BETTY'S BAY FLOODS OF DECEMBER 2013 / JANUARY 2014:

RECOMMENDATIONS FOR ACTION AIMED AT PREVENTING DAMAGE DURING FUTURE EPISODIC FLOOD EVENTS

(Allan Heydorn – 21 January 2014)

Not surprisingly, intensive verbal and electronic debate developed during the aftermath of the serious floods which occurred in the Overstrand region in April 2005, November 2013 and again in January 2014. The key question asked by all is: '*how can flood damage be minimized in the event of future extreme climatic events'?*Many divergent opinions emerged, some practical, some not so, but every contribution was useful in its own right. Eventually the number of ideas placed on the table became so great that an appeal was made not to confuse the responsible authorities by too many conflicting demands.

Much of this debate centred on Betty's Bay which was badly affected by the floods. Flood damage was serious in the catchment of the Harold Porter National Botanic Gardens (HPNBG), the upper floodplain in which the Gardens are situatedand in the lower floodplain seawards of the R44. Within the HPNBG paths, bridges and landscaping were damaged and the parking area was so severely eroded that public access had to be curtailed for more than a week. Even parts of the sturdy fencing between the parking area and the R44 had to be replaced. Near the Dawidskraal Picnic area, the culverted Otter Close Bridge was destroyed and access to thesix Otter Close households was cut off. Houses situated within the floodplain to the west of Waterfall Road were flooded and Waterfall Road itself was so severely eroded that access to these properties, as well as to houses at the western end of Marine Drive, was also cut off. Overstrand Municipality acted with commendable speed to re-establish access to all properties which had been cut off by the floods.

In an attempt to coordinate meaningful action, a meeting of interested and affected parties was held at the HPNBG on 17 December 2013 under the chairmanship of Prof Brian Huntley – former CEO of SANBI who also happens to be an Otter Close resident. Importantly, this meeting was also attended by representatives of Overstrand Municipality and of the environmental engineering firm AURECON.What came into sharp focusis that the problems of the HPNBG, Otter Close, Waterfall Road and the properties on the lower floodplain, are very closely linked. As such, a management strategy encompassing the entire catchment, river and floodplain system is required. The record of the meeting states that:

"***…….an overall study of the hydrology and dynamics of flooding, water, and vegetation management of the entire catchment was needed as a guide to the solution of specific problems. As the principal landowner in the lower catchment of the Disa, Leopards and Dawidskraal Rivers, and with the HPNBG extending from the mountains to the sea,*** *(via a narrow corridor)* ***SANBI indicated that it will, with the technical support from AURECON, commission through its normal supply chain management process, an overall study as a matter of priority".***

Immediately after this meeting a site inspection of various parts of the river/floodplain system with which the AURECON representatives were not familiar, took place. During this inspection AURECON asked me whether I would be prepared to assist with their investigation as they are aware of my many years of experience in the Betty's Bay area and because I had worked with them in a professional capacity on a number of other projects in the field of Coastal Zone Management. This prompted me to write anOverview Report dated 8 January 2014 summarising the key aspects ofthe current situation and various options for preventative action which needed to be weighed against each other. This overview was sent to AURECON via SANBI and was widely circulated to parties who had contributed to the 'flood debate'. It elicited wide and useful response.

The current report was prompted by the widely expressedfear that permanent solutions may be slipping into abeyance asthe temporary repairs in the HPNBG, of Otter Close Bridge and at Waterfall Road appear to be working well. Yet the real-life situation remains that episodic flood events are likely to occur at more frequent intervals and that without appropriate action at this stage, we can be back to 'square 1' overnight. The main conclusions which can be drawn from information gathered so far and recommendations which can be based upon them are therefore presented below:

CONCLUSIONS:

