Dune Geomorphology Specialist Report
for the proposed Koeberg Insulator Pollution Test Station

prepared for ESKOM via Landscape Dynamics

by Illenberger & Associates

May 2017

Frontispiece. The existing Insulator Pollution Test Station on the coast south of Koeberg, being swamped with wind-blown sand.

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10 May 2017

DECLARATION OF INDEPENDENCE

I, Werner Kurt Illenberger as principal of Illenberger & Associates, hereby confirm my independence as a specialist and declare that I do not have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of which Landscape Dynamics was appointed as environmental assessment practitioner in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), other than fair remuneration for worked performed, specifically in connection with the Environmental Impact Assessment for the proposed Koeberg Insulator Pollution Test Station. I further declare that I am confident in the results of the studies undertaken and conclusions drawn as a result of it – as is described in the attached report.

Full Name: Werner Kurt Illenberger

Title / Position: Dr

Qualification(s): BSc, BSc Hons, MSc, PhD

Experience: Consulting for 36 years in physical coastal processes

Registration(s): Geol Soc SA, Pr Sci Nat

Introduction

Eskom proposes to build a new Insulator Pollution Test Station at Koeberg, Western Cape, South Africa, and remove the existing Koeberg Insulator Pollution Test Station (KIPTS) which is being swamped with wind-blown sand. This report is intended to inform the authorisation process with regards to the potential impacts of the proposed activities on physical coastal processes, in particular dunes, in the area. A preferred and an alternative site have been identified (Figure 1).

Figure 1. The proposed, alternative and existing KIPTS sites. GoogleEarth image of 6 Mar 2017.

Study Approach

This is a desktop study, augmented with one field visit on 31 January 2017, and is based on available literature and studies, in particular the *Atlas of South African Coastal dunefields,* prepared for the (then) Department of Environmental Affairs & Tourism (Illenberger, 1998). It covers

- Dune geomorphology
- Dune stability - from a mobility point of view as well as suitability for development
- Mitigation measures for removing the existing Koeberg Insulator Pollution Test Station

Winds

The dominant wind at Duynefontein (just south of Koeberg) is SSE, blowing from September to April. Westerly winds are secondary, blowing mainly from May to September, with some direction variation from WSW to WNW (Figure 2).

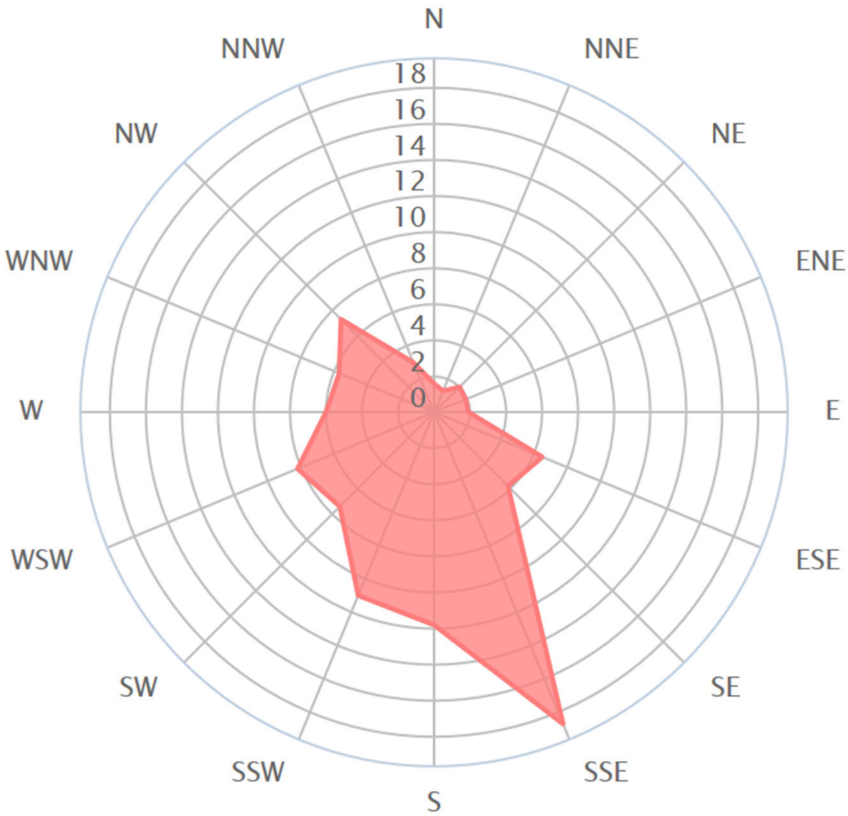


Figure 2. Wind rose for Duynefontein, based on data from 2013 to 2017 (www.windfinder.com)

