Fran and Daniel Huelsmeyer
Ruru Building Limited

07/03/2022

By email
hello@ruru-building.co.nz

Job Title	54 Green Lane Inundation Assessment
Job Reference	J000364-LET-001-C

Dear Fran and Daniel,

Envirolink Limited has been engaged by Ruru Building Limited (the Client) to assess inundation and stormwater flow paths for a proposed development located at 54 Green Lane, Motueka. The proposed development is a commercial/industrial yard for the construction of relocatable buildings.

Background

One dwelling with sheds and outbuildings are presently located at 54 Green Lane, as shown in Figure 1 below.

Figure 1: 54 Green Lane (boundaries in yellow)

The development will involve the construction of a shed, nominally 12x50m, with carparking. Relocatable buildings will be present on site, the number and location will vary. Landscaping bunds

will be developed around the perimeter of the site. Bunds may vary slightly however nominally, 15m long bunds will be developed with a width of 8m and height of approximately 3m. Gaps of approximately 3m will be left between bunds. It is assumed that the toe of the bunds will be at least 1m within 1m the property boundary.

The proposed development layout has been prepared by Allure Architectural as a drawing entitled "Ruru HQ New Site Layout" provided to Envirolink on 4 March 2022. A section of this plan is presented in Figure 2 below.

