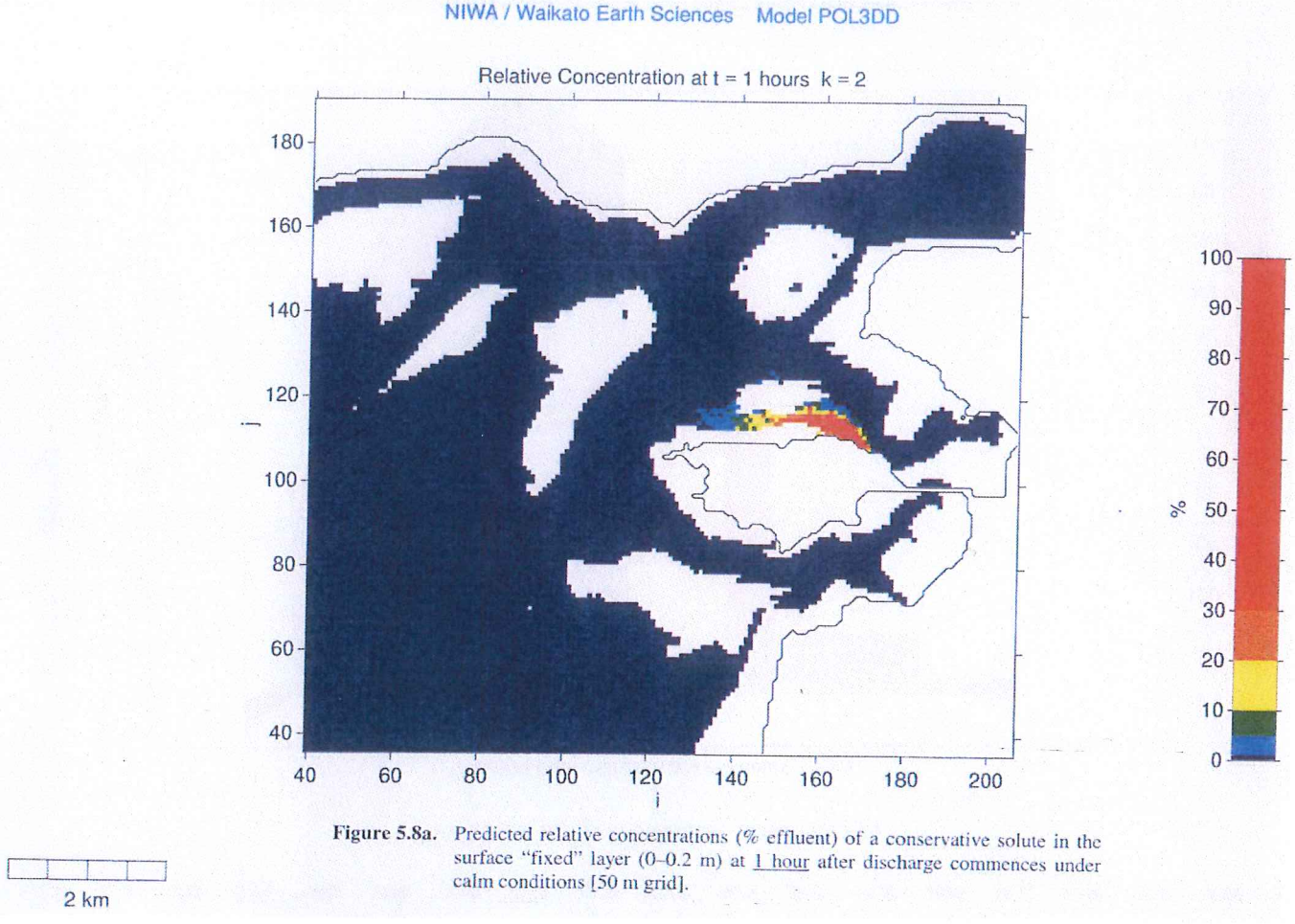


Figure 5.8a. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 1 hour after discharge commences under calm conditions [50 m grid].

