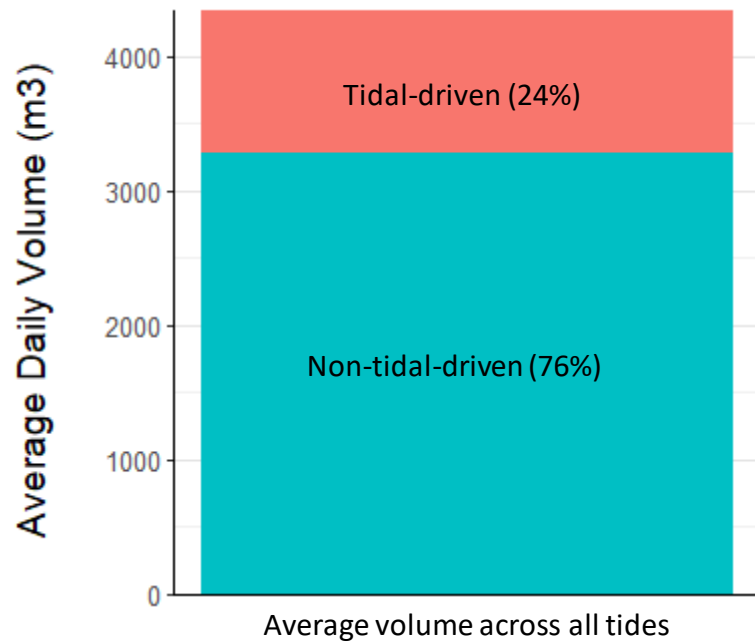
What do we know now?

- There is tidal ingress at all tide levels
- Likely from several sources of ingress, concentrated in the network $>1\text{mAD}$
- Tidal ingress is a significant proportion of flow at extreme tides
- We know what flow to expect for any given tide between -1mAD and $+1.7\text{mAD}$

