JONGENSFONTEIN PROMENADE

12 May 2025

Motivation and Preliminary Development Concept – DRAFT REPORT

This report provides an assessment of the vulnerability and risk associated with the Strand Street shoreline interface from a coastal engineering perspective, and makes recommendations of possible structural interventions to address flooding and associated risks.

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MOTIVATION AND PRELIMINARY DEVELOPMENT CONCEPT – DRAFT REPORT

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INTRODUCTION

The Jongensfontein Ratepayers Association wishes to create a safe shoreline interface between the ocean and the town, specifically along Strand Street which forms an important focal point and link in the town.

The shoreline interface should:

- Provide a secure buffer between Strand Street and the ocean.
- Prevent and/or reduce overtopping of the roadway and flooding of properties during storm events.
- Ensure safe movement of vehicles and pedestrians by providing additional useable space at the level of the road.

In addition, attention is to be given to improvement of the beach on the western side of the bay where sand has been lost due to the 2023 storm event.

A wish to consider alternative access to the sea in this area through consideration of an access jetty was also indicated.

For purposes of this report the project is called the Jongensfontein Promenade Development and the bay which it encompasses is called Jongens Bay.

Figure 1 View of Strand Street interface with the ocean

This report is a first attempt at assessing and describing the problem, and provides recommendations on the manner in which it may be addressed.

GENERAL DESCRIPTION OF THE STUDY AREA

Jongensfontein is a picturesque coastal village located in the Western Cape of South Africa. It is known for its rugged coastline, featuring rocky outcrops and sandy beaches that are perfect for fishing, surfing, and relaxing. The area is surrounded by rolling hills and fynbos vegetation, which is characteristic of the Cape Floral Kingdom. The village offers stunning ocean views and is a haven for nature lovers and outdoor enthusiasts.

Jongens Bay is a south-east facing bay with a length of some 650 m at the heart of Jongensfontein. Strand Street runs along the bay just above the high-water line and forms the physical interface between the beach and the terrestrial (mainly residential) development in the town. The shoreline of the bay is rugged and rocky with very few sandy beaches, and where found, these are located on the upper shore adjacent to the roadway.

The most extensive beach area is located on the north-eastern side of the bay, adjacent to the municipal campsite. An artificial tidal pool, created by removing loose rock over an area of some 1500 m^2 and using these to form permeable pool walls, provides a relatively safe swimming area below the beach in this area.

Figure 2 Strand Street with Chainage Markers in yellow - length of Strand Street about 950 m

Figure 3 Strand Street Ch 900 to Ch 550

Figure 4 Strand Street Ch 550 to Ch 300

Figure 5 Strand Street Ch 300 to Ch 0

Strand Street runs from the north-eastern side of the bay adjacent to the camp site (where Kamp Street interfaces with the shore) southwestwards for a total length of some 950 m until it interfaces at a T-junction with Main Street.

For most of the length of Strand Street a very thin strip of vegetation of between 2 m and 4 m in width provides a vegetated buffer to the road. The nearshore rock reef which forms the primary barrier between the ocean and the road is between 50 m and 70 m in width at low tide.

The area from approximately Ch 150m to Ch 650m is of most interest to this project.

SITE OBSERVATIONS

Visual walkthrough

Appendix A contains images from a visual walkthrough of the project area. Images were taken in the afternoon on 23 April 2025 around mid-tide.

The visual walkthrough starts at the northern (camp site) side of Strand Street and continues southwards, that is from Ch 100 to about Ch750, a length of 650m. Only images of particular interest are placed, and at intervals of about 50m.

In summary, the following is observed:

- The project area is located along Strand Street, with the primary project area located between Ch100 and Ch650.
- A natural rock masonry retaining wall provides a seaward buffer to the roadway along most of its length.
- The top of the wall is more-or-less at the level of the roadway. The height of the wall however varies between about 0.5 to 1.5m depending on the topographic level of the upper beach adjacent to the wall.
- The retaining wall is in reasonable condition, but damage was observed at a number of locations. If left unmaintained this is likely to result in further local deterioration and eventual local failure.
- The retaining wall is typically located a minimum of 2 m from the seaward side of the roadway. This provides for a minimum 2 m wide verge, which over most of its length is vegetated (mostly grass).
- A few larger 'park' areas are located along Strand Street – typically 5m to 6 m width and 20 to 30 m in length with park benches – where users can sit and enjoy the ocean views.
- A concrete pumpstation is located around Ch210 which protrudes 4.5m from the roadway. Its roof slab is at the level of the roadway thus not obstructing views and blending with the general landscape.
- Along the central section (from Ch300 to Ch350) erosion scars are observed on the verge as a result of storm/flood events – likely the Sept 2023 ocean storm and the May 2021 and March 2023 intense rainfall events.
- Gabion mattress edging, some 4 m wide, forms the verge below the roadway for about 100 m length, from approx. Ch510 to Ch610. While effective in protecting the roadway these wire structures are unsightly and sterilise valuable space on the beach from users. While some vegetation growth has taken place the area is largely not vegetated. Also wire mattresses have been damaged which could lead loss of rock and failure of structure in future: injuries to beach users also possible, especially kids, due to sharp protruding wires.
- Along this section of roadway pedestrians have to use the road and compete with vehicles. Beach access is provided a Ch570 through a wooden pedestrian bridge.
- A narrow rock wall is located at the roadway edge is this area. The total wall length is about 100m length. Over the most southerly section of some 25m in length, reconstruction through doubling of the wall width ('double' rock) has taken place providing a sturdier and more aesthetic wall section.
- The beach below the gabion mattress section appears to be denuded of sand and is still rock-strewn -probably a remnant of the Sept 2023 ocean storm event.
- Ocean access can only be obtained by crossing a 70m-wide irregular rock reef.

Google Earth Imagery

Google Earth Imagery of the study area were reviewed to assess changes over time at the site. Details are contained in Appendix A.

Google Earth satellite images for the study area are available for a 20-year period: from March 2004 to April 2024. Only images which are relatively clear have been extracted to provide a means of viewing changes over time. Note that there is difference in image clarity dependent on the prevailing weather conditions and time of day a particular image has been taken.

The most significant observation is the steady increase in the number of dwellings – not surprising.

On the ocean side the differences in wave patterns are obvious, dependent on the prevailing wave conditions at the time the satellite image was taken. Also, images were taken at different tidal levels, hence there is difference in the water line from image to image. Differences in the sizes of sandy beach areas, if they do occur, are of such a limited extent that no particular trends are evident.

Overall, the images indicate a stable nearshore and coastal domain.

COASTAL PROCESSES OF RELEVANCE

The image below indicates the general bathymetry off Jongensfontein and shows 15 m water depth to be about 1 km off the Jongens Bay shoreline. The area from about 15 m depth to the shoreline is defined as the nearshore zone.

Figure 6 Water depths off the Jongensfontein shoreline

A number of important coastal processes take place in the nearshore coastal zone which affect the stability of the shoreline, and impact infrastructure close to the shore. In the context of this project, coastal processes considered are: water-levels, wave processes, nearshore currents and circulation, and sediment transport.

Water-levels

Coastal water-levels are influenced by a variety of astronomical and meteorological/oceanographical factors. At times, these factors interact in a complex way to elevate water-levels significantly above normal levels. Elevated water-levels may intensify damage to coastal structures due to increased incidence of larger waves approaching and breaking closer to the beach. These may result in increased beach erosion, as well as increased threat to coastal development. Elevated water-levels may also cause the inundation of low-lying areas of the coastline and areas around estuaries.

Tides are usually the most important mechanism influencing water-levels. Tides are the periodic rising and falling of seawater that results from gravitational attraction of the moon, sun, and other astronomical bodies acting upon the rotating earth. Semi-diurnal tides such as that along the South African coastline result in, on average, two high tides and two low tides per day with an associated tidal range. The tidal range varies from month to month depending on the alignment of the astronomical bodies.

Storm surge may also significantly increase local water-levels. Strong wind, associated with a storm occurrence, blowing over the surface of the sea towards land may result in elevated water-levels at the beach (wind set-up). In addition, storms are often accompanied by a low pressure system which contributes to a rise in water-levels (barometric set-up). The effect of both wind set-up and barometric pressure on water-level set-up are considered to constitute storm surge.

Wave set-up near the shoreline is the rise in the elevation of the water surface (especially at the shoreline) due to onshore mass transport of the water by wave action alone. The degree of set-up depends on the type, size and period of the breaking waves, as well as on the beach slope.

Global warming has been proven to be taking place. One significant product of global warming is the rise in sea-level which is a response to two possible processes: expansion of sea water as the average temperature of the oceans increase, and increased volume of water in the oceans due to the melting of land-ice. While sea level rise (SLR) is perceived as a "modern" threat, in geological terms it is nothing new to Earth. Changes in sea levels, related to global glacial and warm periods have occurred for most of Earth's history.

Whilst there is general uncertainty on the magnitude of global SLR, for South Africa an appropriate scenario for long-term coastal planning and management is SLR by 2100 of ~ 0.85 m to 1 m ('central estimate'), with a plausible worst-case scenario of 2 m and a low estimate of 0.5 m. The corresponding best estimate (mid-scenario) projections for 2030 and 2050 are about 0.15 m and 0.35 m, respectively[1].

Wave processes

The nearshore wave climate, which plays an integral role in the generation of nearshore currents and sediment transport, is dependent on the deep sea wave conditions and the nearshore wave processes.

When deep-water waves approach a coastline, a number of processes occur. The most important of these are: refraction, shoaling, diffraction and breaking.

Refraction, which takes place when a wave travels at an angle to the bottom contours, includes the change in the orientation of the wave crest towards alignment with the bottom contours. This happens because the portion of the wave advancing in shallower water moves more slowly than the portion which is still advancing in deeper water.

Shoaling is the process by which the wave height changes when a wave travels from deep water to shallow water, irrespective of its direction of travel, as a result of the 'compression' of energy in a generally reducing water depth.

Diffraction is the phenomenon by which energy is transmitted laterally along a wave crest. This effect is particularly noticeable when part of a series of waves is interrupted by a barrier such as a breakwater or rocky headland.

Wave *breaking* occurs due to instability as a result of increased wave steepness. The positions along the shoreline, at which the waves start breaking, together form what is called the breaker line. The zone between the breaker line and the shoreline is called the surf zone.

[1] National Coastal Climate Change Vulnerability Assessment. Supporting Documents. Situational Awareness, Data Audit and Workshop Report. Department of Environment, Forestry & Fisheries (2016).

Wave *run-up* is the rush of water up a structure, rocky slope, or a beach on the breaking of a wave. Run-up is dependent on, among other factors, the beach slope, wave characteristics, and the roughness of the slope.

Wind waves or seas are waves caused by wind at the place and time of observation; that is, waves generated locally by winds. In contrast, swell waves are wind-generated waves that have travelled out of the generating area. Swell waves generally are more regular and have longer periods than wind waves. Storms along the Southern Cape shoreline are dominated by swell waves.

Nearshore currents and circulation

Waves approaching the coastline obliquely and/or a longshore gradient in breaking wave height generate longshore currents in the surf zone.

A series of nearshore circulation cells is formed by the above. Apart from the prevalent longshore current, water enters the surf zone by mass transport (net water movement in the direction of the waves) caused by the waves. Rip currents, which are strong surface currents flowing seawards in a narrow zone, take water out of the surf zone. A part of the longshore current feeds the rip current and some bypasses the rip current to continue alongshore to the next circulation cell.

Winds and tides also generate nearshore currents.

Sediment Transport

Sediment transport in the nearshore region is usually categorized as longshore or cross-shore sediment transport. On an exposed beach, aeolian (wind-blown) sediment transport also plays a role. In general, sediment is very rarely moved by only one mode of transport; longshore, cross-shore and aeolian sediment transport occurs simultaneously. Even on a long straight beach, the current circulation pattern (including rip currents) and the associated sediment transport patterns are very complex. Furthermore, marine sediment transport is dependent on wave and tide conditions with the result that it changes continually, not only in direction and rate, but also in the location at which it takes place in the nearshore zone.

When waves that advance towards the coast reach the nearshore zone, sediment is stirred up. Although non-breaking waves also move sediment, most of the sand is transported inside the surf zone where wave breaking is the primary agent for suspending sand and moving sand along the bottom. Longshore currents can usually not entrain sediment on their own; however, sand stirred up by the breaking waves is transported alongshore by these currents. Along an exposed beach, most of the longshore sediment transport occurs from about +2 m above mean sea level (MSL) to depths of less than about 8 m to 10 m to MSL. Along protected beaches, longshore transport typically occurs to depths of about 3 m to 4 m to MSL.

Depending on the environmental conditions prevailing on a specific day, sediment can be transported alongshore both upcoast and downcoast. The net longshore transport is the difference between the upcoast and downcoast transport rates. The gross transport is the sum of the (absolute values of) upcoast and downcoast transport rates.

