

# Development of bespoke reservoir routing model in Vartry catchment

## 1. BACKGROUND

- Wicklow County Council own lands at Ashford close to Vartry River
- OPW CFRAM maps show lands in Flood Zone C.
- There is uncertainty as history of larger flooding adjacent to site from Hurricane Charlie.

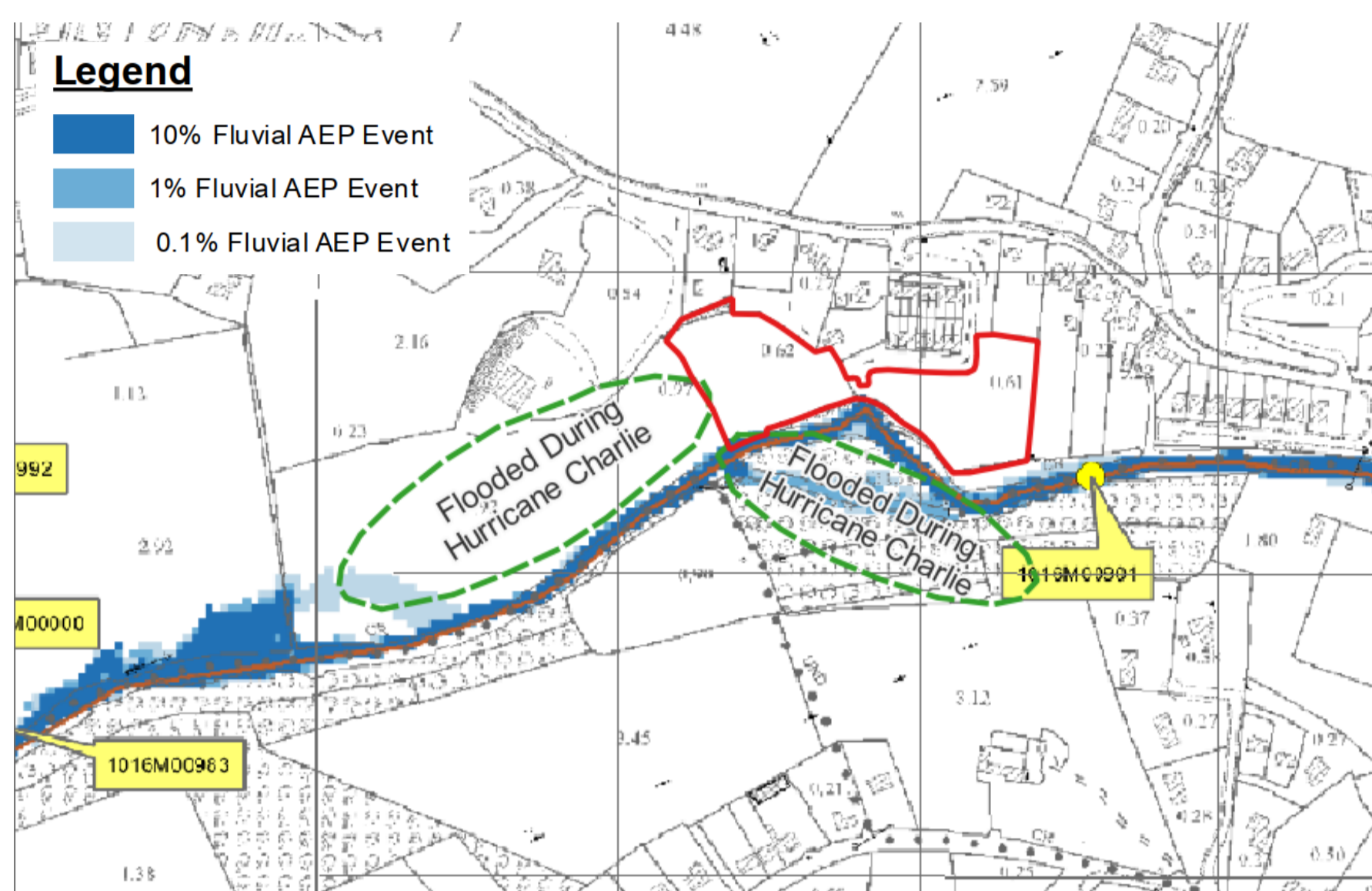


Figure 1 - Recorded history of flooding adjacent to the site

## 2. CATCHMENT CHARACTERISTICS

- Site is downstream of Upper and Lower Vartry reservoirs.
- The catchment is rural with pasture, woodland and peat as main land uses. The baseflow contribution is high due to superficial deposits laid over bedrock.