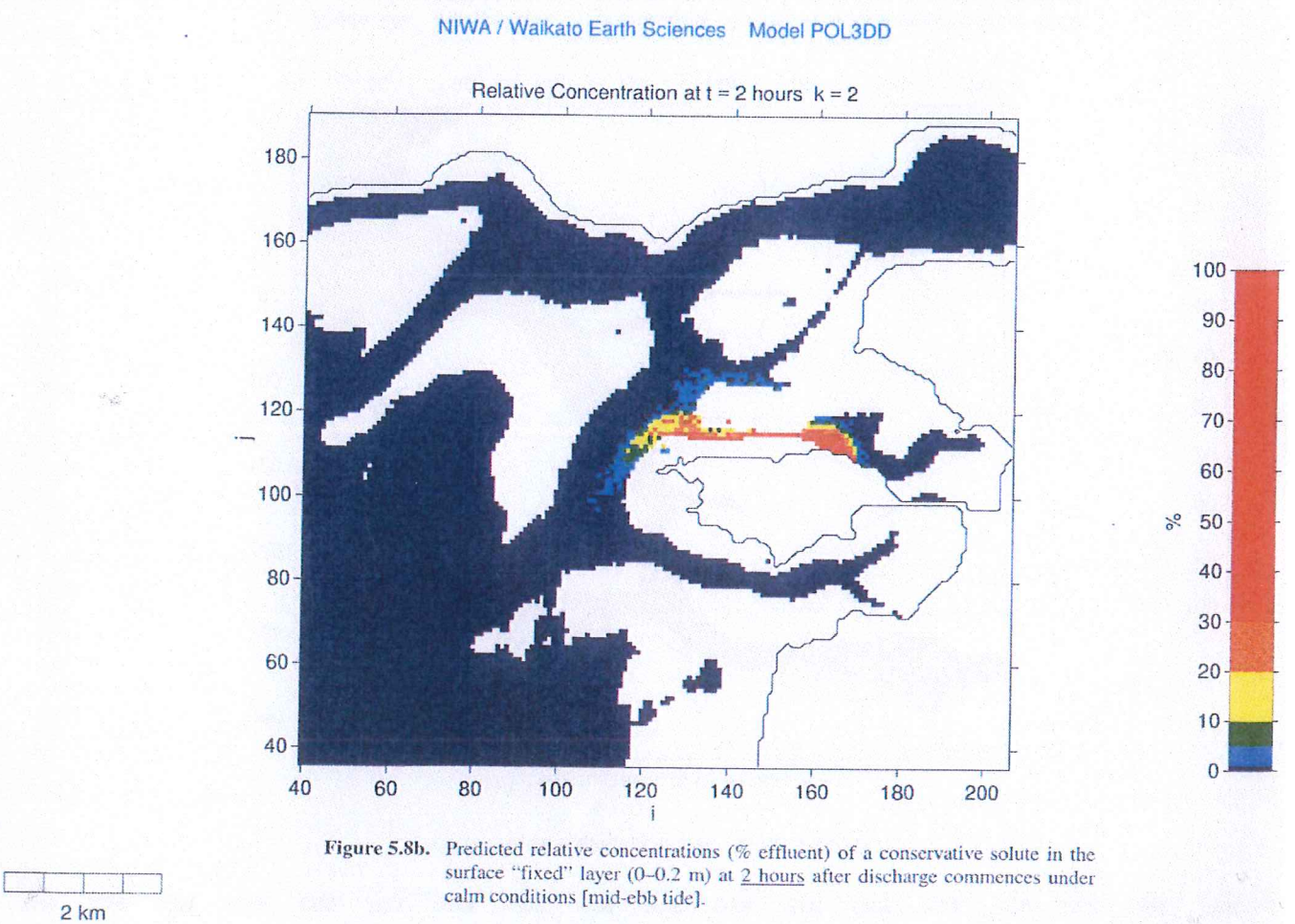


Figure 5.8b. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 2 hours after discharge commences under calm conditions [mid-ebb tide].

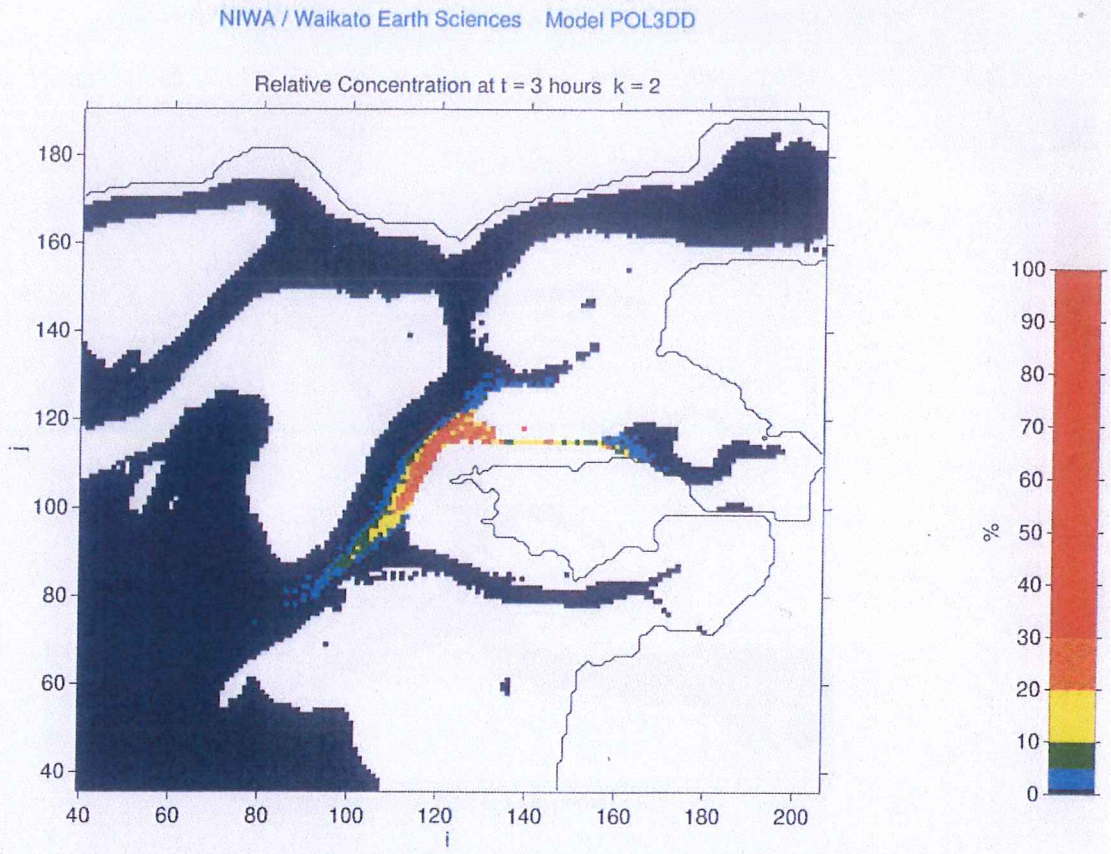


Figure 5.8c. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 3 hours after discharge commences under calm conditions.