If the longshore sediment transport is interrupted by an obstruction, such as a headland, groyne or a breakwater, accretion will occur on the updrift side and erosion on the downdrift side. The latter is due to the fact that the sand that previously fed the downdrift beach is trapped and thereby prevented from reaching the downdrift beach.

Cross-shore sediment transport is usually a swift process whereby a beach is eroded near the water-line during a storm. The sand is transported seawards and deposited in deeper water where it forms an underwater bar on which the storm waves break. When the sea calms down again, sand is slowly transported back to the beach, thus re-establishing approximately the original beach profile if no net loss of sand has occurred. Most of the transport occurs in depths less than 10 m to MSL. Typically, insignificant volumes of sand are transported cross-shore in depths greater than 10 m to 15 m to MSL along exposed beaches.

Aeolian or wind-blown sediment transport refers to sediment that is moved by wind action. Optimum conditions for wind-blown sand transport are the availability of dry, loose sand, strong winds, no vegetation, and a long wind fetch (i.e. a long expanse of sand over which the wind can blow). Usually, the rate of aeolian sediment transport is orders of magnitude lower than the wave-driven transport rate along an exposed coast.

VULNERABILITY AND RISK

The evidence

A particularly severe storm took place in the Stilbaai/Jongensfontein area during the period 15 to 17 September 2023. During this event a significant storm wave event combined occurred during spring equinox tides in combination with strong onshore winds to devastating effect. The very high tidal levels combined with a particularly severe storm surge. At Jongensfontein this lead to severe coastal flooding and damage to infrastructure.

The parking area at the Jongensfontein Tidal Pool south of the town centre was completely destroyed (washed away) and there was significant damage to the dirt road down to the parking lot at the southern extremity of town. Two cars parked at the tidal pool were washed away and were completely wrecked.

Along Jongens Bay, significant flooding of Strand Street occurred and seawater even washed through some of the homes.

Some images taken during this storm event are included below.

Figure 7 Strand Street flooding around Ch 300 with Oom Soon se Huis in right front at 15:29 16 Sept 2023

Figure 8 Strand Street flooding around Ch 550 at 15:30 on 16 Sept 2023

Figure 9 Strand Street flooding around Ch 750 at 15:31 on 16 Sept 2023

Figure 10 Vehicle wrecked below Main Road at 15:39 on 16 Sept 2023

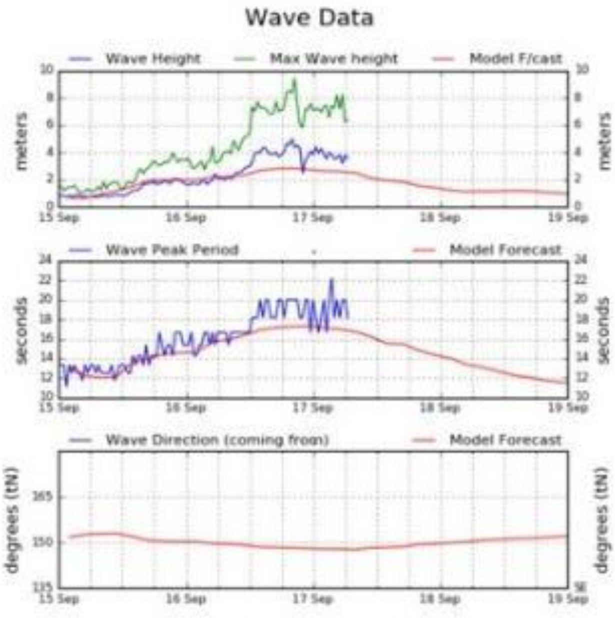
Figure 11 Vehicle wrecked above tidal pool at 15:40 on 16 Sept 2023

Figure 12 Huge breaking waves behind house at 59Main Road at 15:48 on 16 Sept 2023. Notice foam and water damage landward of house!

Figure 13 Strand Street from camp site at 15:58 on 16 Sept 2023. Notice debris all along Strand Street.

The data

Wave and wind conditions recorded at the CSIR's wave buoy within Mossel Bay at the time are depicted in images below. Although conditions off Jongensfontein would not be identical to these due to difference in location along the shoreline and shoreline orientation (Jongensfontein is located some 85 km WSW of the Mossel Bay measurement location), these data are the most relevant to the study site and would be typical of conditions experienced here, except for a temporal change in conditions observed due to the distance between the sites.



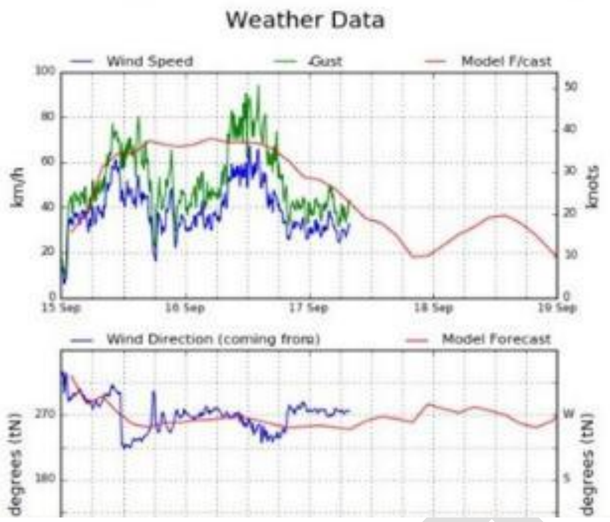
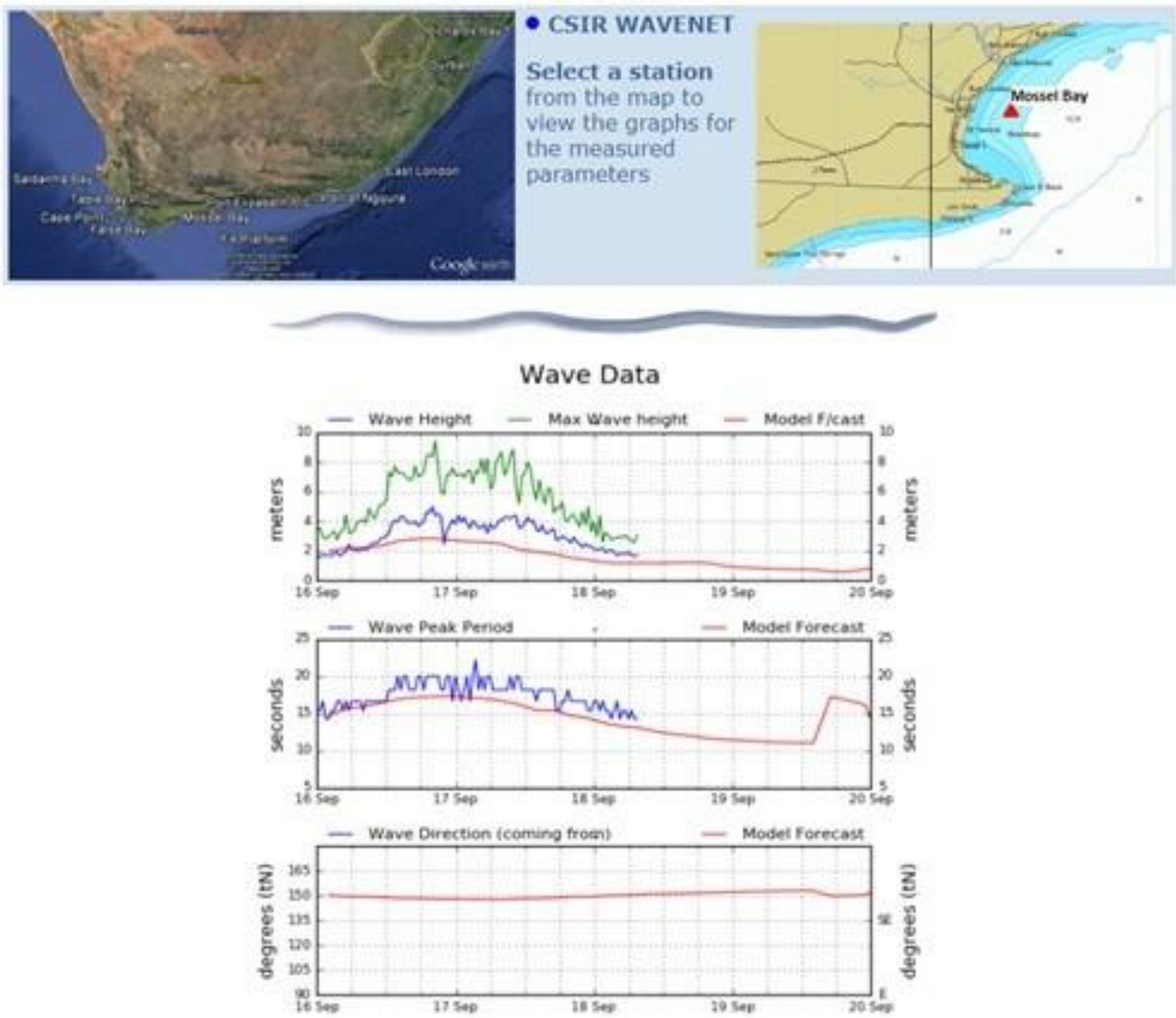


Figure 14 Wave and weather conditions recorded at Mossel Bay 15 to 17 Sept 2023



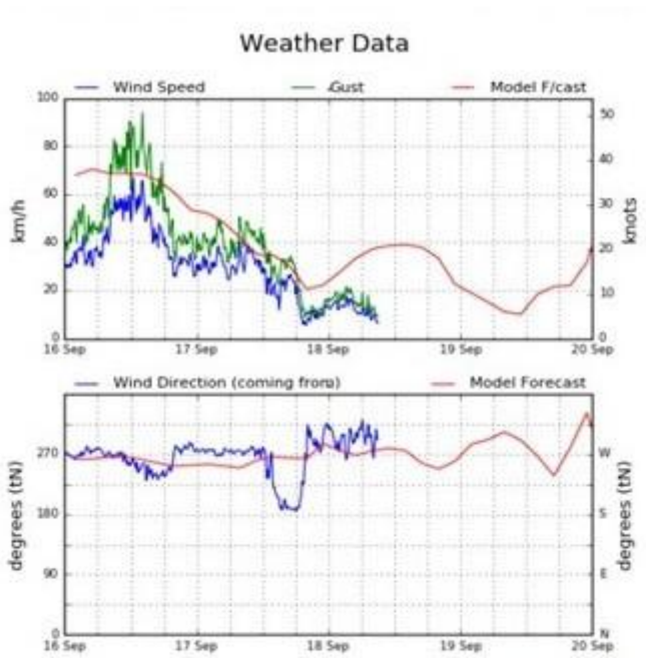


Figure 15 Wave and weather conditions recorded at Mossel Bay 16 to 18 Sept 2023

The graphs above show that the peak of the storm lasted some 30 hours and occurred between midday on 16th Sept to the evening of 17th Sept. During this period a significant wave height of up to 5 m was recorded and maximum wave heights remained high: between 7 m and 10 m. The wave period was consistently between 18 s and 22 s confirming the presence of very long period swells.

Wind speeds peaked around midday on 15th Sept and again around midday on 16th Sept with gusts almost up to 100 km/h, and average wind speeds around 60 km/h. Winds were dominantly from easterly direction.

An extract from the SA Tide Tables for this period (Table 1) shows the storm coincided with a dark moon and predicted high tides in excess of +2 m CD.

Table 1 SA Navy Tidal Predictions for Mossel Bay - September 2023

Day	Times of											Moon Phase
	Sunrise	Sunset	High Water				Low Water					
			Time	Height	Time	Height	Time	Height	Time	Height	Moonrise	Moonset
14	0633	1821	0322	1.93	1534	2.05	0920	0.30	2139	0.36	0626	1752	
15	0631	1822	0348	1.98	**1559**	**2.11**	0944	0.25	2205	0.32	0651	1848	●
16	0630	1823	0414	2.00	**1624**	**2.13**	1009	0.23	2231	0.31	0714	1945	
17	0629	1823	0440	1.99	**1649**	**2.12**	1033	0.25	2258	0.33	0738	2042	
18	0628	1824	0507	1.94	1716	2.07	1058	0.30	2325	0.38	0804	2142	

The storm wind and wave conditions would have caused additional water level setup (storm surge) which raised water levels significantly above the tidal levels as site evidence showed (i.e. Figure 8 to 11).

The information outlined above provides evidence of the vulnerable nature of coastal infrastructure along the Jongensfontein shoreline. While this is only the result of one particularly severe storm event, it does indicate the risks of coastal properties with respect to flooding and erosion.

As a result of global warming and sea level rise these types of storms are expected to become more frequent and more devastating.

Regional risk information

As part of a process to define coastal management lines within the Garden Route District Municipality (then the Eden District), wave runup modelling was conducted.[2] The modelling was based on the following parameters.

Topographic data.

