

PRELIMINARY REVIEW OF THE HIGHVELD STORM  
ON NOVEMBER 9, 2016.



fourthelement



Storm over eastern Johannesburg, 9 November 2016.



Drama on N3 Highway

A Highveld storm caused severe flooding in parts of Johannesburg and Ekurhuleni late in the afternoon of 9<sup>th</sup> November 2016. Severe traffic disruption, property damage and loss of life occurred with dramatic scenes played out in news and social media. This technical note presents the results of a preliminary analysis of the rainfall event.



OR Tambo, 9 November 2016

### Weather station 0476399 at OR Tambo International Airport

This weather station is well located for this event, and it records at 5 minute intervals which is ideal for urban storm analysis. The airport suffered considerable localised flooding that affected airport operations. However, the station is some 10km from the severe flooding on the N3 Highway. Storm cells in this location may be smaller than this, with high spatial variability of rainfall. Hence, using a single station is a rather narrow analysis of an event of this significance. Ideally, in time it will be supplemented with a look at the wider synoptic conditions and weather radar data.

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**Event time series:**

Date & Time	Rainfall (mm)
2016-11-09 5:00:00 PM	0.0
2016-11-09 5:05:00 PM	0.0
2016-11-09 5:10:00 PM	0.2
2016-11-09 5:15:00 PM	4.0
2016-11-09 5:20:00 PM	7.8
2016-11-09 5:25:00 PM	10.8
2016-11-09 5:30:00 PM	9.4
2016-11-09 5:35:00 PM	17.2
2016-11-09 5:40:00 PM	8.2
2016-11-09 5:45:00 PM	3.2
2016-11-09 5:50:00 PM	5.6
2016-11-09 5:55:00 PM	9.0
2016-11-09 6:00:00 PM	4.0
2016-11-09 6:05:00 PM	2.6
2016-11-09 6:10:00 PM	1.6
2016-11-09 6:15:00 PM	0.8
2016-11-09 6:20:00 PM	0.4
2016-11-09 6:25:00 PM	0.2
2016-11-09 6:30:00 PM	0.2
2016-11-09 6:35:00 PM	0.0

**Summary of maximum storm depths and estimate of equivalent return period.**

9-Nov-2017 data		Approx. Return Period <sup>(Ref 1)</sup>
Max 5min	17.2mm	21 years
Max 10min	26.6mm	27 years
Max 15min	37.4mm	50 years
Max 30min	57.4mm	140 years
Max 45min	75.2mm	>200 years
Max 60min	83.4mm	>200 years

These storm durations are typically used in urban stormwater design, though it is usually durations of 15 minutes or more that are applied.

