STATE EMERGENCY SERVICE

TASMANIAN STRATEGIC FLOOD MAP
KING ISLAND STUDY AREA MODEL CALIBRATION

REPORT

MARCH 2023

Level 1, 119 Macquarie Street
Hobart, TAS, 7000

Tel: (03) 6111 1726
Fax: (02) 9262 6208
Email: wma@wmawater.com.au
Web: www.wmawater.com.au

TASMANIAN STRATEGIC FLOOD MAP
KING ISLAND STUDY AREA MODEL CALIBRATION

REPORT

MARCH 2023

Project Tasmanian Strategic Flood Map King Island Study Area Model Calibration	**Project Number** **120038**
Client STATE EMERGENCY SERVICE	**Client's Representative** Chris Irvine
Project Manager Fiona Ling	

Revision History

Revision	Description	Distribution	Authors	Reviewed by	Verified by	Date
0	Draft report for review	Luke Roberts, SES	Sarah Blundy, Fiona Ling, Audrey Lau	Daniel Wood	Mark Babister	APR 22
1	Report updated with responses to review comments	Luke Roberts, SES	Sarah Blundy, Fiona Ling, Audrey Lau	Daniel Wood	Mark Babister	MAY 22
2	Report with minor revisions	Chris Irvine	Sarah Blundy, Fiona Ling, Audrey Lau	Daniel Wood	Mark Babister	MAR 23

Cover image: From 10 must do things on king island Tasmania, https://yentldoggen.com/10-must-do-things-on-king-island-tasmania/

TASMANIAN STRATEGIC FLOOD MAP
KING ISLAND STUDY AREA MODEL CALIBRATION

TABLE OF CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF DIAGRAMS

LIST OF ACRONYMS

AEP	Annual Exceedance Probability
ALS	Airborne Laser Scanning
AMS	Annual Maximum Series
ARF	Areal Reduction Factor
ARR	Australian Rainfall and Runoff
ATP	Areal Temporal Patterns
AWAP	Australian Water Availability Project
AWS	Automatic Weather Station
Bureau/BoM	Bureau of Meteorology
CFEV	Conservation of Freshwater Ecosystem Values (DPIPWE)
CL	Continuing Loss
DEM	Digital Elevation Model
DPIPWE	Department of Primary Industries, Water and Environment
DRM	Direct Rainfall Method
DTM	Digital Terrain Model
FFA	Flood Frequency Analysis
FLIKE	Software for flood frequency analysis
FSL	Full Supply Level
GIS	Geographic Information System
GEV	Generalised Extreme Value distribution
GPS	Global Positioning System
HSA	Human Settlement Area
ICM	Infoworks ICM software (Innovyze)
IDW	Inverse Distance Weighting
IL	Initial Loss
IFD	Intensity, Frequency and Duration (Rainfall)
LiDAR	Light Detection and Ranging
mAHD	meters above Australian Height Datum
PERN	Catchment routing parameter in RAFTS
Pluvi	Pluviograph – Rain gauge with ability to record rain in real time
QAQC	Quality assurance and quality control
R	Channel routing parameter in WMAWater RAFTS WBNM hybrid model
RAF	RAFTS Adjustment Factor
RAFTS	hydrologic model
SCE	Shuffled Complex Evolution
SES	State Emergency Service
TUFLOW	one-dimensional (1D) and two-dimensional (2D) flood and tide simulation software (hydrodynamic model)

1. INTRODUCTION

Flooding occurs regularly throughout Tasmania; the Bureau of Meteorology describes numerous major flood events that have occurred since the early 1800s. Following the 2016 Tasmanian floods, the need for state and local governments, communities and emergency response agencies to better understand flooding in Tasmania was identified. Improved flood intelligence would allow for targeted and appropriate investment in flood recovery and increased community resilience to future flood events. The Independent Review into the Tasmanian Floods of June and July 2016 found that there were gaps in flood studies and flood plans over Tasmania, both in comprehensiveness and currency.

The objectives of the Tasmanian Strategic Flood Mapping Project are to assist flood affected communities to recover from the 2016 floods through a better understanding of flood behaviour, and to increase the resilience of Tasmanian communities to future flood events. The targeted outcomes of the project are that post-flood recovery will be informed by up-to-date flood risk information, ownership of flood risk is appropriately allocated, flood risk can be included in investment decisions, and responsibility for flood mitigation costs can be appropriately allocated.

The Tasmanian Flood Mapping Project aims to address the objectives and outcomes by:

- providing communities with access to a high resolution digital terrain model that can be used for flood modelling, through collection of LiDAR data over Tasmania
- developing state-wide Strategic Flood Maps to support flood risk assessment and post event analysis and
- partnering with Local Government to deliver detailed flood studies and evacuation planning for communities with highest flood risk that do not have a current flood study.

This project addresses the second component of the Tasmanian Flood Mapping Project, the development of state-wide Strategic Flood Maps.

This report describes the calibration of hydrologic and hydrodynamic flood models for the King Island study area.

2. STUDY AREA

The King Island study area is situated to the north west of Tasmania. The north of the island is generally low lying, with the highest mountain on the island, Gentle Annie, rising to 160 m in the south. There are many small rivers and creeks on King Island which discharge directly into Bass Strait.

The population of King Island is 1,585 (2016 census). The main towns on King Island are Currie (population of 768), Grassy (population of approximately 140), and Naracoopa (population of approximately 60). The main industries on King Island are beef, dairy, fishing and tourism.

The Bureau of Meteorology identified a significant rainfall event over King Island in 1946.

King Island has an area of 1,098 km^2. The King Island study area and the available gauge information are shown in Figure 1. Landuse in the King Island study area is shown in Figure 2.

3. AVAILABLE DATA

There was one flow gauge that operated on King Island from 1981 to 1994. Other than the 1946 event, there were no large flood events on King Island in the 13 events supplied by the Bureau of Meteorology for this project. There was no sub-daily rainfall data available on King Island prior to 1994. Given that there was no overlap between the operation of the flow gauge and the sub-daily rainfall gauges, it was decided that there was limited value in identifying additional calibration events for King Island. The January 2011 event was investigated, as this was large for some areas in the north-west of Tasmania, but the rainfall was not large on King Island for this event.

3.1. Historic Rainfall Data

Rainfall data was provided by Bureau of Meteorology as part of the initial project data. The data provided included sub-daily rainfall timeseries data from four different sources: Automatic Weather Station (AWS) data, pluvio data, rolling accumulated rainfall from the Bureau's flood warning network, and 10 minutely accumulation from the Bureau's flood warning network. The datasets were in different formats and required processing to a common format before they could be used to produce rainfall inputs to the model. Rainfall data was provided for 13 events identified by the Bureau of Meteorology for use as calibration events for this project, although not all 13 events have data available or were significant events in the King Island study area (see Data Review Report WMAwater (2020) for details on calibration events). The 1946 event was the only event with significant rainfalls over King Island.

The AWS and pluvio data were found to be the most consistently reliable data. Where multiple data sources were available at the same site, AWS or pluvio data were prioritised for use over the event or accumulated data. Data that was recorded less frequently than at 3 hour intervals was excluded from the analysis.

A summary of the rain gauges and rainfall totals for this study area is shown in Table 1. There was no sub-daily rainfall data available on King Island for the February 1946 event, therefore data from Burnie gauge, on the north coast of Tasmania was used to define the rainfall temporal pattern. This site is approximately 250 km from King Island. Rainfall totals for the highest rain day, the 19th of February, were similar at Burnie and across King Island with 108 mm at Burnie and between 100 and 170 mm at the daily gauges across the island. There was no rain on the 18th of February at Burnie so the approximately 10-25 mm of rain on King Island was distributed evenly across the day. Given the distance from King Island to the Burnie gauge, it is likely that temporal pattern of rainfall at the Burnie gauge will not be an accurate representation of temporal distribution of rainfall over the King Island study area. The gauges on King Island are shown in Figure 1 for the 1946 event.

Table 1: Available Rainfall Information

	February 1946
Number of Sub-daily Stations Available within the study area	0
Number of daily Stations Available within the study area	8
Number of sub-daily surrounding gauges ~15km	0
Number of daily surrounding gauges ~15km	0
Rainfall Totals	130-170 mm
Approx duration of rainfall event (hours)	48*

*Estimated based on review of daily rainfall totals on King Island. The actual duration may be shorter than 48 hours.

The daily and sub-daily rain gauge data were used to create rainfall surfaces for the selected calibration event using an inverse distance weighting method. The method is described in detail in WMAwater 2021 and is summarised below.

1. Daily rainfall data from all gauges within Tasmania was extracted for each of the seven calibration events from 2000 – 2018
2. Rudimentary QAQC and infilling of daily record was undertaken
3. Daily rainfall surfaces for each event were fitted using all daily and available pluviograph data, using Inverse Distance Weighting (IDW)
4. Sub-catchment rainfall depths were calculated from all grid cells within the sub-catchment using areal weighted averages
5. Daily data in each sub-catchment was disaggregated using the temporal pattern from gauge assigned using Thiessen polygon method.

The rainfall surface for the 1946 event is shown in Figure 3.

3.2. Dam information

There is one significant dam in the King Island study area, operated by TasWater. Upper Grassy Dam was built in 1965 on the lower reaches of the Grassy River. The dam discharges directly into Lower Grassy Dam, which then discharges into the estuary. Upper Grassy Dam impounds a reservoir of 191.5 ML at FSL. Spillway and storage rating curves were provided by TasWater for this project. Lower Grassy Dam is operated for mining purposes, and has a capacity of 98 ML.

3.3. Flood Levels and Extents

There was no information on flood levels or extents provided for this study area.

4. METHODOLOGY OVERVIEW

The hydrological and hydrodynamic model calibration methodology has been outlined in the Hydrology Methods Report (WMAwater, 2021a) and the Hydrodynamic Methods Report (WMAwater 2021b). Details on the methods are only included in this report where they deviate from the methods described in these reports or are specific for this catchment.

