

Draft BAR: Appendix D1: Geomorphological Study

Morphodynamic considerations for Erf 1363, Paradise Beach

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1. Introduction and Terms of Reference

A new dwelling is proposed to be developed by the landowner on Erf 1363 Paradys Strand/Paradise Beach (the site; 34° 6'21.00"S; 24°53'16.07"E), located in Kouga Local Municipality (Figure 1). The erf is 741.6 m² in extent. The footprint of the proposed dwelling (including 43.8m² decking area) is 296.9m². A portion of the site falls within 100 m of the highwater mark and there is risk of coastal erosion and dune instability.



Figure 1: Location of erf 1363, Paradys Beach, Kouga Local Municipality

EAP Services contracted GeomorphAfrica to investigate the following at a desktop level:

- Historical aerial imagery for that section of beach to indicate the variability of the system
- Prevailing wind directions, wave directions, sea level rise, sand transport and recommendations to mitigate negative consequences; and
- Design considerations to reduce damage due to dune instabilities.

2. Site character and changes to geomorphic processes along the coastline

2.1. Geology

The site is underlain by the Nanaga Formation which is yellowish fine to medium-grained consolidated aeolian sand or dune rock with shell fragments (Toerien and Hill, 1989). The Nanaga Formation is underlain by a wave-planed Ceres subgroup which consist of resistant shale and fine-grained sandstone layers that form a shallow seaward-sloping rock platform (Toerien and Hill, 1989). The dunes and beaches are composed of shell fragments and quartzitic sands originating from the Cape Supergroup rocks (Toerien and Hill, 1989). Most of the coastal zone around the site consists of erodible aeolian sediment of fine to medium sand size, making the coastline vulnerable to degradation and slumping.

2.2. Wind dynamics and aeolian sand transport

The winds along the southern Cape are mostly influenced by the subtropical anticyclonic belt encircling the Southern Hemisphere, driving strong and persistent south-westerly winds in winter months (Figure 2)(Kruger et al., 2010). Local coastal lows or cutoff lows during summer drive strong easterly winds from the semi-permanent south Indian Ocean high-pressure cell (Kruger et al., 2010).

These dominant and strong wind directions drive aeolian transport in a north-easterly direction along the coast (during south-westerly wind) and in a westerly direction (during easterly wind) across the shore.

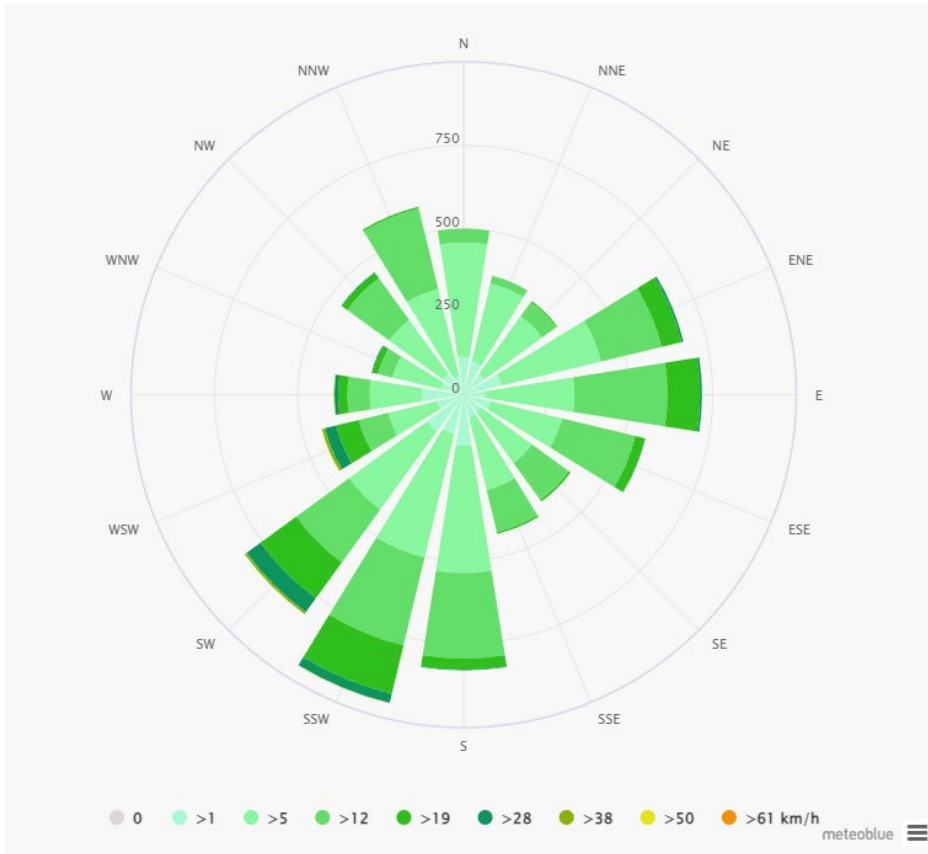


Figure 2 Wind rose for Jeffreys Bay based on 30 years of hourly simulations (Source: MeteoBlue)

Historical measurements and future predictions show an increased intensity and frequency of storm events (wind and wave energy) (Guastella and Rossouw, 2009; Theron and Rossouw, 2008). The response relationship is often non-linear. Theron and Rossouw calculated that an increase of wind speed by 10 % can result in a wave height increase of ~ 26 % and a sediment transport rate increase of ~49 to 100%.

2.3. Wave direction and sediment transport

The majority of the waves experienced along the Paradise Beach coastline are generated in the vast Southern Ocean due to the predominant westerly winds further south in the gale belt of the ‘Roaring Forties’ (Illenberger and Schumann, 2022). These waves approach the coast from a south-westerly direction and have a long wave period (Figure 3). Due to refraction around the Cape St Francis point, the waves approach the coast at an oblique angle, driving longshore currents and associated sediment transport. These longer-period waves often move sand from the offshore sandbank to the beach (Illenberger and Schumann, 2022).

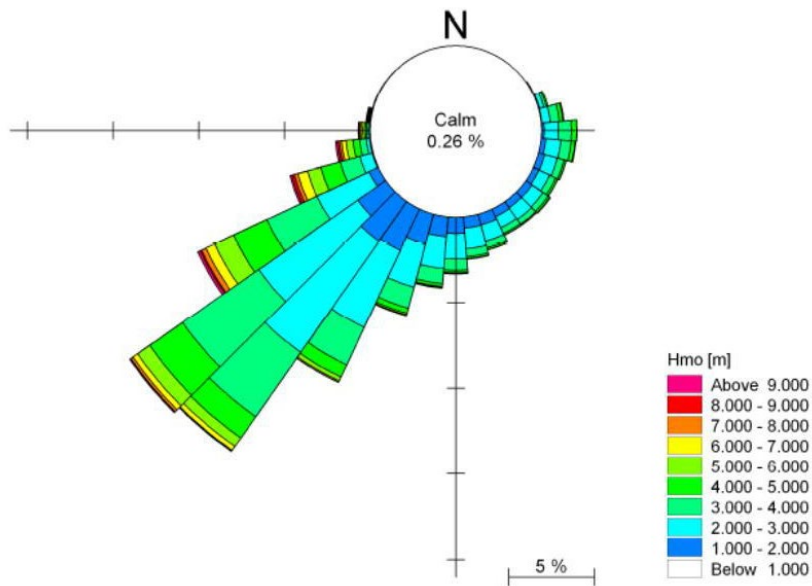


Figure 3 Wave Rose for Cape St Francis for 15 years of data (PRDW 2009 presented in Illenberger and Schumann, 2022)

More locally produced waves associated with strong easterly winds have a shorter wave period. These large waves with a short period are often associated with beach erosion as they approach these east-facing beaches directly from the east. These high-energy waves drive beach erosion, moving beach sand towards the offshore sand bars during high-wave events (Illenberger and Schumann, 2022). These erosional events occur in summer during cutoff lows when strong easterly winds drive high energy waves from an easterly direction into these east-facing bays (Illenberger and Schumann, 2022).

2.4. Dune dynamics

Most of the South African coastline consists of sandy beaches backed by dunes (Tinley, 1985). The dunes are often a mixture of modern and ancient lithified dune systems, with the dunes acting as a sediment store for these dynamic landscapes. This dynamic zone should ideally not be stabilised to allow for coastal processes to continue (sand migration, sand storage and erosion) without impacting infrastructure. The indigenous coastal vegetation is adapted to these dynamic landscapes, with pioneer to climax vegetation structures developing around the coastal morphodynamics and resultant habitat dynamics (Tinley, 1985). Invasive plants often outcompete the native species, forming dense thickets that halt sediment transport. These soft sandy coastlines, as can be seen at the site, are in a constant state of flux due to wave and wind action, changing sand input from the rivers and near-shore environment and sea level rise (Tinley, 1985). Reductions in sand availability in the littoral zone, due to dune bypass stabilisation and

dams trapping terrigenous sediment, drive foredune erosion to supplement the sand budget (Tinley, 1985).