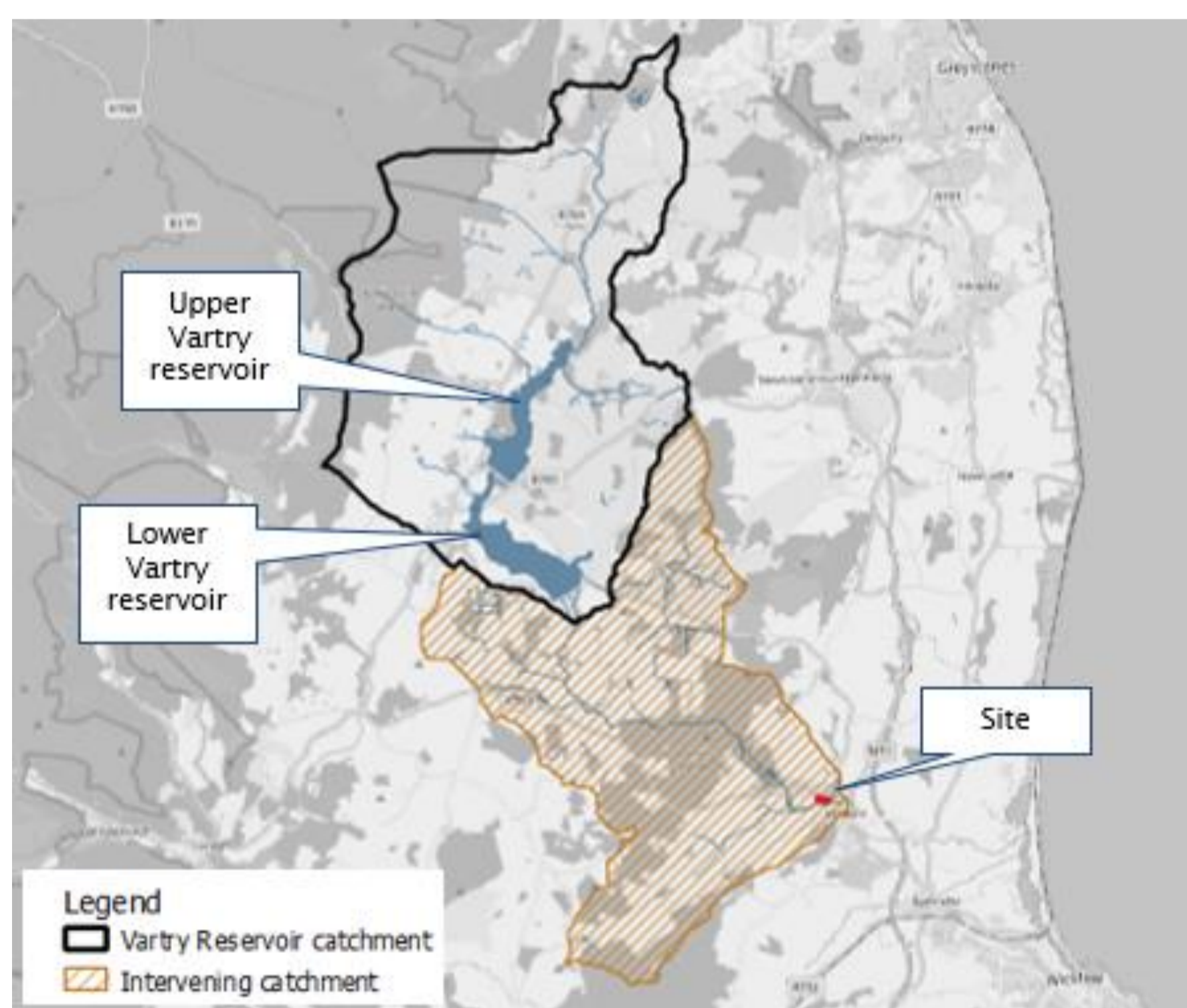


Figure 2 – Catchment to site showing Vartry reservoir contribution

- The impact of reservoirs was identified as the largest uncertainty in estimating flood flows.
- The CFRAM mapping represented reservoirs through lumped 'FARL' parameter (FARL = 0.771) when in reality flows are influenced by specific spillway structures.

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Wicklow County Council



## 3. RESERVOIR UNDERSTANDING

Spillway structures are used when a reservoir is full to pass water safely over, around it or through it.

The loss of water from draw off towers for Public Water Supply was not deemed significant in context of flood flows.