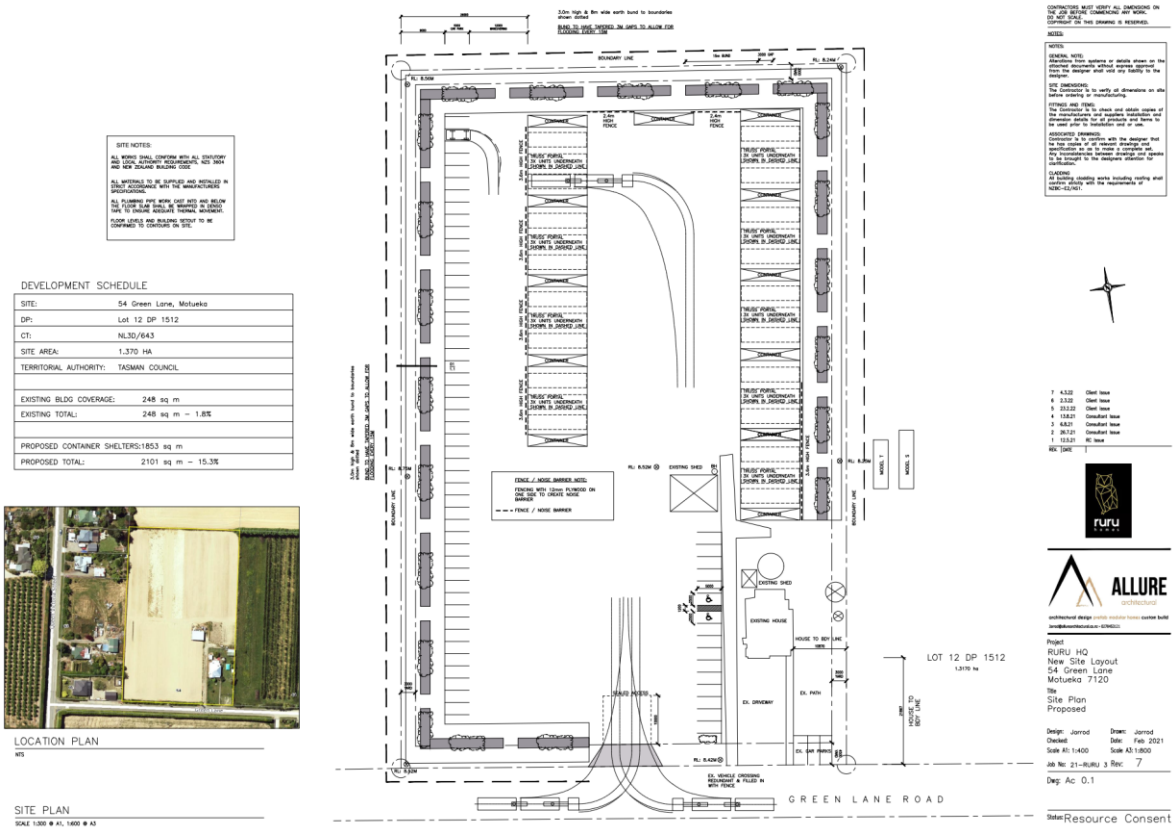

Figure 2: 54 Green Lane proposed development layout

Following submission of a Resource Consent application for the development, Tasman District Council (TDC) has identified that the proposed bund may divert flood waters. TDC have requested that the effect of the bund on stormwater flows is considered for both incidental rainfall within the catchment and in the event of a failure of the Motueka River Stop Bank. From previous discussions with TDC, Envirolink understand that the Motueka River Stop Bank has been designed for a 2% Annual Exceedance Probability (AEP) rainfall event. Present design standards require design for a 1% AEP event. Previous work by others on behalf of TDC has identified that a stop bank breach may occur during a 1% event. TDC have reviewed the different breech scenarios and determined that "Breech 1" scenario, as shown in Figure 3 below, has the most significant potential effect on this site.

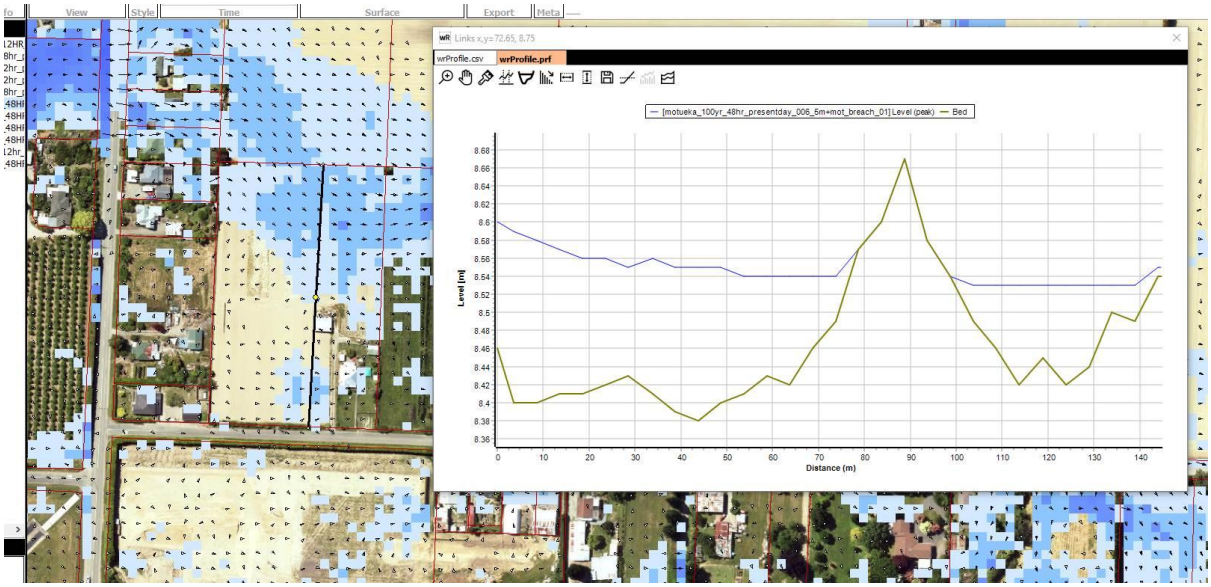

Figure 3: TDC Provided "Stop Bank Breech Scenario 1" flood model

Envirolink have undertaken an assessment of stormwater flow paths for both the stop bank "Breech 1" scenario, and for a 24 hour 1% AEP rainfall event. Following an initial assessment, the bund design was modified as directed by Envirolink to reduce diversion of stormwater flows. The purpose of this letter is to present a final assessment based on the revised bund design.

Regulatory Context

The Nelson Tasman Land Development Manual (NTLDM) requires a minimum freeboard from top water level in a 1% Annual Exceedance Probability (AEP) event to the underside of floor joists or floor slab of 500mm for habitable dwellings and 300mm for commercial buildings. All levels specified in this assessment are relative to the New Zealand Vertical Datum 2016 (NZVD 2016).