Coastal beach-dune systems are inherently unstable dynamic zones with interactions through wave and aeolian sediment erosion and transport (Knight and Burningham, 2021). The level of dune stability increases landward, with the foreshore and backshore experiencing frequent changes (hours to weeks) whereas the fixed dunes experience change on a monthly to decadal+ timescale (Tinley, 1985). Figure 4 shows a typical progression of vegetation cover, stability and sediment transport activity for a beach and dune cross-section. Beach-dune systems show a gradient in dune and vegetation stability due to how often each area is affected: foreshore and backshore are frequently reworked, foredunes only during larger, less common events, and central/back dunes during rare major occurrences like sea level changes. This progression should be reinstated where possible to reduce damage to infrastructure within the dune zone.

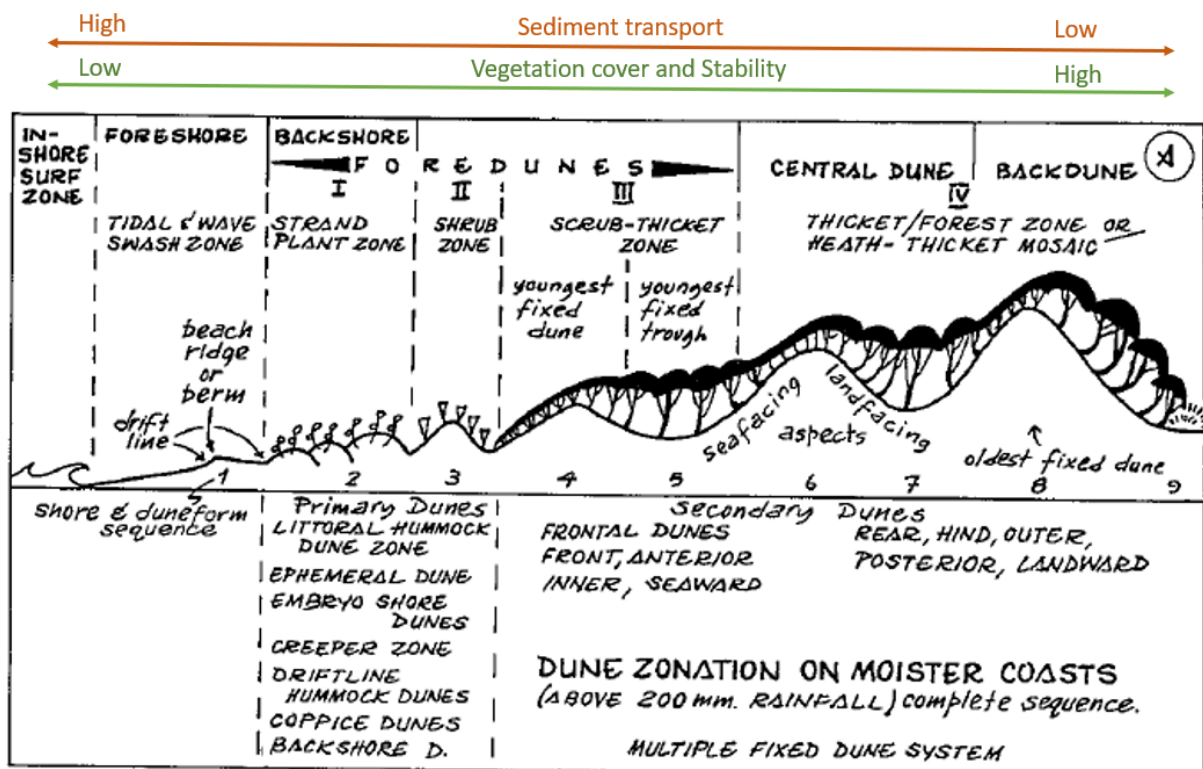


Figure 4: Dune zonation, vegetation cover, stability and sediment transport for a beach to back dune transect (Tinley, 1985)

Blowouts can develop due to the destruction of protective vegetation on a foredune or dune ridge when winds are very strong or the ridge becomes excessively steep, or due to human actions such as fires destroying dune vegetation, footpaths and vehicle access paths on retention ridges (Illenberger and Schumann, 2022). These poorly vegetated

patches act as a source of sand for parabolic dune formation (Illenberger and Schumann, 2022). The parabolic dunes often migrate inland, posing threats of sand inundation to infrastructure.

Several blowouts are visible on the steep eroding foredune in the area of Erf 1363 (Figure 5).

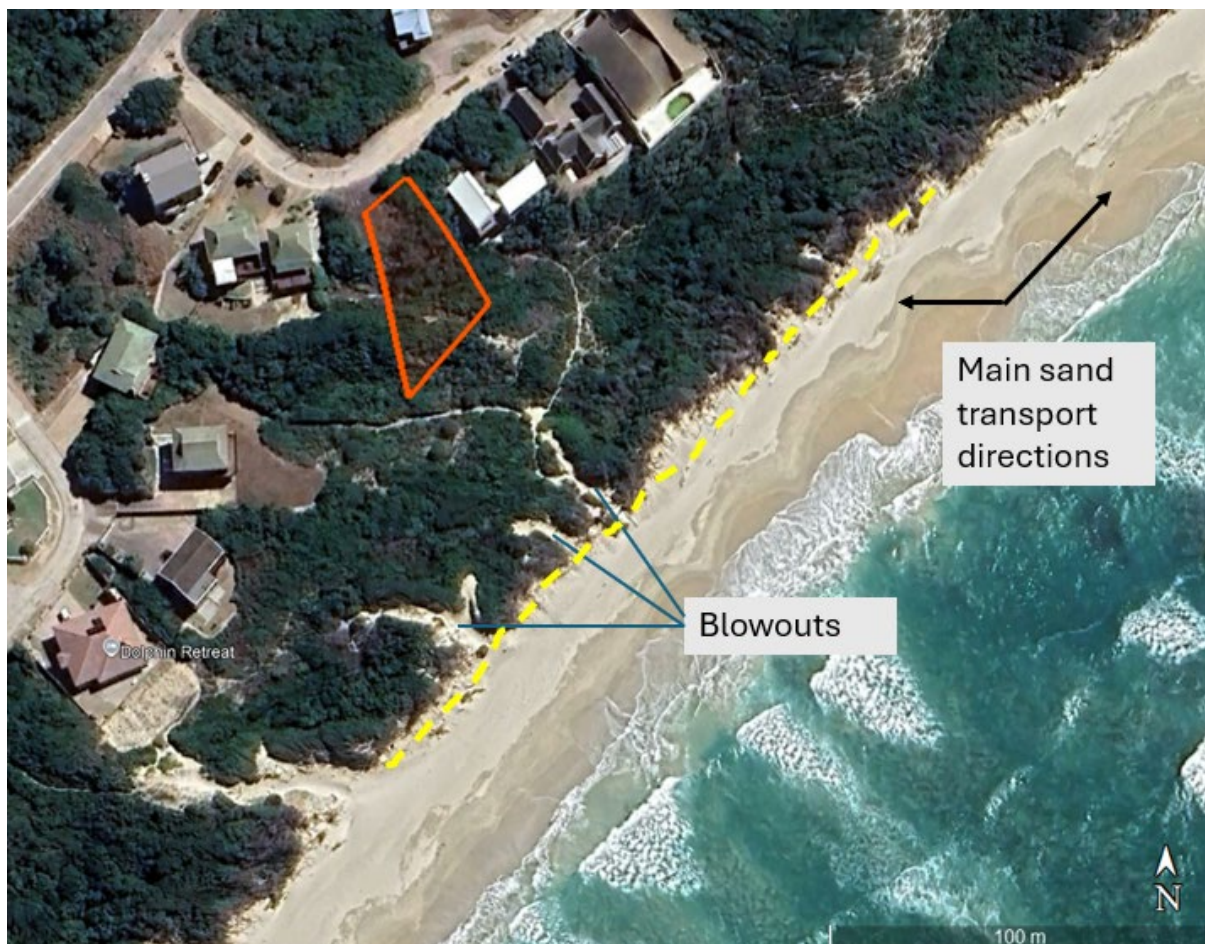


Figure 5: Satellite image showing Erf 1363 (orange outline) in relation to the steep eroding foredunes (yellow dashed line) and blowouts.

2.5. Dune and beach dynamics

Based on the historical images from 1942 onwards it is evident that the dunes were less vegetated and more mobile in the past (Figure 6 and Figure 7). The beach seems to be wider in the older images, possibly supporting a larger foredune sequence because of the unconstrained sediment supply. It is estimated that the current sediment supply is $\sim 1/3$ of the historic volumes resulting in beach narrowing and dune erosion (Illenberger and Schumann, 2022; Schroeder, 2015).