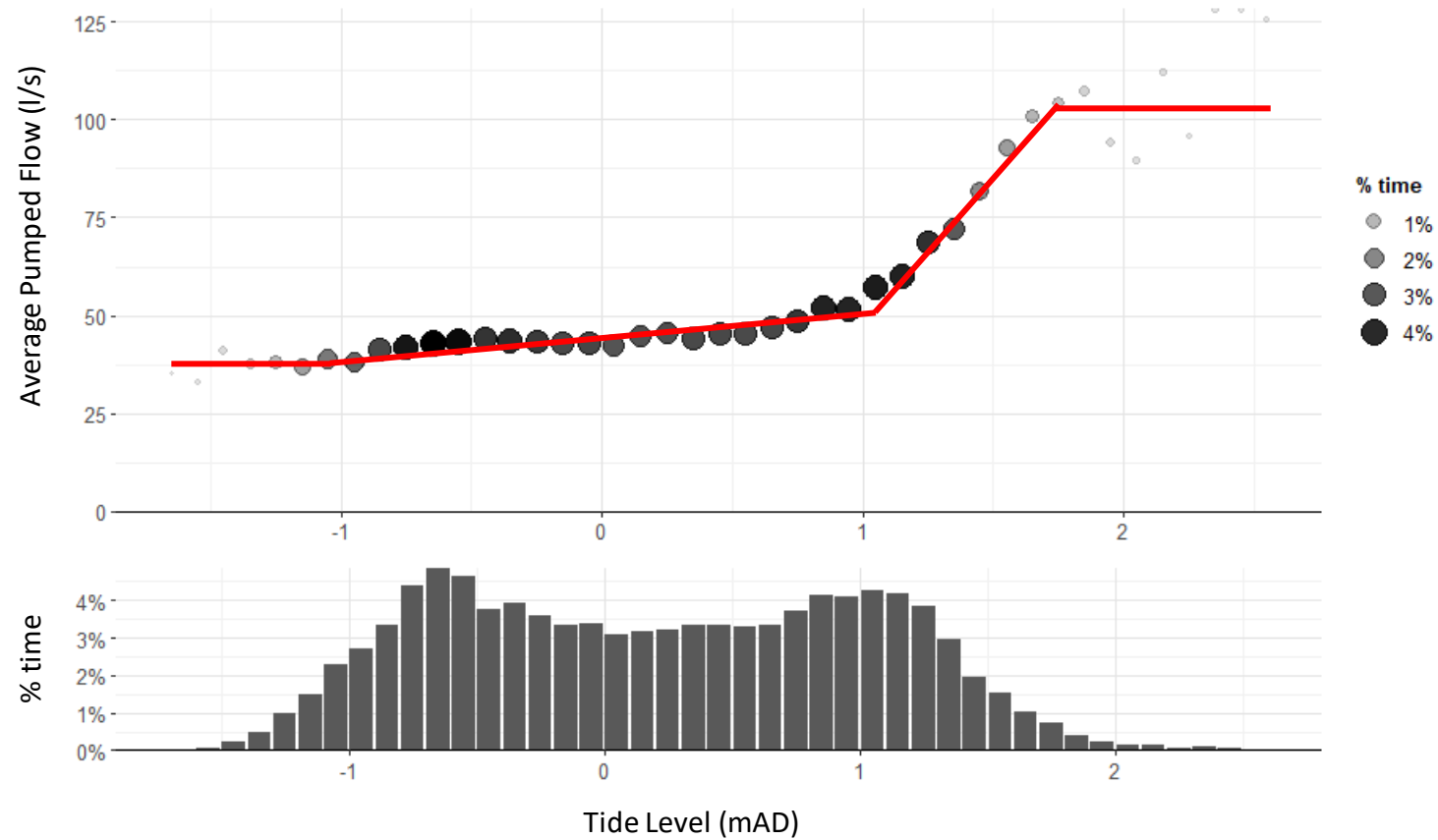
How we use this information



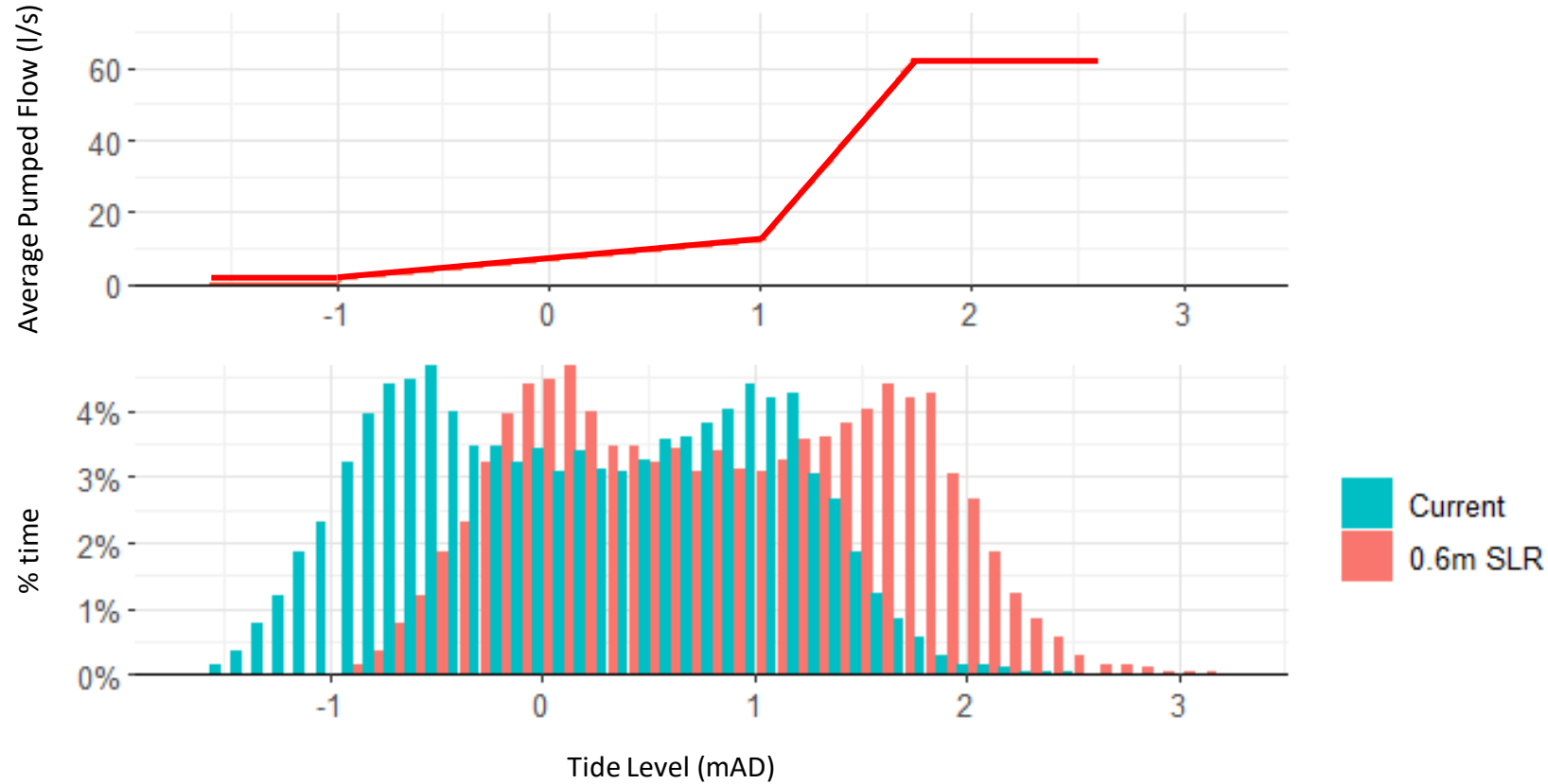
How bad is it?