The New Zealand Building Code (NZBC) requires that surface water from an event with a 2% probability of occurring annually shall not enter buildings. The NZBC requires a building life of not less than 50 years. The NZBC requires that the floor level is set at least 150mm above the finished level of the surrounding ground.

Inundation Assessment

Inundation flow paths and depths have been assessed using a 2D HEC-RAS model. To model the pre-development condition, the existing ground surface taken from Light Detection and Ranging (LiDAR) information provided by TDC and obtained from Land Information New Zealand (LINZ) was modelled. LiDAR in this area is from combined aerial flights undertaken between 2008 and 2015. Ground recontouring after this date is not included in the model. A Manning's roughness of N=0.05 has been assumed for all models for the entire surface, consistent with a rural land use.

For the pre-development condition, the following scenarios have been assessed:

Scenario 1: Stop bank breach 1 – Inflow manipulated to match flow depths shown in the TDC provided model.

Scenario 2: A rain on grid model for the immediately adjacent catchment utilising rainfall for the 1% AEP 24 hour rainfall event. Rainfall depths have been obtained from HIRDS V4, provided by NIWA, for the "RCP 8.5" rainfall scenario as specified by the NTLDM. A detailed catchment wide assessment of runoff has not been undertaken. The rain on grid model is considered a reasonable basis to assess changes in flow paths and depths due to the proposed bunds. It is not an accurate assessment of absolute flow depths during the design event.

The extent of inundation for Scenario 1 is presented in Figure 4 below. Flow depths for Scenario 1 (mid blue) and Scenario 2 (light blue) are plotted in Figure 4.

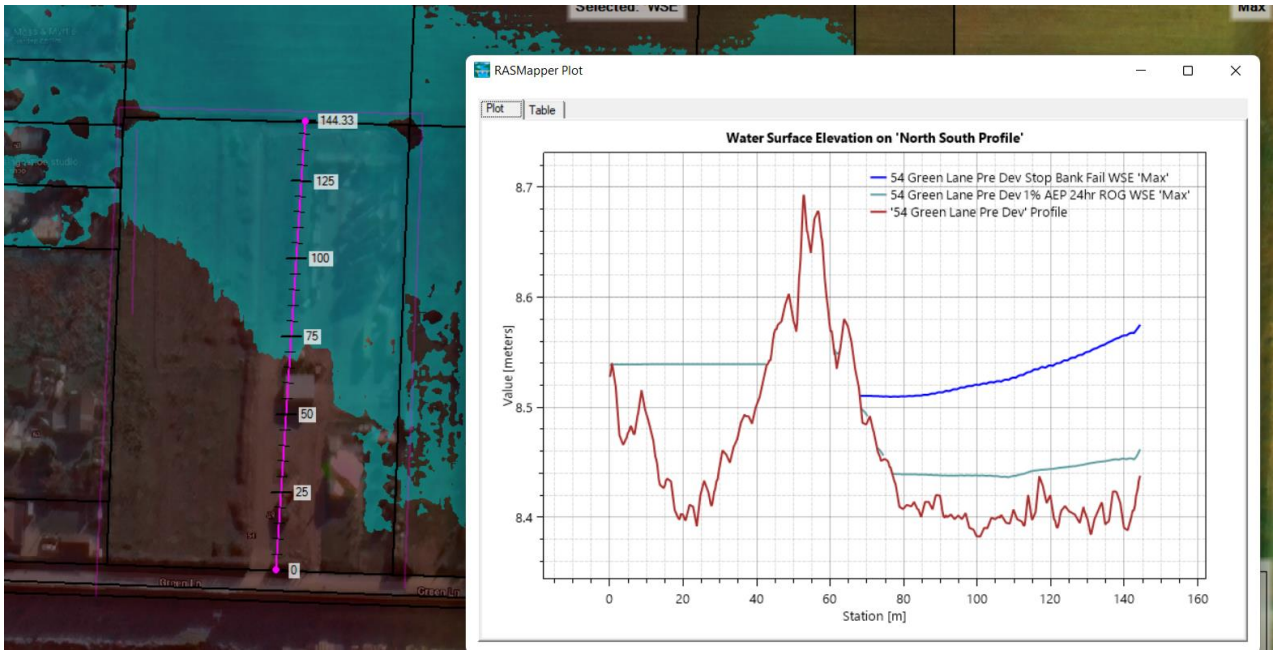

Figure 4: Pre development inundation extent (Scenario 1 site image presented)