1. More information on overall run-off figures from the catchment (surface and sub-surface flow during normal and flood conditions), is urgently required. It is hoped that AURECON will be able to provide this vitally important information.
2. This river/floodplain system is complex as it receives surface and sub-surface flows directly from the mountain slopes and direct runoff from the Disa and Leopardskloof Gorges before converging on the upper floodplain via small flow channels and the major Disa River course.
3. Belowthe R44 this water finds its way to the sea through the lower floodplain which in original condition extended westwards of the former Dawidskraal Road and eastwards of Waterfall Road. Both these roads represent former flow channels. While the lower floodplain is characterised by a multitude of smaller flow channels in a braided configuration, the bulk of the water flowed to the sea via a number of larger flow channels which will be described in more detail below.
4. Rainfall in this catchment is high. It consists of much orographic precipitation (i.e. condensation ofmoist sea air in the cooler air of the mountain tops), of typical winter rains driven by north-westerly winds and gales and of occasional deluges which are associated with atmospheric SE cut-off low conditions. The latter tend to trigger flash floods throughout the Western Cape.
5. The upper and lower floodplains evolved over thousands of years to be able to cope with extreme flood conditions. However, this capacity has been drastically reduced by human incursions including:

    - Road construction, in particular the R44, Broadwith Road, Waterfall Road, the former Dawidskraal Road and Otter Close.
    - Property development within the lower floodplain.
    - Portions of the HPNBG on the upper floodplain.
    - Nutrient enrichment of river water, which in all probability contributed to rampant growth of palmiet (*Prionium serratum)* in river and flow channels.
    - Apparent progressive atmospheric and oceanic climate changes manifesting themselves in many parts of the globe including South Africa.

6. It must therefore be accepted that although road infrastructure and residential development has been permitted to develop within floodplain areas, these developments can now not be wished away. The vulnerability of such development might well be worsened by progressive changes in global climatic patternsmanifesting themselves at present. A guarantee that no further flood damage will occur in future, can therefore not be given.
7. The only course of actionis to manage this vulnerable situation to best ability. Hence the recommendations below:

RECOMMENDATIONS:(please studyFigures 1-5 at the end of the report before reading the recommendations).

1. **As the figures below show, rampant palmiet growth is the major cause of flooding on the upper and lower floodplains (Figs 1, 2 & 3). The palmiet must therefore be cleared from theriver channels - from the Olive May Porter Bridge to the mouth of the former major flow channel at the western end of Marine Drive (please refer to Fig 4). If the bulk of floodwaters are carried to the sea rapidly, the extent to which water levels can rise during flood conditions,will be drastically reduced. However, it must be accepted that clearing of the main flow channels will have to be repeated every few years.**

2. **The palmiet on the remainder of the lower floodplain should be left intact as, in the event of heavy floods, it will curb erosion damage elsewhere, e.g. to roads and the Otter Close and Waterfall Road properties.**

3. **The existing but damaged weir ('keerwal') at the seaward,western side of the R44 bridge, must be rebuilt to direct the bulk of floodwaters into the former major flow channel entering the sea at the western end of Marine Drive (Fig 4) . This will drastically reduce the amount of floodwater in the 'Dawidskraal flow channel'. Thereby swamp vegetation will be allowed to re-establish itself progressively along the Dawidskraal channel banks. With reduced water flow, the newly built, culverted Otter Close Bridge will be protected from further flood damage.**

4. **Waterfall Road suffered extremely serious erosion during the floods of 2005, 2013 and 2014. It receives flood water not only from the HPNBG, but also from Broadwith Road and more seriously, from the large tarred surface of the R44 from both the west and the east. It is highly likely that Waterfall Road was built in a former flow channel at the eastern perimeter of the floodplain. Serious consideration therefore needs to be given to provide this road with adequate stormwater swales on either side, or with a surface capable of carrying short-term storm flows to the seawhile - under non-flood conditions - still providing access to properties on either side. Civil engineering advice needs to be sought. If Waterfall Road is converted into a large stormwater channel capable of also serving as a road, it will have to be provided with adequate culverts at its lower end to allow floodwaters to flow directly into the sea without damming up at the Waterfall Road/Marine Drive junction.**