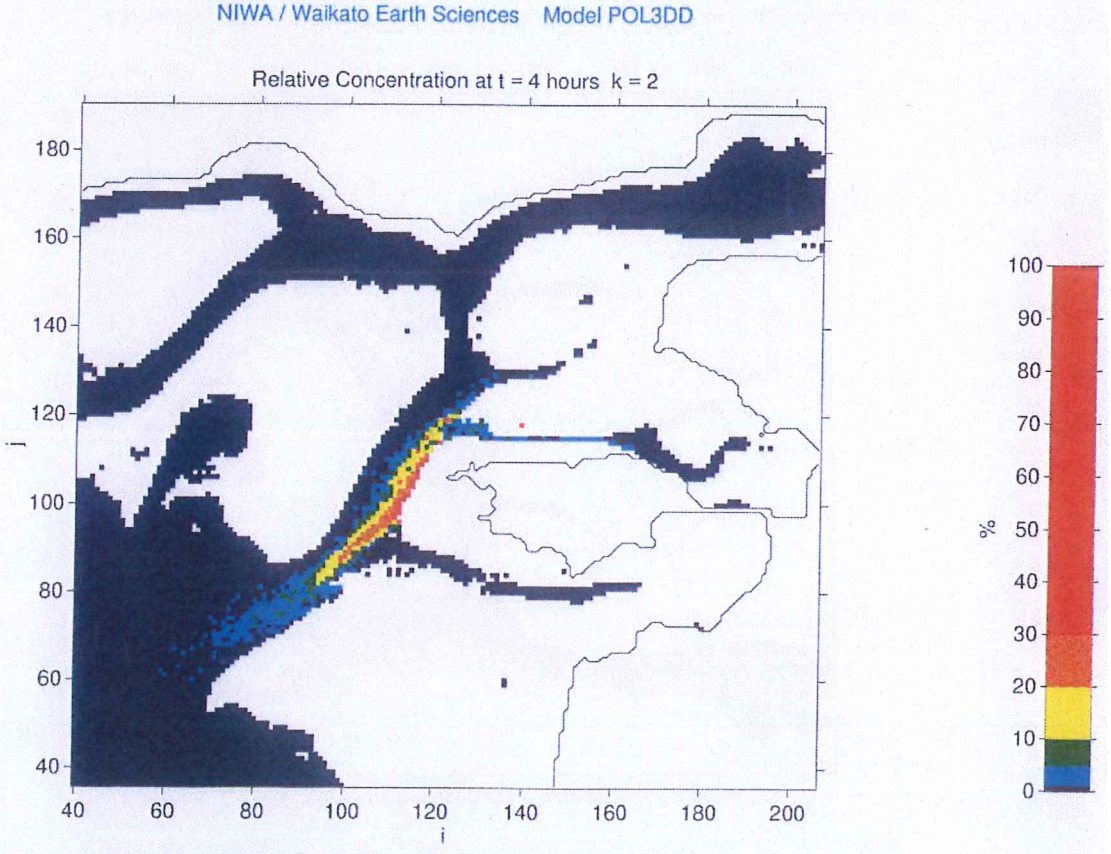


Figure 5.8d. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 4 hours after discharge commences under calm conditions.

