2012 Flooding at River Club Entrance
Source: 2 Oceans Vibe News

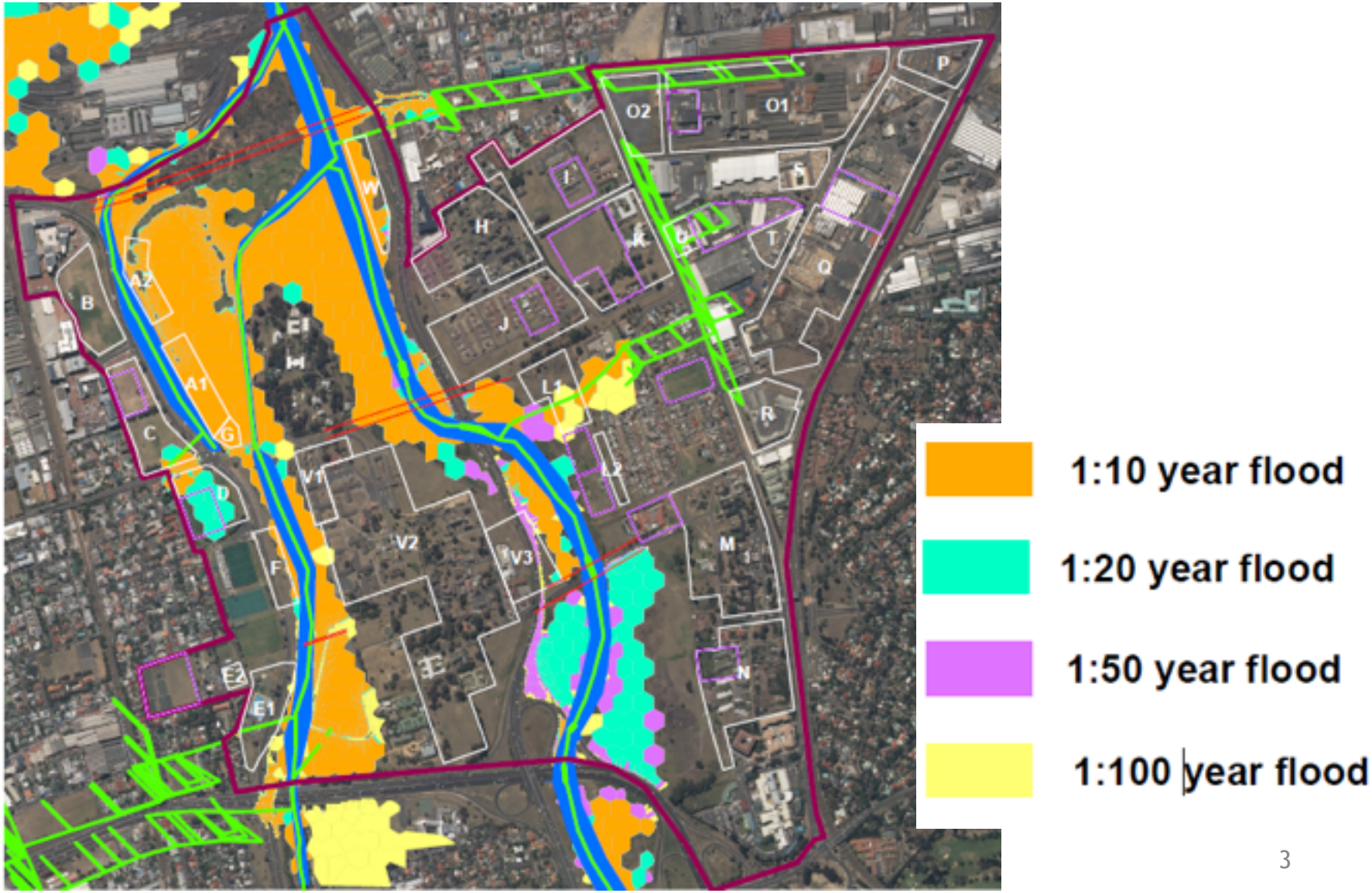
Specialist Study : Modelling Flood Mitigation Options on the Salt River

2004 flooding at River Club
Picture Andrew Ingram.

