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Case # 1424

PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED  
UPGRADE TO THE STORMWATER AND DETENTION FACILITIES IN  
HILLSIDE, BEAUFORT WEST, WESTERN CAPE

Prepared for:  
Kayad Knight Piesold (Pty) Ltd  
P. O. Box 381  
Century City  
7446  
Tel: 021-555-0400  
Email: cblanche@knightpiesold.com

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Prepared by:  
Dr Jennifer Botha-Brink  
Karoo Palaeontology Department  
National Museum  
P. O. Box 266  
Bloemfontein  
9300  
Tel: 051-447-9609  
Fax: 051-447-6273  
Email: jbotha@nasmus.co.za  
Permit No. 80/10/08/009/60



## EXECUTIVE SUMMARY

The Beaufort West Municipality requires the establishment of two detention ponds and the upgrading of existing stormwater earth channels in the suburb of Hillside 2, Beaufort West, Western Cape, in order to solve the problem of frequent flooding and destruction of property in the area. Due to the National Heritage Resources Act, a palaeontological impact assessment is required to detect the presence of fossil material at the proposed development. Although the Beaufort West District is well known for its rich fossil record, only three vertebrate fossil species have been recovered from the Beaufort West Commonage. Due to the paucity of fossils in the town, the flat low lying geography and absence of steep-sided gullies that would preserve fossils, the general lack of exposure due to vegetation cover and the overall degraded nature of the proposed sites, impact on the palaeontology in the area is negligible. Thus, subject to approval from the relevant authorities, the upgrade of the stormwater and detention facilities in Hillside, Beaufort West, Western Cape should proceed.

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## 1. INTRODUCTION

A problem with flooding and stormwater management in the suburb Hillside 2, Beaufort West, Western Cape has been identified. As a solution to the problem, the Beaufort West Municipality proposes the formalization of two stormwater detention ponds and the rehabilitation and extension of existing stormwater earth channels in Hillside 2, Beaufort West. The building of formal detention ponds appears to be the best solution to the current problem as they will detain stormwater and prevent nearby houses from being flooded. It is envisaged that earth channels will carry water from the surrounding high-lying area to the detention ponds, and from there the water will be allowed to dissipate more slowly into the existing downstream stormwater systems. The proposed sites for the detention ponds are situated on municipal and Transnet property within the suburb of Hillside.

Lita Webley, from the Archaeology Contracts Office, Department of Archaeology at the University of Cape Town was asked to conduct a heritage impact assessment of these sites in February 2011. The assessment considered the general heritage and archaeology of the site, but did not consider the palaeontology of the area. The conclusions of the report were that there would be no impact on the archaeology, but there was a possibility that fossil remains were present as the region is known for its fossiliferous strata (Webley, 2011). As palaeontological material is unique and non-renewable, it is protected by the National Heritage Resources Act (Act No. 25 of 1999, section 35). A Palaeontological Impact Assessment of the proposed development is thus necessary to ensure that palaeontological material is either removed, or is not present.

### 1.1 Objective

To conduct a desktop study on the Western Detention Pond (Beaufort West Municipality Erf 8918) and Eastern Detention Pond (Transnet Erven 11 and 12), and associated earth channels to determine the impact on potential palaeontological material at these sites.

## 2. BACKGROUND TO THE GEOLOGICAL AND PALAEOLOGICAL HISTORY

The Beaufort Group, Karoo Supergroup of South Africa is world-renowned for its rich fossil record. The rocks of this region contain some of the most significant evidence of the origins of dinosaurs, mammals and turtles resulting in South Africa being one of the top palaeontological destinations in the world. Beaufort Group rocks are Permo-Triassic in age and characterized by fluvially deposited rocks occasionally intruded by Jurassic dolerite dykes and sheets (Catuneanu et al., 2005). Beaufort West itself contains rocks from the Upper Permian Teekloof Formation, Adelaide Subgroup and are approximately 262 million years old (Catuneanu et al., 2005; Walker and Geissman, 2009).