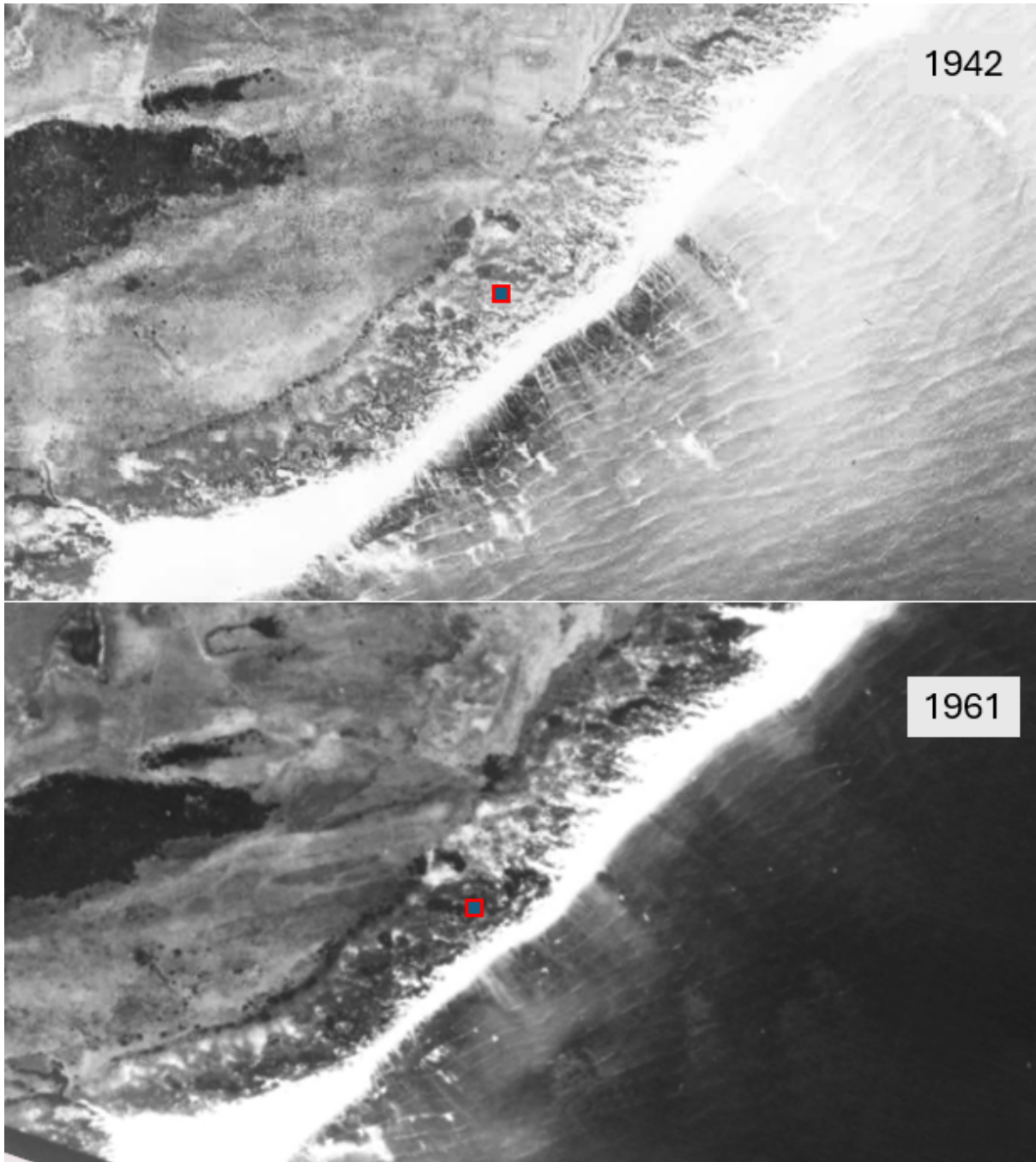


Figure 6: Historical aerial images for 1942 and 1961 of the coastline in the area of Erf 1363 (estimate as red square)

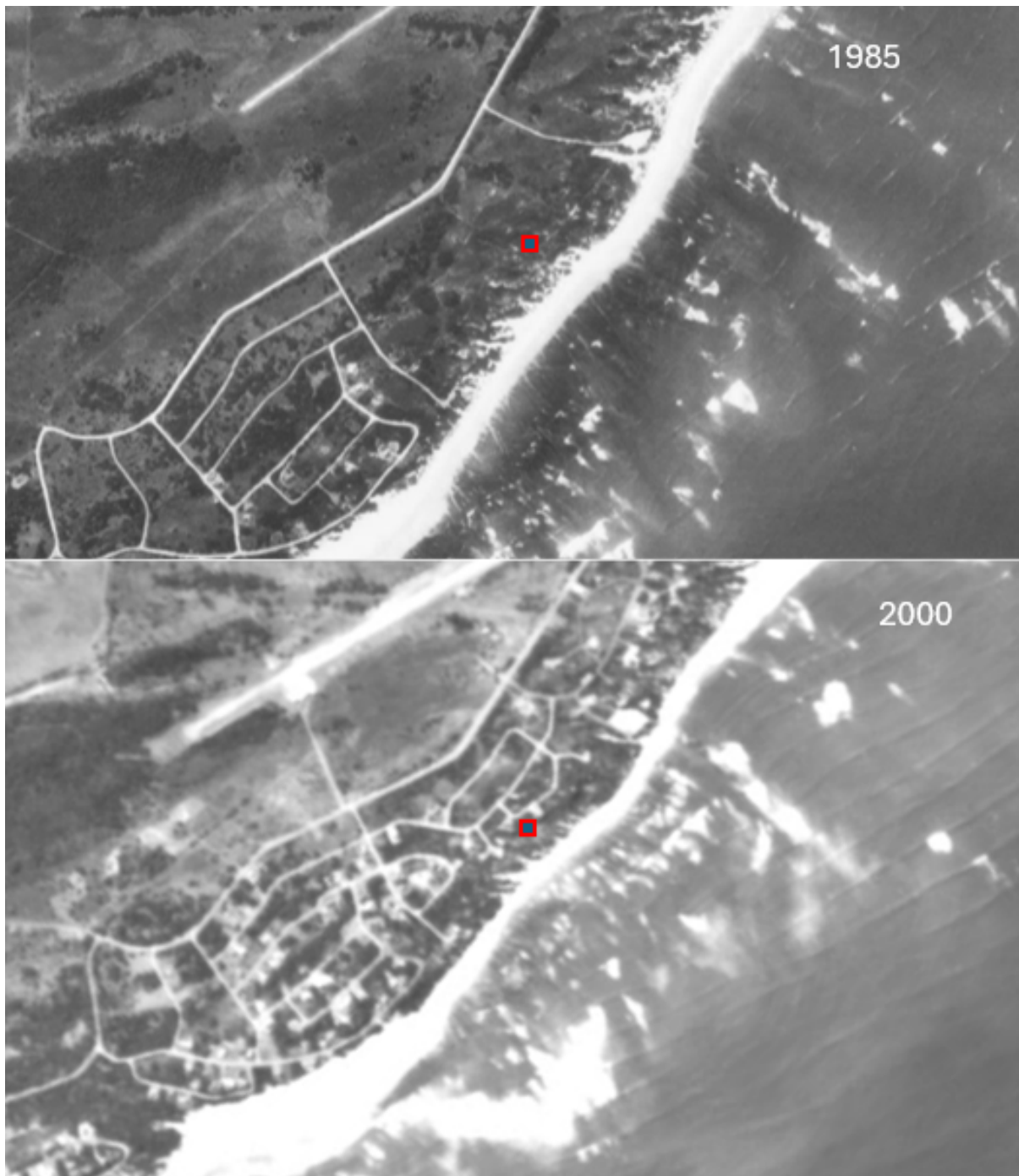


Figure 7: Historical aerial images for 1985 and 2000 of the coastline in the area of Erf 1363 (estimate as red square)

2.6. Sea level rise and future trends

The predicted sea level rise for South Africa varies by region, but recent studies indicate that coastal areas in the region of Port Elizabeth is experiencing sea level rise at a rate ranging from 1.2 to 2.9 mm per year (Figure 8; Kemgang Ghomsi et al., 2025). These values are similar to the global average of 3.3 mm (Kemgang Ghomsi et al., 2025). Some areas of South Africa, such as Cape Town, measured nearly double the global rate (Kemgang Ghomsi et al., 2025). Sea level rise is likely to continue over the next decade

and beyond, with possible changes in the sea level ranging between 0.25 m and 1.25 m by 2100 (Figure 9). These regional variations are driven by warming ocean waters, melting glaciers, melting ice sheets and rising landmasses (partly offsetting rising sea levels).