The modelling method includes the following steps:

- Data preparation
  - Extraction and collation of rainfall data for identified calibration events
  - Gridding rainfall data across each catchment
  - Extraction of flow data for identified calibration events at each flow site, and assessment of suitability of this data for calibration
- Hydrologic modelling
  - Identification of flow gauge locations
  - Identification of dam and diversion locations
  - Sub-catchment delineation in GIS
  - Inclusion of dam storage and spillway ratings where required and available
  - Run hydrologic model with zero losses and default parameters with rainfall for the identified event
  - Confirm the response between the external hydrologic model and ICM hydrodynamic model is consistent to enable design event analysis
- Hydrodynamic modelling in ICM
  - Importing base DEM
  - Setting roughness values, referencing calibrated PERN value from hydrologic model
  - Meshing
  - Incorporation of structures
  - Setting up rainfall inputs (depth and temporal pattern), losses and dam/diversion outflows from the hydrologic model
  - Run model for identified event
  - Compare model results with hydrologic model runs

5. HYDRODYNAMIC MODEL SETUP

5.1. Digital Elevation Model (DEM)

The base dataset that was used for the digital elevation model (DEM) of the hydrodynamic model was the SES state-wide 10 m DEM merged with 2 m DEM subsets at the gauges (where available). There is no LiDAR taken at the gauge, therefore the SES state-wide 10 m DEM is used for the whole island. Where no terrain information was available in the tidal zones, a ground level of -10 mAHD was applied in GIS to the clipped DEM. The resulting DEM (Diagram 1), was then imported into ICM via the grid import interface.

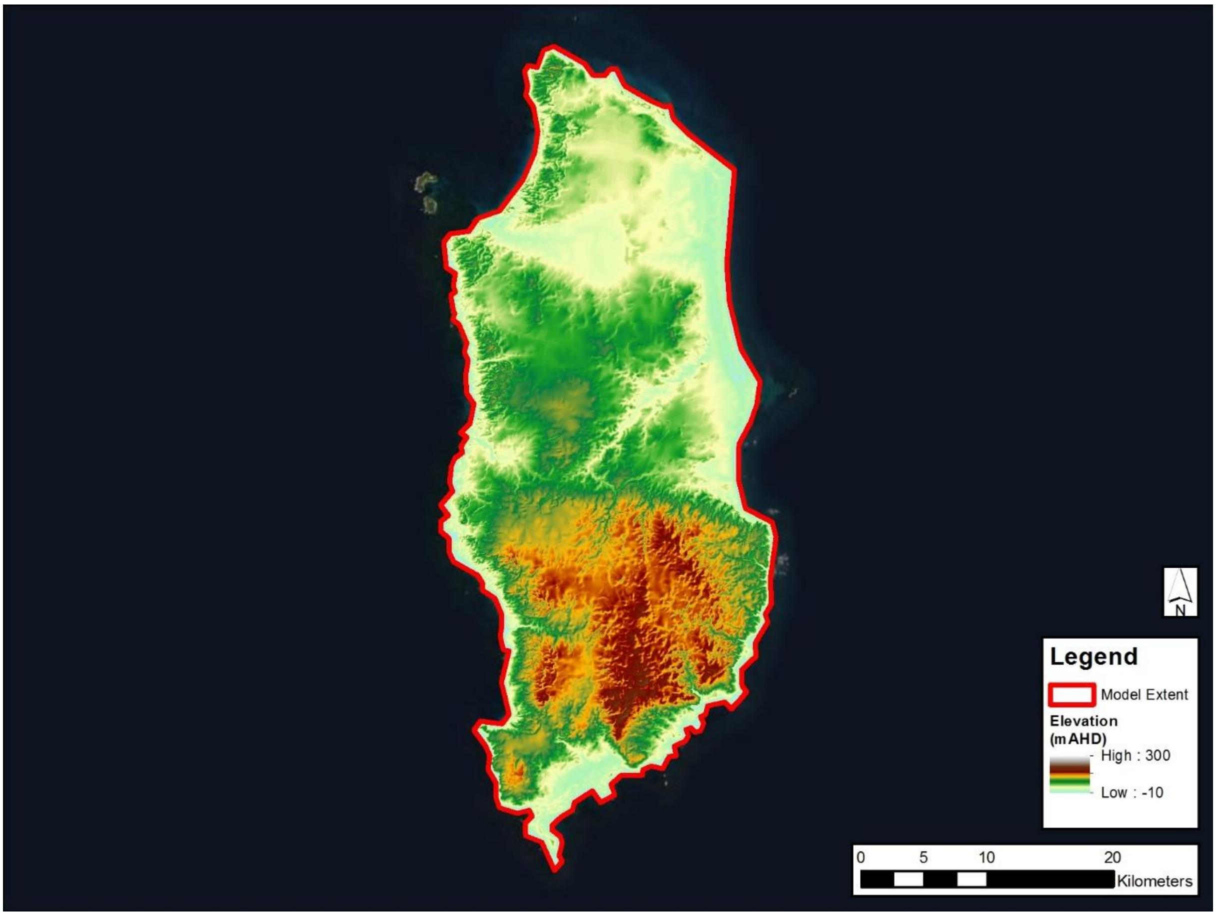


Diagram 1: DEM of the King Island study area

The majority of King Island is covered by the 'Default DTM'. Only areas around the townships of Grassy, Currie and Naracoopa are covered by LiDAR data. The 'Default DTM' is understood to be comprised primarily of photogrammetric contour data and has been used specifically in the lower reaches of the catchment (Diagram 2). The 'Default DTM' is therefore likely to be a poor representation of the topography of the area. Additionally, it is understood that the 'Default DTM' provided for the modelling was pre-processed to include the estimated bathymetry of watercourses.

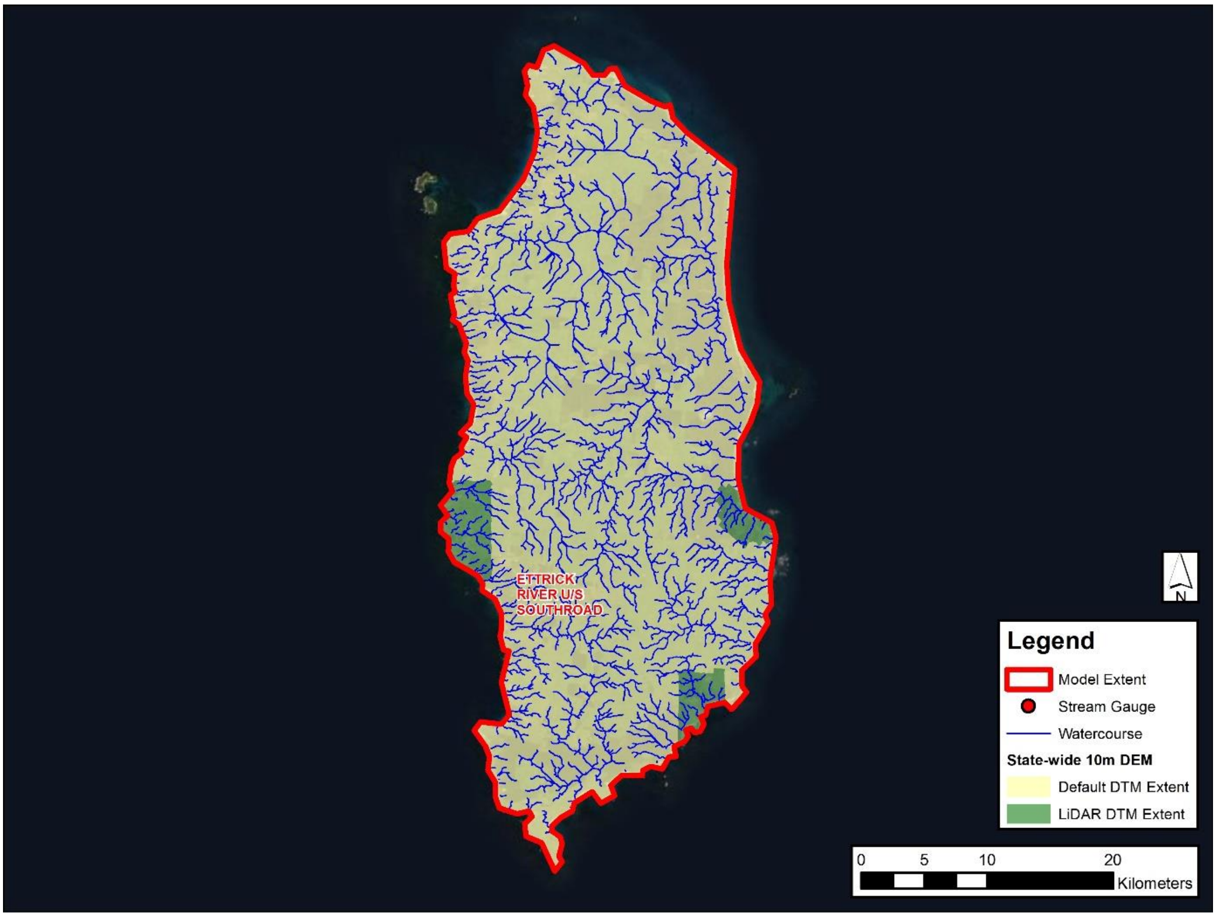


Diagram 2: 'Default DTM' extents for the King Island study area

5.2. Roughness

The base information for the roughness grid was the roughness raster provided by SES for this project. The whole of state dataset was converted to a set of polygons for each land use zone in GIS, and the dataset was cleaned to ensure that the geometry was valid. This data was then exported as a csv file to link land use to friction values.

It is noted that at this stage the roughness values for streams vary greatly with sections of Manning's n of 0.1 crossing streams in many locations. This issue is an artefact of the simplification of the roughness layer when it is converted into triangles. Where the issue was severe, a 20 m buffered zone of single roughness of 0.05 for all streams was utilised. 0.05 was selected as in the upper reaches the computation of levels in triangles also results in artificial attenuation of flow, and thus a slightly lower value than the norm was utilised.

This change will be revised on a case-by-case basis in future assessments as it is managing a very specific issue. The values derived are shown in the 'Hydrodynamic Modelling Report'. The roughness layer in ICM is shown in Diagram 3.