Data from a LIDAR survey (accuracy 20 to 50 cm) undertaken by the Western Cape Government in 2013 was used to create a digital elevation model of the coastal zone.

Bathymetric data.

The bathymetry of the seabed was obtained from bathymetric charts from the South African Navy.

Regional wind data.

Sourced from US-based National Oceanic and Atmospheric Administration (NOAA) for a location in the Indian Ocean some 65 km south of Stilbaai. The basis of the data is the NCEP global scale numerical climate model (https://www.ncei.noaa.gov/products/weather-climate-models/climate-forecast-system). The wind rose is based on more than 100 000 records, for the 36-year period January 1979 to January 2015.

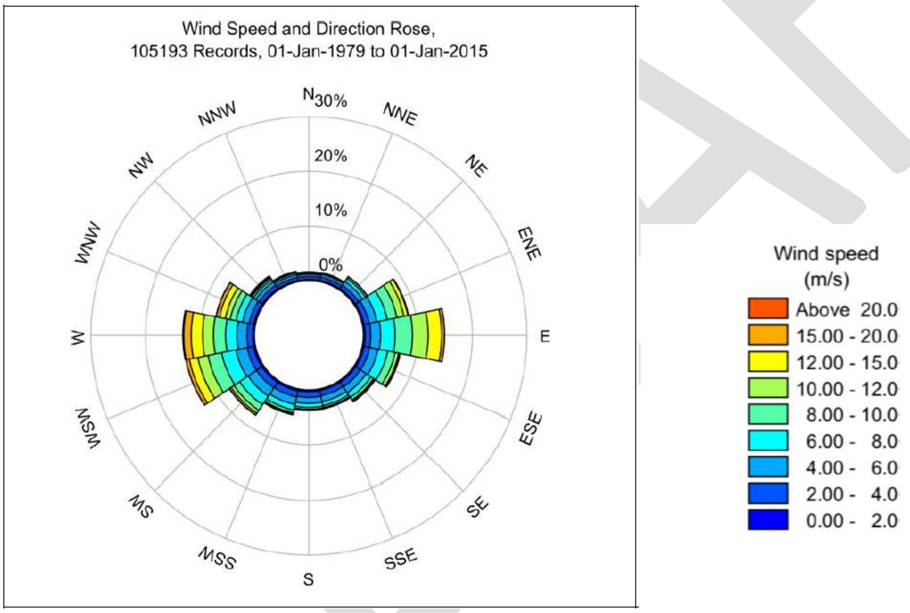


Figure 16 Offshore wind rose off the Stilbaai coast (NOAA)

The wind rose confirms the presence of two dominant wind direction sectors offshore of Still Bay – westerly winds (SW to WNW) and easterly winds (ESE to ENE). Wind speeds in excess of 20 m/s (i.e. 72 km/h) occur from both sectors.

[2] **Royal HaskoningDHV (2018a). Coastal Management Lines for Eden District: Project Report.** Authority Reference No EADP 1/2016. Prepared by Royal HaskoningDHV for Western Cape Government, Department of Environmental Affairs & Development Planning. Royal HaskoningDHV Reference No MD2368, March 2018.

Offshore waves.

The offshore wave climate is indicated below in the form of seasonal wave roses for a location some 65 km south of Stilbaai, constructed from a 10-year wave dataset (January 1997 to June 2008). The basis of the data is the third generation wave model WAVEWATCH III which is coupled to the global scale NCEP numerical climate model (https://www.weather.gov/sti/coastalact_ww3). The data was extracted from the Eden District Coastal Management Lines report[3].

The coordinates of the extraction point is:

35.0°S 21.5°E

The point is located in approximately -100m water depth (below Mean Sea Level).

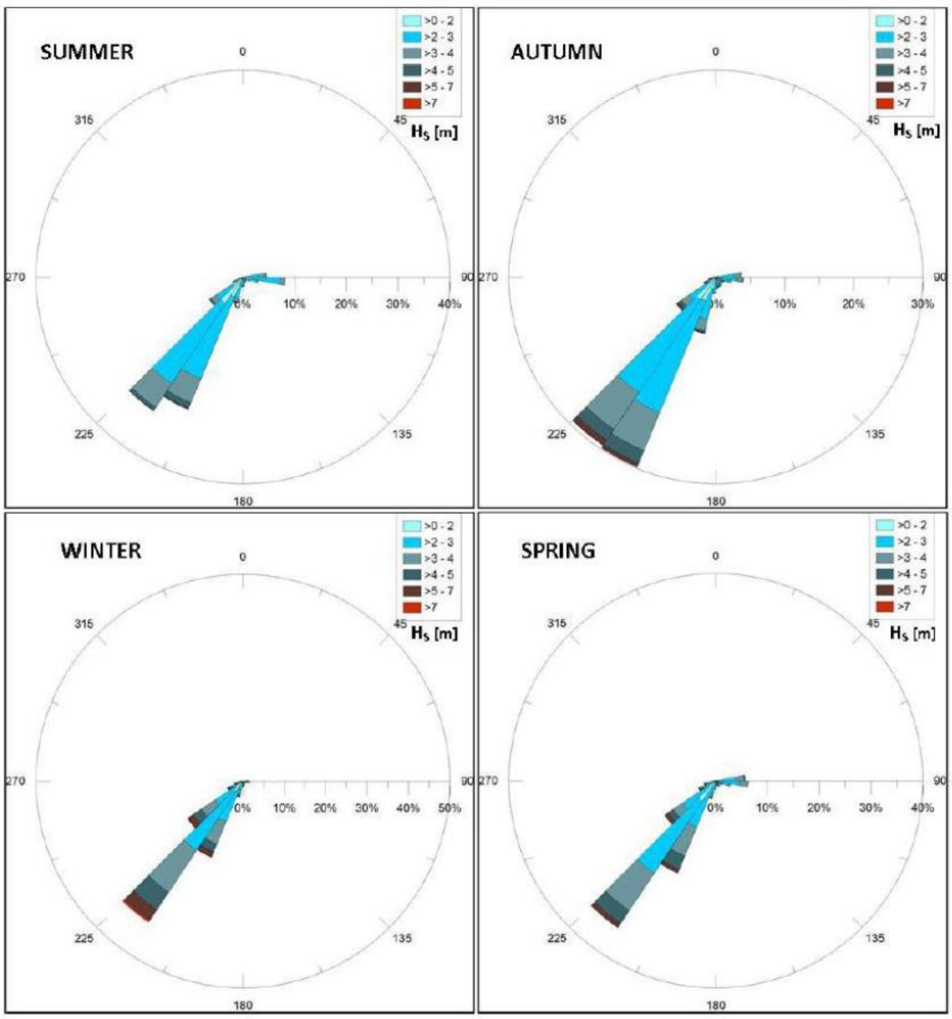


Figure 17 Seasonal offshore wave roses off the Still Bay coast (NOAA)

[3] **Royal HaskoningDHV (2017). Eden District Coastal Management Lines. Coastal Processes and Risk Modelling.** Authority Reference No EADP 1/2016. Prepared by Royal HaskoningDHV for Western Cape Government, Department of Environmental Affairs & Development Planning. Royal HaskoningDHV Reference No MD2368, July 2017.

The wave roses show the direction that waves approach from for each season, and also the percentage occurrence of various wave height ranges.

It is clear that during all seasons, waves predominantly approach from the South-Westerly sector. Waves from the South-Westerly sector are typically swells with wave periods of between 12 s and 16 s. These waves are generated by winds associated with frontal systems in the Atlantic and southern Indian Ocean.

A small component of Easterly waves is also evident in the roses – occurring during the Spring, Summer and Autumn seasons, when winds from the Easterly to SSE'ly sectors occur most frequently.

Extreme wave conditions for storms with return periods from one year to 500 years were derived by Haskoning (2017) from this dataset and is extracted below.

Table 2 Extreme offshore significant wave heights (m, Hs) off Stilbaai/Jongensfontein

Return Period	Direction								
	W	WSW	SW	SSW	S	SSE	SE	ESE	E
1-year	4.12	7.43	8.03	6.80	5.06	3.98	3.86	4.02	4.21
5-year	5.32	8.74	9.08	7.99	6.17	5.26	4.82	4.91	4.84
10-year	5.89	9.16	9.52	8.58	6.68	5.98	5.22	5.28	5.16
20-year	6.53	9.53	9.98	9.24	7.22	6.86	5.62	5.66	5.50
50-year	7.51	9.92	10.59	10.24	7.99	8.32	6.13	6.15	6.02
100-yr	8.37	10.17	11.08	11.11	8.63	9.70	6.51	6.51	6.45
500-yr	10.87	10.61	12.25	13.56	10.32	14.18	7.39	7.36	7.67

Table 3 Extreme offshore wave period (s, Tp) off Stilbaai/Jongensfontein

Return Period	Direction								
	W	WSW	SW	SSW	S	SSE	SE	ESE	E
1-year	9.12	12.05	13.60	14.13	11.10	8.73	8.32	8.20	7.92
5-year	10.36	13.06	14.46	15.32	12.26	10.03	9.31	9.06	8.50
10-year	10.90	13.38	14.81	15.88	12.75	10.70	9.69	9.40	8.77
20-year	11.48	13.64	15.16	16.48	13.26	11.46	10.05	9.73	9.06
50-year	12.31	13.92	15.62	17.34	13.95	12.62	10.49	10.14	9.47
100-yr	12.99	14.09	15.97	18.06	14.50	13.62	10.82	10.44	9.81
500-yr	14.81	14.39	16.80	19.96	15.85	16.47	11.52	11.09	10.69

Water level

Water levels at the coast determine the extent of beach exposure and inundation and hence the magnitude of the waves which reach the shoreline and impact any nearshore infrastructure. Water level at a particular time is determined by a combination of the tide, surge and sea level rise.

The Hessequa coastline experiences semidiurnal tides, with a relatively large spring tide to neap tide variation. The mean spring and neap tidal ranges are about 1.84 m and 0.58 m respectively, based on data from Mossel Bay. (No tidal water level recordings are made in the Hessequa Municipality.)

Table 4 Tidal levels at Mossel Bay tide gauge relative to Mean Sea Level

Tidal Datum	Height Relative to Mean Sea Level (MSL) (m)
Highest Astronomical Tide (HAT)	1.27
Mean High Water Spring (MHWS)	0.93
Mean High Water Neap (MHWN)	0.29
Mean Sea Level (MSL)	0
Mean Low Water Neap (MLWN)	-0.29
Mean Low Water Spring (MLWS)	-0.91
Lowest Astronomical Tide	-1.17

Sea level rise as a result of climate change is another important consideration in determining design water levels since it affect the mean still water level over time – the level around which the tide varies and the storm and barometric induced surges occur.

The global mean sea level rise (SLR) during the 20th century is estimated to have been 1.7mm/year. Between 1993 and 2010 a higher rate of 3.2mm/year is estimated. The present average global sea level is some 0.3 m above the pre-industrial sea level around the year 1700. The global SLR expected until 2050 is in the range of 0.1-0.3 m and until 2100 between 0.25 – 0.95 m above current levels (DEFF, 2020a).

In modelling to determine the Eden District Coastal Management Lines (HaskoningDHV, 2017), the following extreme sea level rise estimates were used:

Table 5 Sea Level Rise Estimates (HaskoningDHV, 2017)

Scenario	Sea Level Rise (mm)	Return Period
Short Term	200	20-year
Medium Term	500	50-year
Long Term	1000	100-year

These values are similar to the modelling scenarios used in the development of DEFF's National Coastal Climate Change Vulnerability Indices (DEFF, 2020b) where the following values were used:

Table 6 Sea level Rise Scenarios (DEFF, 2020b)

SLR Scenario (m)	Expected by year
0.15	2030
0.35	2050
0.50	2070
1.00	2100
2.00	2200

Local SLR rates vary substantially (within ±30% of the global mean sea level rise), partly exceeding and partly staying below the global average. Recorded SLR rates on South Africa's coast are usually below the global rates, and the rates vary along the coast from west to east. Based on the current SLR rate of 1.47 mm/year determined in 2009 along the south coast, SLR values of 0.11 m can be expected by 2050, and only 0.25 m by 2100. These estimates assume the current rate to continue and do not include the proven acceleration of sea level rise. It does however point to the uncertainty in estimates for a particular location.

Surge levels during storm events are typically caused by barometric effects, combined with water level setup as the result of winds and waves. CSIR (2015) have published the results of an assessment of surge levels around the South African coast.

Using the conservative assumption that the extreme water levels coincide at the Mean Spring High Water level, the following water level estimates are obtained:

Table 7 Extreme Water Level Estimates

Return Period	Surge (m)	Tide MHWS (m to MSL)	Sea Level Rise (m)	Total extreme water level (m to MSL)
10-year	0.34	0.93	0.10	1.37
20-year	0.86	0.93	0.20	1.99
50-year	0.93	0.93	0.50	2.36
100-year	0.97	0.93	1.00	2.90

These values, except the 10-year event, were used in the determination of the Eden District Coastal Management Lines (HaskoningDHV, 2017). The 10-year event is based on the Highest Astronomical Tide (HAT) Level from the SA Tide Tables.