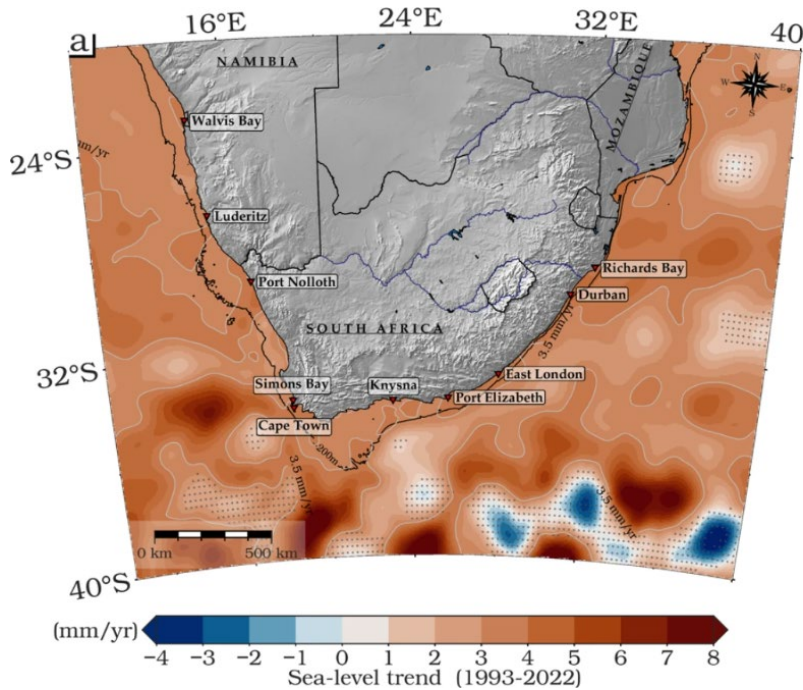


Figure 8 Sea level rise trends from 1993 to 2022 for the South African coastline (Kemgang Ghomsi et al., 2025)

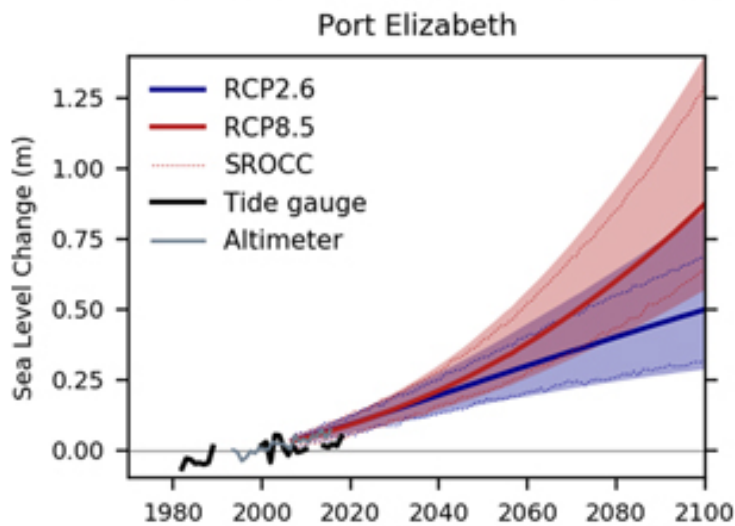


Figure 9 Sea level rise predictions for Port Elizabeth (Allison et al., 2022)

In an assessment of likely future scenarios of the South African coastline Cooper and Green (2023) proposed several models of likely change. The model that applies most to the

Paradise Beach coast, is a beach and dune system that is underlain by a bedrock platform. As the dunes along the Paradise Beach section of the coastline are low in elevation, the supply of sediment from these locations to the beach will be very limited. As these beaches and dunes are underlain by bedrock, the dynamic will be different in that the shoreline and beach will retreat in relation to the elevated sea level and the intersecting underlying bedrock. The angle of the underlying bedrock will influence the rate of shoreline retreat, with shallow bedrock platforms experiencing larger retreat rates compared to steeper bedrock platforms (Figure 10). As most of the Paradise Beach shoreline is formed on this rocky platform, it is likely to follow this model along most of the shoreline.

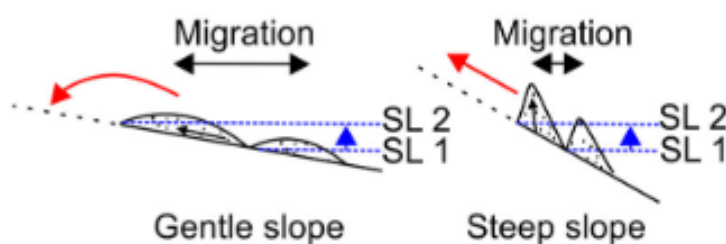


Figure 10: Conceptual model of beach dynamics in relation to sea level rise on a bedrock platform (SL1 is the present-day level and SL2 the elevated sea level)(Cooper and Green, 2023)

Predicting the extent of the coastal erosion can be based on the slope of the wave planed bedrock underlying the beach and the dunes. Unfortunately, this information is not available at present.

2.7. Mitigation measures for coastal erosion and sand inundation along Paradise Beach

Based on the current understanding of the drivers influencing coastal processes, it is apparent that coastal erosion is expected to remain a persistent issue. The factors contributing to this phenomenon include rising sea levels, limited sediment supply, and the low elevation of the existing dune systems. As a result, the retreat of both the shoreline and associated dunes are anticipated to continue in response to ongoing changes in sea level and the dynamics with the underlying geology. These processes collectively indicate that coastal erosion will be an enduring challenge for the area.

The extent and rate are uncertain, but steps can be followed to reduce it as much as possible locally. The following should be encouraged by local landowners:

- Beach access areas should be of such character that it does not funnel the dominant winds (south-westerly and easterly winds) towards infrastructure.

Pathways should be at right angles/perpendicular to the prevailing and strongest wind directions to limit sand propagation along the pathway (Tinley, 1985). Based on the wind data, beach access pathways and structures should be constructed in a south-easterly direction for Paradise Beach.

- Reduce the number of beach access pathways. A single convenient/accessible pathway for several properties in a ~500m range can be selected that meets the directional criteria, the other pathways should be abandoned and revegetated.
- Encourage dense indigenous vegetation along the dunes – limit dune vegetation disturbance as much as possible through cutting, harvesting and developing multiple pathways.
- Encourage smaller foredunes to form to store sand and form a buffer that can be eroded during storm events. See section on brush packs below.
- Private properties should not clear dune vegetation and replant with lawns outside of the accepted fire break corridor as lawn grass has very shallow roots compared to the natural deeper-rooted dune vegetation, and it changes local near-ground wind profiles (accelerating sand transport). The longer roots of the indigenous dune vegetation help to anchor and stabilise the dunes, especially near the beach-dune interface where dune erosion is often a problem. Properties close to the beach should aim to have dense indigenous dune vegetation around their perimeter to slow any erosional threats despite the obstruction of the view.
- If beach access pathways are formalised with infrastructure, use low-impact ecologically friendly and recyclable materials as they are built within the dynamic zone and are likely to be damaged/removed by infrequent high seas. This will limit the onsite and off-site damage if the structures are impacted. Beach access structures with a minimalist design and more frequent maintenance can be more dynamic in the future as the coastal zone adapts to future water levels and storm intensity.
- Parabolic dunes move westward and can threaten infrastructure with sand inundation. As the parabolic dunes are dependent on sand supply, the best way to mitigate its development and propagation is to stabilise the bare sand immediately towards the east of the area affected by sand inundation through a network of hummock dunes. This should be initiated with anchored brushwood clumps (alien tree biomass that does not contain seeds; ~1 to 5 m diameter brush packs) at roughly 5 to 10 m spacings in a grid-type pattern (Figure 11). 5 m spacings should be used where blowouts are to be rehabilitated and larger 10 m spacings where dune hummocks are to be established. The brushwood area should be planted with indigenous sand-binding pioneer dune vegetation that will allow some sediment movement but will reduce the rate of transport (Anderson, 2008). The brushwood will accumulate sand with the hope of creating a network of hummock dunes that can trap sand on the seaward side (foredune area), slow the

wind velocity along the foredune surface and the blowout and act as a buffer against sea surges. It is important to leave a strip of unvegetated foredune that can erode and build up frequently as this will prevent steep dangerous dune cliffs from forming during storm events.



Figure 11: Interventions along the coast to trap sand with brushwood piles (blue circles) and establish pioneer dune vegetation (green highlight)

2.8. Design considerations to reduce damage due to dune instabilities

The dominant wind directions are from the south-west and east. Windblown sand is likely to be transported from these directions, especially from unvegetated patches. Maintaining a dense vegetation cover will trap and stabilise the sand to some extent and avoid the nuisance of sand encroachment. The house design should keep this in mind in terms of doorways and outside spaces. A raised structure would allow sand transport under the structure with less nuisance inside the buildings.

Erf 1363 is partly located on a dune crest with a large part of the property that will be developed sloping towards the south-east (Figure 12). There are smaller undulations on the Erf 1363 and a frontal dune ~ 50 m towards the east. Dune instabilities are possible along the face of the dune due to increased loadings (buildings and wet periods with saturated sands), thus movement in a south easterly direction. The depth of the instability is likely to be shallow (sub-metre to several metres). The design of the foundations of the building should keep this in mind.

The westward extension of the frontal dune is likely as the beach and primary dunes migrate westwards as the sea level rises. The eastward part of the property could be raised (inundated by sand) in future years as the frontal dune migrates onto the property. The rate of movement is not known at this stage.