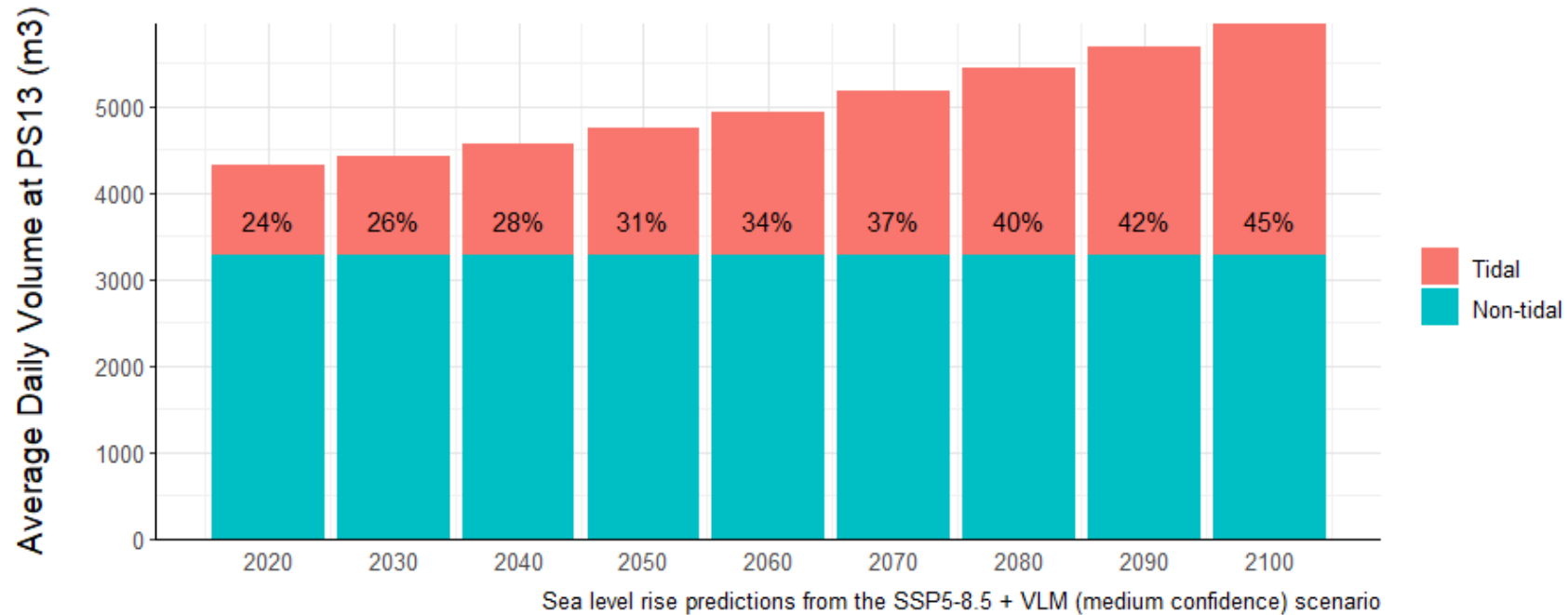
How bad will it be?