Nearshore waves

Knowledge of the nearshore wave climate is required to understand and predict nearshore processes (such as sediment transport), and predict design wave conditions for nearshore infrastructure. The nearshore wave climate can be significantly different from the offshore wave climate since as waves propagate from offshore towards the coast their height and direction are modified as a result of the influence of bathymetry. The main processes responsible for these changes are:

- Refraction: the process by which wave crests tend to align themselves to be parallel to the seabed contours;
- Shoaling: the change in wave height due to waves propagating into different water depths;
- Diffraction: the process that results in the propagation of waves into sheltered areas behind obstructions due to the lateral transport of energy.

Although the offshore waves approach the Hessequa Municipality coast from the southwest, they actually approach the shores of the crenulate bays more from the east in their western corners and more from the south along their eastern ends, after refraction, directional spreading and loss of energy around their western headlands. This causes a decreased wave angle at the coast. Any storm waves that are generated with an east to west trajectory do not encounter the headlands and maintain much of their original energy.

This effect is depicted in Figure 25 below which shows wave rays (lines of wave direction normal to wave crests) for Mossel Bay, which is similar to other crenulate bays in the Hessequa Municipality such as Stilbaai or Jongensfontein.

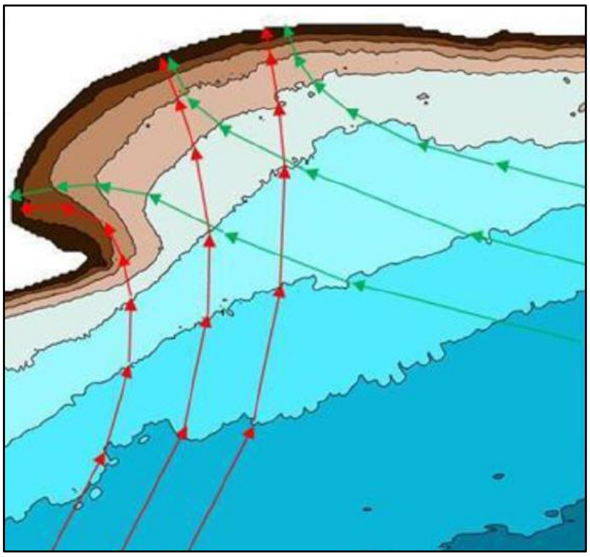


Figure 18 Directions of wave approach in Mossel Bay. Red arrows represent offshore waves from South-West, whilst green arrows represent offshore waves from East

In HaskoningDHV (2017) nearshore wave conditions along the 15 m depth contour were determined through numerical wave modelling in which the requisite wave transformation processes were taken into account. Offshore wave data were analyzed to determine wave height and period distribution, extreme (storm) values and associated wave direction – refer Tables 1 and 2 above.

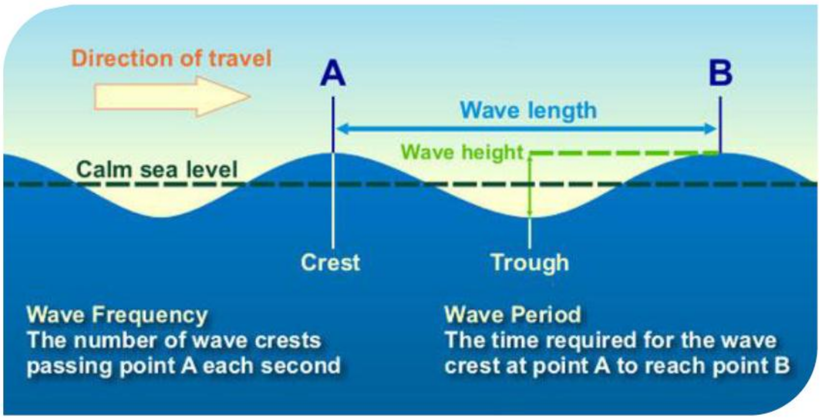


Figure 19 Wave characteristics and terminology

Wave modelling results were extracted at key locations along the shoreline. For the Stillbaai/Jongensfontein region refer to Figure 20.

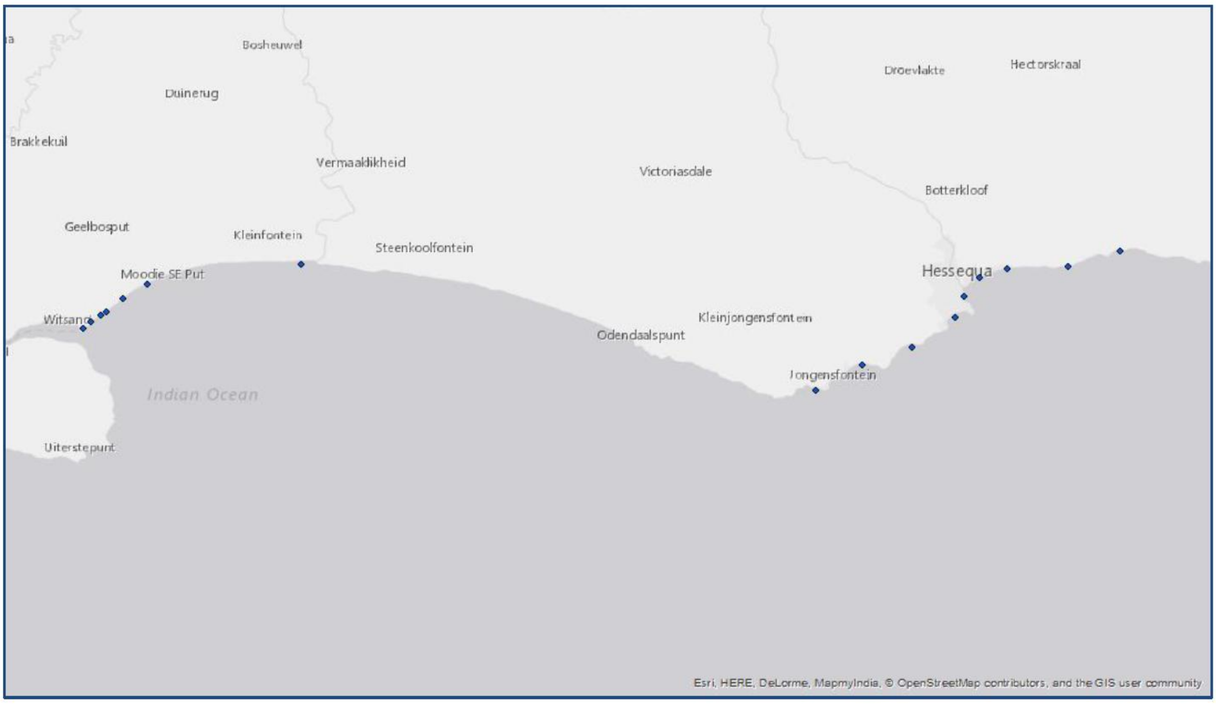


Figure 20 Location of model output points (HaskoningDHV, 2017)

The numerical model computational mesh for this region is indicated in Figure 21 below.

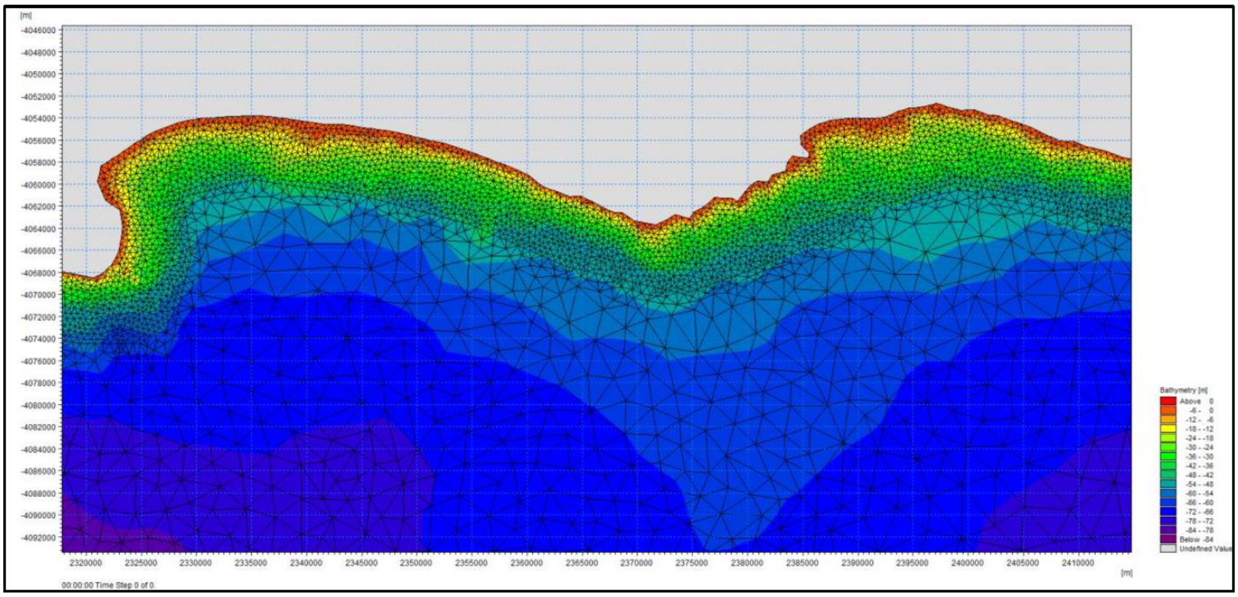


Figure 21 Computational mesh (HaskoningDHV, 2017)

The nearshore wave conditions as extracted for the two locations – Jongensfontein 1 (west of town in vicinity of Tidal Pool) and Jongensfontein 2 (east of town and Jongensbaai) – is listed in Table 6 below. Data is provided for return periods of 10, 20, 50 and 100 years for three primary wave directions – SW, SSW and E'ly waves. Values marked in RED below appear to be erroneous since they do not follow the trends but have been extracted here as provided in HaskoningDHV (2017). Note that according to this report, the data was extracted along the -15 m depth contour.

Table 8 Nearshore significant wave heights extracted at two Jongensfontein locations

Inshore Significant Wave Height (m)			
Location	**Jongensfontein 1**		
Return Period	**SW**	**SSW**	**E**
10-year	3.98	3.77	2.76
20-year	6.02	6.68	3.00
50-year	6.39	7.39	1.68
100-year	6.75	8.04	3.45
Location	**Jongensfontien 2**		
Return Period	**SW**	**SSW**	**E**
10-year	4.03	3.84	2.10
20-year	5.13	5.84	2.29
50-year	5.44	6.37	1.62
100-year	5.75	6.91	2.76

The nearshore bathymetry off Jongensfontein is provided in Figure 6. This shows clearly the significant distance of the -15 m depth contour from the shoreline, mostly more than 1 km off the coast. Wave conditions which are tabulated in Table 7 above thus will still undergo significant transformation before they reach the shoreline.

Wave run-up calculations

Wave run-up calculations were performed using the European Overtopping Manual (referred to as EurOtop) which is a comprehensive technical manual on estimating wave run-up and overtopping of sea defences and related structures. The overtopping manual was largely based on European research, but was designed for worldwide application. The guidance defines wave run-up height as: “the vertical difference between the still water level, which is exceeded by 2% of the number of incident waves”. The definition of wave runup is indicted pictorially below.

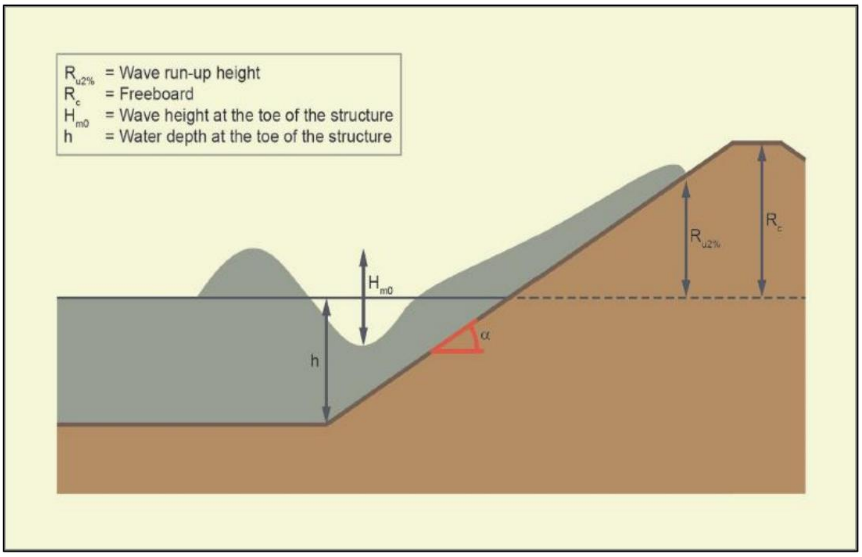


Figure 22 Definition of the wave run-up height on a smooth slope (HaskoningDHV, 2017)

To derive continuous wave run-up lines for three time horizons along the coast, the calculated wave run-up heights were converted to an upper beach line and three risk lines using GIS processes. This includes the plotting of the wave run-up calculations and a process of interpolation between the modelled points. Interpolation followed high resolution (0.5m) lidar-derived contours corresponding to wave run-up heights to shape the risk lines along the shoreline.