The Dunes at Koeberg

The area is characterised by a high dune mobility (Illenberger, 1998), because rainfall is low, resulting in low vegetation vigour, while wind energy is high. The natural state of the dunes was mobile, unvegetated dunes that were blown northward by the dry summer winds, as can be seen in the 1938 and 1960 aerial photographs (Appendix A). The dominant dune type was the transverse dune (transverse to the summer southerly winds); the winter north-westerlies would modify the shape somewhat to create a more complex shape.

The beach acted as the feeder zone for the dunefield that stretches inland for 10's of km. Ken Tinley (1985) very aptly called these "*corridor dunefields*".

The dunes around Koeberg were artificially stabilised during the 1970's. Koeberg Nuclear Power Station was then built on the stabilized dunes (1974 and 1985 aerial photographs: Appendix A).

Once the dunes were stabilized, they remained in a fixed, vegetated state with little or no human intervention. Re-activation would take place on a time scale of 10's of years, starting from the shoreline where the beach acts as a source of mobile dune sand that will transgress landward (if no mitigation is taken to limit or prevent this). Reactivation of the dunes is currently taking place in a zone with an average width of 75 m from the high-water mark along the shore of Van Riebeeckstrand and Duynefontein suburbs (Figure 3).

Figure 3. Dunes along the shore of Duynefontein suburb.

From the northern margin of Duynefontein suburb till about halfway to the existing KIPTS, there is a deflated area (Appendix B: Mar 2017 image).

Further north, towards the existing KIPTS, the belt of mobile dunes increases to 100 m width, and the dunes are higher (Figure 4). This agglomeration of dunes represents a pulse of sand that was generated when dunes started mobilizing in the area north of Duynefontein suburb about 2005, and then was blown northward, reaching the access road to the existing KIPTS about 2014 (Appendix B) and is now inundating the existing KIPTS.

Figure 4. A pulse of dunes along the shore just south of the existing KIPTS.

Dune Stability and Suitability for Development

The proposed preferred and alternative sites for the new KIPTS (Figures 5 & 6) are entirely within the area that was formerly mobile dunes. At both sites, development can take place safely without any impacts on the now-stabilized dunes. Both sites are equally suitable from the dunes perspective.

When vegetation is cleared from an area for development, it must be re-vegetated as soon as the development is completed, so that the dune sand do not become re-mobilized.

Figure 5. The preferred site for the new KIPTS.

Removing existing Koeberg Insulator Pollution Test Station

As described above, a pulse of sand is currently inundating the existing KIPTS and its access road. Moving the sand out of the way while the KIPTS structures are being removed will have a negligible impact on the dynamics of the moving dunes.

Sand should be cleared off the access road by shifting it northward, the direction in which the dominant wind would move it. Alternately sand could be moved seaward, which would represent a delay in its natural wind-blown movement, but would have no consequences within the natural high variability in the wind regime.

It is preferable to work during the calm season, i.e. autumn, so that wind-blown sand will be less of a nuisance.

Figure 6. The alternative site for the new KIPTS.

References

Brown A C & McLachlan A 2006. *The Ecology of Sandy Shores.* 2nd edition. Academic Press, 392 pp.

Illenberger W K 1993. Variations of coastal sediment dynamics in Algoa Bay during the Holocene. *S Afr J Sci* **89**, 187-196.

Illenberger W K 1998. *Final report: Atlas of South African Coastal dunefields.* Report of the Institute for Coastal Research, University of Port Elizabeth, submitted to Dept of Environmental Affairs & Tourism.

Tinley, K. L. 1985. *Coastal dunes of South Africa.* South African National Scientific Programmes Report no. 109. Foundation for Research Development, Council for Scientific and Industrial Research, Pretoria, South Africa, 300 pp.

Appendix: Curriculum Vitae – Werner Kurt Illenberger

Relevant experience

Widely experienced in the coastal environment; consulted for 25 years around the world in research and management issues and visited many of the world's coastlines. Conducted a detailed study to map coastal dunes around the whole South African coast, before and after human impacts. Broad multi-disciplinary knowledge of coastal dunes and the coastal environment: coastal sediment dynamics, beaches, dunes and estuaries; coastal diamond mines, coastal groundwater.