There is a pan-handle Erf to the south of Erf 1363 that will access the property from De Jager Street. Its development can lead to excavations to grade the driveway exposing several metres of dune sand adjacent to Erf 1363. Retaining features will likely be put in place along the driveway, but shifts of the dune layers are possible over time, especially under wet saturated conditions. These shifts can affect the stability of the dune on Erf 1363. To avoid these possible shifts, it is advised that the foundations/pylons of the building on Erf 1363 extend down as far as possible along the southwestern side of the building (engineering advise recommended on depths). This will allow movements of the upper part of the dune without impacting the foundations of the building on Erf 1363. The risk of these shifts is less towards the north of Erf 1363.

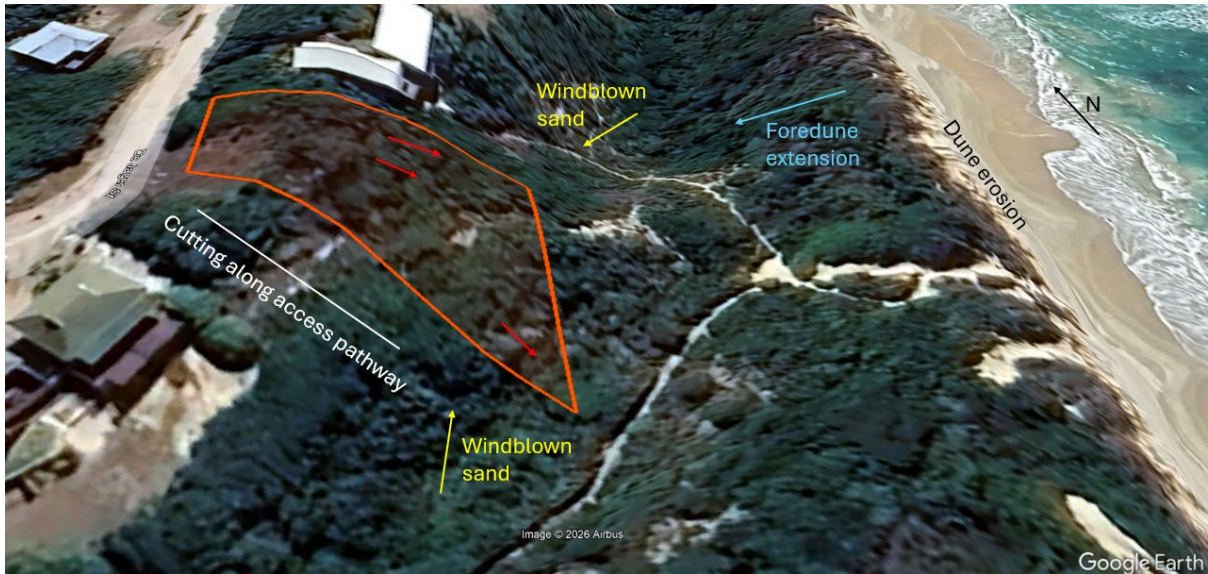


Figure 12 Oblique image indicating the likely processes in the future. The small red arrows indicate possible dune instabilities.

Dune excavation with volume of $\sim 230 \text{ m}^3$ will take place near De Jager Street for the garage. The excavated sand should be deposited on the low-lying eastern part of Erf 1363 to stabilise the dune face where the construction will take place and act as a sand store for future coastal sand transport processes. Excess sand should be dumped in the coastal zone where sand infilling is done by the local Municipality to augment the sand supply.

2.9. Conclusions and recommendations

Erf 1363 is situated within the dynamic coastal zone of Paradise Beach. The factors influencing the area's physical landforms have evolved over time, with ongoing environmental changes anticipated in the future. Coastal degradation may be mitigated by minimizing dune disturbance, reducing the number of beach access pathways, reintroducing indigenous pioneer dune vegetation, and establishing brush structures to trap sand. Continued sand transport and potential shifts in dune layers remain possible. Building designs should account for these considerations to mitigate risks associated with dune instability and sand encroachment. Obtaining further geotechnical data and comprehensive structural engineering analysis regarding foundation depth within the development footprint will provide valuable insights to enhance the foundation design process.

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CURRICULUM VITAE
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 PERSONALITY TYPE: Architect (IntJ-A of the 16 Personality types) or Enneagram 5s

Education and training:

INSTITUTION	QUALIFICATIONS AND TRAINING OBTAINED:
Australian Water School, 2023	Fluvial Geomorphology essentials course
UNESCO-ISI, 2021	Sediment Transport Measurement and Monitoring Training Workshop
AulaGeo Academy, 2020	Hec-RAS and ArcGIS for Hydrologic Engineering
GEO Data Design (Pty) Ltd 2018	Introduction to ERDAS remote sensing
Land Rehabilitation Society of Southern Africa (LaRSSA) and Vetiver Network International (TVNI) 2017	A practical course in the use of bioengineering and Vetiver grass
Secolo Consulting Training Services 2016	Flood control, land drainage and urban stormwater management design workshop.
Rhodes University (Grahamstown) 2011-2014	PhD in Geography - Sediment connectivity in the upper Thina catchment, Eastern Cape, South Africa. Supervised by Kate Rowntree.
Rhodes University (Grahamstown) 2012	Basic conversational isiXhosa Level I
International Association of Geomorphologists 2011	Landmap Intensive Course on Landslide Mapping
PADI 2010	Open water diver
Rhodes University (Grahamstown) 2009	Tools for Wetland Assessment Certified Short Course by Fred Ellery
Makana Meadery 2009	Beekeeping Course Level I
Eastern Wilderness School 2009	Pilot-Aircrew Survival Course
Rhodes University (Grahamstown) 2008-2009	MSc. in Geography

	Thesis: The influence of <i>Acacia mearnsii</i> invasion on soil properties in the Kouga Mountains, Eastern Cape, South Africa. Supervisors: Prof K Rowntree & Dr J Gambiza
Rhodes University (Grahamstown) 2007	BSc Hons (Environmental Water Management) Thesis: A study of sediment tracing applied to the Heuningnes River, Kouga Catchment, Eastern Cape (<i>Forbes Prize awarded for best honours project</i>) Supervisor: Kate Rowntree Courses covered: Integrated Water Management, Water Quality, Geographical Information Systems and Research Philosophy and Methodology
North-West University (Potchefstroom campus) 2004-2006	BSc. (Courses covered: Botany, Geography and Environmental Science, Biochemistry, Microbiology, Statistics, Computer Science, Chemistry, Mathematics, Economics)
Shangoni Management Services cc 10-14 Nov 2003	ISO 14001 and Environmental Auditing

Language Proficiency: English (speak, read and write)
Afrikaans (speak, read and write)
Dutch (speak, read and write)
isiXhosa (basic conversational)

Computer literacy: Microsoft Office (Word, Excel, PowerPoint, Access); GIS (ArcMap3/9/10 and QGIS); Google Earth; Pix4D; Agisoft Photoscan; Surfer; GlobalMapper; CloudCompare; GNSS Solutions; Spin43; Zotero; Refworks; Statistica; R; GammaVision; TopComm; Solinst Levellogger; Hobo software; Spatsim; Mastersizer, Qreview, HEC RAS, Spatsim and Habflo.

Profile: Dr. Benjamin van der Waal is an experienced geomorphologist with fifteen years of practical expertise in river, catchment and coastal sustainability. He is dedicated to promoting the long-term viability of the landscapes we inhabit. His specialities encompass landscape, river and coastal dynamics, sediment monitoring, hydrology, hydraulics, restoration planning, sustainable land management (SLM) planning and implementation, and environmental flow assessments. He is also proficient in monitoring framework development, capacity building and mentoring. His work is focused on Africa's varied landscapes, with the intention of fostering sustainable futures.

As a registered Professional Natural Scientist in Earth Science, Dr. van der Waal serves on the council of the World Association for Sedimentation & Erosion Research (WASER) and actively participates in the South African Wetland Society. In his capacity as a Research Associate at Rhodes University, he undertakes research in river and sediment processes, contributes to international academic literature, and presents at both national and international conferences.

Research Interests: water resource management, catchment systems, geomorphology, fluvial geomorphology, coastal processes, wetlands, river ecology, environmental flows, hydrology, hydraulics, catchment management and erosional processes. The interest in understanding river systems and general ecological processes has led to experience in many locations across Africa (Liberia, Rwanda, Kenya, Tanzania, Zambia, Mozambique, Botswana, Namibia, Zimbabwe, South Africa and Lesotho).

Key Skills:

- Project design, planning and administration;
- Critical eye for landscape connectivity, barriers, processes and risk in field or using remote sensing;
- Project management & report writing;

- Primary and secondary experience includes:
 - Mapping, classification and description of landscape types and function;
 - Training and leading communities of practice;
 - Surveying with dumpy level, total station, differential GPS and UAVs;
 - GIS analysis including remote sensing and hydraulic modelling;
 - Sediment monitoring and tracing;
 - Coastal process description and planning;
 - Soil analysis and erosion prevention planning;
 - Vegetation surveys and assessments;
 - Fish surveys in a variety of habitats, ranging from headwater streams to large open waters. Fish identification, measurement and sexing. Stomach content analyses, parasite extraction and DNA sampling;
 - General ecological sampling and analysis;
 - Confident navigation on challenging terrain (foot, 4x4 and boat).
- Data analysis and interpretation;
- Capacity development of staff, colleagues and students;
- Lecturing and supervision at all levels;
- Hosting workshops, meetings and training sessions; and
- Enjoy national and international travel regardless of conditions.