Table 9 Wave Run-up Heights extracted at two Jongensfontein locations

Wave Run-up Height Ru2% (m)	
Location	**Jongensfontein 1**
Return Period	**Run-up Height (m)**
10-year	2.41
20-year	3.24
50-year	3.58
100-year	3.89
Location	**Jongensfontein 2**
Return Period	**Run-up Height (m)**
10-year	6.58
20-year	7.47
50-year	8.20
100-year	8.90

Wave run-up projections for the Jongensfontein area have been extracted and plotted on a Google Earth image of the study area in Figure 22 below.

The image shows that the 1:10-year wave runup level coincides more-or-less with the level of the Strand Street roadway. Storm of lesser probability (20-year, 50-year, 100-year), hence greater in intensity, have higher run-up values and impact seafront properties.

The findings of these studies have also been included in the Department of Forestry, Fisheries and the Environment's (DFFE) Climate Change Vulnerability Assessment. Figure 23 below is an extract from an image using the DFFE Coastal Viewer platform (https://ocims.environment.gov.za/coastal%20viewer/) which shows the "very high" risk of coastal flooding of Jongensfontein according to their classification. It should be noted that the same classification is applicable to other areas with the Hessequa Municipality, i.e. the beachfront properties along Waterkant Street in Stilbaai.

Conclusion

The information outlined above provides evidence of the vulnerable nature of coastal infrastructure along the Jongensfontein shoreline. It would thus be prudent to consider measures to mitigate this risk.

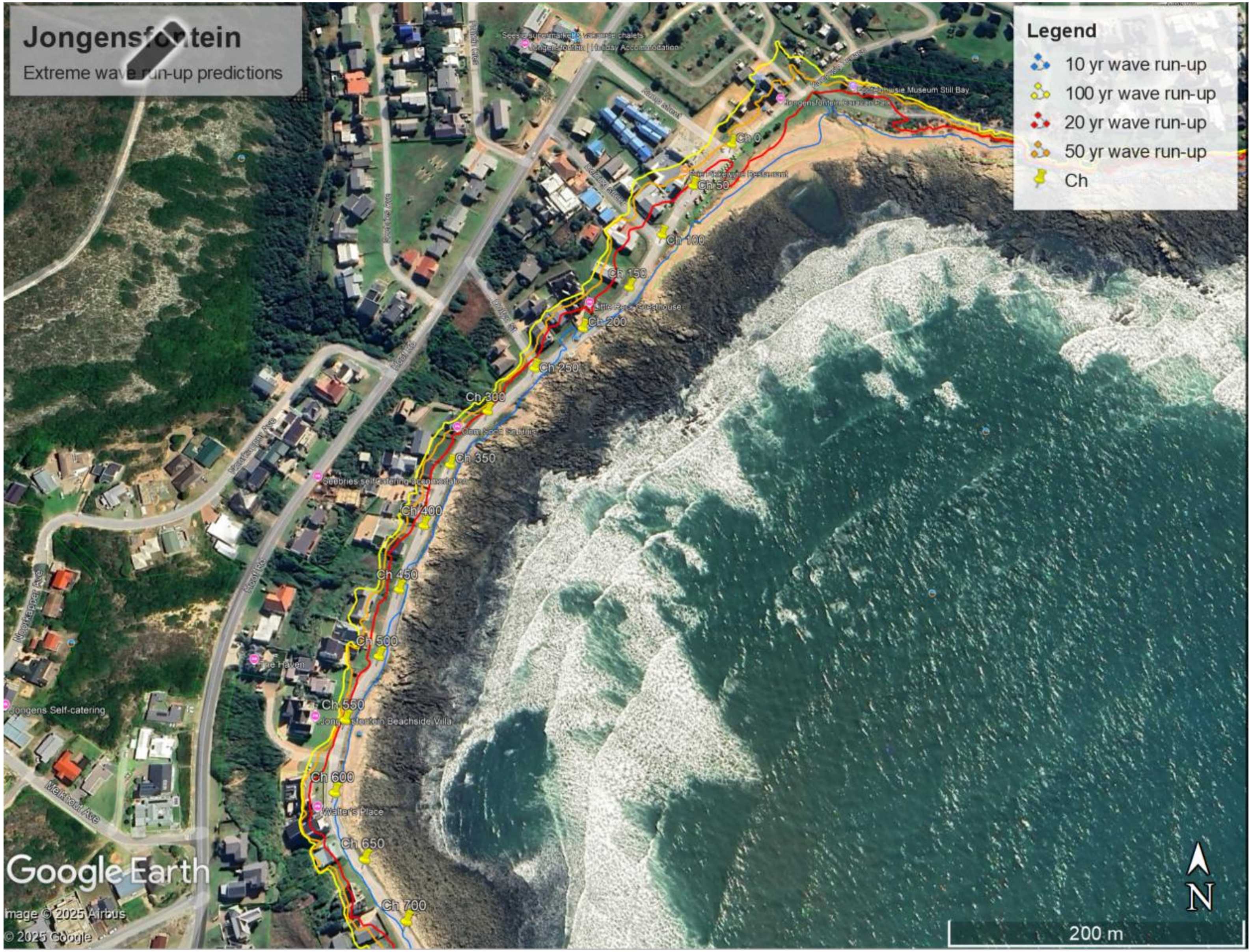


Figure 23 Extreme wave run-up predictions for Jongensfontein area

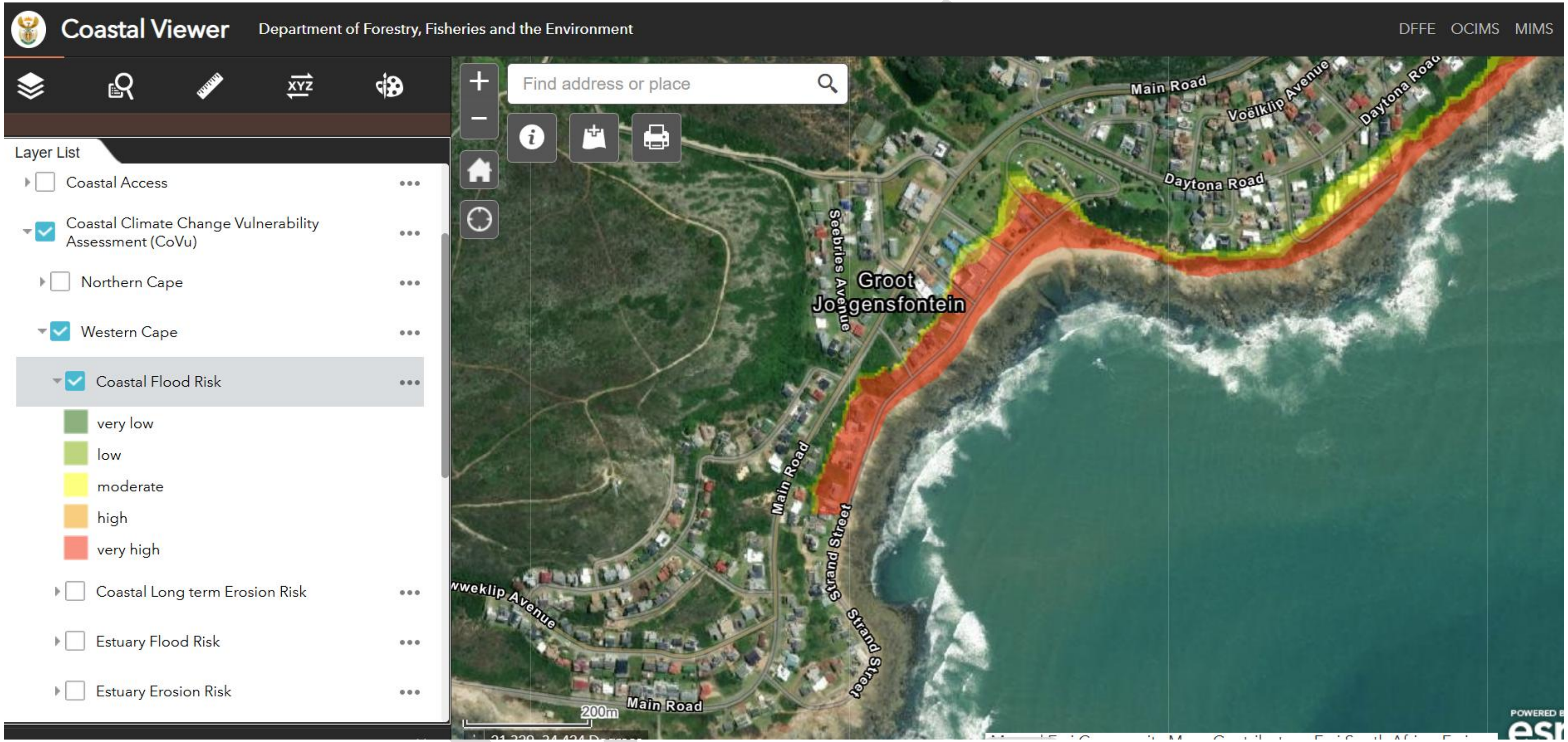


Figure 24 Coastal Flood Risk indicated in Coastal Viewer

SEAWALL OPTIONS

Background

A Seawall is a structure separating land and water areas. It is designed to prevent coastal erosion and other damage due to wave action and storm surge, such as flooding. Seawalls are normally very massive structures because they are designed to resist the full force of waves and storm surge (https://www.coastalwiki.org/wiki/Seawall).

A seawall is constructed at the coastline, at the foot of possible cliffs or dunes. A seawall is typically a sloping concrete structure; it can be smooth, stepped-faced or curved-faced. A seawall can also be built as a rubble-mound structure, as a block seawall, steel or wooden structure. The common characteristic is that the structure is designed to withstand severe wave action and storm surge. A rubble-mound revetment often protects the foot of such non-flexible seawalls. A rubble-mound seawall bears a great similarity to a rubble-mound revetment; however a revetment is often used as a supplement to a seawall or as a stand-alone structure at less exposed locations.

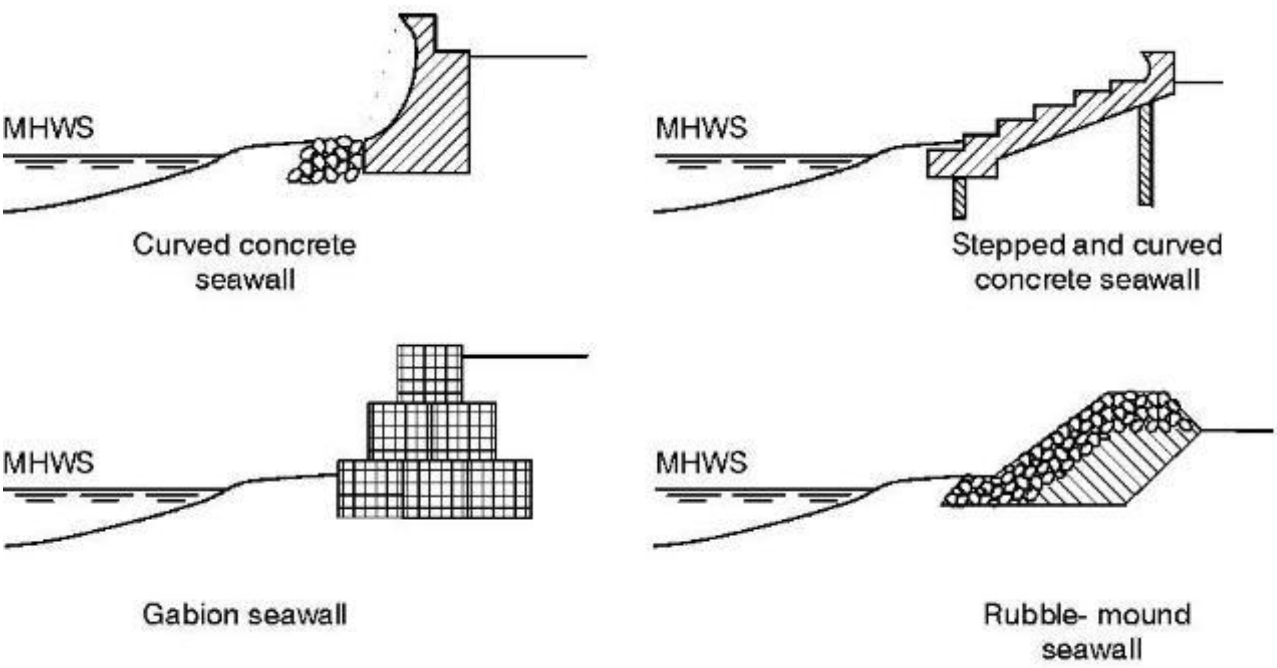


Figure 25 Examples of seawall structures – in cross-section

A seawall provides a high degree of protection against coastal flooding and erosion. It fixes the boundary between the sea and land which can be beneficial if important infrastructure or buildings are located on the shoreline.