Key skills and interests

- Coastal environmental consultant - beaches, dunes & estuaries
- Coastal sediment dynamics, palaeoenvironments
- Theoretical sedimentology, particle shape and size
- Coastal evolution since the break-up of Gondwanaland
- Quaternary dating techniques
- Global wind field
- Alternate energy
- Fallout dust
- Photography, including aerial photography
- Computer skills: MS Word, Excel, PowerPoint, Thumbsplus, Lightroom
- Languages: English, Afrikaans, German

Employment History

1989 - present time	Environmental consultant, self-employed, Illenberger & Associates
1984 – 1995	Coastal environment researcher, University of Port Elizabeth, South Africa

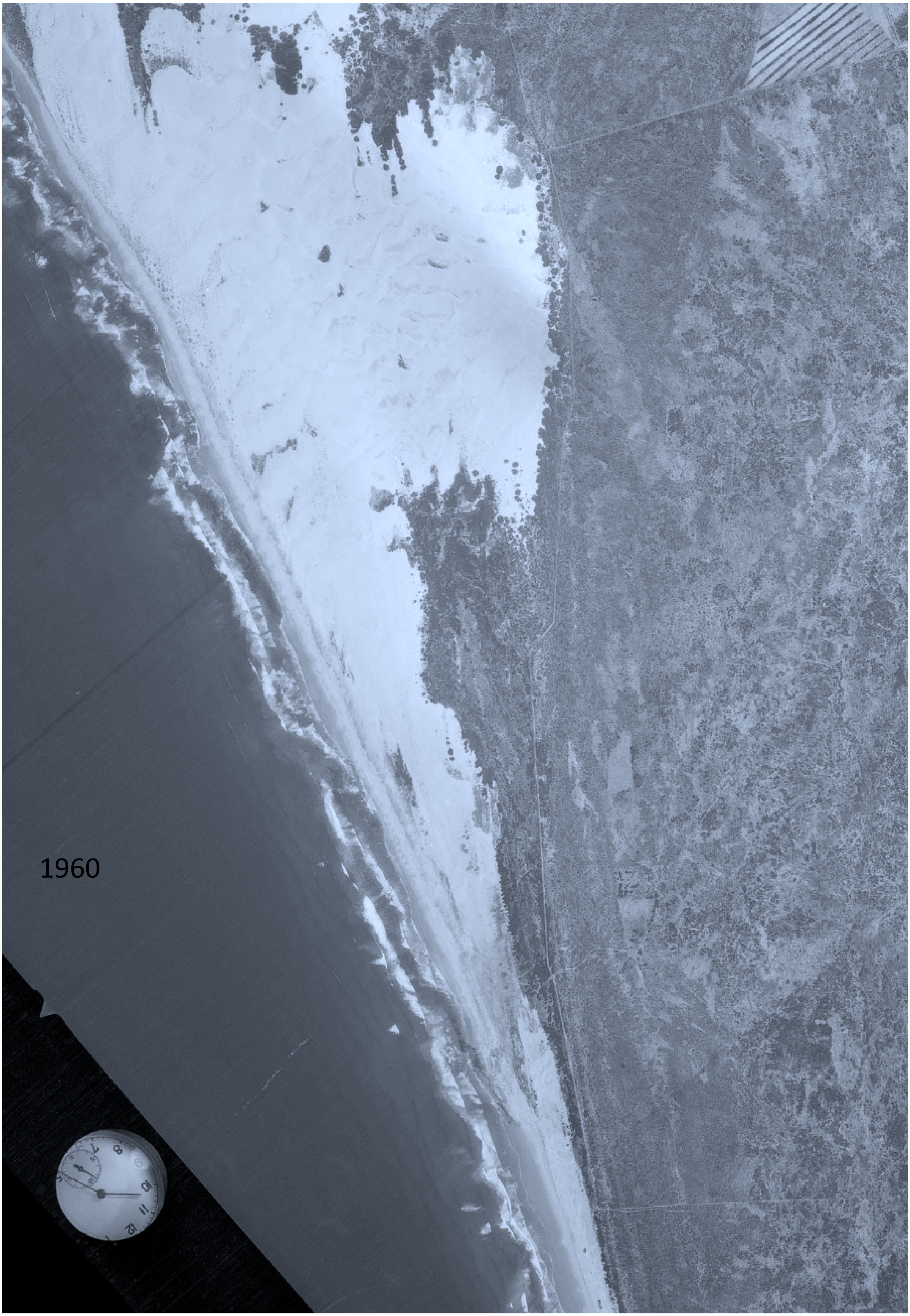
Education and Training

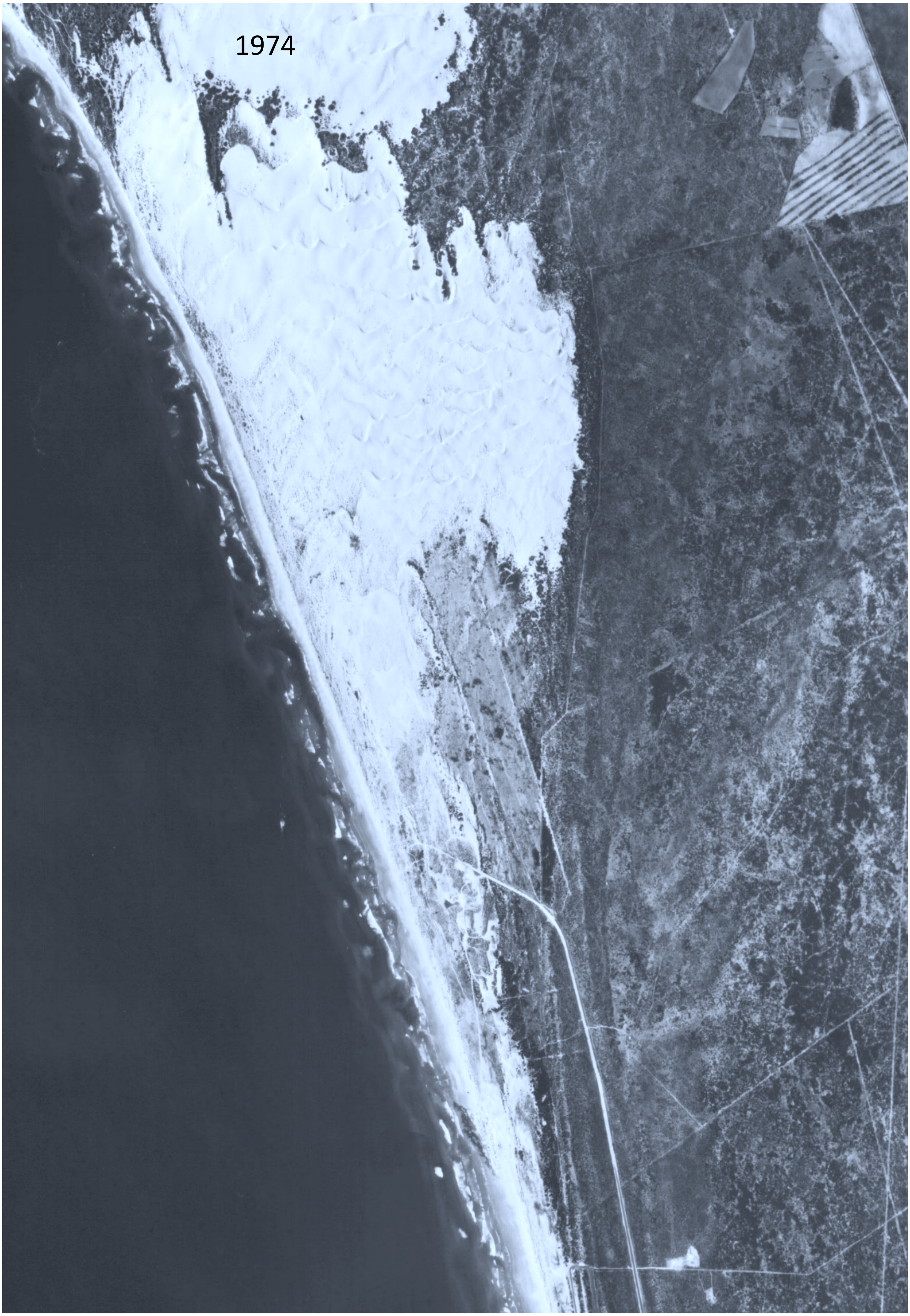
BSc	University of Port Elizabeth, South Africa, 1976
BSc Honours:	University of Port Elizabeth, South Africa, 1977
MSc:	University of Port Elizabeth, South Africa, 1986
PhD:	University of Port Elizabeth, South Africa, 1991