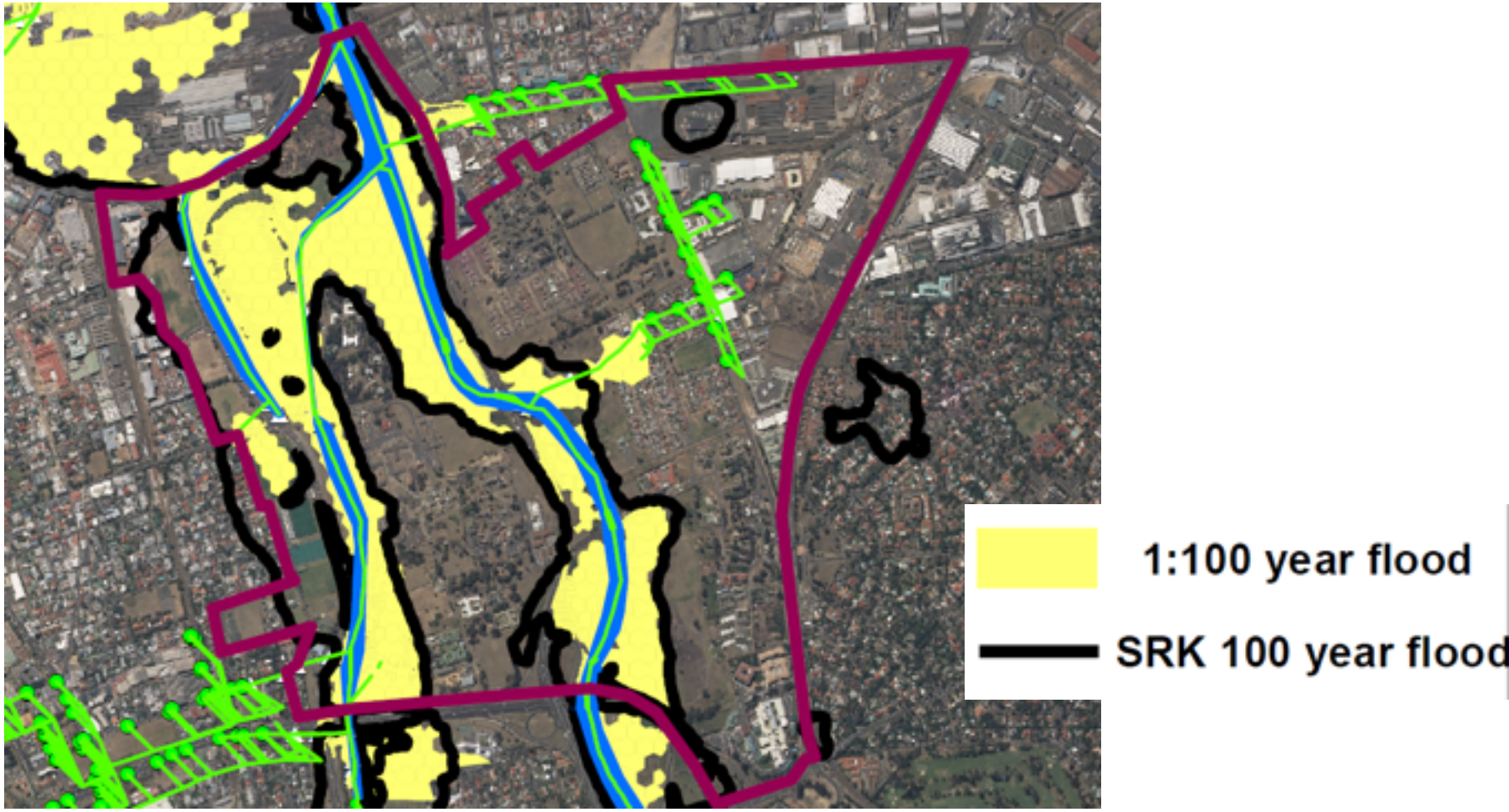
Approach

- Use PCSWMM software to predict flood extents for design condition
- Design conditions: e.g. 1:100 year design flood has a 1/100 chance of being exceeded in any year.
- Related to assumptions regarding:
  - Rainfall
  - Split of rainfall between initial storage, infiltration and runoff
  - Tide levels
  - Constant channel geometry
  - “Roughness”

