

Christchurch City Council
PO Box 73012
Christchurch Mail Centre
Christchurch 8152

Attention: Peter Kingsbury

Dear Peter

Coastal Hazard Assessment - Stage II. Revision taking into account Peer Review Panel Final Recommendations

Following our discussion of 7 September 2016, we are pleased to re-confirm the basis on which we will revise the dynamic modelling previously used to determine the harbour coast inundation zone, for both the Avon-Heathcote Estuary and the Brooklands Lagoon and Lower Styx area. This proposal is intended to be read in conjunction with the parallel proposal aimed at further addressing recommendations made by the peer review panel.

This proposal includes:

- Methodology and scope to revise the dynamic modelling using the existing model.
- Make allowance for the use of the CCC City-Wide Stormwater Model (CWSM) once this becomes available for use, in such a way that doubling up of effort is reduced to a practical minimum for preparation of maps showing both the CIHZ and CEHZ.

In undertaking the above, we note one major change in the approach to be adopted, this being to apply data recorded over historic events that caused flooding. This approach is a departure from the previous design event based approach, where sets of synthetically derived conditions were previously run through the model to yield results. Under the revised approach, data recorded from historic events will initially be used in model calibration and validation, and then the data from these previously recorded (i.e. actual) events will be scaled upwards to meet the required event frequencies (50-year and 100-year ARI).

We note that the current approach is to develop multiple scenarios and plot the hazard extents for all of these, and have this information ready to be distributed for public consultation. This is quite different from our previous report where we selected the events to map. It will require the production of a range of maps for both inundation and erosion and these will be required for present day, 2065 and 2115 (i.e. three time periods), although I am suggesting we change the last year to 2120 to be consistent with the MfE plots (2065 is acceptable as a mid-time period point). MFE (2016) draft only have projections for RCP8.5 and 4.5, so for CCC point of view, probably we can only consider these two time projections.

Response to Para 223 – Harbour Coast CIHZ

Preliminary phase

- Task 1: Review the peer review panel report and develop a suggested methodology.
- Task 2: Meet with CCC to develop methodology.

Modelling Phase

Task 3: *Develop the model for use*

- Task 3.1: Prepare breaklines in the model to represent relevant features that are poorly represented using the grid based digital elevation model. This includes stopbank crests as well as other elements such as the Sumner Seawall that currently exist.
- Task 3.2: Undertake analysis of historic events known to have caused flooding in Christchurch. Source data for these, including spatially varying rainfall, wind speed and direction and sea level. At this stage we anticipate up to 8 events being used, to cover the weather events that are known to have caused historic flooding. In particular, southerly frontal systems and easterly sub-tropical systems need to be included (separately). The recorded sea level data will be disaggregated into components including tide level and barometric effects, to enable meaningful frequency to be applied.
- Task 3.3: Undertake model calibration for 2 of the above events, covering different weather systems. Use the remainder of the events for model validation.
- Task 3.4: Discuss “reasonably foreseeable” changes to the model terrain that may occur within the time horizons considered with CCC. Of particular interest is revised lower Avon stopbank alignment. If such discussion yields a need to re-run the model for these reasonably foreseeable changes, agree the scope of the model runs to be undertaken. Develop the model terrain in sympathy with these changes.
- Task 3.5: Assess the assumptions surrounding estuary bathymetry, mouth geometry and tidal prism for future climate scenarios. Consultation with NIWA, CCC and published literature should be included.

Task 4: *Run the model scenarios*

- Task 4.1: Scale up the selected historic events considered to be both 50-year and 100-year ARI events. For each of these event frequencies, note that there will be an envelope of sea level and rainfall than needs to be applied (2 model runs per event). This will be for the present-day climate. Envelope all runs across the different observed, but scaled up, weather events to yield inundation extents.
- Task 4.2: Establish design events for 50-year and 100-year ARI, using synthetic rainfall and sea level as per the CCC WWDG. Run the model for these (2 runs per event frequency) for the present-day climate.
- Task 4.3: Compare the results from Tasks 2.4 and 2.5. Discuss the findings with CCC to establish the set of events to be used for establishment of the CIHZ.
- Task 4.4: Using the outcome from Task 2.6, run the model for climate adjusted scenarios (RCP8.5 and RCP4.5) for the two future horizons (2065 and 2120) for the sets of events selected for the present-day climate.
- Task 4.5: Pending the outcome from Task 2.4 above, it may become necessary to re-run Tasks 4.1 to 4.4 inclusive using revised model terrain.

Task 5: Mapping of results

Task 5.1: Using the model outputs of inundation extents (as indicated in Tasks 4.1 to 4.4 inclusive), develop the CEHZ as per the parallel proposal covering this.

Task 5.2: Revise the CEHZ using the outcome from Task 4.5, if found to be necessary.

Reporting**Task 6: Reporting**

Task 6.1: Add to the report (including revised maps) being prepared in response to the Peer Review Panel report and update/modify report taking into account suggested changes, edits and minor errors.

Report on future work programme**Task 7: Work programme**

Task 7.1: Identify work programme based on recommendations from the PRP over the next 5 to 10 years and prepare work scope.

Task 7.2: Develop model inputs to the CCC City-Wide Model to be used for development of the CIHZ, such that the inputs to both models (CCC City-Wide and T+T Tuflow) are consistent.

Task 7.3: Availability to discuss model inputs and outputs while the CCC City-Wide model is developed for use in this regard.

Programme and Team

Tasks 1 and 2 have already been completed.

We will start work within one week of your instruction to proceed and expect to present our final report by the end of February 2017 for Tasks 3 to 6. Task 7 will be completed after this phase and the hydrodynamic modelling is completed.

Our team comprises the following members:

Project Director:

Project Manager and technical lead:

Hydraulic modelling and analysis:

Technical review:

Health & Safety

T+T is committed to providing and maintaining a safe and healthy working environment at all of our places of work. In line with this commitment, and as required by health and safety legislation, we will develop and implement a health and safety management plan for our work in consultation and co-ordination with you and others who will be working on the project. To assist us in this, please provide a list of any known hazards and a copy of any health and safety management plan you operate which are relevant to our services.

Terms and Conditions

We will carry out the work in accordance with our attached Conditions of Engagement. These terms place certain limitations on our liability and they will apply in precedence to any terms and conditions in any purchase order or other confirming document that you may issue to us.

We provide our reports and other deliverables for your benefit only and they cannot be relied upon by any third parties. However, if you want us to, we may allow a third party to rely on them after signing an appropriate reliance statement with us.

This offer is valid for 3 months from the date of this letter.

Closing remarks

We trust that this satisfactorily meets your needs. We look forward to receiving your instruction to proceed and to working with you on this project. You can confirm your acceptance by returning the attached signatory form. Alternatively, we will take your written instruction to proceed as confirmation that you accept this proposal.

Please contact Richard Reinen-Hamill at rrh@tonkin.co.nz if you'd like to discuss anything about this project.

Yours sincerely

Richard Reinen-Hamill
Business Leader Natural Hazards

Attached:

- 1 Signatory page
- 2 ACENZ IPENZ Short Form Model Conditions of Engagement (April 2016) and T+T IT terms