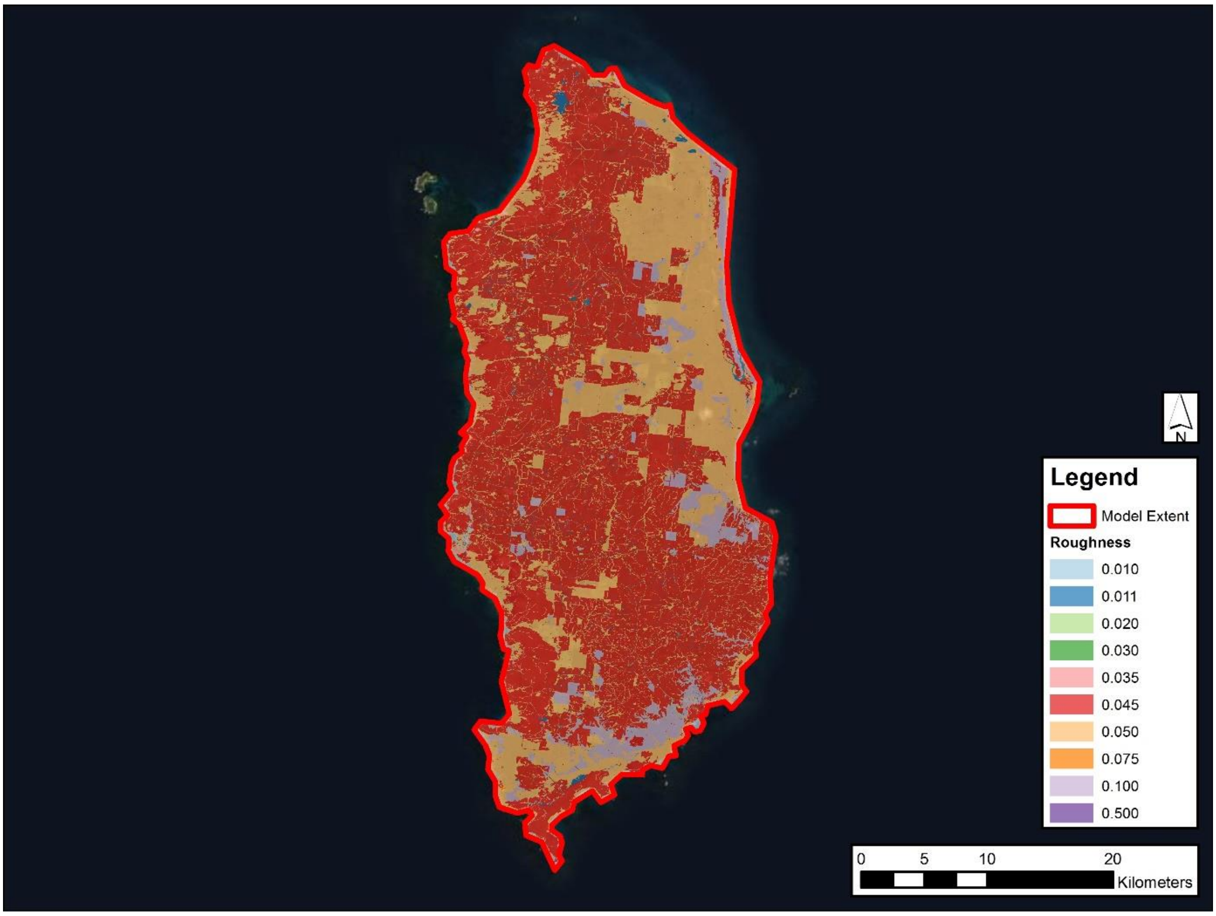


Diagram 3: Roughness layer for the King Island study area

5.3. Meshing

Meshing in ICM was undertaken using zones, with the following rules:

- Base 2D zone – regional extent mesh size set to a maximum of 2500 m^2 with a minimum of 400 m^2
- Stream zone – set as an independent area with a maximum mesh size of 400 m^2 and a minimum of 100 m^2
- Human Settlement Area – set as an independent mesh zone with a maximum area of 100 m^2 and a minimum of 25 m^2
- Upper stream reaches – streamlines of Strahler order 2-5 were buffered by 10 m either side of the centre line with Strahler order 6-8 buffered by 20 m either side of the centre line and incorporated into the hydrodynamic model as a mesh zone. The mesh zones had a maximum area of 150 m^2. This process was to ensure that the meshing process did not result in artificial blocking of the flow paths along main stream lines.

The resulting mesh zones for the King Island study area are shown in Diagram 4.

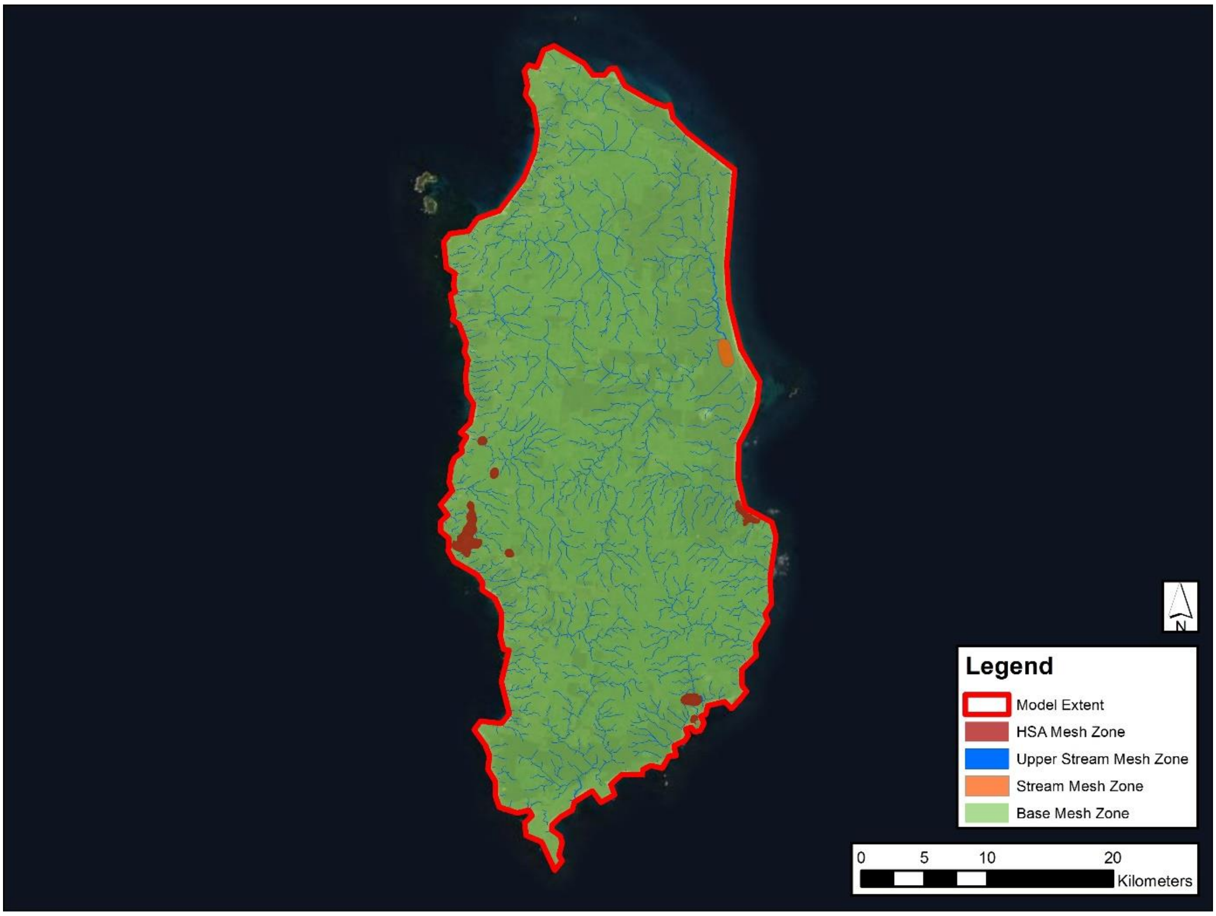


Diagram 4: Mesh zones for the King Island study area

5.4. Structures

Bridges are represented within the ICM model as linear 2D bridge structures, using the SES state-wide bridge database for location and reach of associated structures.

For the King Island study area only one bridge longer than 30 m was identified and imported into the hydrodynamic model. This bridge was located at Sea Elephant River on Reekara Road. Further discussion on this process is provided in the Hydrodynamic Modelling Methods Report (WMAwater, 2021b). No major culverts were identified.

5.5. Dams and Storage areas

Upper Grassy Dam was modelled using storage and spill ratings provided by TasWater.

5.6. Downstream Boundaries

Downstream boundaries were applied at the base of the model to provide interaction with the tidal zone. Synthetic tide data was provided by the Bureau of Meteorology (BOM) for the original 13 calibration event and was used to set a varying tide level for the calibration events. This data was extracted off the coast of the Disappointment Bay at 10 min time increments and was imported into ICM as a time varying boundary condition. Diagram 5 shows the synthetic tide data that was extracted for the 1946 event.

Note there is no calibration information to verify the function of the tailwater condition, thus no allowance for local storm effects has been undertaken. It is considered the synthetic tide data are reasonable estimations of tailwater levels for the purposes of calibration assessment.