5. **The idea has been mooted that ALL floodwaters should be directed into the 'new', now seriously eroded 'Dawidskraal flow channel' and to provide access to Otter Close from the east, i.e. from the western end of Marine Drive. This idea should be abandoned for the following reasons:**
   - **As Fig 4 clearly shows, this wouldinterfere with the natural functioning of the entire lower floodplain and the formermajor flow channels entering the sea at the western end of Marine Drive, would just become more overgrown.Unpredictableecological consequenceswill inevitably arise.**
   - **As Fig 5 shows, erosion at the Dawidskraal corner is already extreme. It was vaguely suggested that gabions could be used to control this erosion. Examples in numerous areas along the coast make it abundantly clear that gabions seated on soft substrates are of no use in such situations, as floodwaters simply scour under and around them. Gabions used to re-enforce a former Otter Close Bridge provide a good example – they were simply washed away. Were the bulk of floodwaters to be sent down the already seriously eroded Dawidskraal flow channel, this would spell the end of at least part of the ancient Dawidskraal milkwood forest and also of the public picnic facility itself. In no way would this solve the access problems to Otter Close properties.**

ACKNOWLEDGEMENTS:

Sincere appreciation is expressed to all who participated in the intensive debate about the Betty's Bay flood problems over the past few weeks. While the conclusions and recommendations outlined above are my own – and I take full responsibility for them – I could not have reached them without input from so many sides.

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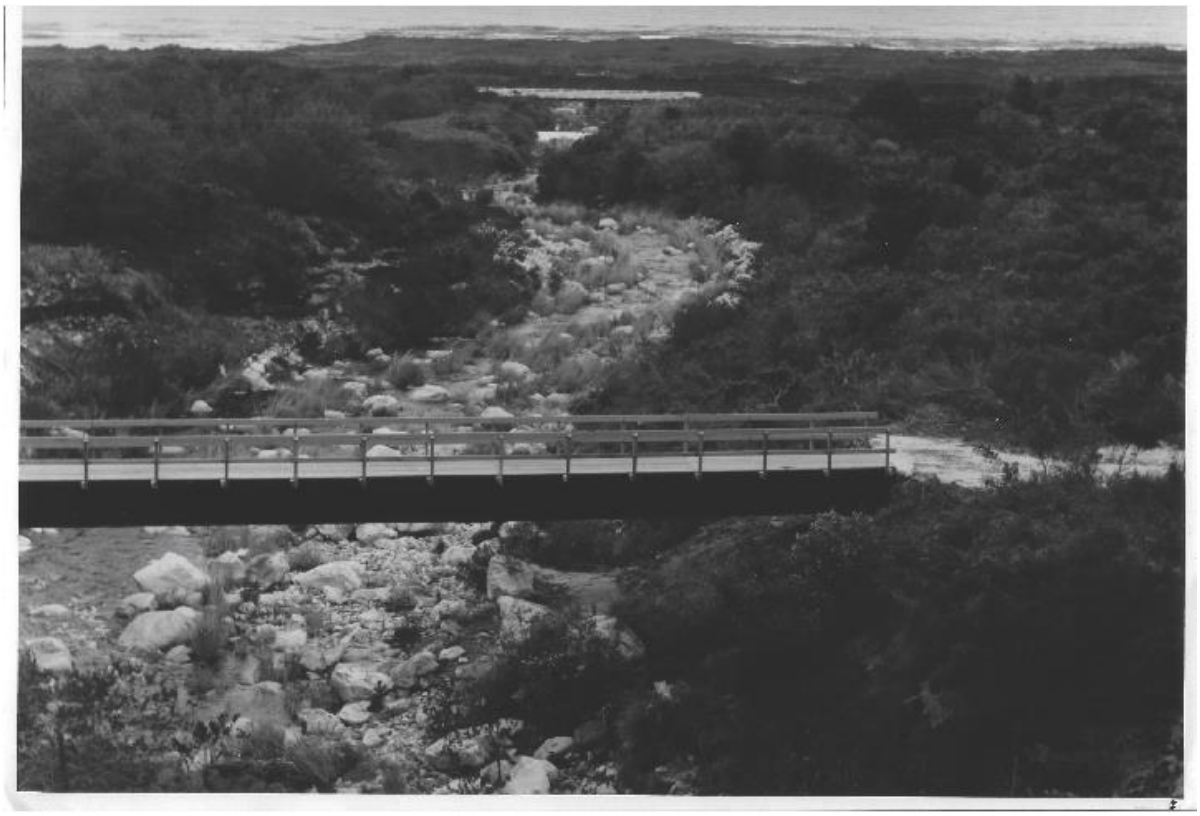