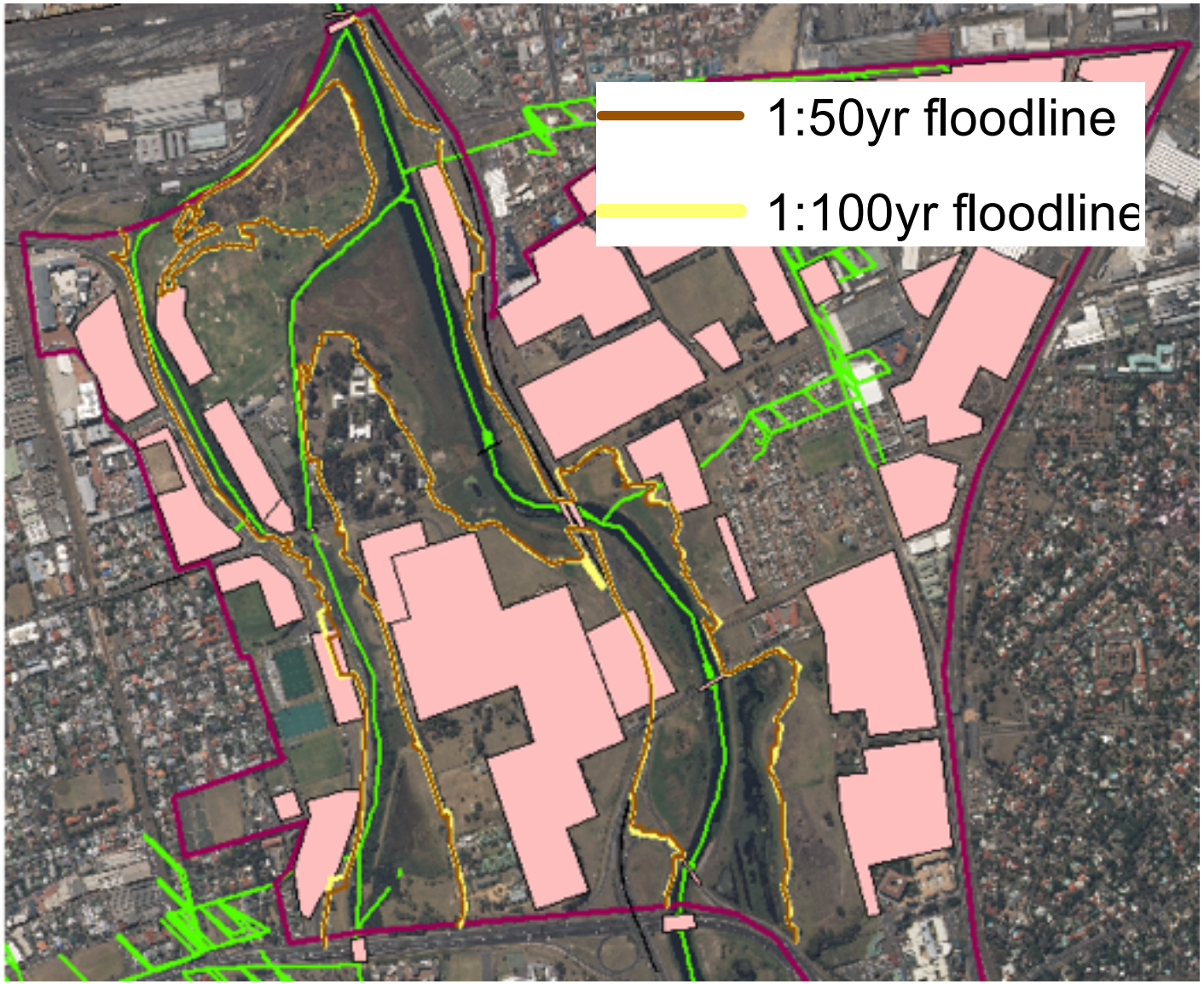
Comparison floodlines and potential development



Map with original floodlines compared



New floodlines (with proposed development)



Flood Mitigation Measures

- Flood protection berms, infill and construction;
- Reducing catchment inflows
- Channel modification (enlargement);
- Flood water storage; and
- Outflow improvement (possible improvement of Zoarvlei outflow not modelled)