Seawalls can have adverse effects on the coastal environment by interfering with natural processes such as habitat migration, causing the reduction of intertidal habitats. However, these effects depend very much on the main wave and sediment transport direction, the design of the seawall and the local site conditions.

Recent examples in South Africa

Coastal Protection Works, Strand, Western Cape

Coastal protection works were undertaken between Strand Pavilion and Da Gama Street for the City of Cape Town. The Contactor for the works was Civils2000[4]. The objectives of the work were to upgrade the seawall to prevent overtopping and minimize sea sand from blowing onto Beach Road.

The scope of work included:

- Demolition of the existing seawall, existing ablution block and existing bus shelters, and alterations to the existing slip way near the pavilion.
- Relocation of an existing rising main, construction of a new 355mm diameter effluent line, and building alterations to an existing pump station. In addition, there was 540m of culvert pipes and 80m of concrete portal culverts constructed.
- Construction of a new 1.5km seawall along Beach Road, in Strand, with stairs and ramps providing access to the beach, and including the relocation of a sewer pipeline behind the new seawall and repair of existing stormwater outlets.
- Removal of existing paving, construction of raised pedestrian esplanade between new seawall and Beach Road, installation of new paving and construction of a concrete sidewalk and steps.
- Relocation and protection of existing services and landscaping.

The new seawall was built on foundations comprising a rock fill and pioneering layer, with 1630m^3 of concrete making up the wall. The wall was then finished off with 2075 precast concrete units of two different profiles, comprising L-shaped units and standard copings with a sand blasted finish. The precast units were placed on mass concrete with a levelling layer of sand/cement mortar and grouted in their final position. 1500m^3 of reno mattresses were constructed in front of the sea wall to provide support and erosion protection.

Construction of these works were completed in 2018 after a construction duration of 20 months at a contract value of R 82,000,000.

Images of the construction are provided below.

This type of structure provides an example of a high-end type of seawall structure, a scaled-down version of which could be considered for Jongensfontein.

[4] https://www.civils2000.co.za/project/coastal-protection-works-strand-western-cape/

Figure 26 Seawall elements lined up. Seaward side. Note construction in the dry

Figure 27 Seawall units in L-shape. Landward side

Figure 28 Seawall after backfilling. Note beach on seaward side

Figure 29 Aerial view of completed seawall

Walkway and seawall, Witsand

A new formalized walkway with low "seawall" has been constructed at Witsand in the recent past, adjacent to the Anchorage Beach Restaurant and parking lot. Members of the JRA visited this site on 27 February 2025. Images shared are shown below.

The structure can be classified as a low seawall with the walkway along the crest of the structure. The structure is located on the upper beach. It is not clear from the imagery how high above the high water mark the structure is located and whether wave runup ever reaches it.

The structure does provide an example of a sound low-cost option which is not too far off the existing structures at Jongensfontein.

Figure 30 Paved walkway below parking area. Note sloped retaining 'seawall' on seaward side

Figure 31 Further continuation of walkway with sloped 'seawall'

Figure 32 Westward view of walkway/seawall

Figure 33 Picnic areas with seawall protection

Figure 34 New Witsand jetty within Breede River

Figure 35 Landward view from Witsand jetty platform

PROPOSED APPROACH

There can be no doubt that measures are required to address ocean storm impacts on Jongensbaai infrastructure. A two-phased approach is proposed – Phase 1 for short-term improvements and Phase 2 longer term enhancements.

Phase 1

The first phase of the project will focus on the area towards the western side of Strand Street from about Ch500 to Ch650 – thus a distance of about 150m. The focus of the initial intervention will be to provide additional safe pedestrian space and improved beach access.

Since there is no space available on the roadway the only useable space will be that which is currently occupied by the gabion mattresses. The following two options can be considered:

Option 1: Wooden Walkway

The gabion mattresses are left in position, but where their condition has deteriorated, repairs are done to yield an aesthetically pleasing structure. A wooden pedestrian walkway is constructed all along Strand Street above the gabion mattress section. An indicative cross-section is provided below.

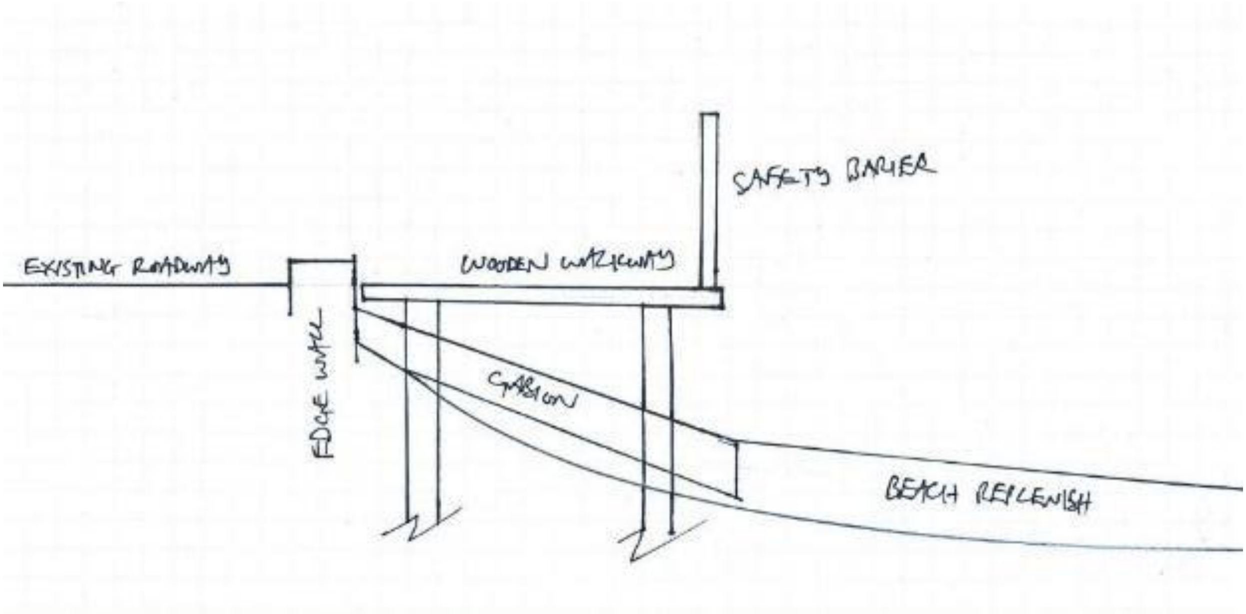


Figure 36 Indicative cross-section for wooden pedestrian walkway

Option 2: Brick Pavement Walkway

A walkway similar to that at Witsand is installed. The gabion mattresses are thus removed and replaced by an earthworks mound protected on the seaward side by rock armour, possibly in a mortar base and with a brick pavement layer on the structure crest (more-or-less at the road surface level). See indicative section in sketch below.

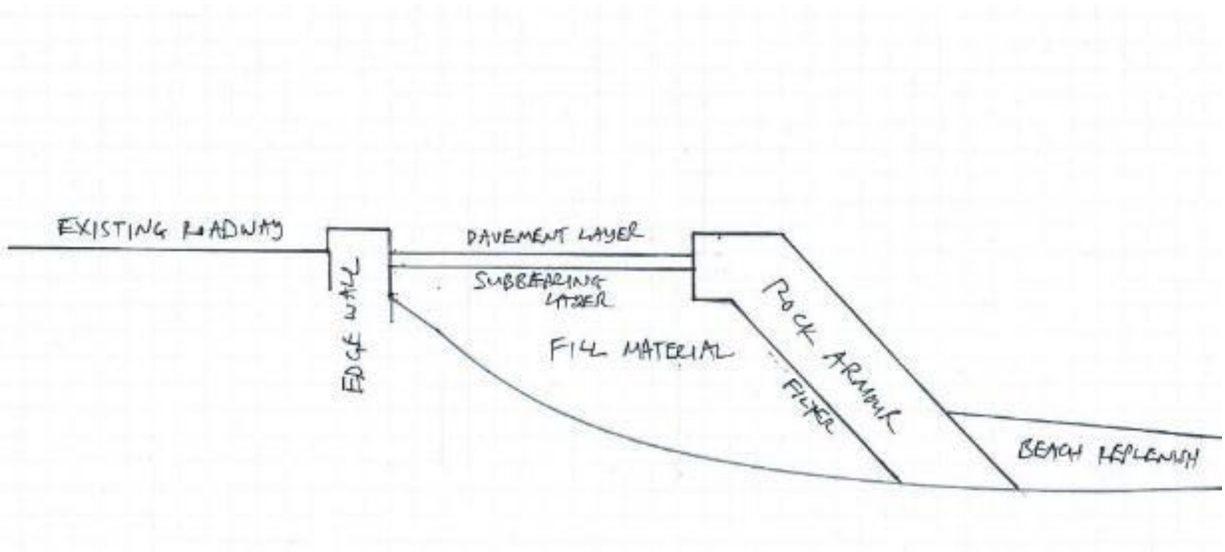


Figure 37 Indicative cross-section for rock-armoured reclamation

In both cases a few access platforms each with a walkway to the beach can be installed – similar in character to those at Witsand. Proposed distances between these points some 50 m.

In addition, it is recommended that the beach material in this section is replenished by sand filling. It is understood that excess sand is currently available at the fountain/eye in Jongensfontein. This sand should be similar in character to that found on the beach (sand from this source would naturally wash out to the beach), and should therefore be suitable for placement on the beach. The sand characteristics and volume available will need to be confirmed prior to placement.

Furthermore, the narrow rock wall which is located at the roadway edge along most of this area should be reconstructed to provide a more sturdy and safer edge between the roadway and the pedestrian walkway, through doubling of the wall width ('double' rock), such as has already been done along the most southerly section of some 25m in length.

It should be noted that the proposed infrastructure changes outlined above will have only a limited impact on flood risk from the ocean.

Phase 2

The 2nd phase of the project focusses on the provision of a seawall along Strand Street which will contain flooding to manageable levels and thus limit infrastructure damage and loss during storm events. In addition, the seawall installation should provide a wider promenade along the seafront to allow for a wider pedestrian walkway and thus improved vehicle/pedestrian movement and safety.

The height (i.e. level) of the top (soffit) of the seawall is typically chosen based on the water level and wave run-up level. For a particular frequency storm event (i.e. 1:20 year) a maximum overtopping discharge is specified which defines the height of the wall. In the case of Jongensfontein, a practical consideration which will influence this is the level of the existing roadway and the housing behind. To not obstruct existing views, the typical soffit level of the seawall is probably limited to no more than about 800mm above the road level.

Two types of seawalls can be considered: a natural rock structure or a conventional concrete structure.

Option 1: Natural Rock Structure

Along most of the shoreline a natural rock masonry retaining wall has been constructed below the roadway surface. The upper level of this structure is at the level of the road surface or less than 0.5m below it. The wall is typically 1.0 to 1.5m in height. This wall can be considered as the basis of a seawall and by adding a parapet wall on top of the existing structure one can obtain the same effect as that of a new seawall. The parapet wall can be constructed from rock and/or concrete.

Provided the existing wall is structurally sound and can carry the additional load of a parapet wall this will be the most cost-effective alternative since more than half the seawall is already in place. In addition, the seawall with the natural rock base will not be foreign and blend in with the existing surroundings.

Figure 38 View from ocean side of natural rock masonry retaining wall from Ch320 southwards. Wall aesthetically pleasing and blends in with natural surroundings. Note however damage on top side from storm/flood events

Option 2: Conventional Concrete Structure

The alternative is to construct a conventional concrete seawall along the full length of Strand Street – similar to that provided as an example in Strand, but of course at a reduced scale. This will be a major and costly undertaking and will change the existing character of the area.

Since a project of this nature will require the demolition of the existing rock retaining structure the benefit would be that the alignment of the wall does not need to follow that of the existing retaining structure and thus a wider and more usable promenade can be created than would be obtained from the use of the natural rock structure outlined above.

The seawall may incorporate a curved face on the seaward side to deflect waves back to sea. Such a feature allows a reduction in wall height relative to a vertical-faced wall.