Appendix A

Aerial photographs of the Koeberg site from 1938 to March 2017

1938


1960


1974


1985

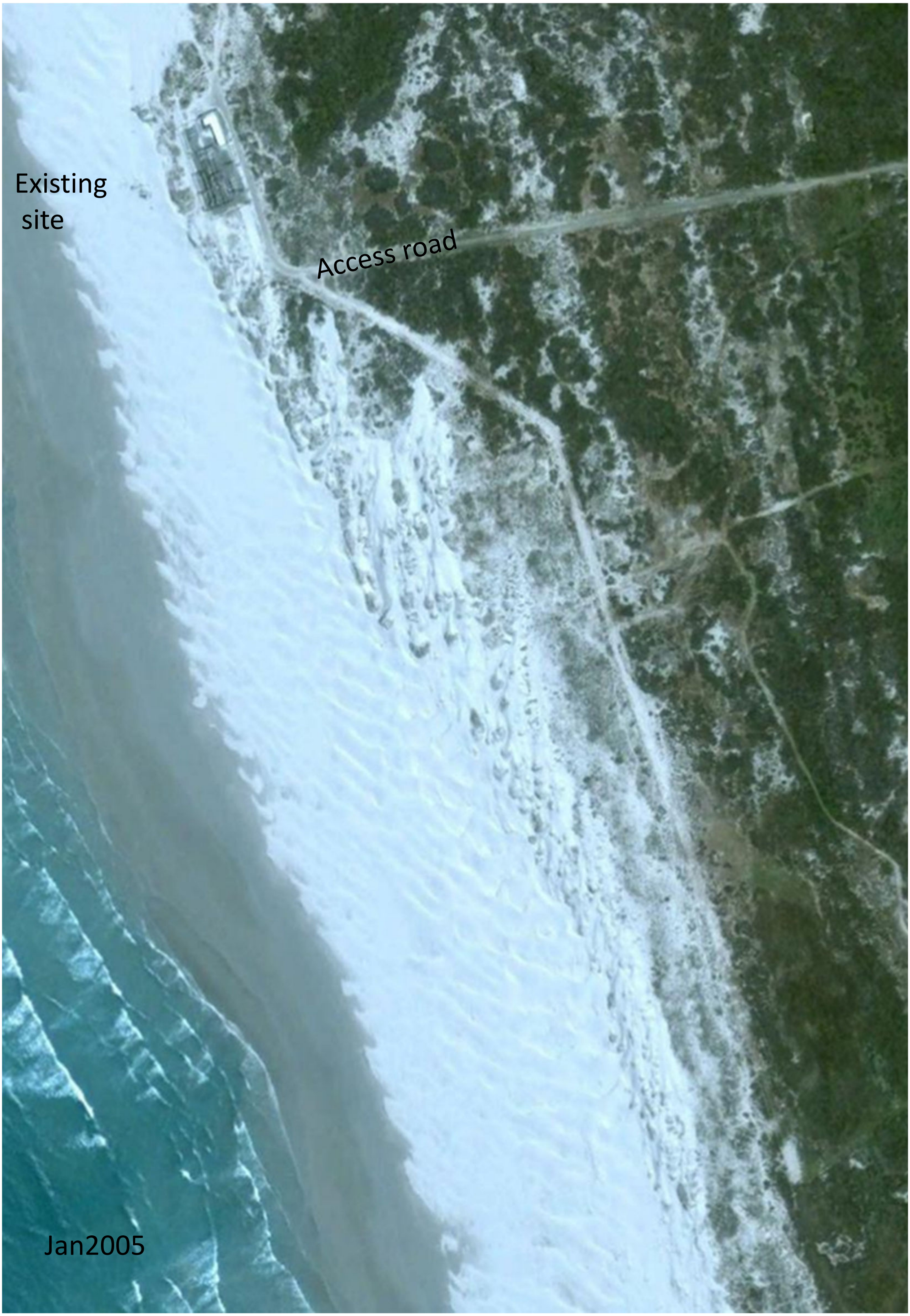
Preferred site
Alternative site
Existing site
6 March 2017