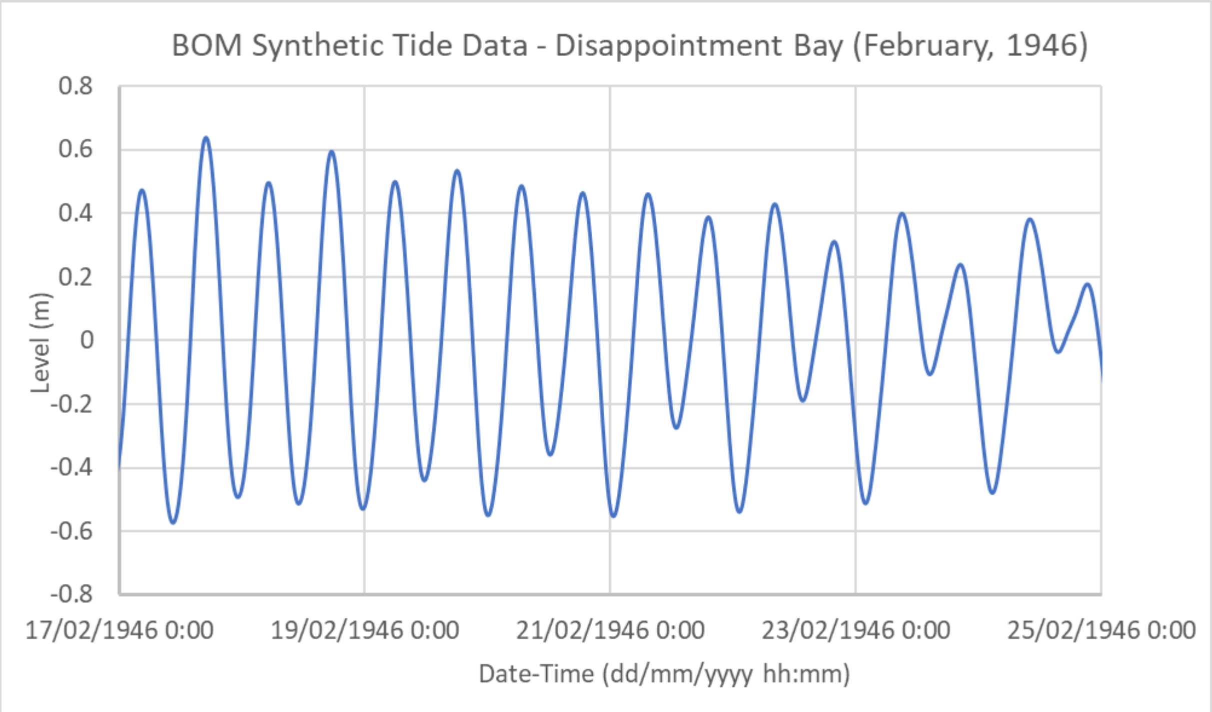


Diagram 5: Synthetic tide data off the coast of Disappointment Bay for the February 1946 calibration event

5.7. Flow Application for Hydrodynamic Modelling

Two approaches were used for application of flow in ICM:

- ICM-RAFTS sub-catchment routing, applied to each sub-catchment in the model at the downstream end of the sub-catchment
- Direct rainfall to model overland flow (short duration events).

The reason for using two approaches is to enable the model to be run efficiently for longer durations by limiting the number of cells wet, focusing on the major tributary flooding while also ensuring the local areas in the upper tributaries are mapped for short duration flooding.

The two flow scenarios sit within the same ICM hydrodynamic model as alternative flow condition scenarios (base and direct rainfall). For the calibration events, the ICM-RAFTS approach is used, where the rainfall information is derived from rainfall files created by the hydrologic model.

For the design events, an envelope of the ICM-RAFTS approach and the design rainfall approach will be used. Rainfall and temporal pattern information derived from the ARR datahub will be used to establish the design rainfall and temporal pattern information for the ICM-RAFTS approach and a synthetic, duration independent storm will be used to assess a range of storm durations and temporal patterns in a singular rainfall event for the design rainfall approach.

5.7.1. ICM-RAFTS Sub-catchment Routing

For the ICM-RAFTS sub-catchment routing, the RAFTS model within ICM was used to calculate the hydrologic routing at each sub-catchment. Rainfalls, model information and model parameters developed through the external hydrologic model were imported into ICM through the open data input tool.

The information imported into ICM included:

- Sub-catchment name
- Slope
- PERN
- RAF
- Initial and Continuing Loss
- Sub-catchment rainfalls (for calibration events)

Each sub-catchment is connected directly to the 2D mesh surface at the downstream end of the catchment. The RAFTS sub-catchment model setup in ICM for the King Island study area is shown in Diagram 6. Figure A 1 and Figure A 2 show the hydrological soil groups used to distribute the CL and the average PERN used for each sub-catchment.

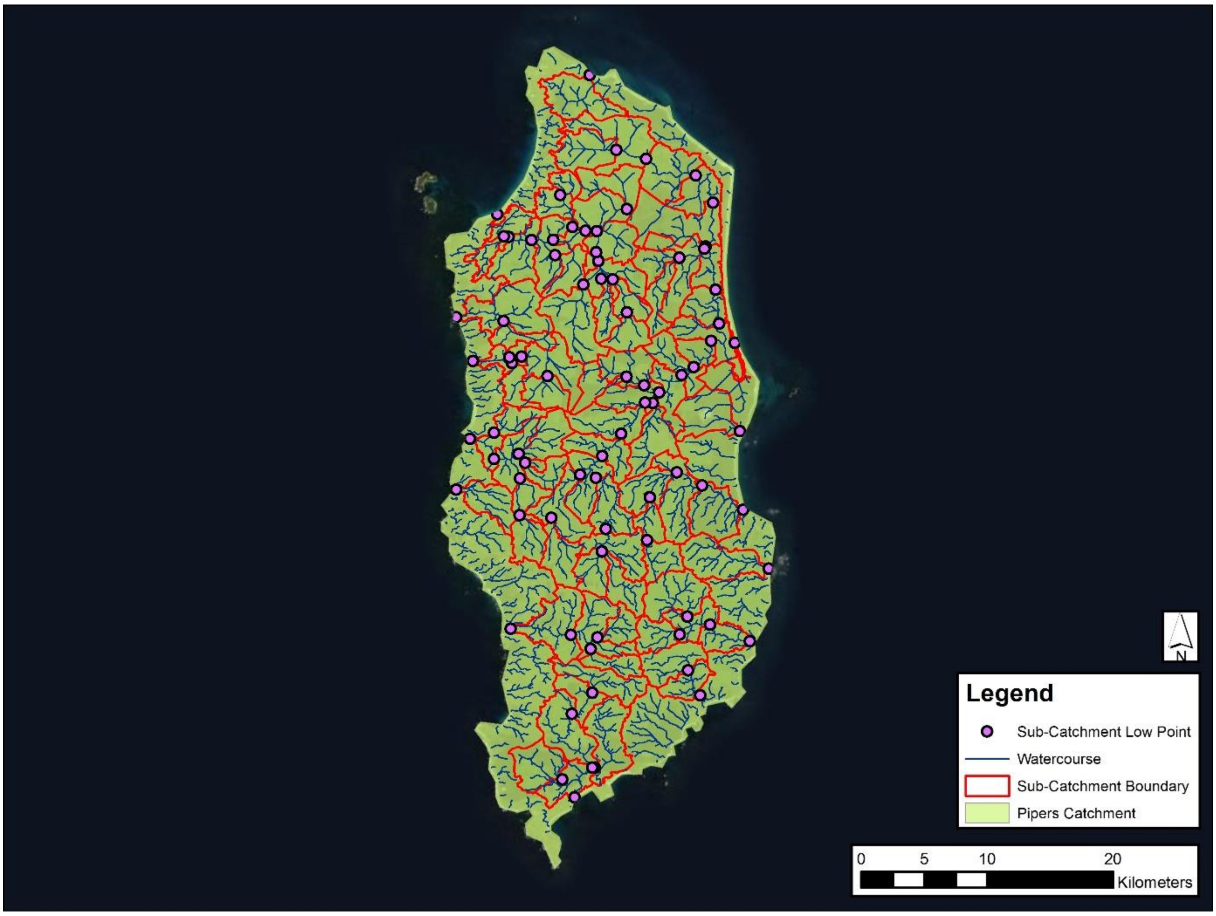


Diagram 6: RAFTS sub-catchment model setup in ICM for the King Island study area

6. CALIBRATION RESULTS

There were no events identified that could be used to calibrate a model for King Island. The ICM model was prepared for modelling of design events following the methodology outlined in WMAwater 2021a and 2021b, and was run for the 1946 event with zero losses and an RAF of 1.

It was found that the model results were very poor due to the poor representation of flow paths in the DEM, based on comparison to mapping and aerial photography (Section 6.1). The flow comparisons between the hydrodynamic and the external hydrology model in Appendix C reflect the issues with the DEM. It was not considered that acceptable flood mapping could be produced for this study area using the regional flood methodology agreed for this project, therefore no flood maps are presented.

6.1. Identified Issues

The following issues and limitations were identified, which should be investigated further if future detailed analysis is undertaken:

- The DEM is largely limited to the 'Default DTM' of the state-wide 10 m DEM. This results in a very poor representation of flooding with unrealistic flood paths. The definition of the elevation in this area is not sufficient to define flow paths, and the resulting flood extents produced from the model are incorrect.

  An example showing an artificial choke point in the DEM that resulted in incorrect floodplain storage is shown in Diagram 7. An example of an incorrect flow path in the DEM is shown in Diagram 8.
- The Mannings ‘n’ roughness layer has deficiencies in some areas. In the state-wide methodology, the upper stream layer provided by SES is buffered by 10m and added to the roughness layer. The roughness ‘n’ value of 0.05 is applied to the stream roughness polygon. However, the location of the streams is incorrect, especially in flatter areas, when compared to the aerial image (Diagram 9). This should be reviewed in the future if further flood modelling is undertaken.
- There is limited sub-daily rainfall information available on King Island. This may result in any derived rainfalls over the study area not well representing the actual rainfall for these events.
- There is limited flow gauge data available for the study area, and the period of operation of the flow gauge did not coincide with availability of sub-daily rainfall data on King Island.

Modelling of the township areas covered by LIDAR data could be undertaken for design using direct rainfall only for areas not likely to be impacted by riverine flooding. For these areas of townships, flows derived from the hydrologic model could be directly input to an ICM hydrodynamic model covering these areas only, if there is sufficient definition of the river in the ICM model. In the current model, using the agreed methodology, the issues with flow paths mean that flows are incorrect in these areas and the resulting flood maps are not representative of on-ground conditions.

If further modelling is required in this area, it is recommended that future works aim to address issues through access to improved topographic data (such as LiDAR capture), and reinstatement or installation of a flow gauge on King Island. TasWater holds some records of water levels in Upper Grassy Dam and these could possibly be used in conjunction with information on extractions to derive inflows to the dam, which could be used for model calibration.