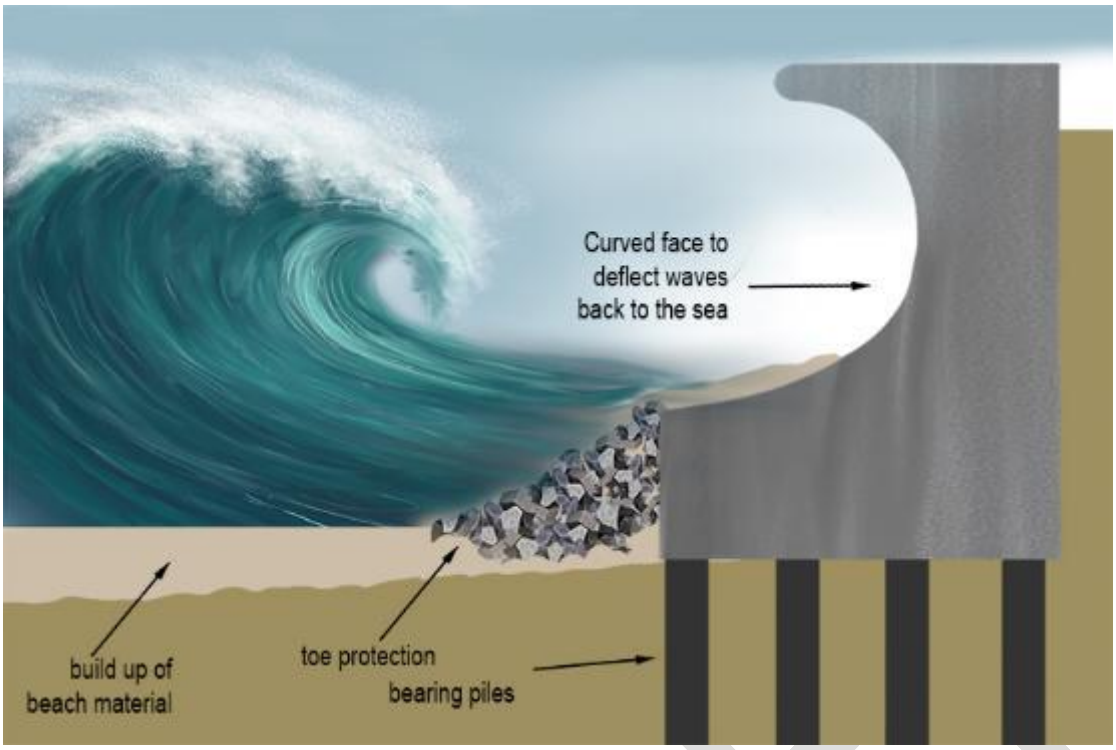


Figure 39 Conventional concrete seawall

Access Pier

In order to access the ocean from within Jongensbaai, a 70 m wide rough rocky shoreside has to be traversed. This is difficult and dangerous. The JRA has voiced a desire to consider the creation of a jetty/pier to provide direct ocean access. The pier is to be used by fishermen, surfers, divers, etc.

Due to the rough ocean conditions a structure of this nature will have to be of strong and sturdy design – a structure like the Witsand jetty (Figure 34 above) will not be suitable for the site, nor will any wooden pier.

The pier will have to be a reinforced concrete structure. The most suitable likely to be of deck-on-pile design with deck level such that it remains above the crest of the waves, except under the most severe storms. The pier will need safety barriers and access would have to be controlled, especially during storm events, to limit the likelihood of accidents.

An example of such a structure, but at a somewhat larger scale, is Shark Rock Pier in Port Elizabeth – see Figure 41 below.

Such a structure can be located at any one of a number of positions along the bay. The best location for such a pier is probably around Ch 700 where deep water appears to be closest to the shore. An indicative layout is shown in Figure 40 below.

It should be noted that the costs for such a pier structure are unlikely to be recoverable from its use.

Figure 40 Potential location for pier

Figure 41 Shark Rock Pier at Hoby Beach in Port Elizabeth

Technical Feasibility Study

The following approach - a technical feasibility study - is proposed prior to considering implementation of the 2nd phase of the seawall project. This will consist of the elements discussed below.

Coastal Engineering Studies

The focus of the coastal engineering studies will be to confirm design conditions. The studies by RHDHV discussed earlier were of a regional nature and were useful for planning purposes and for the development of management policies. For site specific design, further detailed investigations will however be required.

Detailed wave transformation and wave run-up studies will have to be carried out through the use of numerical modelling tools. This should build on and refine the work by RHDHV specific to the Jongensfontein site.

Field data required to undertake this includes:

- Topography: LIDAR data, depending on quality available from WC Government, possibly supplemented by a local topographic survey (or data available from Hessequa Municipality).
- Bathymetry: SAN charts in combination with a local bathymetric survey.
- Wave and water level data: the data sources used by RHDHV should be reviewed in the light of data available since 2017 when the work was carried out to confirm design events.

Structural Engineering Studies

From a structural engineering perspective, the existing retaining wall structures will need to be assessed to determine their structural integrity and soundness and thus allow a determination to be made as to whether they can be used as basis for a seawall that has to last for the longer term.

These structural assessments will need to go hand-in-hand with the determination of the geotechnical founding conditions of these walls which will in all likelihood require test pits to be dug.

Conceptual design

Based on the findings from the studies outlined above, the Basis for Design will be developed. This will outline the design approach, design conditions for the structure(s), the applicable design codes and standards, and other related matters.

Concept designs will be developed for at least the two alternatives outlined above, but also including other variations conceived through the execution of the studies. These concepts will be dimensioned; material quantities will be determined and cost models set up. The manner in which construction of the seawall options will take place will be considered, provisional methodologies and schedules developed.

The alternatives will be compared through a multi-criteria analysis and the option considered most suitable will be recommended for detailed design and eventual implementation.

In addition, the services of a landscape architect/planner should be obtained to develop, together with the coastal engineer, an overall plan for the creation of the new Jongensfontein Promenade which will integrate the engineering requirements with the requisite vision and use for this area.

CONCLUSIONS & RECOMMENDATIONS

This report addresses the *creation of a safe shoreline interface* between the ocean and the town, specifically along Strand Street which forms an important focal point and link in the town.

A *visual walkthrough* of the project site confirmed the following:

- A natural rock masonry retaining wall provides a seaward buffer to the roadway along most of its length. The retaining wall is in reasonable condition, but damage was observed at a number of locations. (If left unmaintained this is likely to result in further local deterioration and eventual local failure.)
- The retaining wall is typically located a minimum of 2 m from the seaward side of the roadway. This provides for a minimum 2 m wide verge, which over most of its length is vegetated (mostly grass).
- Erosion scars were observed along the central section of the site as a result of storm/flood events – likely the Sept 2023 ocean storm and the May 2021 and March 2023 intense rainfall events.
- Gabion mattress edging, some 4 m wide, forms the verge below a section of the roadway for about 100 m length, at the western end of site. While effective in protecting the roadway these wire structures are unsightly and sterilise valuable space on the beach from users. Some vegetation growth has taken place here, however the area is largely not vegetated. Also wire mattresses have been damaged which could lead loss of rock and failure of structure in future: injuries to beach users also possible, especially kids, due to sharp protruding wires. Along this section of roadway pedestrians have to use the road and compete with vehicles.
- The beach below the gabion mattress section appears to be denuded of sand and is still rock-strewn -probably a remnant of the Sept 2023 ocean storm event.

The study of *Google Earth imagery* for the study area, available for a 20-year period from March 2004 to April 2024, reveals limited changes due to the predominant rocky shoreline, indicative of a stable nearshore and coastal domain.

The *vulnerability of the site* was assessed through a description of the September 2023 storm at the hand of photographic evidence and pertinent data which measured during the storm event. The peak of the storm lasted some 30 hours. During this period a significant wave height of up to 5 m was recorded and maximum wave heights remained high: between 7 m and 10 m. The wave period was consistently between 18 s and 22 s confirming the presence of very long period swells. Wind speeds averaged around 60 km/h and peaked with gusts almost up to 100 km/h. Winds were dominantly from an easterly direction. The storm coincided with equinox spring tides predicted to be in excess of 2 m. The storm wind and wave conditions would have caused additional water level setup (storm surge) which raised water levels significantly above the tidal levels.

A review of *regional risk information available* from studies, carried out to define coastal management lines for the Garden Route District Municipality, confirmed the vulnerability of the project area with respect to flooding from ocean storm events. These studies give valuable information which can be used as basis for the definition and design of mitigation measures.

Seawall options to protect the shoreline were explored, and examples of recent works of relevance discussed.

A *two-phased approach for shoreline improvement measures* is proposed – Phase 1 for short-term improvements and Phase 2 longer term enhancements.

The focus of the initial *Phase 1 intervention* will be to provide additional safe pedestrian space and improved beach access. Since there is no space available on the roadway the only useable space will be that which is currently occupied by the gabion mattresses. Two options (i) a wooden walkway above the current gabion mattress section, and (ii) Witsand-type paved earthworks reclamation with rock armour, are proposed for consideration.

The *2^{nd} phase* of the project focusses on the provision of a seawall along Strand Street which will contain flooding to manageable levels and thus limit infrastructure damage and loss during storm events. In addition, the seawall installation would provide a wider promenade along the seafront to allow for a wider pedestrian walkway and thus improved vehicle/pedestrian movement and safety. Two types of seawalls are proposed for consideration: a natural rock structure (building on the existing rock retaining structure) and a conventional concrete structure (requiring removal of existing retaining wall).

The report concludes with the proposed scope of a technical feasibility study which should be carried out to refine the proposed Phase 2 interventions prior to implementation.

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APPENDIX A

APPENDIX A: SITE OBSERVATIONS

Visual walkthrough

Images were taken in the afternoon on 23 April 2025 around mid-tide.

The visual walkthrough starts at the northern (camp site) side of Strand Street and continues southwards, that is from Ch 100 to about Ch750, a length of 650m. Only images of particular interest are placed, and at intervals of about 50m.


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Figure 42 Ch100 looking southwards showing lawn alongside roadway some 5 m width on foreground reducing to about 3 m at Ch110

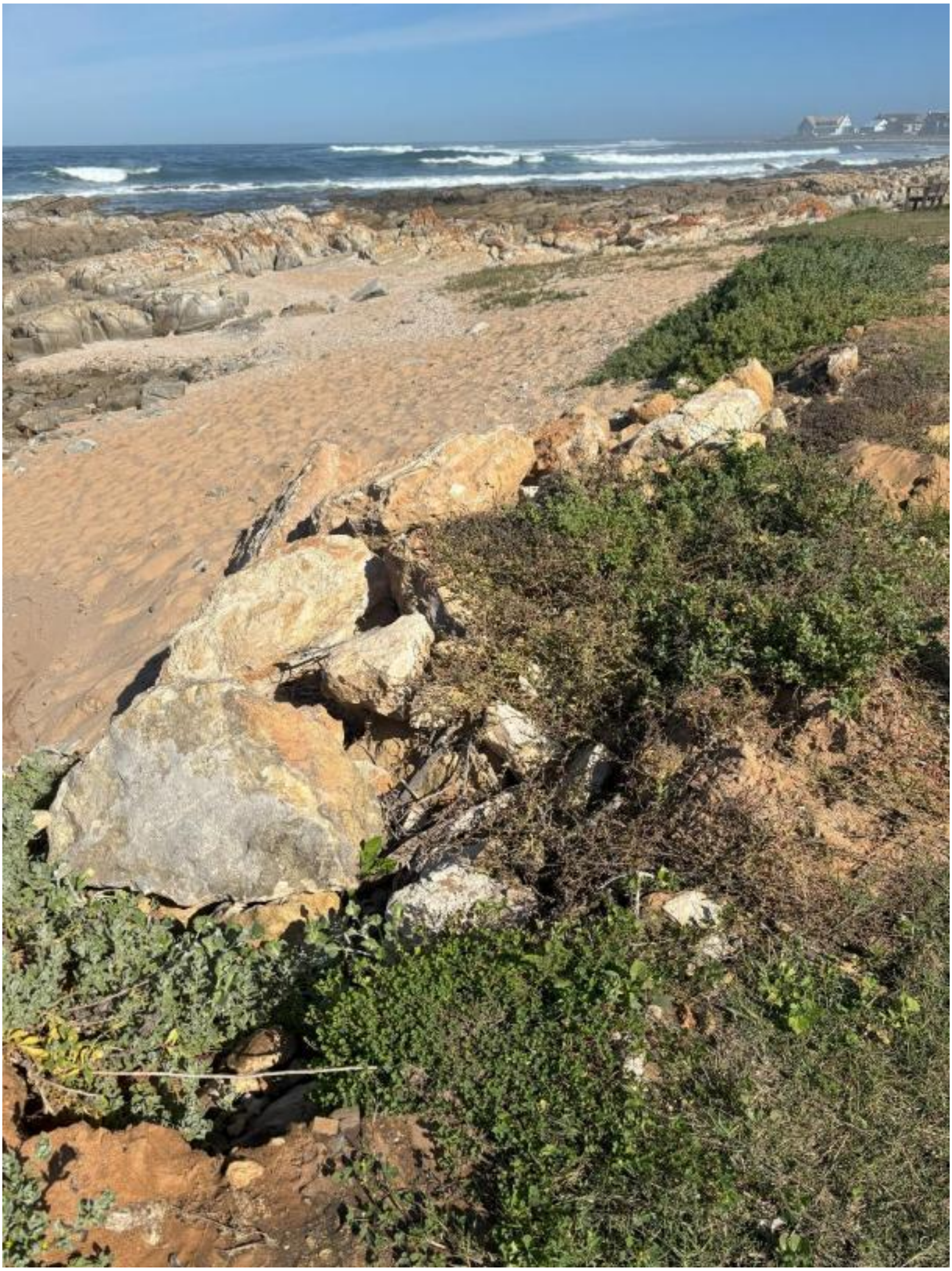


Figure 43 Ch125 looking southwards untidy and not very ineffective rock revetment supporting lawn/vegetation alongside roadway. Sound sandy upper beach area