Figure 3 - Upper Vartry bellmouth spillway structure



Figure 4 - Lower Vartry weir spillway structure

## 3. MODELLING APPROACH

- 1D-2D InfoWorks ICM direct rainfall model developed
- 10m DTM used as surface elevation
- Runoff lost to infiltration using Horton's infiltration model
- Reservoir key components represented:
  - Reservoir footprints: initial water level and roughness
  - Embankment crest
  - Bellmouth and weir spillway structures
- Roughness zones to represent wooded areas

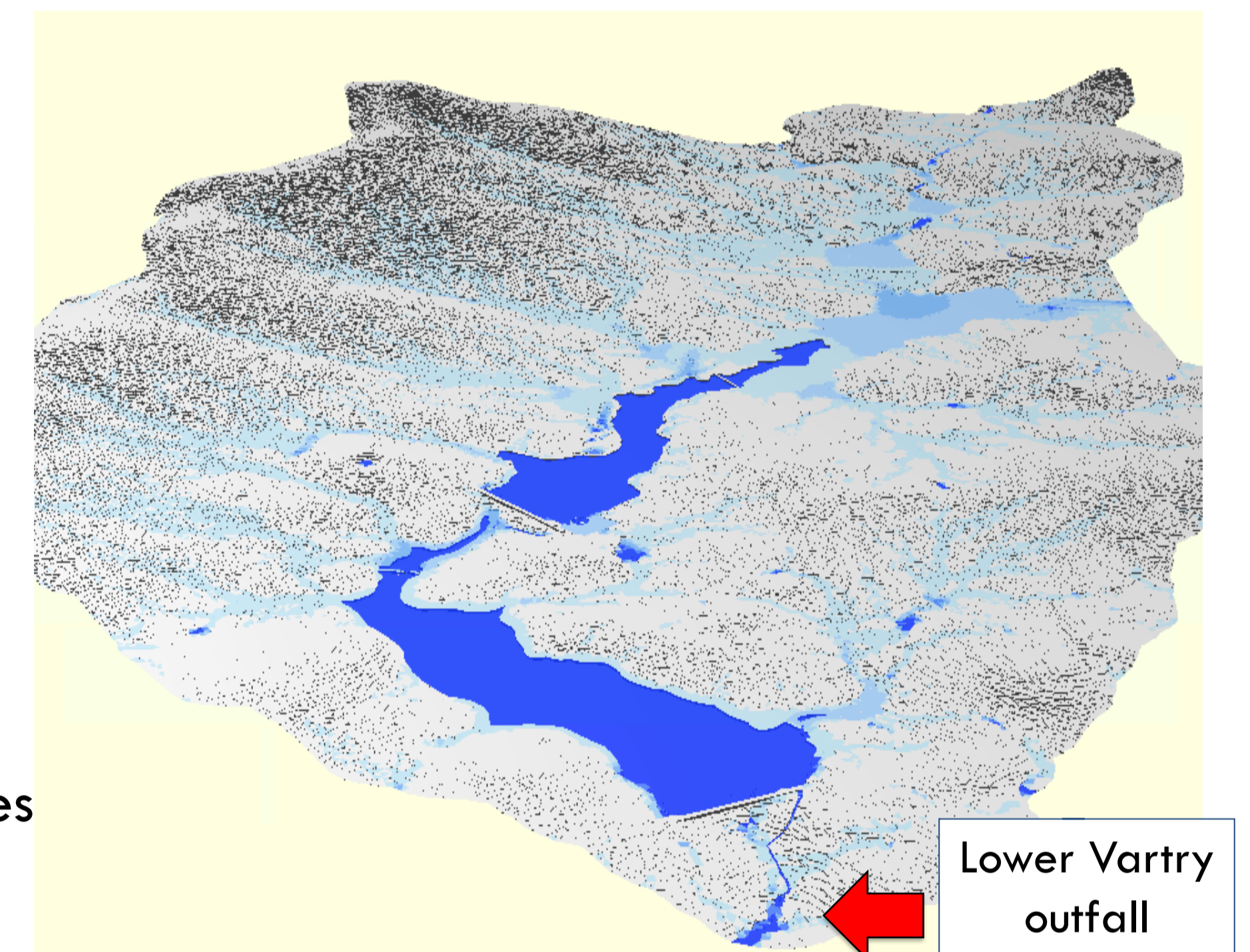


Figure 5 – Upper and Lower Vartry reservoir represented in model

- Model calibrated to gauge at Lower Vartry outfall using observed rainfall and reservoir levels for 3 events.
- The model replicated the observed peak flow within  $\pm 20\%$  by adjusting reservoir roughness and spillway weir coefficients.
- Design rainfall was applied to the model and outflow generated.
- Lower Vartry reservoir outflow + Intervening catchment flow (standard FSU approach) = Inflow to site specific 1D-2D model

A site specific 1D-2D model was developed to accurately predict flood levels at the site.