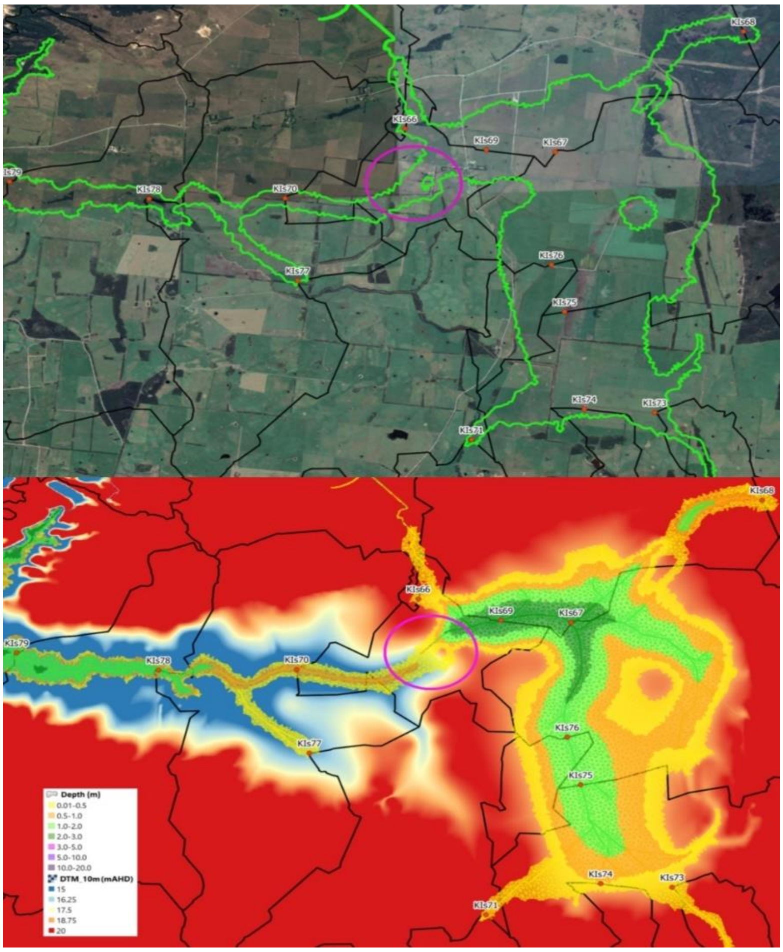


Diagram 7: Example of artificial choke point in model that created a floodplain storage.

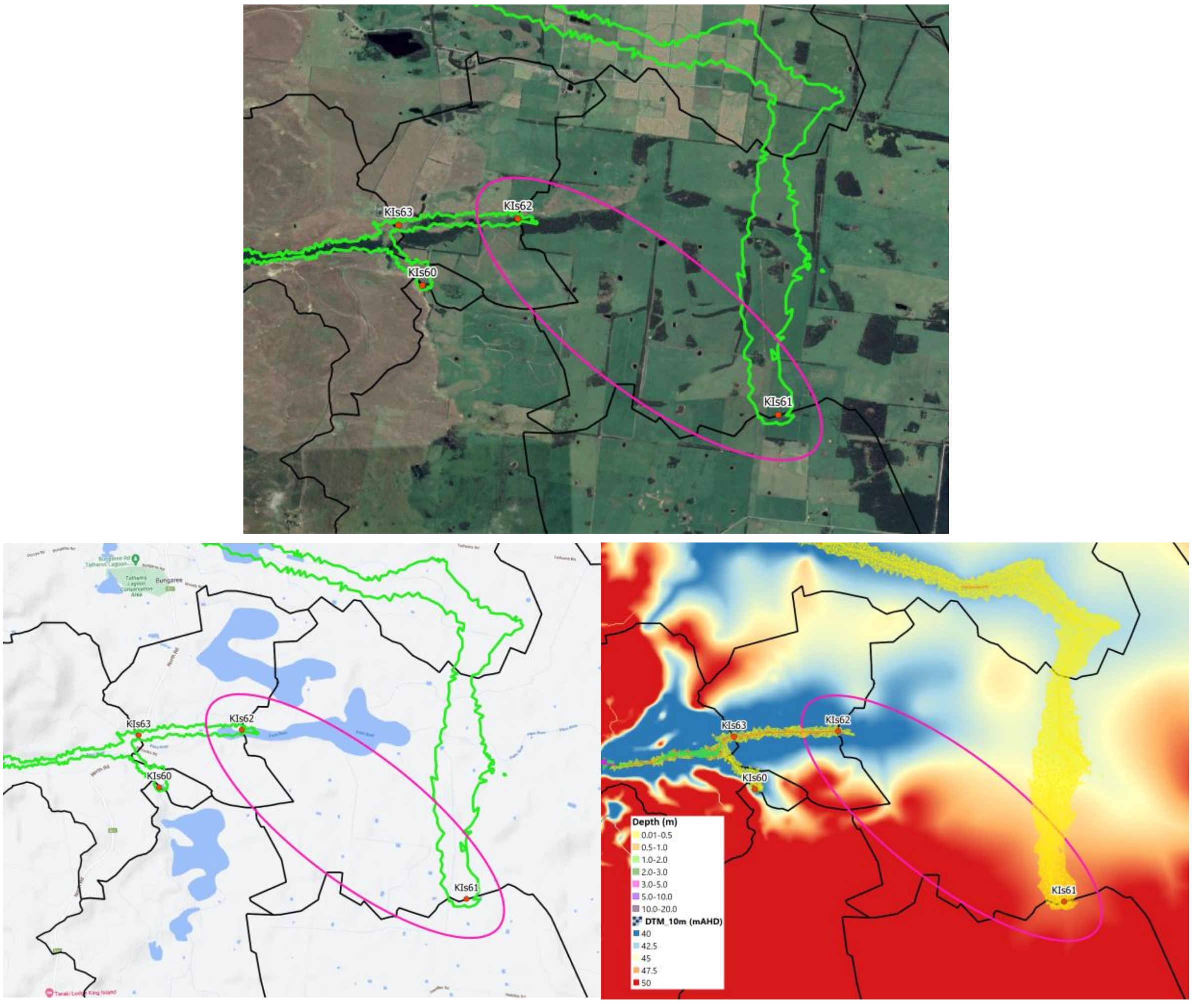


Diagram 8: Example of incorrect flow paths in the model. The pink circle shows the actual flow path based on the aerial image (top) and the terrain map (bottom left). The green extent and the mesh (bottom right) shows the flood extent in the ICM model.

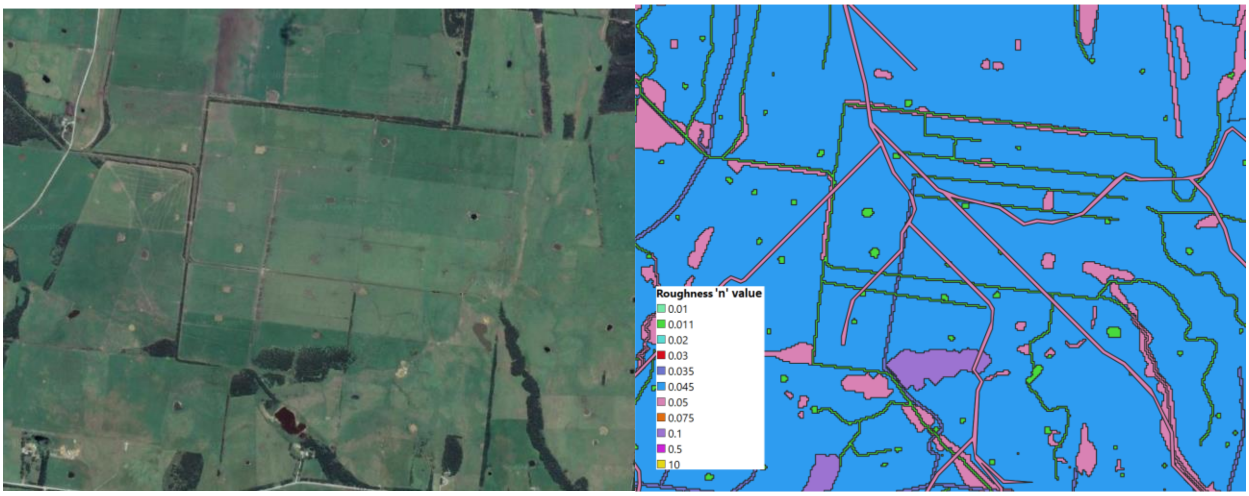


Diagram 9: Comparison of ICM roughness layers (right pane) and the aerial image.

7. UNCERTAINTY ASESSMENT

The Bureau of Meteorology identified February 1946 as a large event in the King Island study area. There was one flow gauge that operated on King Island from 1981 to 1994. Other than the 1946 event, there were no large flood events on King Island in the 13 events supplied by the Bureau of Meteorology for this project. There was no sub-daily rainfall data available on King Island prior to 1994. Given that there was no overlap between the operation of the flow gauge and the sub-daily rainfall gauges, it was decided that there was limited value in identifying additional calibration events for King Island.

Due to the very limited rainfall, flow and water level data available for calibration, and the low resolution of the underlying data for the DEM, it is considered that there is insufficient information to produce a calibrated model for this study area. The design model for this area will use losses and routing parameters derived for other study areas, based on soil types and catchment characteristics. The King Island study area is covered by the 'Default DEM' in all areas except for some very small areas around towns. This has resulted in significant unrealistic ponding in the model, to the extent that it was not possible to produce acceptable flood mapping using the regional flood modelling methodology agreed for this project.

The uncertainty assessment for the modelling is shown in Table 2 and Appendix B.