Flood Mitigation Measures

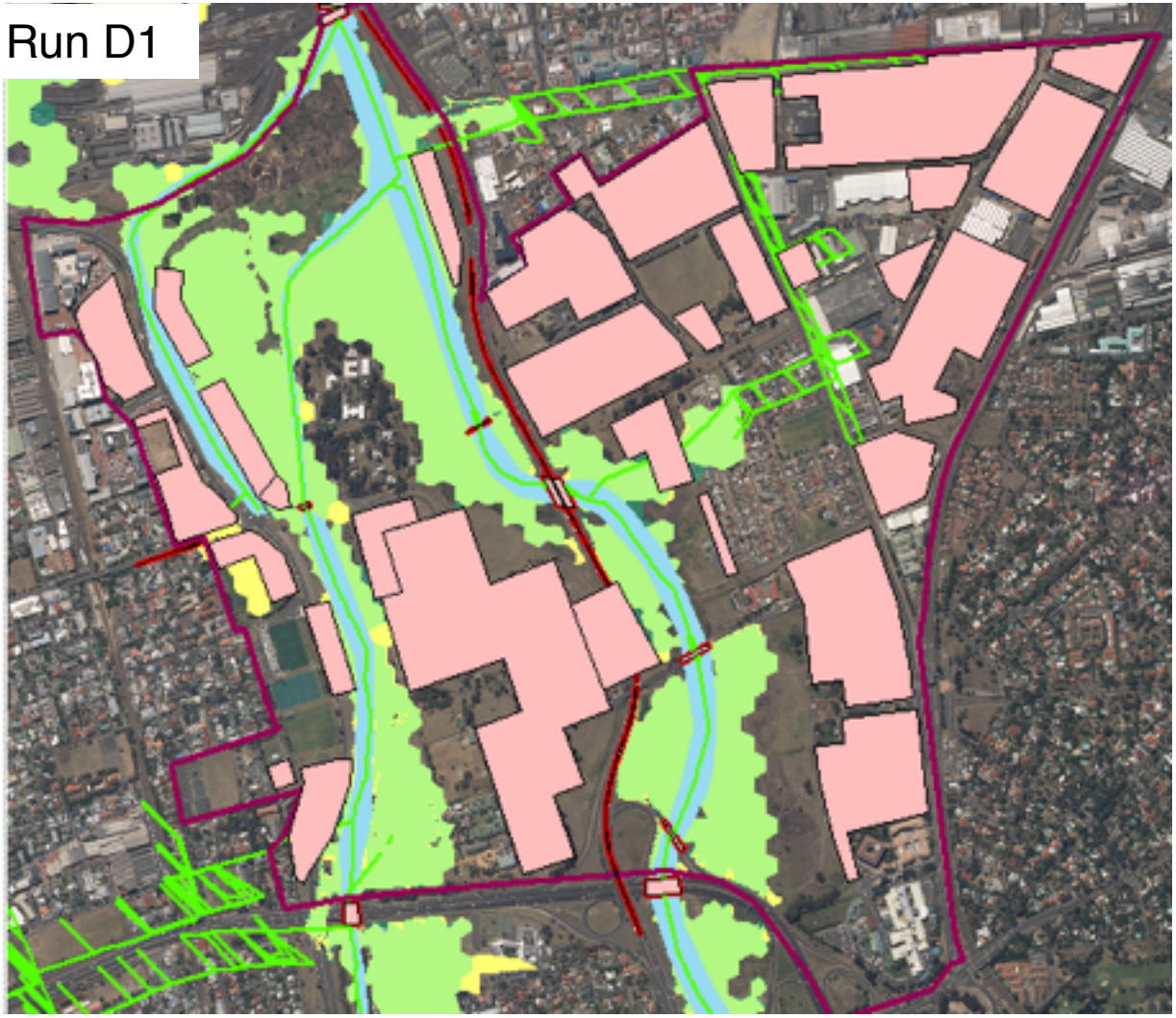
Geometry	Run or refinement No.	Flow condition		
		Rainfall	Upstream inflow from Black and Liesbeek rivers	Tide setup
Proposed development footprint (scenario 6)	D1	1:100 year	1:100 year	1:50 year
	D2	1:100 year	85% of the 1:100 year	1:50 year
	D3	1:50 year	1:50 year	1:20 year
	D4	1:20 year	1:20 year	1:50 year
	D5	1:20 year	1:20 year	1:20 year
Widening of Salt River and Black River canals and bridges	D6	1:100 year	1:100 year	1:50 year
	D7	1: 50 year	1:50 year	1:20 year
	D8	1:20 year	1:20 year	1:20 year
Floodplain storage areas in combination with proposed development footprint	D9	1:100 year	1:100 year	1:50 year
	D10	1:50 year	1:50 year	1:20 year

Flood protection berms, infill and construction

Flood resistant buildings, Hamburg harbour district, Germany

- Land within the floodplain can be used;
- Because flow is partially blocked, upstream flood levels may be increased

Effect of proposed development on 1:100 year flood extents



Effect of proposed development (as obstruction or infill) on 1:100 year flood levels in the Black River