Both the TDC provided model and the Envirolink model show an elevated section of the site adjacent to the existing shed. For Scenario 1, the Envirolink model shows similar inundation levels to the TDC model north of the elevated land, with water levels ranging from 8.51-8.6m RL for the Envirolink model and 8.54-8.6m RL for the TDC model. The Envirolink model does not show inundation south of the fill pad, as shown in the TDC model. Inflow locations and flow rates were manipulated to better replicate the TDC model however this area remained free of inundation, most likely to the considerably different model extents. Scenario 2 does show inundation in this area, with similar depth to the TDC model and hence between the two scenarios, the Envirolink model is considered a reasonable basis to assess the effect of the proposed bund on inundation. Overall, flood depths on site are typically up to 200mm however higher depths do occur in some areas of the site.

To assess changes in post development flow paths, bunds were added to the existing ground surface using HECRAS. 15m long bunds were added with gaps of approximately 3m between bunds. Bunds are nominally 2m high however, once bunds are above inundation levels, the height does not affect the outcome of the model. The exact extend of bunds will depend on the amount of fill to be managed on site however the modelled scenario is considered to represent the maximum amount of fill to be used. Bunds are illustrated in Figure 5 below.

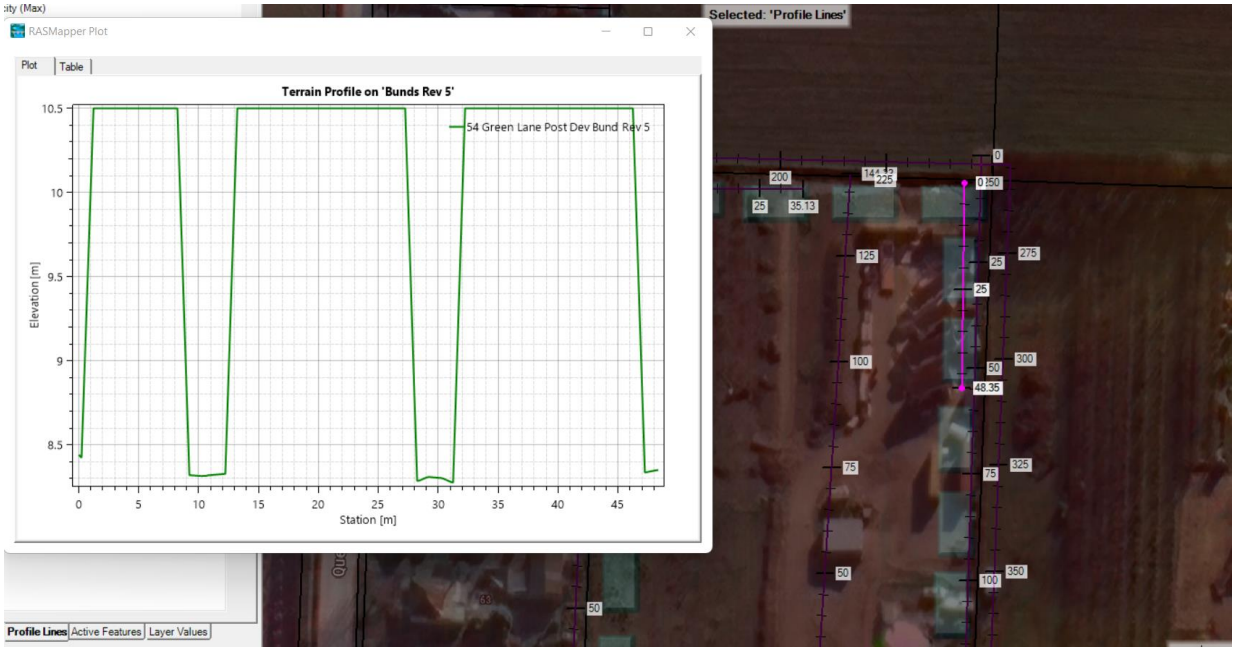

Figure 5: Bund Configurations

From preliminary investigation, a solid bund did cause a material increase in inundation depths, particularly in adjacent to51-55 Queen Victoria Street for the Stop Bank fail scenario.