Table 2: Uncertainty assessment for King Island study area model

Category	Quality statement
Hydrology – rainfall input quality	The quality of the rainfall data is generally poor. There are no sub-daily rain gauges within the King Island study area for the February 1946 event and a site at Burnie was used to define rainfall temporal patterns. Sub-daily rainfall data is available in the study area from 1994.
Hydrology – observed flows	There is one gauge site with data available within the King Island study area, however the gauge was operational between 1981 and 1994 only, and the period of operation does not coincide with availability of sub-daily rainfall data over King Island.
Hydrology – calibration events	The February 1946 event was identified as a high rainfall event over King Island by the Bureau of Meteorology
Hydrology – calibration results	No calibration was possible for this study area
DTM definition	The base dataset that was used for the digital elevation model (DEM) of the hydrodynamic model was the SES state-wide 10 m DEM. The "default DTM" covered the entire study area, other than some very small areas around townships on King Island, where LiDAR data was available. This is likely to be a very poor representation of the topography of the area. The DTM definition is considered to be poor and does not provide enough definition to adequately define flow paths in the model.
DTM waterways	No bathymetric data was available and waterway definition was based on the DEM, and waterway definition is considered to be very poor.
Hydrodynamic – calibration results, peak levels	No calibration was possible for this study area

Category	Quality statement
Hydrodynamic – calibration results, flood extents	No flood extents were available in this study area
Hydrodynamic – calibration results, flood depths	No flood depths were available in this study area

8. REFERENCES

Babister, M., Trim, A., Testoni, I. & Retallick, M (2016): The Australian Rainfall & Runoff Datahub 37th Hydrology and Water Resources Symposium Queenstown NZ, 2016 available at http://data.arr-software.org/

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (2019): Editors Australian Rainfall and Runoff: A Guide to Flood Estimation Commonwealth of Australia, Australia, 2019

Bureau of Meteorology (2021). Australian Baseline Sea Level Monitoring Project Hourly Sea Level and Meteorological Data. Bureau of Meteorology, Victoria, Australia URL: Australian Baseline Sea Level Monitoring Project Hourly Sea Level and Meteorological Data (bom.gov.au)

Bureau of Meteorology (2020). Rainfall Map Information. Bureau of Meteorology, Victoria, Australia URL: http://www.bom.gov.au/climate/austmaps/about-rain-maps.shtml

Bureau of Meteorology (2019). 2016 Rainfall IFD Data System. Bureau of Meteorology, Victoria, Australia URL: http://www.bom.gov.au/water/designRainfalls/revised-ifd/

DPIPWE (2009): Dam Permit Locations – The List Map. https://www.thelist.tas.gov.au/app/content/data/geo-meta-data-record?detailRecordUID=94cdc4f5-07f6-4ac7-9db1-0c21d3715e32

DPIPWE (2019): Hydrologic Soil Groups of Tasmania (Unpublished). Department of Primary Industries and Water, Hobart, Tasmania. Created March 2019

Tasmanian Irrigation (2021): Active Schemes List – Scheme Snapshots. https://www.tasmanianirrigation.com.au/active-schemes-map

WMAwater (2020): Tasmanian Strategic Flood Map Data Review, September 2020. Report for State Emergency Service, Tasmania.

WMAwater (2021a): Tasmanian Strategic Flood Map Hydrology Methods Report, August 2021. Report for State Emergency Service, Tasmania.

WMAwater (2021b): Tasmanian Strategic Flood Map Hydrodynamic Model Methods Report, August 2021. Report for State Emergency Service, Tasmania.

WMAwater (2021c): Tasmanian Strategic Flood Map, Flow Gauge Rating Revision, May 2021.

WMAwater (2021d): Tasmanian Strategic Flood Map, Addition Calibration Event Rainfalls, Nov 2021.

Figures

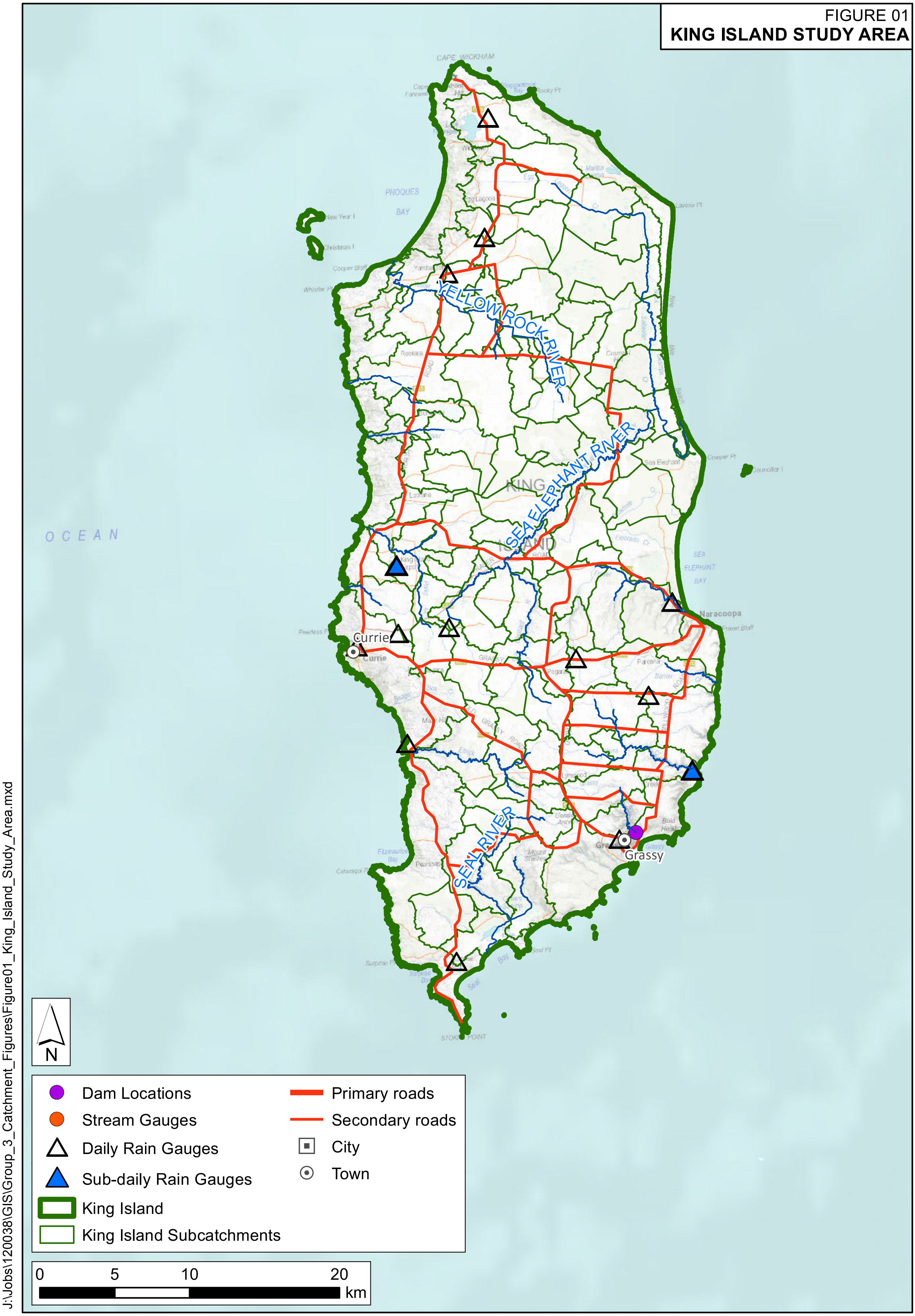
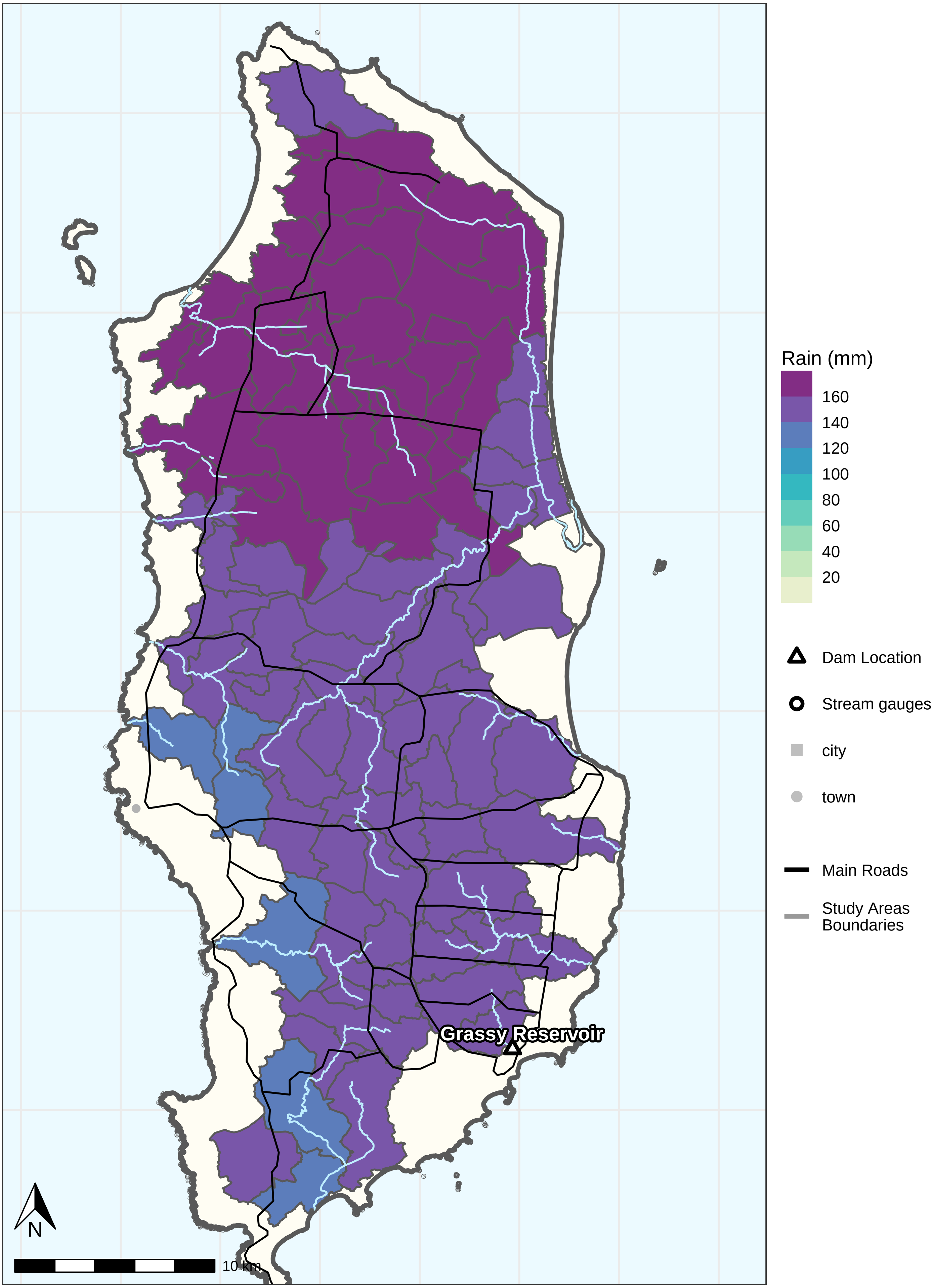