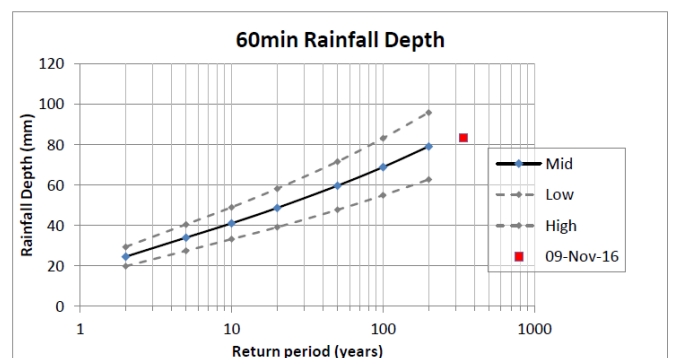
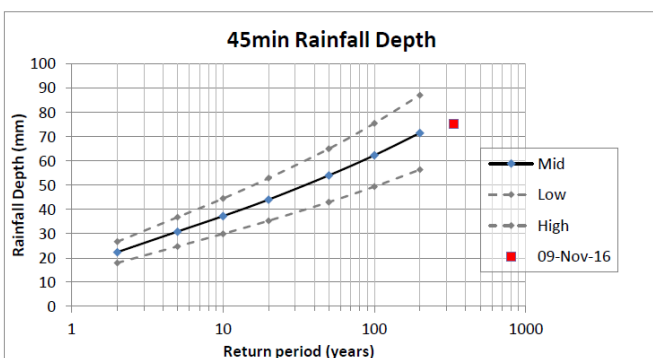
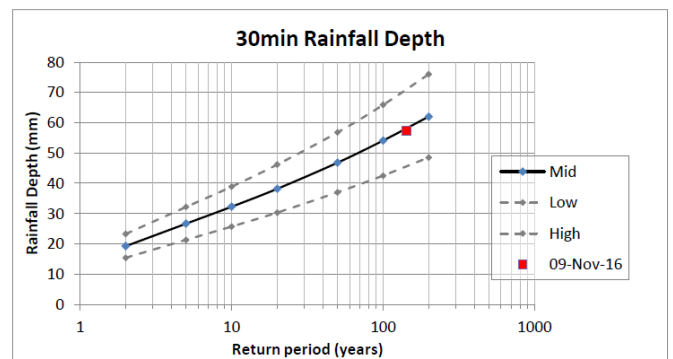
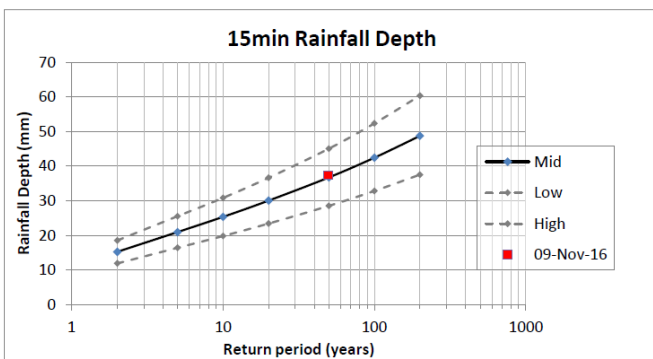
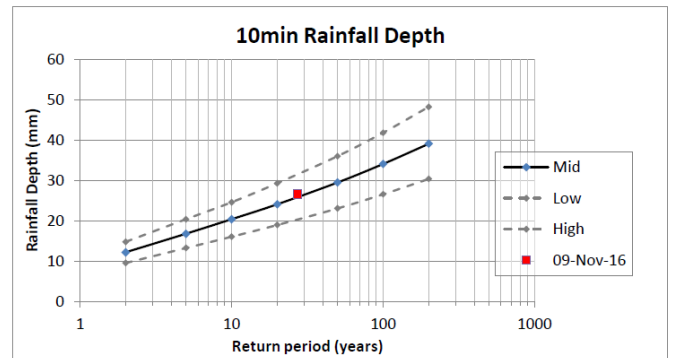
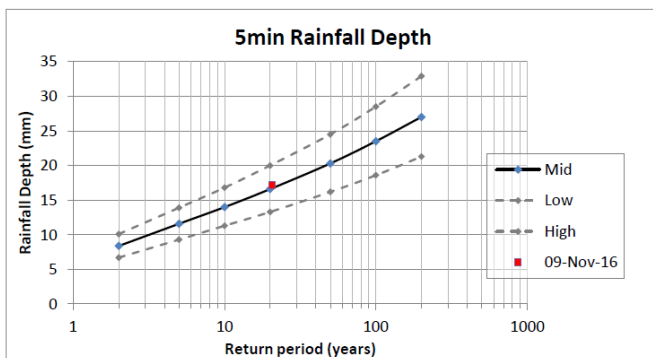
Comparing the maximum values extracted from the time series with design rainfall by Smithers & Schulze (2002) suggests the event falls not only in the extreme category (i.e. above 1 in 50 years), but also in the “devastating” category (>100 years) and approaching the “catastrophic” category (~500 year). These rainfall depths are well above normal design standards and it would be expected that stormwater infrastructure would have failed in the event. It perhaps explains the catastrophic failure of the road drainage system on the N3 Highway.

Events of this nature always need to be reviewed in the context of stormwater design and planning. Key questions include:

- Is the event accurately analysed? (As mentioned this is a fairly narrow analysis other data should be included.)
- Is this is actually just a rare event that should be within normal design standards, or is it in the in the category of the extremely rare, catastrophic category where we should expect our stormwater systems to fail under these conditions?

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- Is this linked to climate change? Is it coincidence that this event is within 15km from a rare tornado event earlier in the same year (July 26)? Hydrological statistics says that such coincidences are possible, but there is also increasing reports of extreme weather disasters globally that are being linked to climate change.
- Do we need to review design standards for critical infrastructure? The “Red Book” (Ref 2) promotes 50 years as the design standard for major systems, but up to 100 years for high value central business districts.
- Do we need different design standards as catchment areas increase? This is particularly applicable to metropolitan areas where urban catchment sizes are large.



The 9 November 2016 maximum storm depths in context with design rainfall (Ref 1).

## References

- Ref 1: *Smithers, JC, RE Schulze, 2002. Design Rainfall and Flood Estimation in South Africa. Water Research Commission, WRC Report No. K5/1060.*
- Ref 2: *CSIR, 2000. Guidelines for Human Settlement Planning and Design Boutek Report No. BOU/E2001*

## Please reference this document...

Reference to this Technical Note may be made as follows:

*Fourth Element, 2017. Preliminary review of the Highveld Storm on November 9, 2016. TN/3/2017.*  
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