The rocks of the Beaufort Group are subdivided into assemblage zones according to the various vertebrate fossils found in each zone. Beaufort West falls within the *Priesterognathus* Assemblage Zone, named after the most common therapsid fossil found in the zone. Fossils in this biozone are found in mudrock sequences between major channel sandstone units. They are usually preserved as

isolated skulls or postcranial fragments in beds of greenish-grey siltstone (Keyser and Smith, 1995).

Vertebrate fossils that have been recovered from the *Pristerognathus* Assemblage Zone include two fish species, one amphibian species, and several reptile species. However, by far the most common vertebrates recovered are the therapsid synapsids, ancient ancestors of mammals. These include biarmosuchians, gorgonopsians, therocephalians and anomodonts (see Appendix 1 for detailed species list). Three plant taxa, namely *Glossopteris*, *Phyllothea* and *Schizoneura*, have also been recovered from this zone (Keyser and Smith, 1995). Potential trace fossils include vertebrate burrows and trackways (Keyser and Smith, 1995). Although numerous fossils have been recovered from the *Pristerognathus* Assemblage Zone, relatively few taxa have been found in the Beaufort West Commonage itself. The late Dr James Kitching, a world-renowned palaeontologist, famous for his ability to locate fossils, surveyed the Beaufort West Commonage during the 1970s and published his findings in his 1977 Memoir (Kitching, 1977). Taking species validity into account, Kitching only recovered the dicynodont anomodont *Endothiodon*, the gorgonopsian *Gorgonops* and the therocephalian *Ictidostoma* from the Commonage (Kitching, 1977).

### 3. NAME AND GEOGRAPHICAL LOCATION OF THE SITE

Western Detention Pond: Beaufort West Municipality Erf 8918, Hillside, Beaufort West, Western Cape (32° 21' 22.04" S, 22° 33' 53.51" E).

Eastern Detention Pond: Transnet Erven 11 and 12, Hillside, Beaufort West, Western Cape (32° 21' 15.77" S, 22° 34' 16.22" E).

Earth channels: extension along existing service roads, Hillside, Beaufort West, Western Cape.

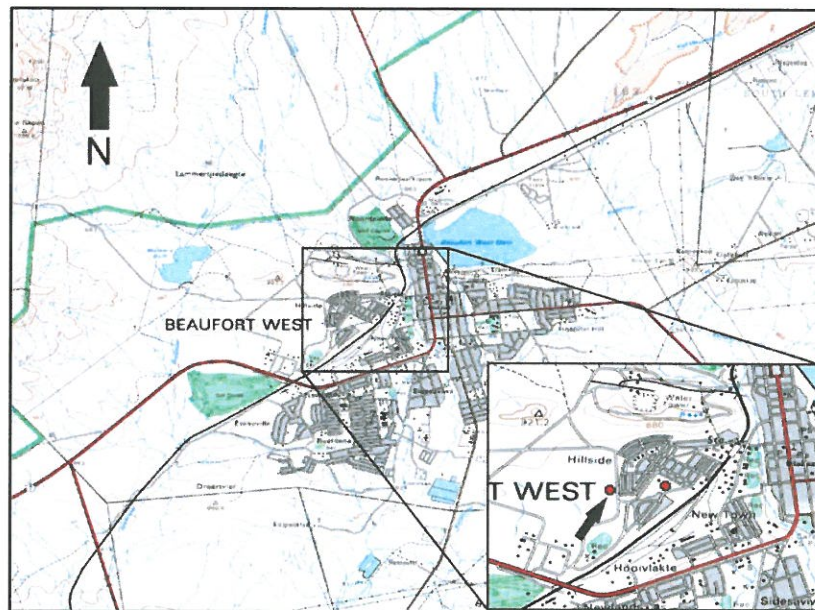


Figure 1. Site and close up (insert) of the proposed development in Hillside, Beaufort West, Western Cape (1: 50 000 map of Beaufort West 3222 BC, 1979). Informal housing has since encroached onto the proposed site for the Western Detention Pond (arrow in insert).





Figure 2. Aerial photograph of site (current), Western Detention Pond (WDP), Eastern Detention Pond (EDP), and associated earth channels (in yellow) of the proposed development in Hillside, Beaufort West, Western Cape.