FIGURE 01
KING ISLAND STUDY AREA
CAPE WICKHAM
PHOQUES
BAY
YELLOW ROCK RIVER
SEA ELEPHANT RIVER
SEAL RIVER
KING
ISLAND
OCEAN
SEA
ELEPHANT
BAY
Naracoopa
Currie
Grassy
STOKES POINT
N
Dam Locations
Stream Gauges
Daily Rain Gauges
Sub-daily Rain Gauges
King Island
King Island Subcatchments
Primary roads
Secondary roads
City
Town
0
5
10
20
km
J:\Jobs\120038\GIS\Group_3_Catchment_Figures\Figure01_King_Island_Study_Area.mxd

FIGURE 02
KING ISLAND STUDY AREA LAND USE

J:\Jobs\120038\GIS\Group_3_Catchment_Figures\Figure02_King_Island_Catchment_Land_Use_SubOutline.mxd

FIGURE 03
KING ISLAND STUDY AREA
RAINFALL 1946_FEB



created by J:/Jobs/120038/Hydrology/R_scripts/Generalised_for_statewide/Create_Updated_Report_Rainfall_Figures.R
J:/Jobs/120038/Hydrology/Statewide/Calibration/King Island/Subcatchment_rainfalls/Figure03_Rain_Whole_catchment 1946_Feb_Report.pdf

Appendix A

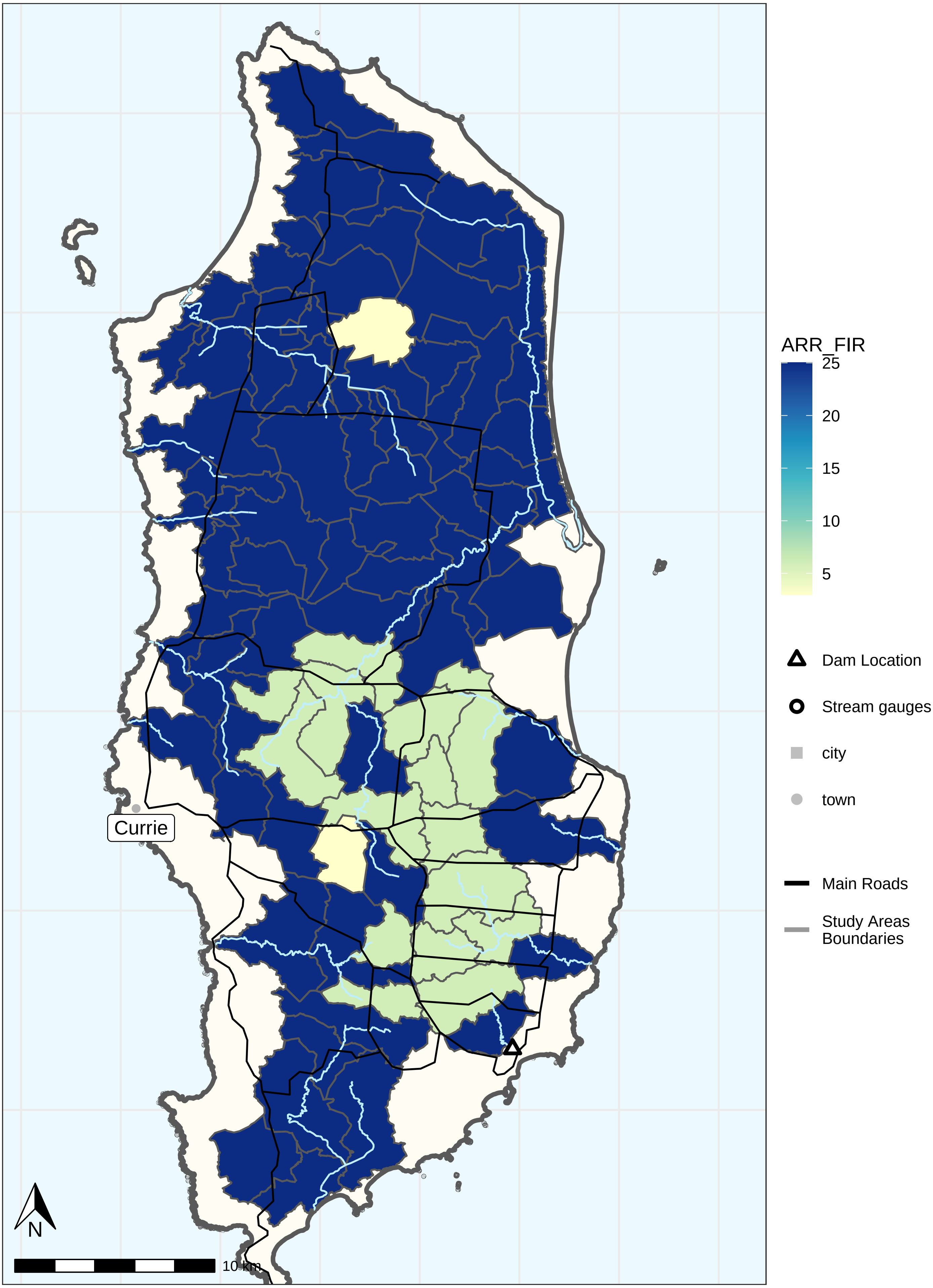
APPENDIX A. AVALIABLE DATA

A.1. Sub catchment data

FIGURE A1

HYDROLOGICAL SOIL GROUP MAPPING

DOMINANT SUBCATCHMENT SOIL INFILTRATION RATE

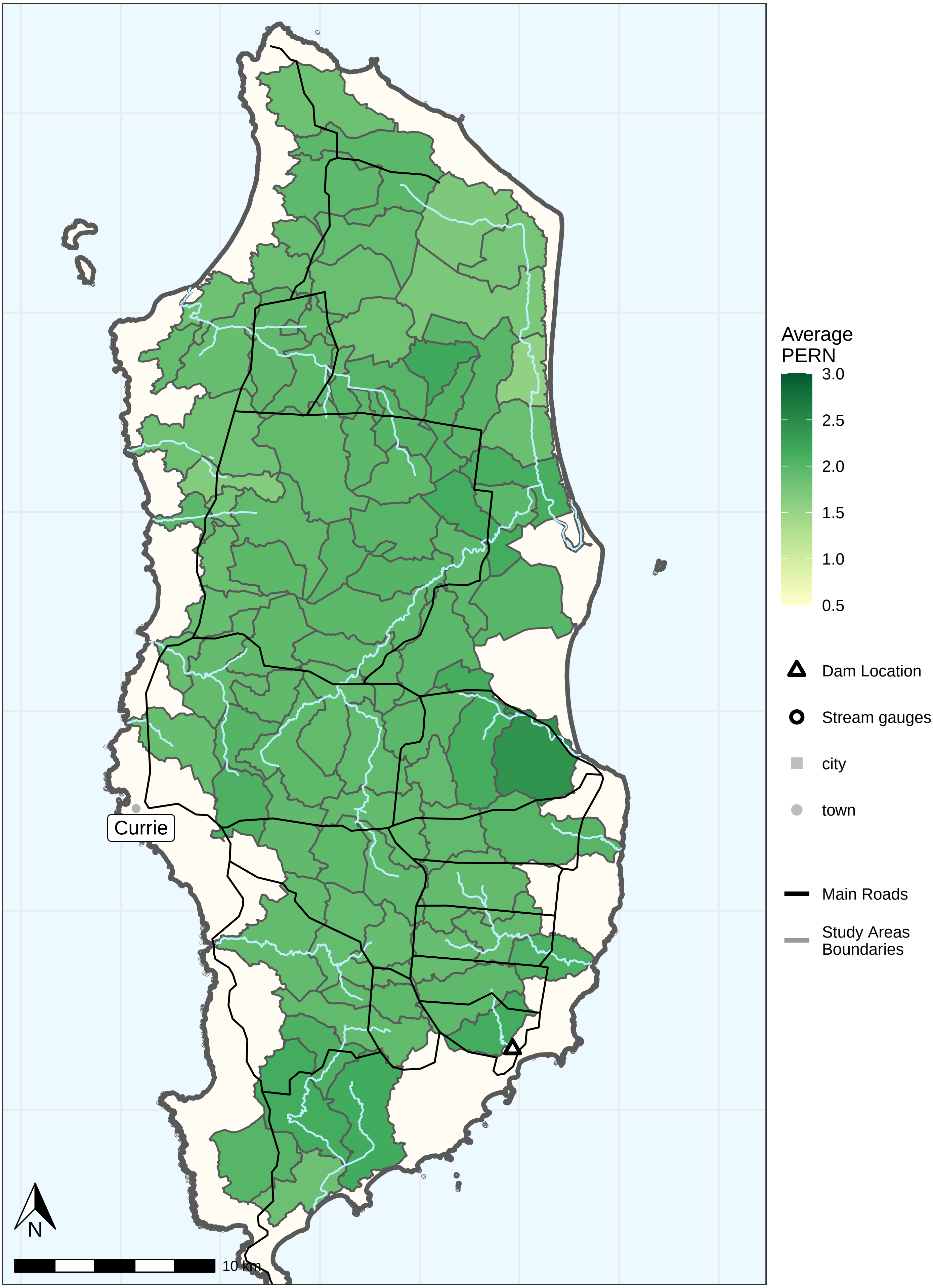


created by J:/Jobs/120038/Hydrology/R_scripts/Generalised_for_statewide/Create_Updated_Report_Rainfall_Figures.R
J:/Jobs/120038/Hydrology/Statewide/Calibration/King Island/Subcatchment_rainfalls/Figure_A1_King Island_SoilTypesReport.pdf

FIGURE A2

KING ISLAND STUDY AREA

SUBCATCHMENT AVERAGE PERN



created by J:/Jobs/120038/Hydrology/R_scripts/Generalised_for_statewide/Create_Updated_Report_Rainfall_Figures.R
J:/Jobs/120038/Hydrology/Statewide/Calibration/King Island/Subcatchment_rainfalls/Figure_A2_King Island_PERNsReport.pdf

Appendix B

APPENDIX B. UNCERTAINTY ANALYSIS

B.1. Hydrologic Model Uncertainty

Table B 1 shows the calibration event rating. Green shading is used to highlight relevant statements, relating to the February 1946 event, noting that no flow data was available and model calibration was not possible.