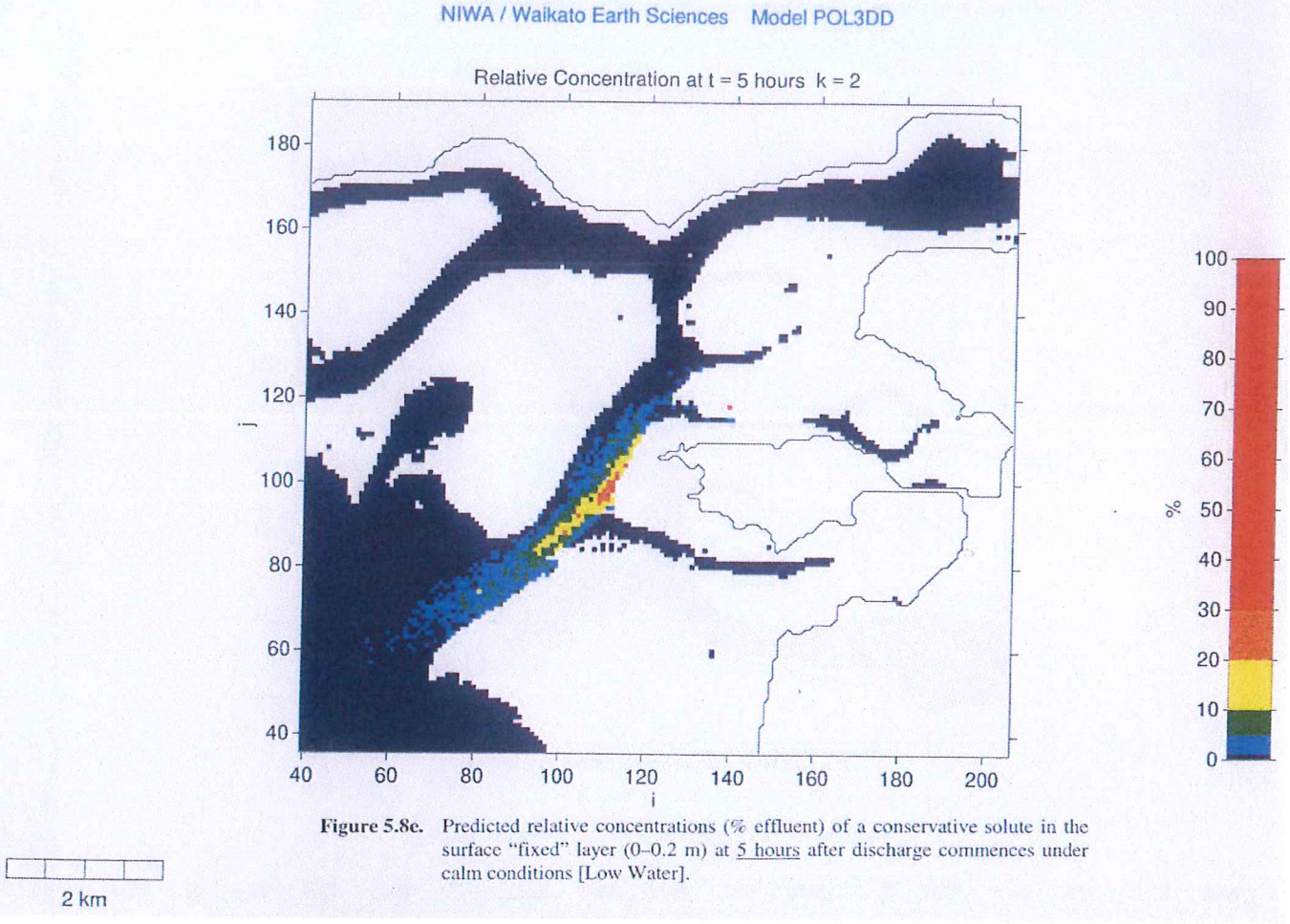


Figure 5.8e. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 5 hours after discharge commences under calm conditions [Low Water].

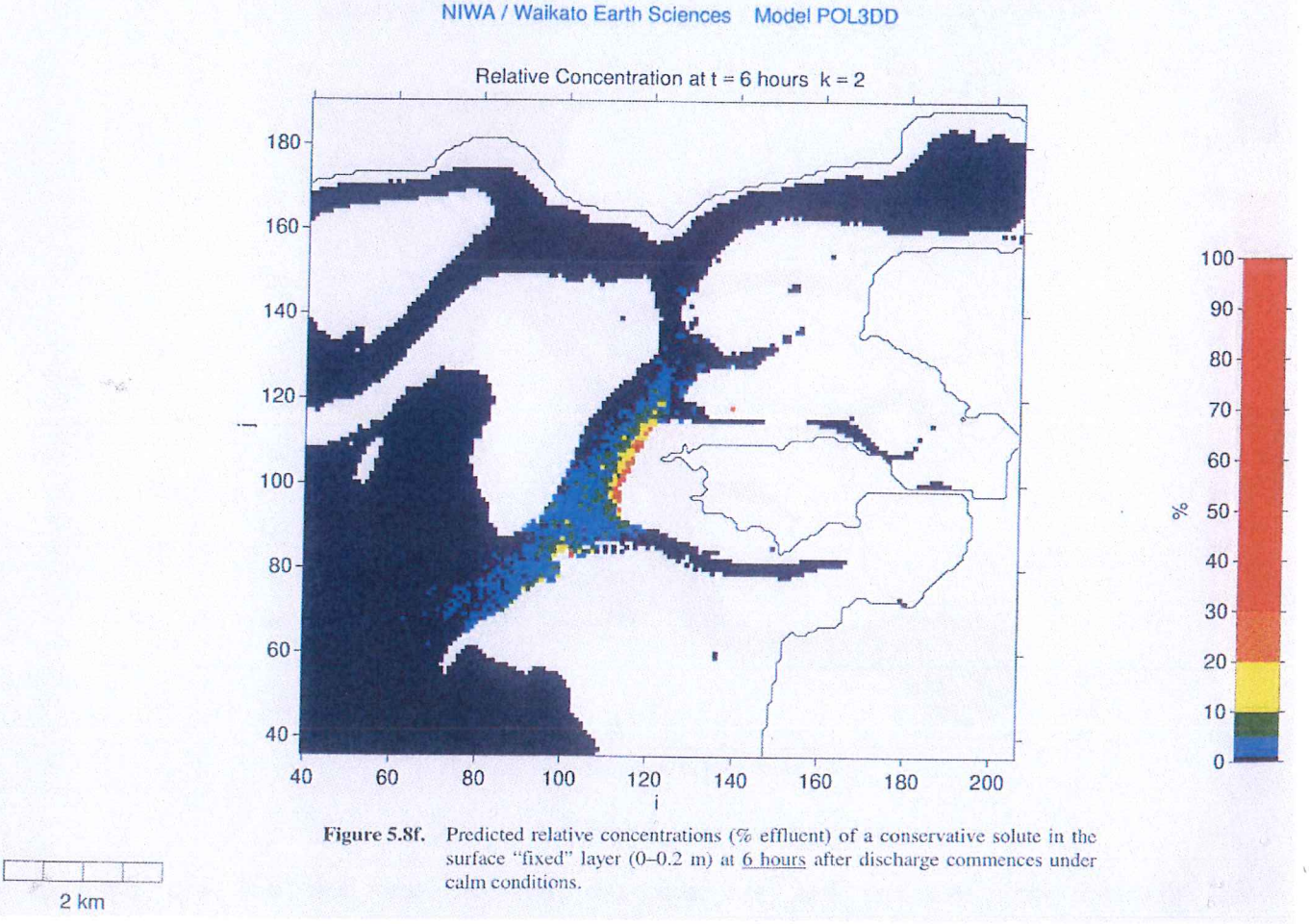


Figure 5.8f. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 6 hours after discharge commences under calm conditions.