Location	Difference in peak water level (m) (9 minute average maximum head)
Downstream of N2	0.007
Downstream of Valkenburg Bridge	0.008
Downstream of M5 bridge	-0.006
Downstream end of TRUP	-0.003

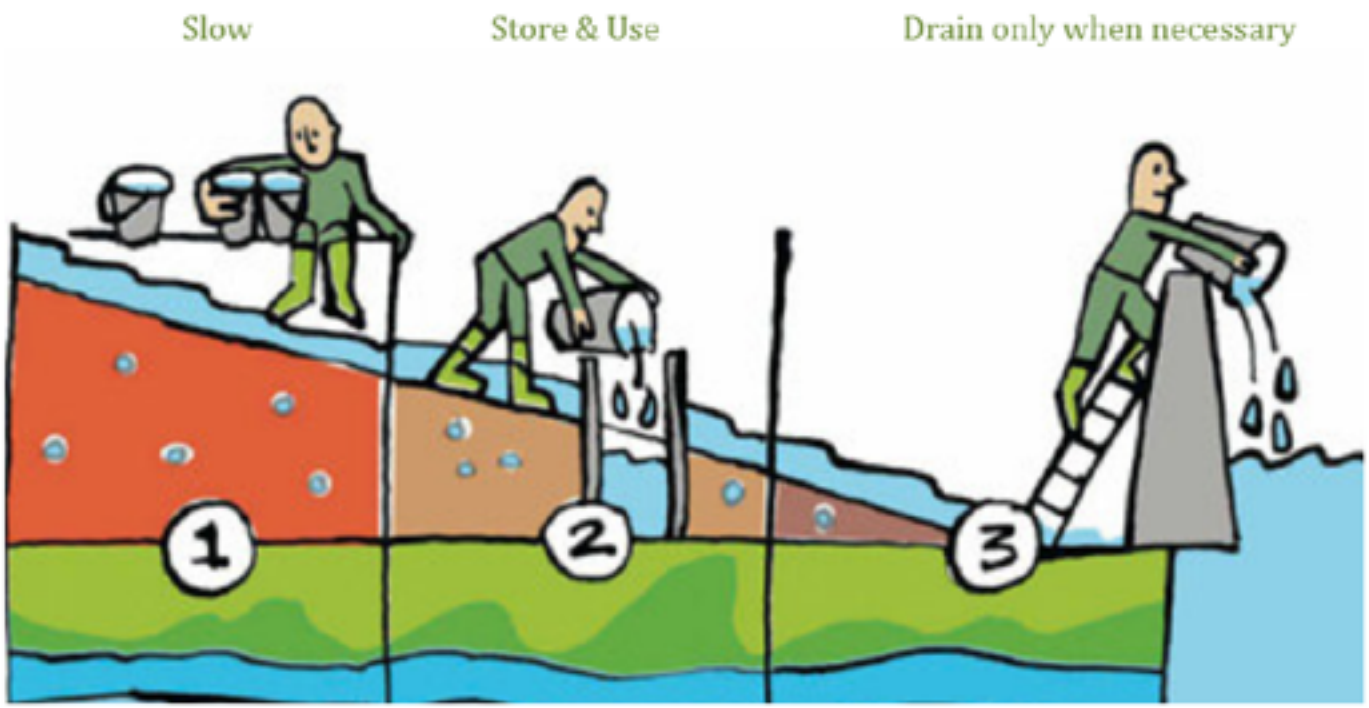
- Effect on Liesbeek is even less.

Run D1

Possible refinement:

i. Include the remainder of River Club island

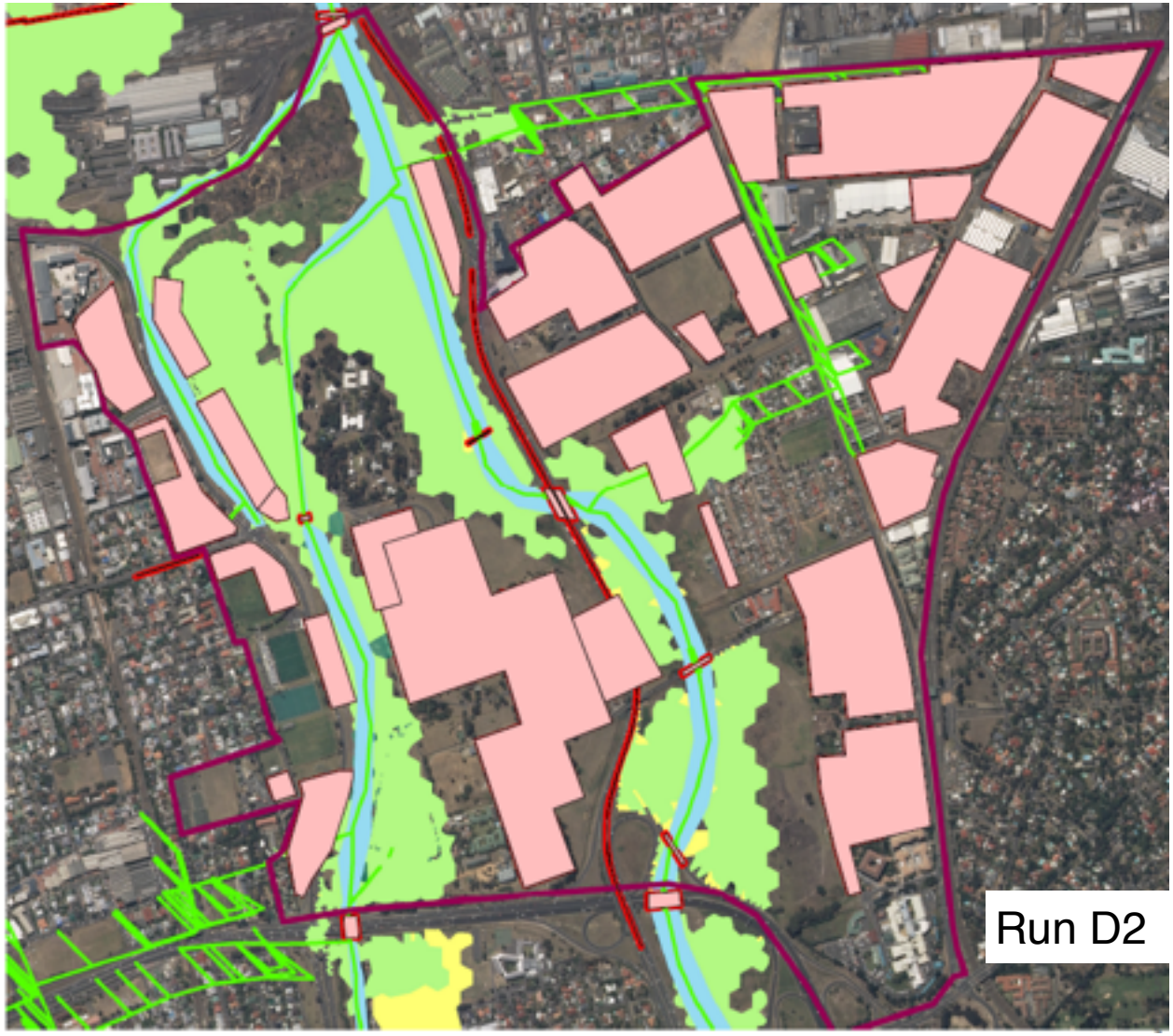
Reducing catchment inflows: Retain, store, drain



Dutch water management policy

- Stormwater harvesting;
- Attenuation ponds
- Infiltration (permeable areas)
- Drain to elsewhere (Elsieskraal diversion discussed – could reduce peak by approximately 5 to 10%)