Recent projects

- Development of the physical component of the St Lucia Mouth Management Plan - iSimangaliso Wetland Park Authority in association with Indaloenhle Environmental Consultants, 2025 ongoing.
- Floodplain history, dynamics and rehabilitation along the Krom River, KZN. Zwartberg Farmers Association, 2025.
- Hydraulic and geometry survey of the Malibomatsu River for the Ox-Bow Hydro Power Project, Lesotho. ELC Electroconsult in association with The Biodiversity Company, 2025.
- River history, river routing options and implications for the Doring River floodplain, Western Cape. Climor Holdings, 2025.
- Geomorphic risk, climate adaptation and restoration for the Olifants-Doring Ecological Infrastructure Strategic Plan. FRC, 2025.
- Geomorphic input on Kaap River Dam feasibility study, DWS in association with Water4Africa, 2025.
- Water quality baseline sampling along N3 road development. UNIK Consulting, 2025.
- Hydraulic and habitat assessment for the Luchenene and Mutinondo HPP eflow assessment in Zambia, MLPC and Berkeley-Energy in association with ACER Environmental, 2024 - 2025.
- Geomorphological specialist study for the St Paul II Hydro Power Project as part of the eflows study, Liberia. Worldbank and Liberia Electricity Corporation in association with Southern Waters, 2024.
- Geomorphological impacts and mitigation of the proposed Ga-Mogara River diversion at the Assmang Black Rock Mine Operations. Assmang Black Rock Mine Operations in Association with MineLock Environmental Engineers and SAS Environmental, 2024.
- Sediment monitoring for the e-flow implementation monitoring approach as a part of the CGIAR digital twin in the Limpopo and Incomati Basin. CGIAR and IWMI in association with Rivers of Life, 2023.
- Strategic geomorphic plan for the Piesang River wetland offset plan, Durban South Africa. eThekweni Municipality in association with Verdant Environmental, 2023 to 2024.
- Sediment and morphological monitoring programme for a constructed tidal wetland - Les Salines, Mauritius. Les Salines in association with Verdant Environmental, 2023.
- Orange River (lower) eflow study, DWS in partnership with WSP, 2024 - 2025.

- Geomorphological input to the Technical Feasibility Study – Evaluation of Downstream Ecological Impacts of the four Dam Options in the Incomati Basin. DWS in association with *iX Engineers, WRP Consulting Engineers and Rivers for Africa, 2023.*
- Hydrological monitoring for the Gabosh Dam development, Amsterdam, South Africa, DWS in partnership with UNIK Consulting, 2023 onwards.
- Geomorphic impact of GaMogare River diversion around York and Hotazel opencast pits, Kudumane Manganese Resources in association with SAS Environmental, 2023.
- Developing a sediment monitoring framework, conceptual model and the capacity of LIMCOM to monitor sediment. GWPSA, LIMCOM and UNDP in association with JGAfrica, 2024 onwards.
- Coastal erosion and River Dynamics for the Noetzie Area, Western Cape. Danistan Investments 2024 to 2025.
- Sediment and morphology study for the dredging of the uMsunduzi River and Beach Channel. iSimangaliso Wetland Park Authority in association with Indaloenhle Environmental Consultants, 2023.
- Updating the 2011 Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Database for Secondary Catchments on a Sub-Quaternary Scale including the Significant Tributaries of the Main Stem Rivers, instream wetlands and estuaries within a Sub Quaternary Reach. Orange/Vaal River catchment (in association with Ecology International consulting and Umzimvubu/Tsitsikamma (in association with WSP) for DWS and WRC, 2023 to 2026.
- Coastal morphodynamics, management and mitigation for the Coastal MMP for the Kabeljous Estuary to Kromme Estuary Coastline. Kouga Municipality in association with CEN Environmental, 2023 to 2024.
- Geomorphological specialist input and hydraulic oversight for the Holisitc Eflows Assessment and a Joint Basin Survey for the Limpopo Basin, southern Africa. GWPSA, LIMCOM and UNDP in association with Rivers of Life, 2024 ongoing.
- Update of the Seekoei Estuary Management Plan. Kouga Municipality in association with CEN Environmental, 2023 to 2024.
- Develop and integrate the upper uMkhomazi catchment and Ecological Infrastructure management plan with Smithfield Dam design using NatSilt Dam Operations model. Water Research Commission, Department of Water and Sanitation in collaboration with INR, 2022 to 2024.
- Piloting the siltation management model to reduce soil erosion and siltation in the Hazelmere Dam and Welbedacht Dam catchments, Water Research Commission, 2022 to 2024.
- Geomorphic impact assessment and eflows of the Ruzizi III hydropower development, Rwanda. AFD in association with SLR, 2022.
- Environmental Hydraulics for eflows of the streams around Letseng Mine, Lesotho. Letseng Mine in association with SRK, 2023.
- Sediment Management options for the reservoirs and floodplains within the OR Tambo District Municipality. OR Tambo District Municipality in association with CEN Environmental, 2023.
- Environmental Hydraulics for the eflow assessment of the Solaieyea, Gngangbai, Tiboi and Gbomi Rivers, Sierra Leone. Sierra Rutile Limited in association with Jones and Wagener and Wetland Consulting Services, 2024.
- Habitat monitoring along the Kromdraai, Saalboomsprui, Wilge and Olifants Rivers post large Acid Mine Drainage spill. Thungela Resources Ltd, Khwezela Colliery in association with the Biodiversity Company, 2022 – 2025.
- Geomorphological specialist input - ORASECOM Establishment of Basin-Wide Resource Quality Objectives. ORASECOM and GroundTruth, 2021 to 2025.
- Geomorphological specialist input - High confidence Reserve Determination study for surface water, groundwater and wetlands in the upper Orange catchment, ORASECOM in association with GroundTruth, 2021 -2022.
- Geomorphological specialist and hydraulic survey - Determination of Water Resource Classes, Reserve and the Resource Quality Objectives in the Keiskamma and Fish to Tsitsikamma Catchments. DWS in association with GroundTruth, 2021 to 2025.

- Geomorphological specialist input - Determination of the Water Resource Classes, Reserve and Resource Quality Objectives Study for Secondary Catchments A5-A9 within the Limpopo Water Management Area (WMA 1) and secondary catchment B9 in the Olifants Water Management Area (WMA 2) Project (WP: 11352), DWS in association with Myra Consulting, 2021 to 2025.
- Geomorphological and hydraulic specialist input - Risk framework for multiple stressors and integrated sustainability management of the trans-boundary water resources of the Inkomati Basin, southern Africa, WRC and Rivers of Life, 2021 to 2024.
- Hydraulic assessment for eflows of the Hlotse and Caledon Rivers, Lesotho. GroundTruth, 2021.
- Hydrological monitoring for the Klinkerstene Wastewater release along the Bronkhorstspruit, 2022, Ecology International and Interwaste.
- Geomorphological and Hydraulic specialist study for the Kakono Hydropower Project ESIA and Environmental Flows in Tanzania. AFD, TANESCO in association with SLR, 2020 - 2022.
- Geomorphology and hydraulics of the Tugela Estuary to inform the Water Resource Classes and associated Resource Quality Objectives. DWS in association with Golder Associates Africa, 2020.
- Geomorphological and Hydraulic specialist study for: E-flows for the Limpopo River - building more resilient communities and ecosystems through improved management of transboundary natural resources, USAID in association with IWMI, 2020 -2022.
- The resilience of regulatory ecosystem services of wetlands, NRF, 2019 to 2024.
- Geomorphic and hydraulic specialist study for: Environmental flows for the Lower Mara River, Tanzania, GIZ in association with UNESCO-IHE, 2019.
- IFR External Audit of LHDA, Lesotho. LHDA in association with GroundTruth, 2019.
- Geomorphic assessment of Kalungwishi River in Northern Zambia – Environmental flow requirements, ERM, Globeleq in association with Groundtruth, 2017.
- Hydraulic and geomorphic assessment for EWR determination in the lower Thukela River, SAPPI in association with Rivers of Life. 2017.
- Geomorphic effects of an inter-basin transfer near Butterworth, Eastern Cape. Indwe Consulting, 2017.
- Review of wetland assessment for wetlands within the Ndlambe Municipal area. CES consulting, 2017.
- Hydraulic and Geomorphic assessment for EWR in the Mara River, Kenya. UNESCO-IHE, Nile Basin Initiative and MaMaSe. 2015 – 2016.
- Geomorphological specialist study: supplementary information for the Da-xa Sand CC sand mining application: Buffels River, Kwa-Zulu Natal. Enprocon (2016).
- Geomorphological specialist study: supplementary information for the construction of 12 reservoirs on the Goede Keus Farm, Kwa-Zulu Natal. Enprocon (2016).
- Green Village Project. Water Research Commission (2015 - ongoing).
- Sediment dynamics, biophysical monitoring and integrated planning of/for the Tsitsa River Catchment, South Africa. Department Environmental Affairs (2014 - ongoing).
- Geomorphological specialist study: supplementary information for the Da-Xa Sand CC sand mining application: Buffels River, Kwa-Zulu Natal. Enprocon (2015).
- Investigating the impact of connectivity on water-linked ecosystems, upper Thina River, Eastern Cape, South Africa. Water Research Commission of South Africa (2011 – 2015).
- Umzumbe River and Estuary Geomorphological Assessment for sand mining application. NatureStamp (2014).
- Rapid Reserve Determination: Tsitsa River at Lalini - Geomorphological assessment. GroundTruth (2014).
- Estuarine bank stability – implications for the proposed development of Portion 12 of farm Vetmaakvlakte No. 312 along the Sundays River Estuary, Eastern Cape. Scherman Colloty & Associates (2013).
- Geomorphological assessment and macro reach analysis of the Mokolo River. Water Research Commission (2010 – 2013).