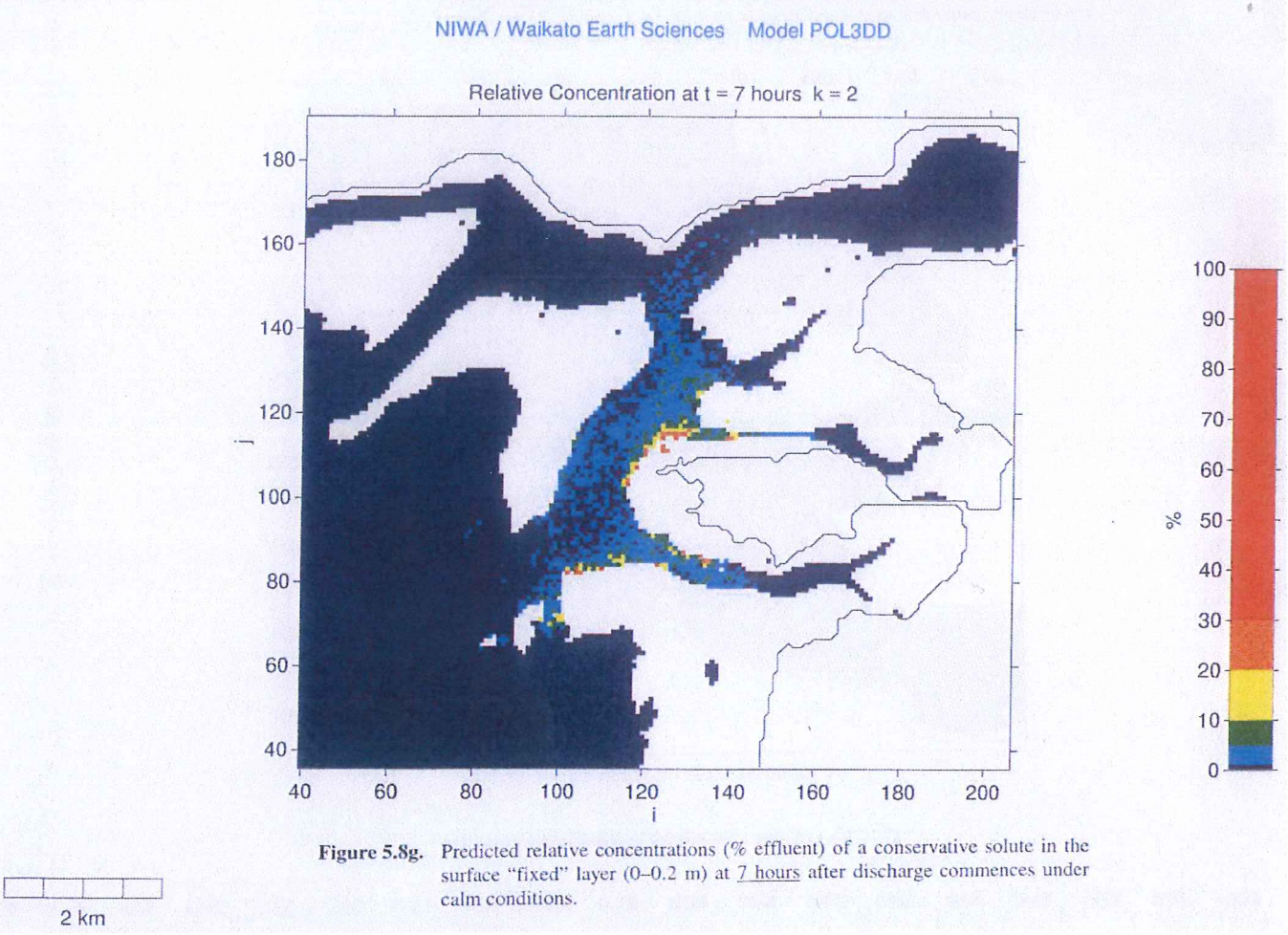


Figure 5.8g. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 7 hours after discharge commences under calm conditions.