With the proposed non-continuous bund, changes in flow depths are considerably reduced. The model indicates that the flow depth in the backyard of 53 Queen Victoria Street is increased by up to approximately 70mm adjacent to the boundary with 54 Green Lane, as shown in Figure 6 below.

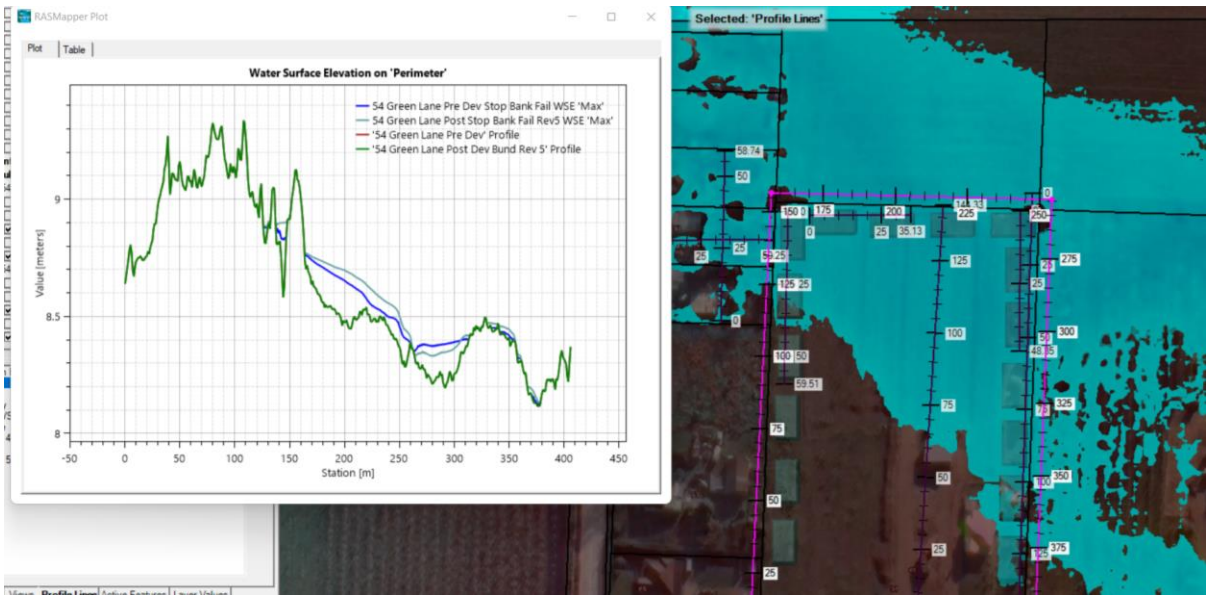

Figure 6: Pre and Post Development stop bank fail inundation depths

Adjacent to the dwelling at 53 Queen Victoria Street, flood depths change by 0mm to a maximum of 20mm as shown in Figure 7. The dwelling does not appear to be inundated regardless of the proposed bunds. Whilst the model is not considered accurate to within +/- 20mm, it does generally indicate that the effect of the proposed bunds on flood depths is not material.