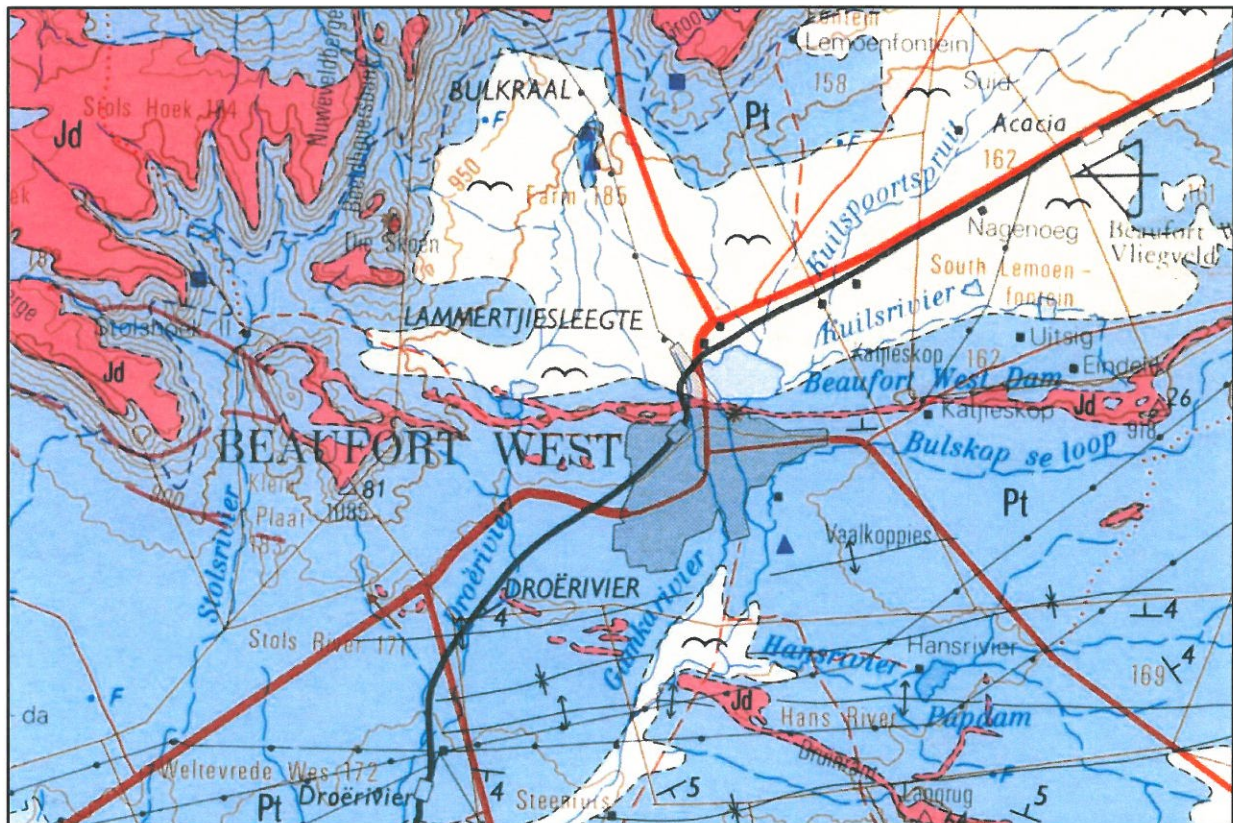


Figure 3. Geological map (1: 250 000, Beaufort West 3222), showing the geology of the Beaufort West area. Jd (area shaded in pink), Jurassic dolerite; Pt (area shaded in blue), Permian rocks that may contain fossils; area shaded in yellow is alluvium.



#### 4. METHODS

A desktop study was conducted to assess the potential risk to palaeontological material (fossils, trace fossils) in the proposed area of development. Aerial photos (using Google, 2010), topographical and geological maps were examined. The Basic Assessment Report, the Foundation and Materials Investigation conducted by Aurecon and the Heritage Impact Assessment completed by the Archaeological Contracts Office were also examined.