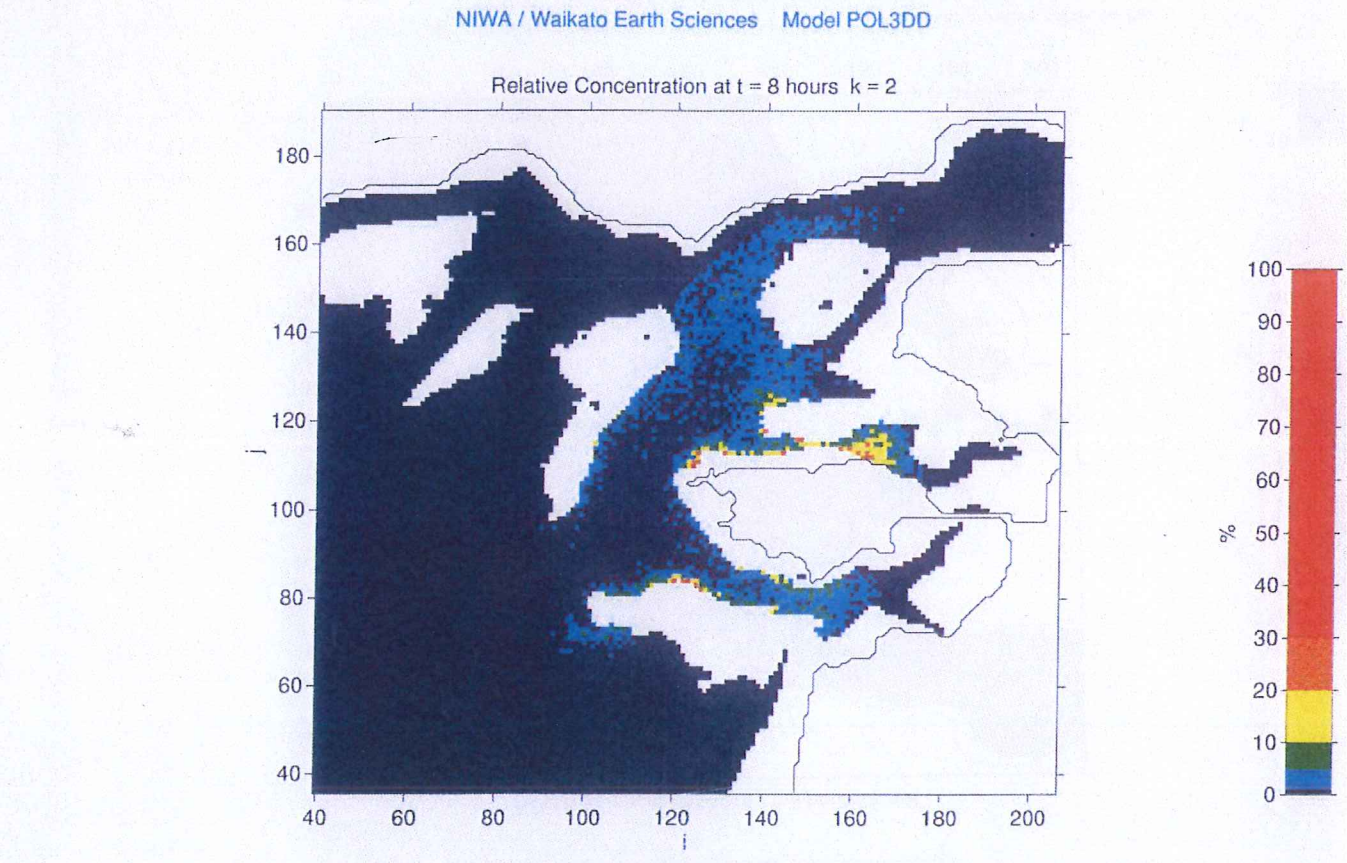


Figure 5.8h. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 8 hours after discharge commences under calm conditions [mid-flood].

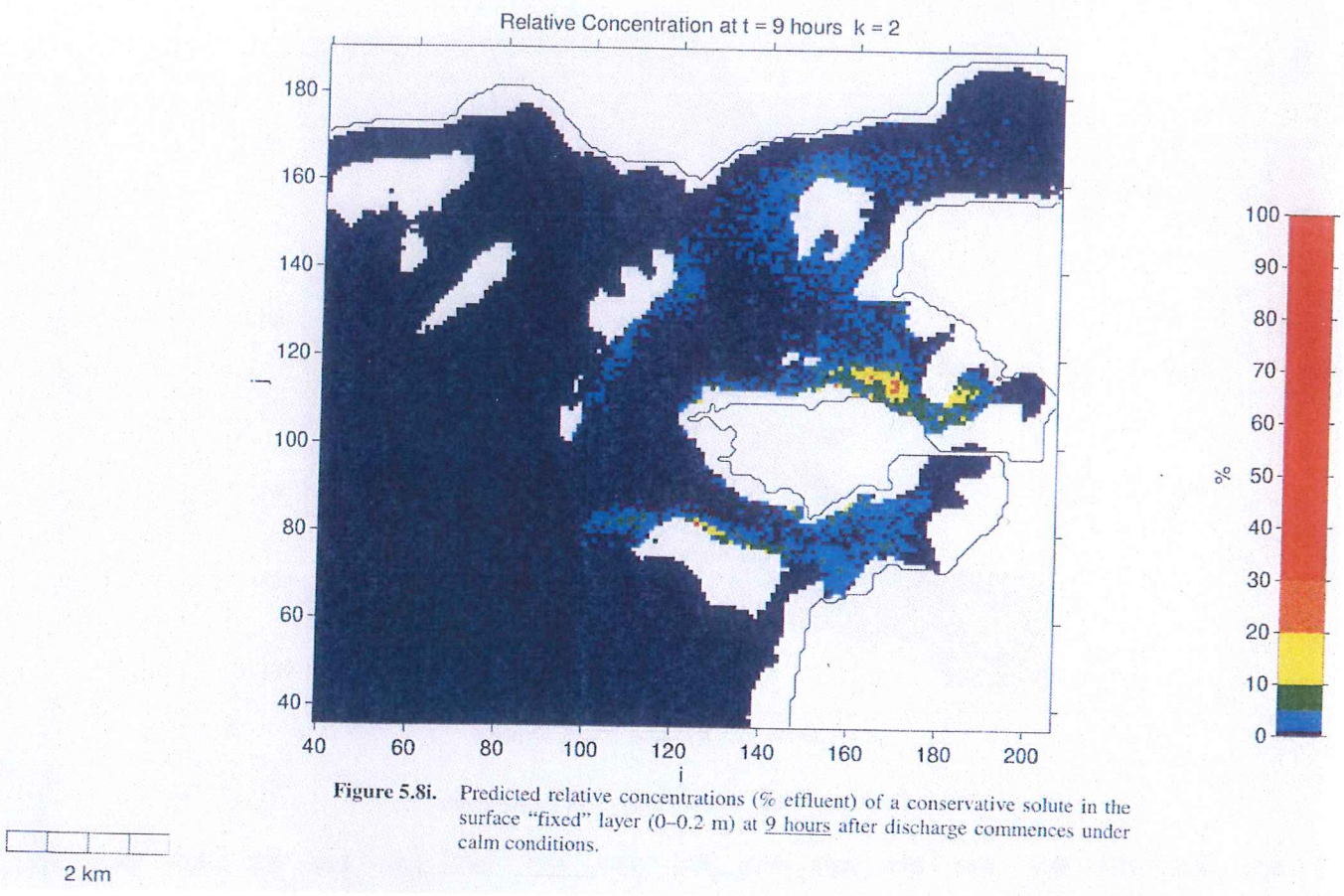


Figure 5.8i. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 9 hours after discharge commences under calm conditions.