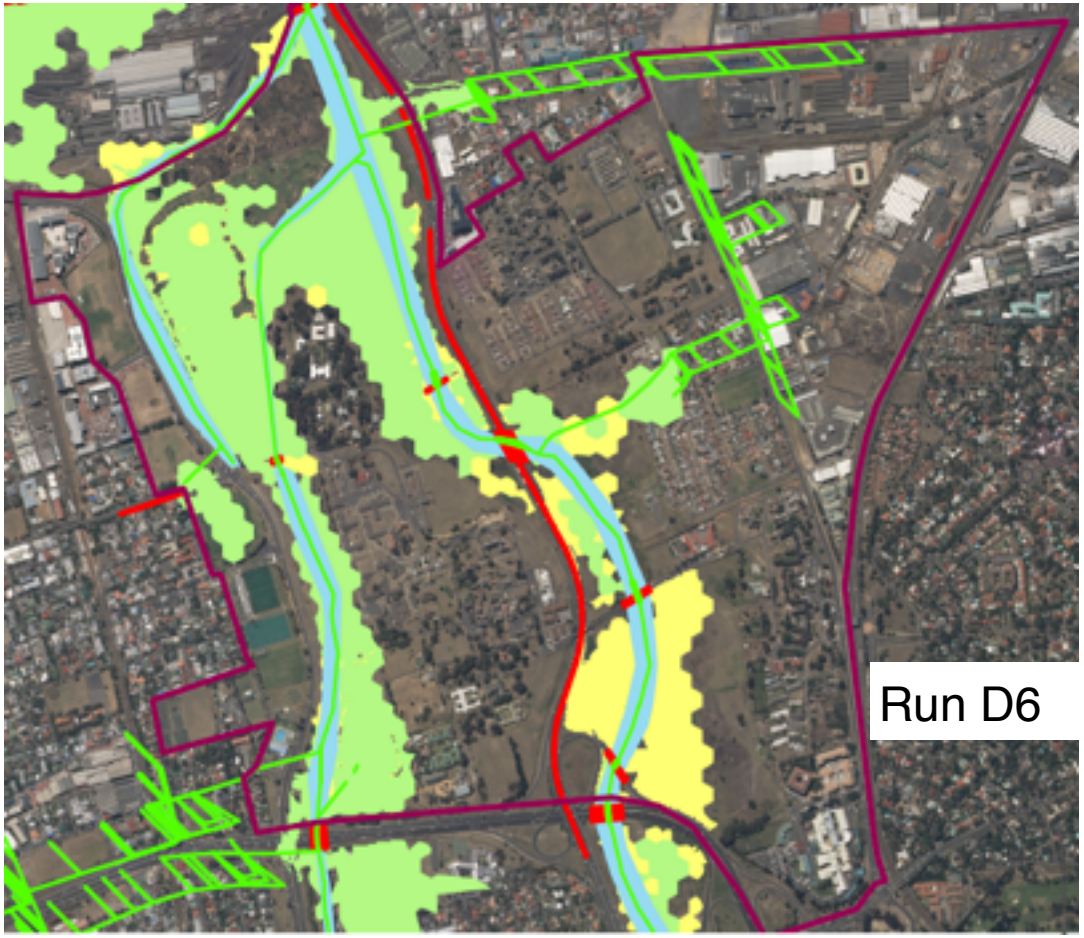
Effect of a 15% reduction in peak inflow from the Liesbeek and Black rivers



Effect of channel widening: Black and Salt

- Many different shapes are possible
- For maximum effect, considered widening over full depth by 25m for both Black and Salt River
- Including widening all bridges