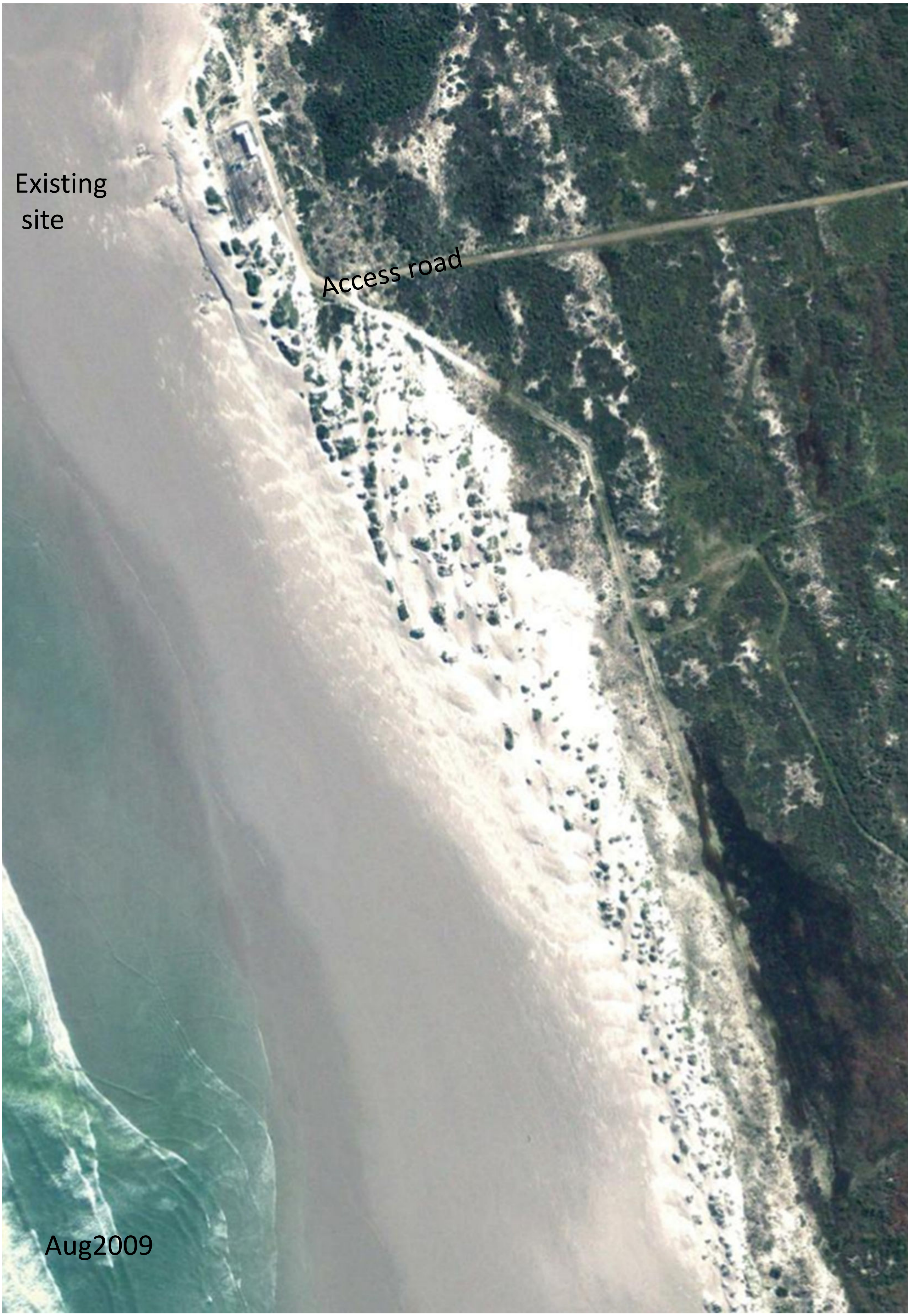
Appendix B

Time series of existing Koeberg Insulator Pollution Test Station and the mobile dunes along the shore to the south, based on GoogleEarth images of May 2003 to March 2017


Existing site
Access road
May 2003


Existing
site
Access road
March 2004


Existing
site
Access road
Jan2005


Existing
site
Access road
Aug2009


Existing site
Access road
Sep 2011


Existing
site
Access road
Feb2014


Existing
site
Access road
June 2015


Existing
site
Access road
Feb 2016


Existing site
Access road
deflated area
Mar 2017