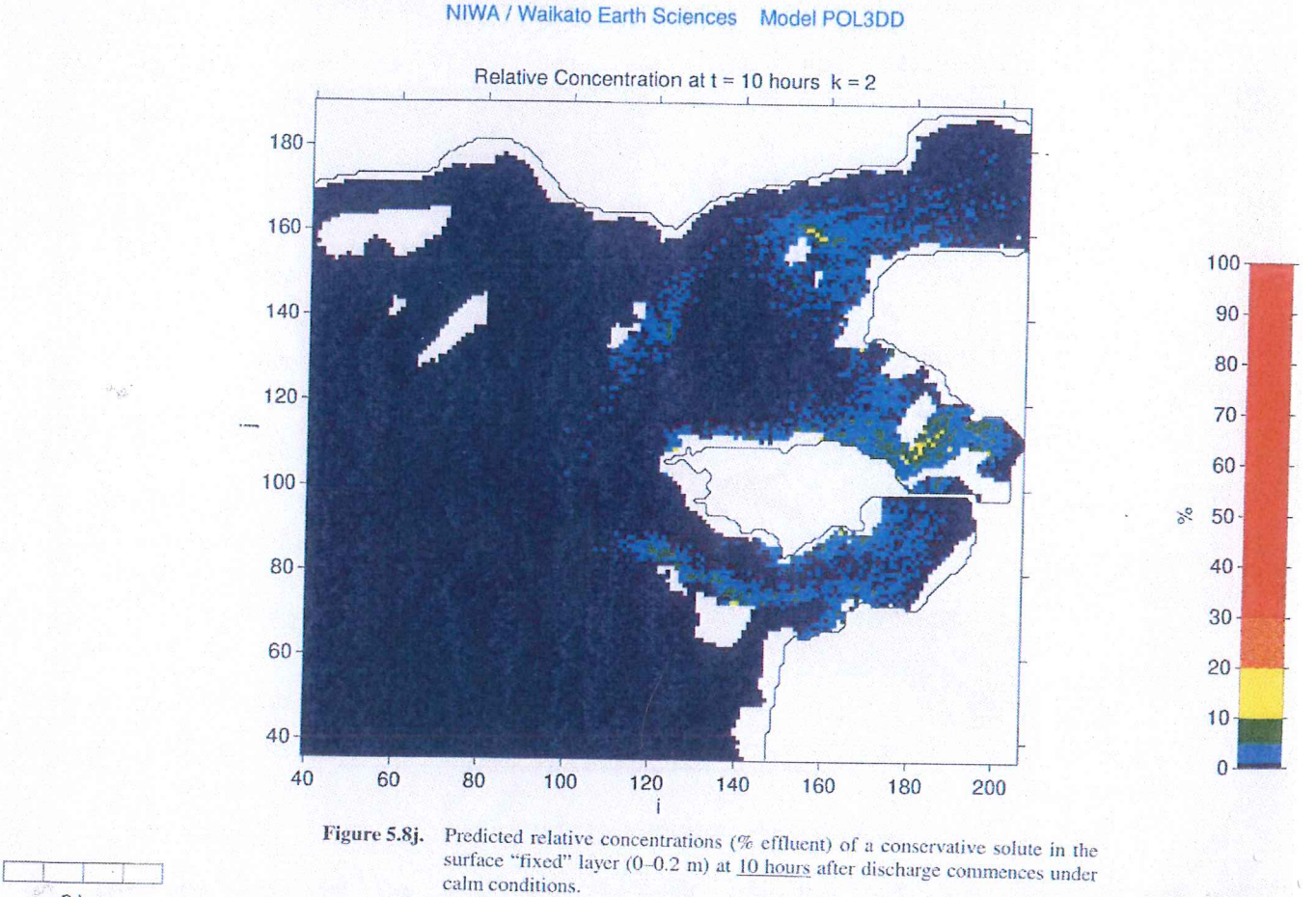


Figure 5.8j. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 10 hours after discharge commences under calm conditions.