## 5. LIMITATIONS

- Limited calibration data due to short gauged record at Lower Vartry gauge (<2years) where no extreme events were recorded.
- The model is unable to replicate the slow baseflow response leading to a flashier model response compared to observed.

## 4. RESULTS

The revised flood estimate for the reservoir catchment infers that CFRAM "design" flood flows are significant underestimates e.g., 385% increase in flow for 1% AEP at site.

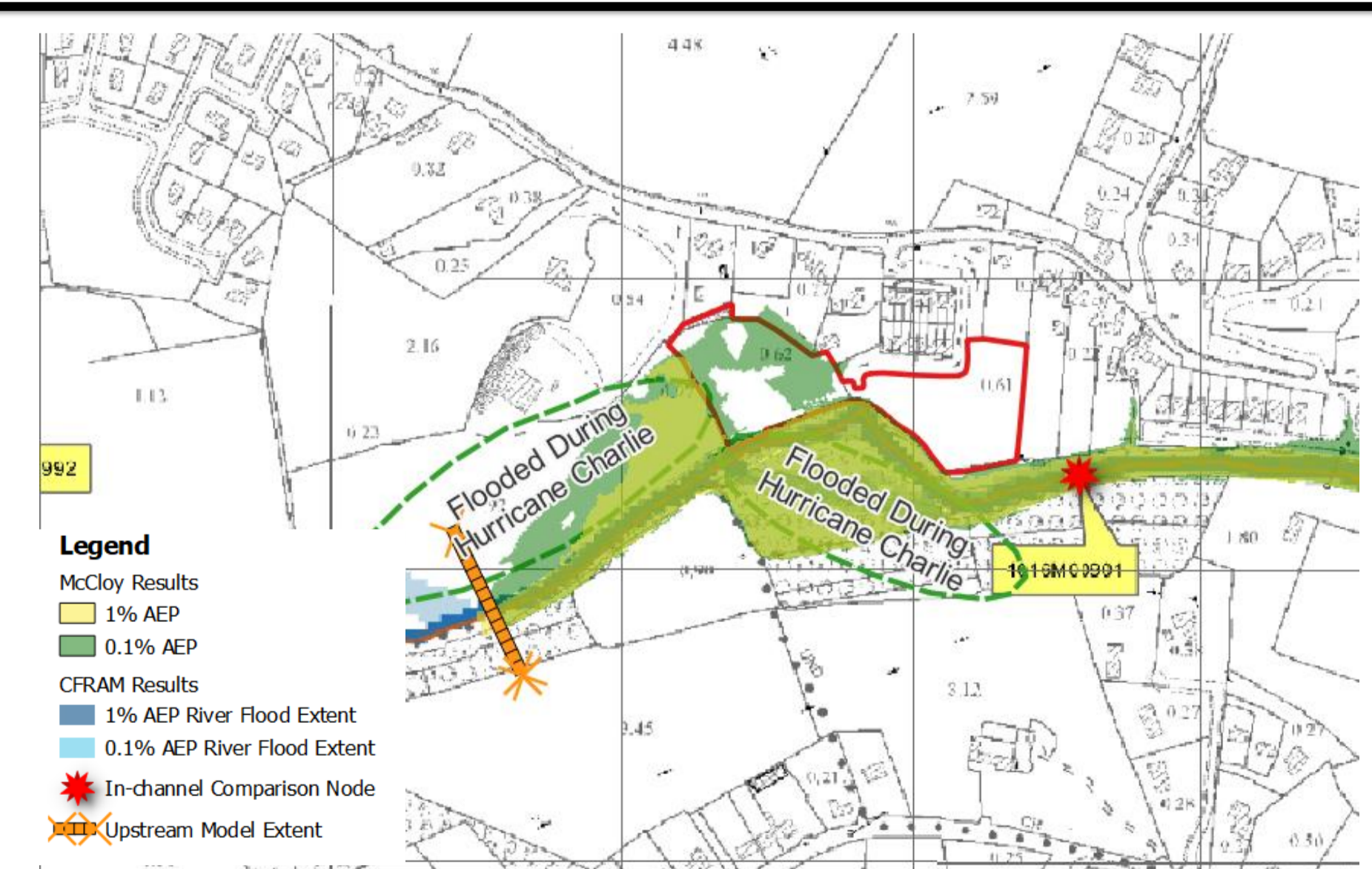


Figure 6 – Comparison of new modelled results with CFRAM results at the site

- Model results now match and exceed the established flood history from Hurricane Charlie on adjacent lands and show 30% of the site in Flood Zone B.
- Outcome is reduced uncertainty in hydrology and greater confidence around climate change resilience for development.