#### 5. FINDINGS AND RECOMMENDATIONS

The Beaufort West District is well known for its fossiliferous strata, found in Upper Permian rocks of the Beaufort Group (Figure 3; Appendix 2). Numerous vertebrate fossils, mostly therapsid synapsids (Appendix 1), have been recovered from the outcrops surrounding the town Beaufort West. However, these outcrops are situated mostly in the Nuweveldberge protected by the Karoo National Park. In contrast, very few fossils have been recovered from the Beaufort West Commonage; these comprise *Endothiodon*, *Gorgonops* and *Ictidostoma*. There is no record of trace or plant fossils being recovered from the town itself. The geology of the area for the proposed detention ponds includes a thin layer of sand overlying mudrock and dolerite. Fossils are only preserved in mudrock. However, much of this mudrock appears to be broken up, is particularly hard and partially covered in vegetation (see Aurecon's geological report for photographs). Furthermore, fossils are usually preserved in the high lying areas in outcrops on hills, or low lying areas, but in river channels. They are not usually preserved on flat surfaces such as those found in Hillside. As no loose fossil bone was found by either Aurecon or Webley, it is highly unlikely that fossils have been preserved in these areas. When fossil bone is preserved *in situ* (i.e. fixed in solid rock), loose fossil bone is always found in the vicinity. The absence of loose (or *in situ*) fossil material excludes the possibility that fossils are present at either the Western or Eastern detention pond sites. The rehabilitation of the earth channels includes upgrading existing channels and extending these channels along service roads, which also excludes the possibility of disturbing fossils and this would have already occurred when the roads were made. Furthermore, the service road along the hill, north of Hillside, was made along an outcrop that consists mostly of dolerite, which does not preserve fossils (Figure 3, area shaded in pink is Jurassic dolerite).

Thus, considering the rarity of fossil preservation at the Beaufort West Commonage, the poor nature of fossil-bearing sediments and lack of appropriate exposure (i.e. steep-sided gullies) at the proposed sites and the degraded nature of the area (partially covered in vegetation, housing encroachment, acting as a rubbish dump and being routinely flooded by stormwater), the impact on palaeontological material at these sites is negligible.

In conclusion, subject to approval from the relevant authorities, I recommend that the upgrade of the stormwater and detention facilities in Hillside, Beaufort West, Western Cape proceed.

## 6. REFERENCES

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## 7. APPENDICES

Appendix 1. Fossil taxon list for the Upper Permian *Pristerognathus* Assemblage Zone, Beaufort Group, Karoo Supergroup, South Africa. The taxa in bold have been recovered from the Beaufort West Commonage.

| Group         | Genus                     |
|---------------|---------------------------|
| Pisces        | <i>Atherstonia</i>        |
|               | <i>Namaichthys</i>        |
| Amphibia      | <i>Rhinesuchus</i>        |
| Parareptilia  | <i>Bradysaurus</i>        |
|               | <i>Embrithosaurus</i>     |
|               | <i>Eunotosaurus</i>       |
| Therapsida    |                           |
| Anomodontia   | <i>Galepus</i>            |
| Dicynodontia  | <i>Diictodon</i>          |
|               | <i>Dicynodontoides</i>    |
|               | <b><i>Endothiodon</i></b> |
|               | <i>Emydops</i>            |
|               | <i>Pristerodon</i>        |
| Biarmosuchia  | <i>Hipposaurus</i>        |
| Gorgonopsia   | <b><i>Gorgonops</i></b>   |
|               | <i>Scylacognathus</i>     |
| Therocephalia | <i>Hofmeyeria</i>         |
|               | <b><i>Ictidostoma</i></b> |
|               | <i>Ictidosuchoides</i>    |
|               | <i>Pristerognathus</i>    |
|               |                           |

Appendix 2. Geological map (1: 250 000, Beaufort West 3222) of Beaufort West and surrounding area. Most fossils are recovered from outcrops in the Nuweveldberge, in Upper Permian rocks (Pt, area shaded in blue) that are exposed under the overlying Jurassic dolerite (Jd, area shaded in pink). Dolerite is particularly hard and does not weather easily. It thus preserves much of the softer underlying sedimentary rocks by capping the hills in the Karoo.