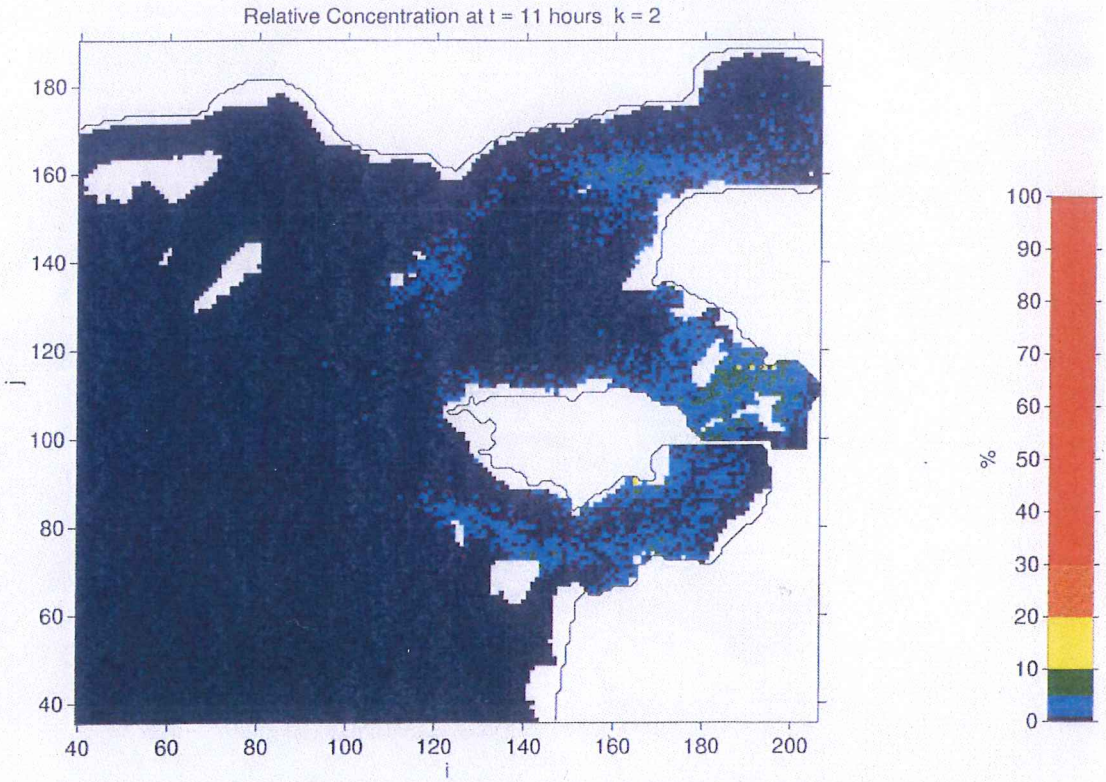
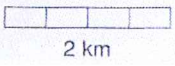


Figure 5.8k. Predicted relative concentrations (% effluent) of a conservative solute in the surface "fixed" layer (0–0.2 m) at 11 hours after discharge commences under calm conditions.



RUSSELL McVEAGH

28 August 2013

Julie McKee / Paulette Gagamoe **By email**
Auckland Council
Private Bag 92300
AUCKLAND 1142

Dear Julie / Paulette

CENTRAL INTERCEPTOR

1. On the final day of the Central Interceptor hearing the Panel requested additional information from Mr Roan.

2. This is now **enclosed**.

3. Please do not hesitate to contact us if you have any queries.

Yours faithfully
RUSSELL McVEAGH

Bronwyn Carruthers
Partner

Direct phone: +64 9 367 8869
Direct fax: +64 9 367 8590
Email: bronwyn.carruthers@russellmcveagh.com

Tonkin & Taylor

T&T Ref: 26145.100
27 August 2013

Watercare Services Ltd
Private Bag 92 521
Wellesley St
Auckland 1141

Attention: Belinda Peterson

Dear Belinda

Central Interceptor Main Project Works - NIWA Modelling Outputs

In response to the request made by Commissioner Hill at the hearing for the Central Interceptor Main Project Works applications, **attached** are plots from the NIWA modelling work completed for dilution and dispersion of discharge at the tidal storage basin.

These plots are from the NIWA report entitled "Numerical Modelling of a Future Diffuse Shoreline Discharge Option for the Mangere Wastewater Treatment Plant", dated December 1995. The modelled conditions represented in the plots are summarised as follows:

- Discharge from the tidal storage basin at a rate of 25m^3/s;
- Calm weather conditions (conservative dilution and dispersion scenario as no allowance is made for wind induced mixing);
- Mean tidal conditions (i.e. tidal range mid-way between neap and spring); and
- Model run over 1 tidal cycle (12 hours).

The plots (Figures 5.8a to 5.8k) show the fate of a conservative tracer (i.e. there is no allowance for contaminant decay or change due to physical, chemical or biological breakdown in the modelled scenario), and depict predicted effluent dilution and dispersion at hourly time intervals over the tidal cycle following discharge (i.e. Figure 5.8a represents dilution and dispersion 1 hour after discharge commences, while Figure 5.8k represents conditions after 11 hour).

The plots depict dispersion down the Purakua Channel over the outgoing tide (Figures 5.8a to 5.8e), and on the incoming tide show dispersion back up the Manukau Harbour in the Purakau Channel and Wairopa Channel and along the Hillsborough coastline and Mangere Inlet area (Figures 5.8f to 5.8K). The plots also show dispersion in the area occupied by the former oxidation ponds over the incoming tide (Figures 5.8g to 5.8k).

The plots show that after 1 tidal cycle of the discharge ceasing Figure 5.8k), the discharge is diluted to very low levels (around 100 times) over the area influenced by dispersion (note: the rate of discharge modelled by NIWA (25 m^3/s) is higher than the peak 20 m^3/s discharge rate from the EPR structure).

Numerous other scenarios were also assessed as part of the NIWA modelling work, including for example where the effects of other wind and tidal conditions are examined. Of these available scenarios, the modelled scenario presented in the attached plots is considered to represent "worst-case" dilution and dispersion conditions for discharge from the EPR structure (i.e. calm wind conditions).

I trust this addresses Commissioner Hill's request and would be happy to provide additional information from the NIWA studies as required, or make myself available to discuss the model outputs if further clarification was sought.

Yours sincerely

Peter Roan

Attachments:

Figures 5.8a to 5.8k Source: NIWA report entitled "Numerical Modelling of a Future Diffuse Shoreline Discharge Option for the Mangere Wastewater Treatment Plant", dated December 1995