- Nelson Mandela Bay Municipality - Proposed Jachtvlakte Sustainable Human Settlement Plan: Preliminary Hydraulic, Aquatic and Terrestrial Ecological Assessment. Scherman Colloty & Associates (2012).
- Soil study of land on Erf 309 Port Ngqura, Port Elizabeth. Scherman Colloty & Associates (2012).
- Geomorphology and Hydrology of Ephemeral Rivers – literature review. Van der Waal & Associates (2012).
- Reserve determination for the Mzimkhulu River, junior fluvial geomorphologist. Institute for Natural Resources (2010).

Membership of scientific societies

SACNASP Professional Natural Scientist – Earth Science Reg. number 127809

World Association for Sedimentation & Erosion Research (WASER) Council Member 2022-2025

Southern African Association of Geomorphologists

South African Wetland Society

Society for Ecological Restoration

NPO involvement

Board member of LIV Likhanyiso Childrens Home 2017 - 2024.

NPO training - Governance for NPO's - An overview of Board Leadership, Directorship and Corporate Governance, June 2022

Papers in Peer-Reviewed Journals

Anderson, R. L., le Roux, J., van der Waal, B., Rowntree, K., & Hedding, D. W., 2023. Assessing the short-term inter-annual growth of the largest documented gully network in South Africa using UAV and SfM methodology. *Physical Geography*, 1-23.

Van der Waal, B., Grenfell, S., Huchzermeyer, N., & Schlegel, P., 2023. Selecting and refining suitable methods of developing digital elevation models to represent geomorphic features and characteristics of smaller wetlands in data-scarce environments. *Wetlands Ecology and Management*, 1-12.

Bannatyne, L.J., Foster, I., Rowntree, K.M. and Van der Waal, B.W., 2022. Suspended Sediment Load Estimation in a Severely Eroded and Data Poor Catchment. *Hydrological Processes* 36 (11), DOI: 10.1002/hyp.14730.

Le Roux, J., Morake, L., van der Waal, B., Leigh Anderson, R. and Hedding, D.W., 2022. Intra-gully mapping of the largest documented gully network in South Africa using UAV photogrammetry: Implications for restoration strategies. *Progress in Physical Geography: Earth and Environment*, p.03091333221101057.

Wiener, K.D., Schlegel, P.K., Grenfell, S.E. Van der Waal, B.W., 2022. Contextualising sediment trapping and phosphorus removal regulating services: a critical review of the influence of spatial and temporal variability in geomorphic processes in alluvial wetlands in drylands. *Wetlands Ecology and Management* (2022). <https://doi.org/10.1007/s11273-022-09861-9>

Cockburn, J., Rosenberg, E., Copteros, A., Cornelius, S.F. (Ancia), Libala, N., Metcalfe, L., van der Waal, B., 2020. A Relational Approach to Landscape Stewardship: Towards a New Perspective for Multi-Actor Collaboration. *Land* 9, 224. <https://doi.org/10.3390/land9070224>

Pulley, S., Collins, A.L. and van der Waal, B.W., 2018. Variability in the mineral magnetic properties of soils and sediments within a single field in the Cape Fold Mountains, South Africa: Implications for sediment source tracing. *Catena*, DOI10.1016/j.catena.2017.12.019

Pulley, S, van der Waal, B.W., Collins, A.L. and Rowntree, K.M., 2018. Colour as a reliable tracer to identify the sources of historically deposited flood bench sediment in the Transkei, South Africa: A comparison with mineral magnetic tracers before and after hydrogen peroxide pre-treatment. *Catena*, DOI10.1016/j.catena.2017.09.018

Pulley, S, van der Waal, B.W., Collins, A.L. and Rowntree, K.M. 2017 Are source groups always appropriate when sediment fingerprinting? The direct comparison of source and sediment samples as a methodological step. *River Research and Applications*, DOI: 10.1002/rra.3192

Van der Waal, BW and Rowntree, K., 2017. Landscape Connectivity in the Upper Mzimvubu river Catchment: An assessment of Anthropogenic Influences on Sediment Connectivity: Landscape connectivity in the upper Mzimvubu River Catchment. *Land Degradation and Development*, DOI: 10.1002/ldr.2766.

LJ Bannatyne, KM Rowntree, BW van der Waal, and N Nyamela. 2017. Design and implementation of a citizen technician-based suspended sediment monitoring network: Lessons from the Tsitsa River catchment, South Africa. *WaterSA* Vol 43 No. 3

Rowntree, K.M., van der Waal, B.W. and Pulley, S., 2017. Magnetic susceptibility as a simple tracer for fluvial sediment source ascription during storm events. *Journal of Environmental Management*, 194, pp.54-62.

Mander, M., Jewitt, G., Dini, J., Glenday, J., Blignaut, J., Hughes, C., Marais, C., Maze, K., van der Waal, B. and Mills, A., 2017. Modelling potential hydrological returns from investing in ecological infrastructure: Case studies from the Baviaanskloof-Tsitsikamma and uMngeni catchments, South Africa. *Ecosystem Services*.

Shackleton, R.T., Angelstam, P., van der Waal, B. and Elbakidze, M., 2017. Progress made in managing and valuing ecosystem services: a horizon scan of gaps in research, management and governance. *Ecosystem Services*.

Prucha, B., Graham, D., Watson, M., Avenant, M., Esterhuysen, S., Joubert, A., Kemp, M., King, J., le Roux, P., Redelinghuys, N., Rossouw, L., Rowntree, K., Seaman, M., Sokolic, F., van Rensburg, L., van der Waal, B., van Tol, J., Vos, T., 2016. MIKE-SHE integrated groundwater and surface water model used to simulate scenario hydrology for input to DRIFT-ARID: The Mokolo River case study. *Water SA* 42, 384–398. doi:10.4314/wsa.v42i3.03

Seaman, M., Watson, M., Avenant, M., Joubert, A., King, J., Barker, C., Esterhuysen, S., Graham, D., Kemp, M., le Roux, P., Prucha, B., Redelinghuys, N., Rossouw, L., Rowntree, K., Sokolic, F., van Rensburg, L., van der Waal, B., van Tol, J., Vos, T., 2016a. DRIFT-ARID: Application of a method for environmental water requirements (EWRs) in a non-perennial river (Mokolo River) in South Africa. *Water SA* 42, 368–383. doi:10.4314/wsa.v42i3.02

Seaman, M., Watson, M., Avenant, M., King, J., Joubert, A., Barker, C., Esterhuysen, S., Graham, D., Kemp, M., le Roux, P., Prucha, B., Redelinghuys, N., Rossouw, L., Rowntree, K., Sokolic, F., van Rensburg, L., van der Waal, B., van Tol, J., Vos, T., 2016b. DRIFT-ARID: A method for assessing environmental water requirements (EWRs) for non-perennial rivers. *Water SA* 42, 356–367. doi:10.4314/wsa.v42i3.01

Van der Waal, B.W., Rowntree, K.M. and Pulley, S. 2015. Flood bench chronology and sediment source tracing in the upper Thina catchment, South Africa: the Role of Transformed Landscape Connectivity. *Journal of Soils and Sediments*, 15 (12), 2398-2411. DOI 10.1007/s11368-015-1185-4

Van der Waal, B.W., Rowntree, K.M. and Radloff, S.E., 2012. The effect of *Acacia mearnsii* invasion and clearing on soil movement in the Kouga Mountains, Eastern Cape, South Africa, *Land Degradation and Development*, 23: 577–585.

Conference proceedings

Rowntree, K., Mzobe, P. and Van der Waal, B., 2012. Sediment source tracing in the Thina catchment, Eastern Cape, South Africa, IAHS publication, 356: 404-411.

Van der Waal, B. and Rowntree, K., 2012. A Geomorphological Response Model for predicting sediment-related habitat change in ephemeral rivers, IAHS publication, 356: 276-283.