Table B 1: Hydrology calibration event rating

Category	Rating				
	Poor	Fair	Good	Very good	Excellent
Rainfall input quality	Nearest pluvi > 15 km from catchment in unrepresentative location	Nearest pluvi > 15km from the catchment in similar climate area	Pluvi within the catchment or within 15km	1 pluvi within or very near catchment for each 300km2 of catchment area	1 pluvi within catchment for each 150km^2 of catchment area (spaced out)
	No daily rainfall sites within 15 km of catchment	No daily rainfall sites within 10 km of catchment	One daily rainfall site within 10 km of catchment in similar climate area	multiple gauges within 15km in different directions	multiple gauges within 10km in different directions
	Known high rainfall gradients (from BoM or investigation of surrounding gauges)	Known rainfall gradients for calibration events	No known large spatial variation in event rainfall relative to gauges	Event rainfall known to be generally spatially uniform if catchment is large, or well represented by raingauges	Event rainfall known to be spatially uniform if catchment is large, or well represented by raingauges
Observed flows	Highest gauging within channel and flow breaks out of channel at high flows.	Rating or gauging info unavailable, but flow contained in channel.	Calibration event is out of channel, good set of gaugings but no gaugings out of channel	Calibration event is out of channel, site has been gauged out of channel during different rating period (with changes at top end)	Calibration event is out of channel, site has been gauged during applicable rating period out of channel
	Rating extrapolated with no consideration for shape of cross section	Rating extrapolated with no consideration for shape of cross section	Rating shows consideration to shape of cross section	Rating shows consideration to shape of cross section	Rating shows consideration to shape of cross section
Calibration events	Smaller than 20% AEP	Between 20% and 10% AEP	Between 10% and 5% AEP	Between 5% and 2% AEP or within largest 4 events on record	Larger than 2% AEP or within largest 2 events on record

B.2. DTM Uncertainty

The study area DTM quality rating is shown in Table B 2 with green shading.

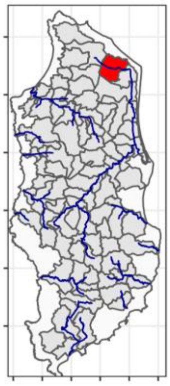
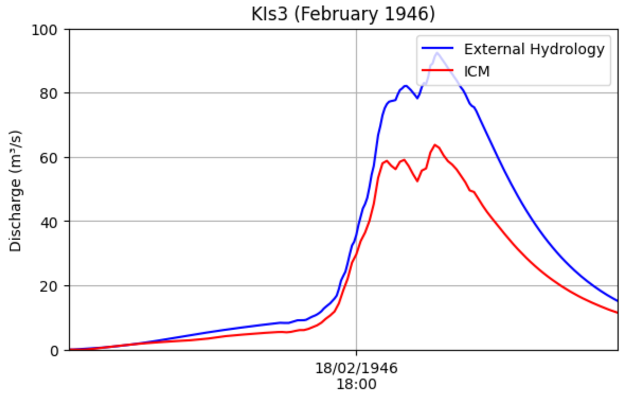
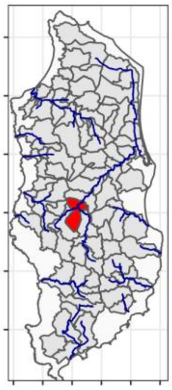
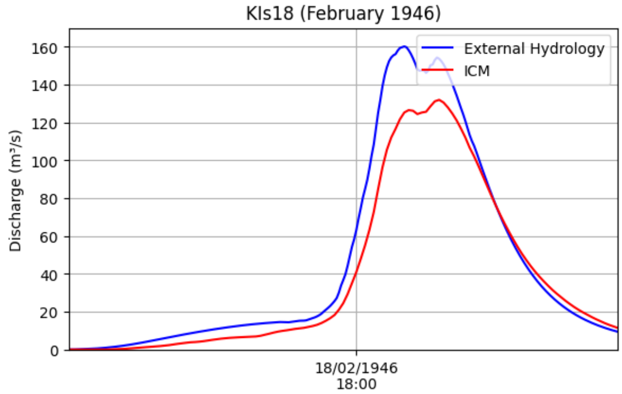
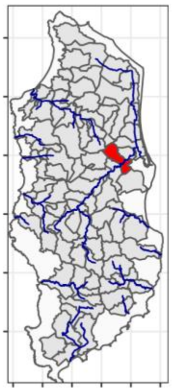
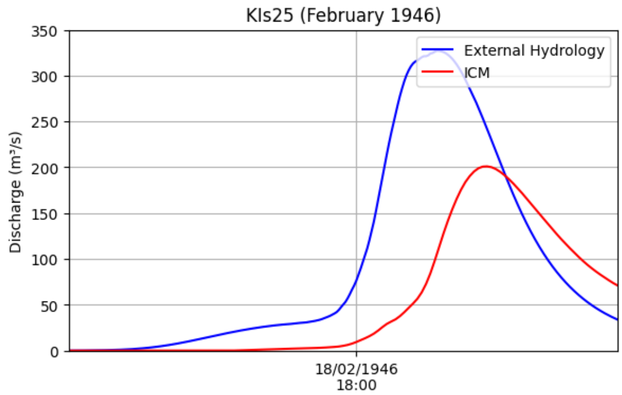
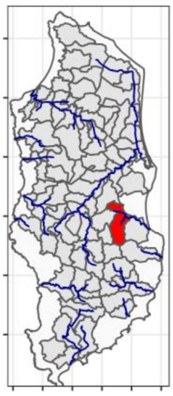
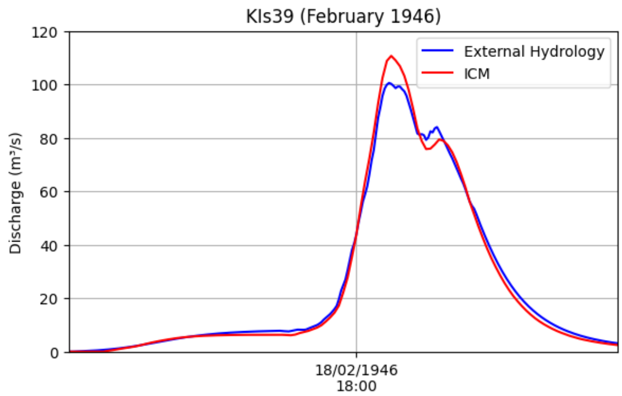
Table B 2: DTM rating

Category	Rating				
	Poor	Fair	Good	Very good	Excellent
DTM definition	Low resolution	Low resolution	High resolution at HSA/gauges	High resolution in HSA	High resolution in >60% of catchment
	Minimal Ground Control Points (GCP)	Minimal GCP	Reasonable GCP coverage	Good GCP coverage	Good GCP coverage
DTM waterways	Bathymetrical data unavailable	Bathymetrical data poor – e.g. LiDAR with estimated bathymetric information	Bathymetrical data reasonable	Bathymetrical data good	Detailed bathymetrical survey data available

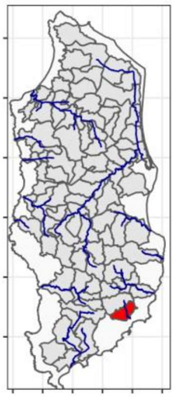
Appendix C

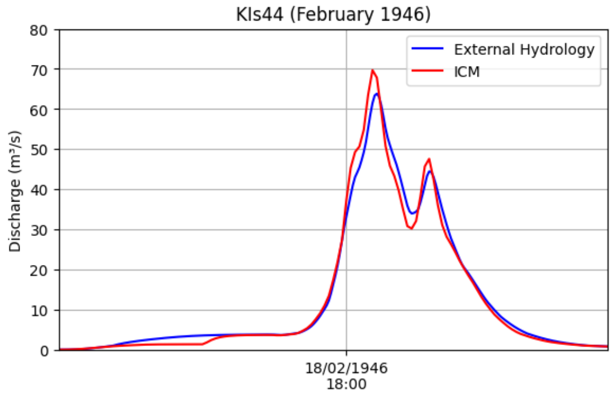
APPENDIX C. EXTERNAL HYDROLOGY MODEL TO ICM HYDRAULIC MODEL COMPARISON CHARTS

Figure C 1 Event hydrographs

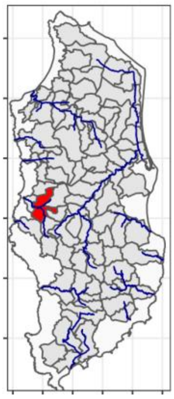
Network Line	February 1946
kis3 	
kis18 	
kis25 	
kis39 	

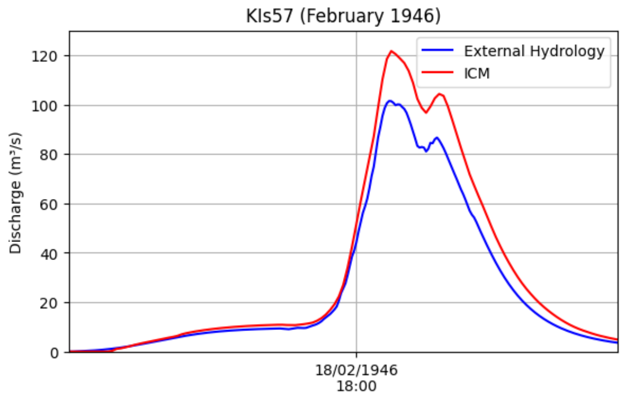
KIs44



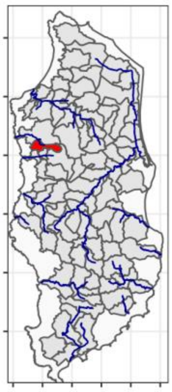


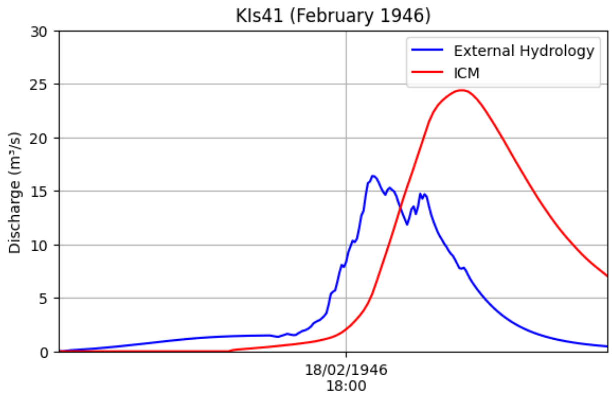
kis57





KIs41





kis78