Figure 1:Olive May Porter Bridge across Disa River. Date ± 1966.

(This figure was dated by Roger Porter. It shows the newly built Olive May Porter Bridge and the Disa River ± 1966. Note that the river bed is virtually clear of palmiet growth.)

(Photo provided by Brian Huntley)

Figure 2:

Disa River channel on the upper floodplain, in the HPNBG. Note the dense growth of Palmiet undamaged by the floods of mid-November 2013. The photo was taken from the Olive May Porter Bridge on 16.12.2013. The lawn of the amphitheatre of the HPNBG can just be discerned at the top/middle of the photo.

(Photo: Allan Heydorn - 16.12.2013)

Figure 3:

The lower corner of the amphitheatre area of the Harold Porter National Botanic Garden showing the plug of palmiet which causedflood waters to overflow into the lower portion of the gardens, restaurant and the parking area in December 2013 and January 2014.

(Photo: Allan Heydorn- 16.12.2013)

Figure4:

Aerial view of the seaward portion of the lower Disa River floodplain taken. This extremely interesting photo was provided by Richard Starke and depicts the lower floodplain ±1982. Dawidskraal Road is still intact, but it can clearly be seen that it cuts right through the original floodplain and that part of the original flow channel was simply filled in during construction of the road. Equally interesting is the fact that the lower portion of this flow channel is virtually straight and that it is situated at least 50 m away from milkwoods of the Dawidskraal Picnic Area (compare with the current situation in Fig 5). Note also that at that stage the bulk of floodwaters from the HPNBG flowed through a major flow (or river channel) entering the sea at the western end of Marine Drive). Further observations:

a. **When the photo was taken, the lower floodplain still functioned as a braided multi-flow channel system .**
b. **However, three larger flowchannels can be discerned clearly on the photo. The largest one can be seen at the lower border of the photo. It is joined by another flow channel (approximately parallel with Waterfall Road) just before it enters the sea at the western end of Marine Drive.The flow channel immediately to the east of Dawidskraal Picnic Area is small and shows NO signs of meandering. It only became a major flow channel during the 2005 flood event when Dawidskraal Road was washed away entirely. The powerful meandering of this flow channel now threatening the milkwoods of the picnic area (Fig 5), only started once major water flows, coursed down this channel rather than down the original major flow channel to the east.**
c. **A number of plots had been laid out at the edge of the dunes at the lower end of the floodplain, but no building had begun.**
d. **Otter Close Road can just be discerned as nothing more than a jeep track. It is unlikely that it acted as a dam affecting water flow in the floodplain at that stage. Unless this, now much larger, road is provided with adequate culverts, it will continue acting as a dam, which probably enhances the meandering tendencies of the Dawidskraal flow channel**

(Photo provided byRichard Starke)

Figure5:

This photo was taken at the height of the flood on 6 January 2014. Note that the raging floodwaters are approaching the Dawidskraal milkwoods at virtually right angles. Erosion in this corner is extreme and both the ancient milkwoods and the picnic area itself are under serious threat. Note also that the fence of the Dawidskraal picnic area is collapsing into the river due to erosion of the bank. Compare this situation with the configuration as it was in 1982 (Fig 4).

(Photo: Allan Heydorn - 06.01.2014)