Book chapter

Dalu, T., Masese, F.O., Parker, D.M., Chanyandura, A., Dube, T., Fugère, V., Gwapedza, D., Kori, E., McClain, M.E., Madzivanzira, T.C., Malapane, C., Mangadze, T., Mungenge, C.P., Muvundja, F.A., Mwedzi, T., Reid, M.K., Keates, C., O'Brien, G.C., Utete, B., van der Waal, B., Mpopetsi, P.P., 2025. Chapter 29 - Overview and future prospects of African rivers research, in: Dalu, T., Masese, F.O. (Eds.), *Afrotropical Streams and Rivers: Overview and future prospects of African rivers research*. Elsevier, pp. 773–785. <https://doi.org/10.1016/B978-0-443-23898-7.00029-4>

Rowntree, K., Van der Waal, B. and Smith-Adao, L., 2018. Fluvial system response to environmental change. In *Southern African Landscapes and Environmental Change*, Routledge, London.

Popular article

Tooth, S. and Van der Waal, B., 2019. The 'Global Wetland Outlook' report. *Geography* 104: 3, pp 154-159.

Policy and practise briefs

Tsitsa Project, Clifford-Holmes, J., Van Der Waal, B., Cockburn, J., Biggs, H. and Wolff, M. 2021. The Tsitsa Approach to Sustainable Land Management and Rehabilitation. Tsitsa Project Practice and Policy Brief #1. Tsitsa Project, Department of Environmental Science, Rhodes University, Makhanda.

Lecturing

Guest lecture – Biogeography – drainage evolution and speciation in Africa, Geog202, second year, Rhodes University, 2019.

Guest lecture – Geomorphology and water management, 1st (CONS102), 2nd (REM201) and honours classes, University of Mpumalanga, 2019.

Guest lecture – Geography Environmental Water Management Honours class, Integrated Catchment Management of the Tsitsa River, 2019.

Guest lecture – Environmental Science 2nd years, Rhodes University – Landscape restoration to mitigate sediment erosion – the Tsitsa River catchment case study. 2017.

Guest lecture – Environmental Science 3rd year course in environmental monitoring, Rhodes University, 2015, 2016 and 2018.

Guest lecture – Land degradation short course by Environmental Science, Rhodes University, 2015.

Supervision

Graduated: 2 BSc Hons, 6 MSc (3 with distinctions) and 1 PhD

Current students: 1 PhD

Conferences

Van der Waal, BW, Huchzermeyer, P, 2025. Recent observations of changes to geomorphological processes and habitats in Africa, Southern African Society of Aquatic Scientists Congress, Hilton, South Africa.

Van der Waal, BW, Grenfell, S, Schlegel, P, Huchzermeyer, N, 2021. Refining and selecting suitable methods of developing digital elevation models for wetlands in data-scarce environments. Wetlands Indaba, Online.

Bannatyne, L, Huchzermeyer, N, Rowntree, K, Van der Waal, B, 2021. Hydrological variability at sub-catchment scale in the Tsitsa River catchment: the implications for sediment transport and catchment management. SAAG Conference Online.

Le Roux, J and Van der Waal, B, 2020. Gully erosion susceptibility modelling for avoided degradation planning. EGU, Vienna.

Bannatyne, L, Foster, I, Meiklejohn, I and Van der Waal, 2020. Determining sub-catchment contributions to the suspended sediment load of the Tsitsa River, Eastern Cape, South Africa. EGU, Vienna.

Van der Waal, B., Biggs, H., Powell, M., Braack, M., Kawa, K., Mtati, N., Lunderstedt, K., Palmer, T., Rowntree, K., Wolff, M. and Cockburn, J., 2019. Integrated restoration planning: from science-led to science-management-society-led planning in the Tsitsa catchment. SER, Cape Town, South Africa.

Herd-Hoare, S., Van der Waal, B., Coetzer-Hannack, K. and Meiklejohn, I., 2019. Poster: Seasonal trends of rainfall intensity, ground cover and sediment dynamics in the Little Pot River and Gqukunqa River catchments, South Africa. SER, Cape Town, South Africa.

Van der Waal, B., Tooth, S. and Ellery, W., 2019. Poster: A geomorphological approach to the prioritisation of wetlands for sediment buffering: Tsitsa River catchment, South Africa. SER, Cape Town, South Africa.

Le Roux, J. and Van der Waal, B., 2019. Avoiding degradation, the importance of soil erodibility. SAAG Biennial Conference, Cintsu, South Africa

Van der Waal, B. and Le Roux, J., 2019. Community based natural resource management planning: the role of geomorphology. SAAG Biennial Conference, Cintsu, South Africa.

Van der Waal, B., Tooth, S., Lisenby, P. and Ellery, W., 2018. Poster: A geomorphological approach to the prioritisation of wetlands for sediment trapping: Tsitsa River catchment, South Africa. BSG, Aberystwyth, United Kingdom.

Van der Waal, B., Powell, M. and Braack, M., 2018. Opportunities for participation in Sustainable Land Management (SLM) and restoration - an assessment of the need for restoration. Symposium of Contemporary Conservation Practise, Lions River, South Africa.

Schlegel, P.K., Huchzermeyer, N.H., van der Waal, B., 2018. Poster: Wetland prioritisation for livelihoods: avoiding further degradation. Wetland Indaba, Kimberley, South Africa.

Van der Waal, B., Tooth, S., Ellery, W. and Lisenby, P., 2018. Degraded riverine wetlands in the Tsitsa River catchment: a geomorphological approach for assessing rehabilitation options. Wetland Indaba, Kimberley, South Africa.

Van der Waal, B., Rowntree, K. and Buckle, J., 2017. Geomorphic principles for developing a catchment rehabilitation strategy: the case of the NLEIP in the Tsitsa catchment, South Africa. SAAG Biennial conference, Mbabane, Swaziland.

Rowntree, K. and Van der Waal, B., 2016. Application of modelling and monitoring to guiding rehabilitation practice: the case of the NLEIP in the Tsitsa catchment, South Africa. ICCE Conference, Rothamstead, UK.

Bannatyne, L., Rowntree, K., van der Waal, B.W. and Nyamela N., 2016. Jam-jars, smartphones, and Open Data Kit: A citizen science-based approach to direct suspended sediment sampling in the Tsitsa River catchment, Eastern Cape Province of South Africa. ICCE Conference, Rothamstead, UK.

Van der Waal, B. and Rowntree, K., 2015. Applying geomorphic connectivity thinking to catchment rehabilitation planning - insights from research in the upper uMzimvubu. WRC symposium, Pretoria, South Africa.

Van der Waal, B. and Rowntree, K., 2015. Landscape connectivity in the upper Umzimvubu River catchment: an assessment of anthropogenic influences on sediment connectivity. SAAG Conference, Sani, Lesotho.

Van der Waal, B. and Rowntree, K., 2015. Changing suspended sediment dynamics over two flood events in the Vuvu River, Mzimvubu catchment, South Africa: an application of sediment source tracing. IGU Conference, Prague, Czech Republic.

Van der Waal, B. and Rowntree, K., 2014. Sediment connectivity in the upper Thina River, Eastern Cape, South Africa. IASWS conference, Grahamstown, South Africa.

Van der Waal, B. and Rowntree, K., 2013. Sediment connectivity in the upper Thina River, Eastern Cape, South Africa. International Association of Geomorphology, Paris, France.

Van der Waal, B. and Rowntree, K., 2012. Predicting sediment related habitat change in non-perennial river systems: a Geomorphological Response Model. Southern African Association of Geomorphologists, Gobabeb, Namibia.

Van der Waal, B. and Rowntree, K., 2012. A Geomorphological Response Model for predicting sediment-related habitat change in ephemeral rivers. IAHS-ICCE International Symposium, Chengdu, China.

Van der Waal, B. and Rowntree, K., 2011. A geomorphological response model for predicting habitat change in non-perennial river systems: lessons from the Mokolo River, Limpopo Province, South Africa. IAG regional conference, Addis Ababa, Ethiopia.

Van der Waal, B., Rowntree, K, Gambiza, J. and Ripley B., 2009. Poster: Influence of *Acacia mearnsii* invasion on soil properties in the Kouga Mountains, Eastern Cape, South Africa. EMAPI Conference, Stellenbosch, South Africa.

Van der Waal, B., 2008. Wattle – the bomb sinking the rehab ship? Fynbos Forum, Outshoorn, South Africa.

Van der Waal, B. and Rowntree, K., 2007, A study of sediment tracing applied to the Heuningnes River, Kouga Catchment, Eastern Cape. SSAG conference, Port Elizabeth, South Africa.

Review of Journal Articles

Water South Africa (1)

South African Geographical Journal (2)

Wetlands Ecology and Management (1)

Asian Journal of Soil Science and Plant Nutrition (1)

Applied and Environmental Soil Science (1)

Review of research proposals

Afromontane Research Unit of the University of the Free State (1)

Water Research Commission (1)

External examination of theses

Rhodes University Honours (1)

University of the Western Cape MSc (1)

University of Stellenbosch MSc (1)

Macquarie University PhD (1)