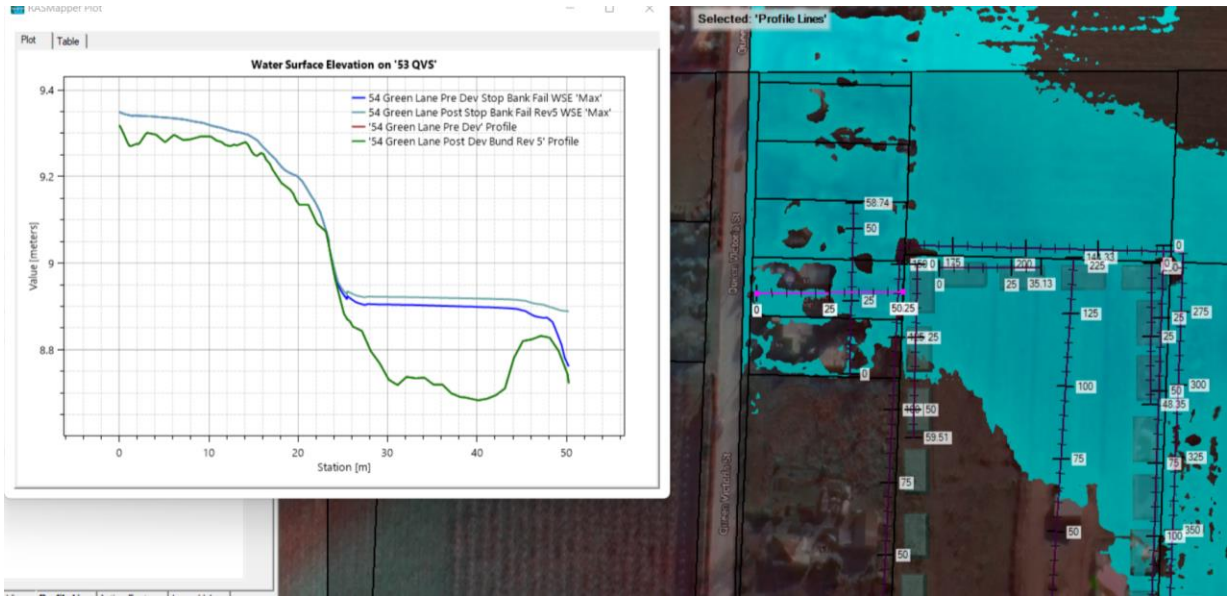

Figure 7: Pre and Post Development depths, stop bank fail 53 Queen Victoria Street

Along the northern boundary, the increase in flow depth is 0-30mm. The extent of inundation does not significantly alter and hence the model indicates that these bund configurations have a “less than minor” effect on land to the north.

For the Rain on Grid model, flow depths are lower, less than 100mm both on and off site. Non-continuous bunds have no material effect on stormwater flow paths.

The proposed fence may also cause some diversion of overland flows. It is recommended that either a 50-100mm gap is implemented under the fence, alternate fence pails are cut short of the ground level or other similar mitigation to allow some flow of water. A 50-100mm gap is inadequate to allow all runoff from a stop bank breech scenario to pass unimpeded however if a larger gap is left, adjacent landholders may fill the gap. It is considered preferable to leave a smaller gap which is less likely to be filled.

Conclusions

An assessment of inundation flow paths has been undertaken for a proposed development located at 54 Green Lane, Motueka. The site will be developed with a shed, office and yard area for the construction of relocatable dwellings. It is proposed that bunds, nominally 15m long with 3m gaps between bunds will be constructed around the perimeter of the site to mitigate visual and acoustic effects.

A 2D hydraulic model has been prepared to assess the effect of the proposed bund on overland stormwater flow paths. Two overland flow scenarios have been considered, the "Breech 1" Motueka River stop bank failure scenario, based on data provided by TDC, and a 24 hour 1% AEP "Rain on Grid" rainfall event. The highest flow depths occur during the stop bank failure scenario.

This assessment has concluded that the most significant potential effect of the bund occurs at 53 Queen Victoria Street. Adjacent to the dwelling, inundation depth increases from a maximum of 220mm with no bund to 240mm with the proposed bund. The model is unlikely to be accurate to +/10mm however it indicates that the proposed non-continuous bund will not have a material effect on stormwater flow paths. The following conditions of consent are recommended:

- Maximum 15m long bunds.
- Minimum 3m gap between bunds.
- Minimum of 50% of the fence has a gap of 100mm from the base of the fence to ground level, OR, the entire fence has a 50mm gap from the base of the fence to ground level.

Please contact the undersigned should you have any further questions regarding this assessment.

Regards

David Carlson-McColl

Water and Wastewater Engineer | CP.Eng

envirolink
Nga tangata ki putaiao

Limitations

This report has been prepared solely for the benefit of our client, Ruru Building Limited, as per our brief and consultancy agreement. The reliance by any other parties on the information or opinions contained in this report shall, without our prior written agreement, be at such parties' sole risk.

The conclusions and recommendations contained within this report have relied on information prepared by others including ground levels from Top of the South Maps and inundation modelling information provided by TDC. Envirolink has not undertaken any independent validation of this work. Further investigations such as site survey may identify conditions different to that assumed. This report has been prepared solely to address the issues raised in our brief, and shall not be relied on for any other purpose.