Effect of channel widening: Black and Salt

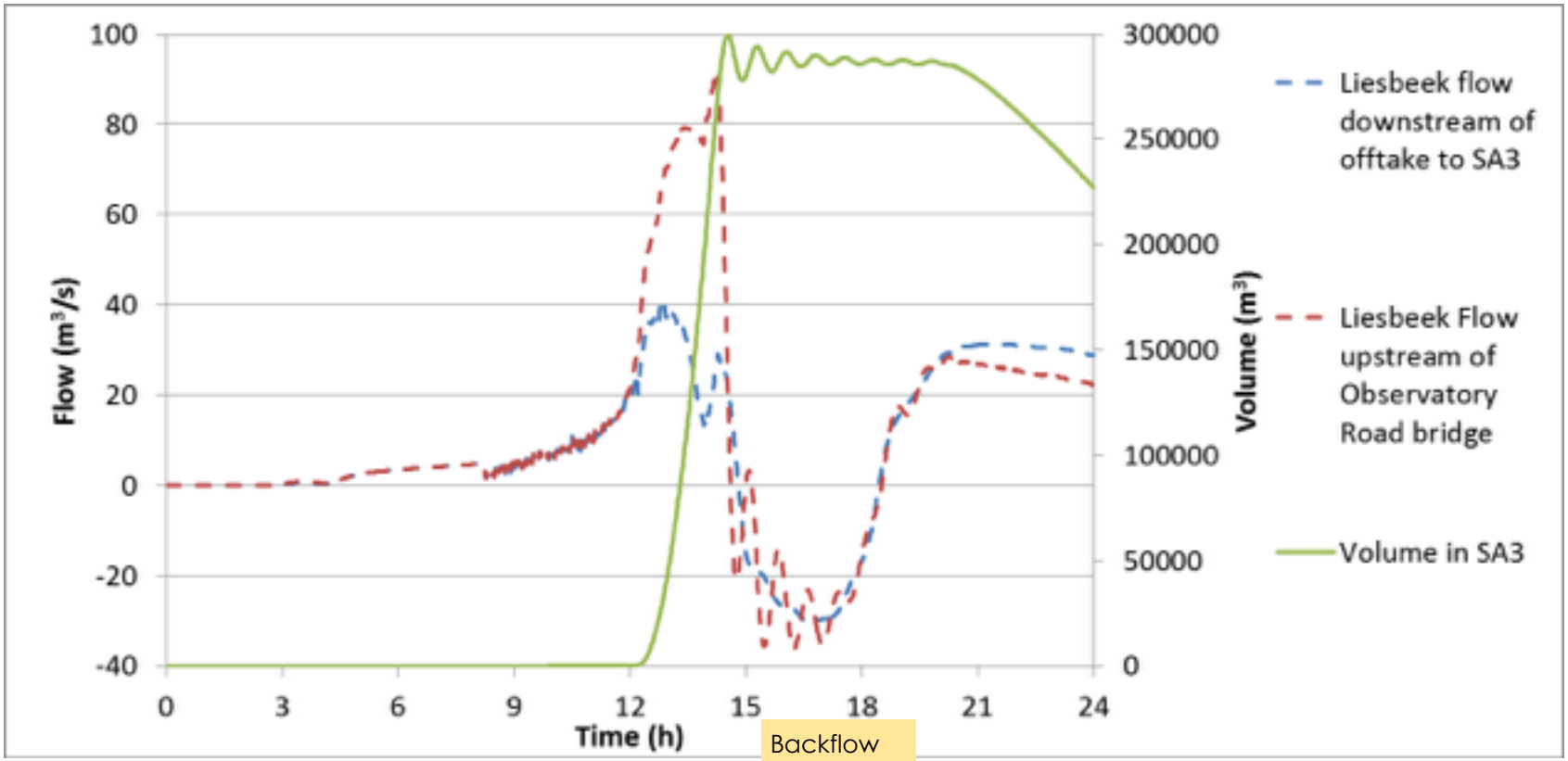


Effect of flood water storage

Storage areas

Proposed deve-
lopment

Flood storage on River Club Island



Backflow
Black River

Conclusions for urban planning 1/2

- Local flooding due to capacity of the bulk storm-water network being exceeded by the 1:10 year flood:
  - Northern parts of Maitland Garden Village,
  - in the area around Eastman Road and
  - between Berkley Road and Frere Road and
  - at the hockey stadium.
- Most of the sports fields to the West of Liesbeek Parkway are not predicted to be flooded; significant difference from 1D model. They are protected by the raised parkway.
- Proposed development has very little effect on flood levels & extents.

Conclusions for urban planning 2/2

- Flood storage within TRUP can improve local stormwater flooding, but has little effect on river flood extents for 1:100 year floods.
- Channel enlargement has the potential to significantly reduce flooding, particularly in the Black River towards the upstream end of TRUP site. Flooding at the PRASA depot from the Liesbeek is also reduced.
- A moderate reduction in catchment inflows has no discernible effect on flood extents within TRUP, but would reduce flood extents of 1:100 year floods immediately upstream of the N2.

Key Assumptions

Increase flood extents	Neutral	Decrease flood extents
Peak rainfall preceded by 12h of heavy rain (Standard 24h distribution)	Peak rainfall over entire catchment at the same time	No debris blocking bridge openings or weirs
All sub-catchments have peak rainfall of the same return period	Best estimate runoff parameters	No additional blockage by sediment transported during flood
No flow through barriers and balustrades (solid)	Best estimate channel and floodplain roughness	
Existing "solid" sediment remains during flood	Quazi-2D flow modelling	
Sea level: set up of same return period with near spring tide	Low tide coincides with incoming flood peak	
Rainfall includes extra 15% for climate change		
Best estimate sea level rise to 2060		

Climate change included

The total of assumptions will likely cause predicted flood extents to be larger.

Further modelling

Suggested refinements:

1. Change initial and inflow levels for local stormwater ponds

Possible additional Geometries (would require variation)

1. Include infill on the remainder of River Club island
2. Widen Black River only, not Salt River and try widening by 40m
3. Revised development footprint
4. Increase flood flows into and out of Zoarvlei
5. Alternative channel cross-section for Black River
6. Proposed development with a combination of different measures i.e.
   - Floodplain storage
   - Channel widening
   - Possibly reduction of upstream inflows