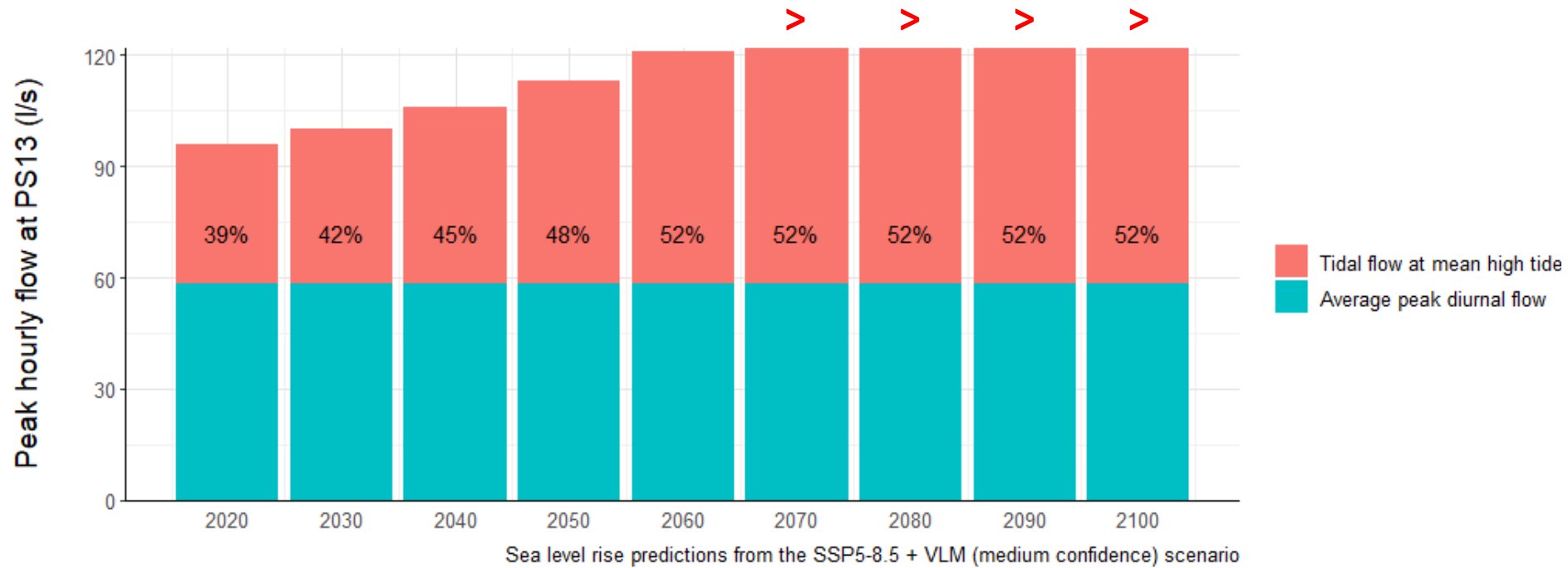
Making predictions



Predicted increase in daily volume at the pump station due to sea level rise alone



Predicted increase in peak flow at pump station due to sea level rise alone



Have we answered our questions?

How bad is it?

24% of all pumped flow is sea water.

How bad will it be?

At least 45% of all pumped flow will be sea water in 2100 because of sea level rise.

Modelling Symposium

Thank you!
Questions? Patai?