Figure 44 Ch150 looking southwards showing lawned area with park bench alongside roadway, some 7 m width, concreted area of some 30 m^2 adjacent

Figure 45 Concreted area with natural rock masonry retaining wall just past Ch150. Note storm water outfall

Figure 46 Southward view from Ch200. Note concrete encased sewerage pumpstation (?) and narrow concrete sidewalk/retaining structure with rock boulder foundation on sand(?). Innovative use of upright rocks in concrete as bollards

Figure 47 Southward view from pumpstation(?) slab approx. Ch210. Dolfyn Street intersection ahead. Large rock boulders as protection around pumpstation. Natural rock masonry wall adjacent to roadway

Figure 48 Southward view from Ch250: vegetated verge between 1.5 and 2m in width supported by natural rock masonry wall

Figure 49 Park bench on wide 6m X 35m area adjecent to roadway at Ch300. Note natural rock masonry wall in distance

Figure 50 Natural rock masonry retaining wall from Ch320 southwards creates a 3m to 3.5m wide verge for pedestrian use – largely vegetated but showing erosion scars from storm/flood events

Figure 51 View from ocean side of natural rock masonry retaining wall from Ch320 southwards. Wall aesthetically pleasing and blends in with natural surroundings. Note however damage on top side from storm/flood events

Figure 52 Vegetated roadway verge at Ch 350 looking southwards. Natural rock retaining wall on seaward side not visible

Figure 53 Vegetated roadway verge at Ch 400 looking southwards. Natural rock retaining wall on seaward side not visible

Figure 54 Vegetated roadway verge above natural rock masonry retaining wall around Ch450

Figure 55 Between Ch450 and Ch500 no verge with retaining wall next to roadway

Figure 56 Vegetated area on road verge next to Paaltjie Ch500

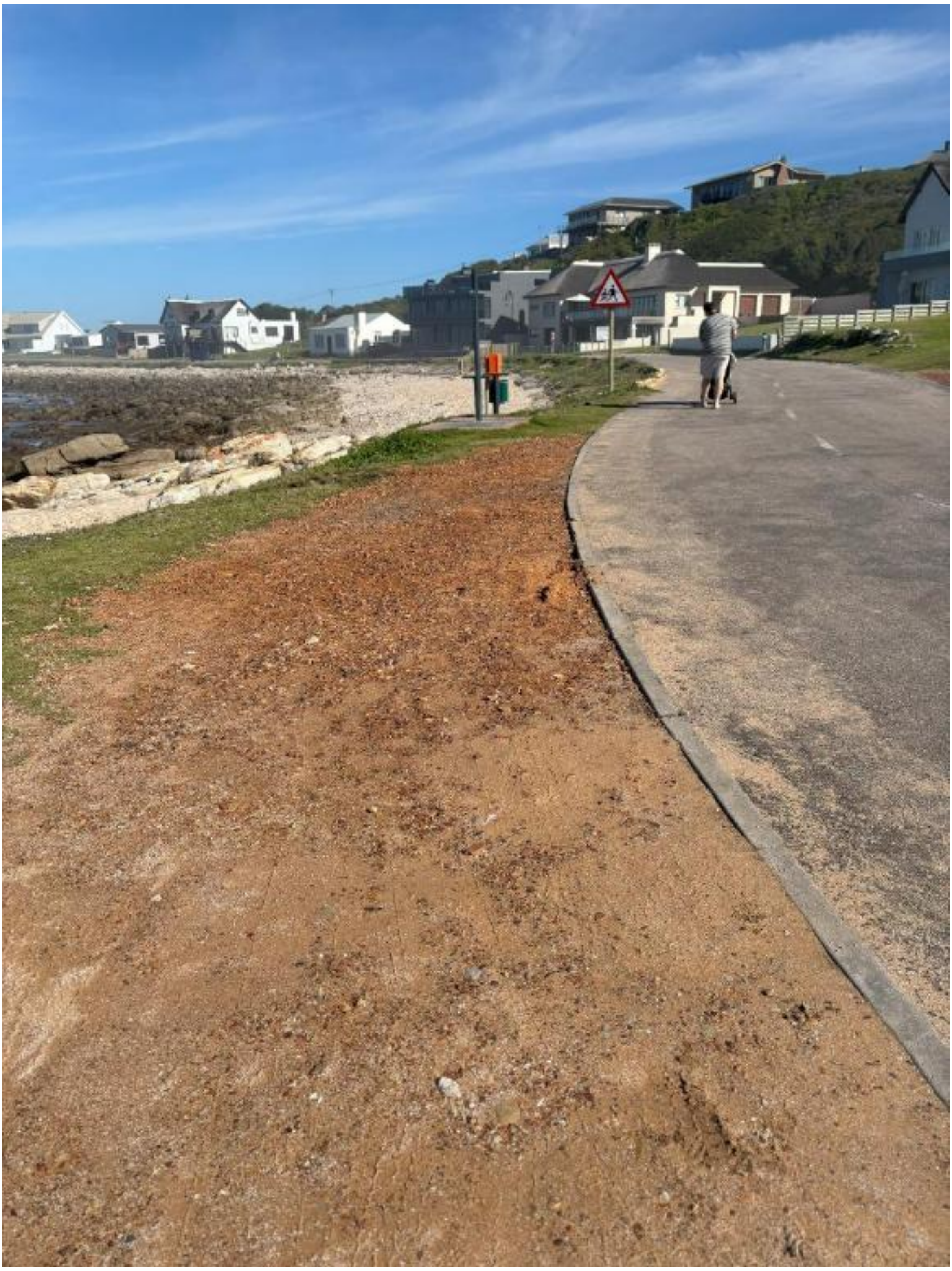


Figure 57 Gravel verge Ch500

Figure 58 Gabion mattress edging below low natural rock retaining/edge wall from approx. Ch510. While effective in protecting the roadway these wire structures are unsightly and sterilise valuable space on the beach from users. While some vegetation growth has taken place the area is largely not vegetated. Also wire mattresses have been damaged which could lead loss of rock and failure of structure in future: injuries to beach users also possible, especially kids, due to sharp protruding wires

Figure 59 Gabion edging below low natural rock wall Ch550. While effective in protecting roadway these wire structures are unsightly and limit use of valuable space on the beach.

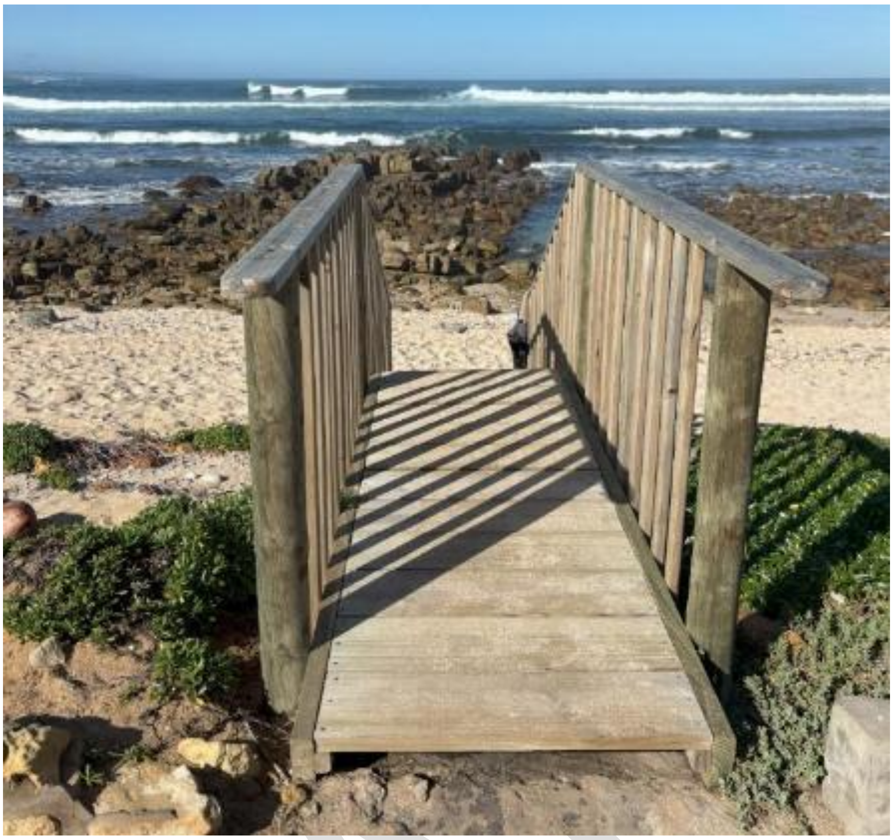


Figure 60 Beach access bridge across gabion mattress area Ch570. Excellent use

Figure 61 Seaward view Ch570 showing gabion mattress edge followed by sandy beach strip and rocky foreshore to ocean

Figure 62 Southward view from access bridge at Ch570: Pedestrian-unfriendly gabion mattress verge above sandy beach area

Figure 63 Northward view from Ch570 covering much of the extent of Jongensfontein Promenade

Figure 64 Southward view from Ch600: Gabion mattress verge coming to end and replaced by vegetated verge going south

Figure 65 Northward view from Ch600: Note unsightly exposed and damaged wiring from gabion mattresses. Also newly reconstructed 'double' rock retaining wall in foreground This new wall has length of some 25m

Figure 66 Southward view from Ch650: Vegetated verge of some 2m width adjacent to roadway and adjoining rock beach

Figure 67 Strand Street view, northward from Ch650

Figure 68 Southward view from Ch700

Figure 69 Southward view from Ch750

Figure 70 Natural rock retaining wall from seaward side at Ch780

Figure 71 Natural rock retaining wall from seaward side at Ch750

In summary, the following is observed:

- The project area is located along Strand Street, with the primary project area located between Ch100 and Ch650.
- A natural rock masonry retaining wall provides a seaward buffer to the roadway along most of its length.
- The top of the wall is more-or-less at the level of the roadway. The height of the wall however varies between about 0.5 to 1.5m depending on the topographic level of the upper beach adjacent to the wall.
- The retaining wall is in reasonable condition, but damage was observed at a number of locations. If left unmaintained this is likely to result in further local deterioration and eventual local failure.
- The retaining wall is typically located a minimum of 2 m from the seaward side of the roadway. This provides for a minimum 2 m wide verge, which over most of its length is vegetated (mostly grass).
- A few larger 'park' areas are located along Strand Street – typically 5m to 6 m width and 20 to 30 m in length with park benches – where users can sit and enjoy the ocean views.
- A concrete pumpstation is located around Ch210 which protrudes 4.5m from the roadway. Its roof slab is at the level of the roadway thus not obstructing views and blending with the general landscape.

- Along the central section (from Ch300 to Ch350) erosion scars are observed on the verge as a result of storm/flood events – likely the Sept 2023 ocean storm and the May 2021 and March 2023 intense rainfall events.
- Gabion mattress edging, some 4 m wide, forms the verge below the roadway for about 100 m length, from approx. Ch510 to Ch610. While effective in protecting the roadway these wire structures are unsightly and sterilise valuable space on the beach from users. While some vegetation growth has taken place the area is largely not vegetated. Also wire mattresses have been damaged which could lead loss of rock and failure of structure in future: injuries to beach users also possible, especially kids, due to sharp protruding wires.
- Along this section of roadway pedestrians have to use the road and compete with vehicles. Beach access is provided a Ch570 through a wooden pedestrian bridge.
- A narrow rock wall is located at the roadway edge is this area. The total wall length is about 100m length. Over the most southerly section of some 25m in length, reconstruction through doubling of the wall width ('double' rock) has taken place providing a sturdier and more aesthetic wall section.
- The beach below the gabion mattress section appears to be denuded and is still rock-strewn - probably a remnant of the Sept 2023 ocean storm event.
- Ocean access can only be obtained by crossing a 70m-wide irregular rock reef.

Google Earth Imagery

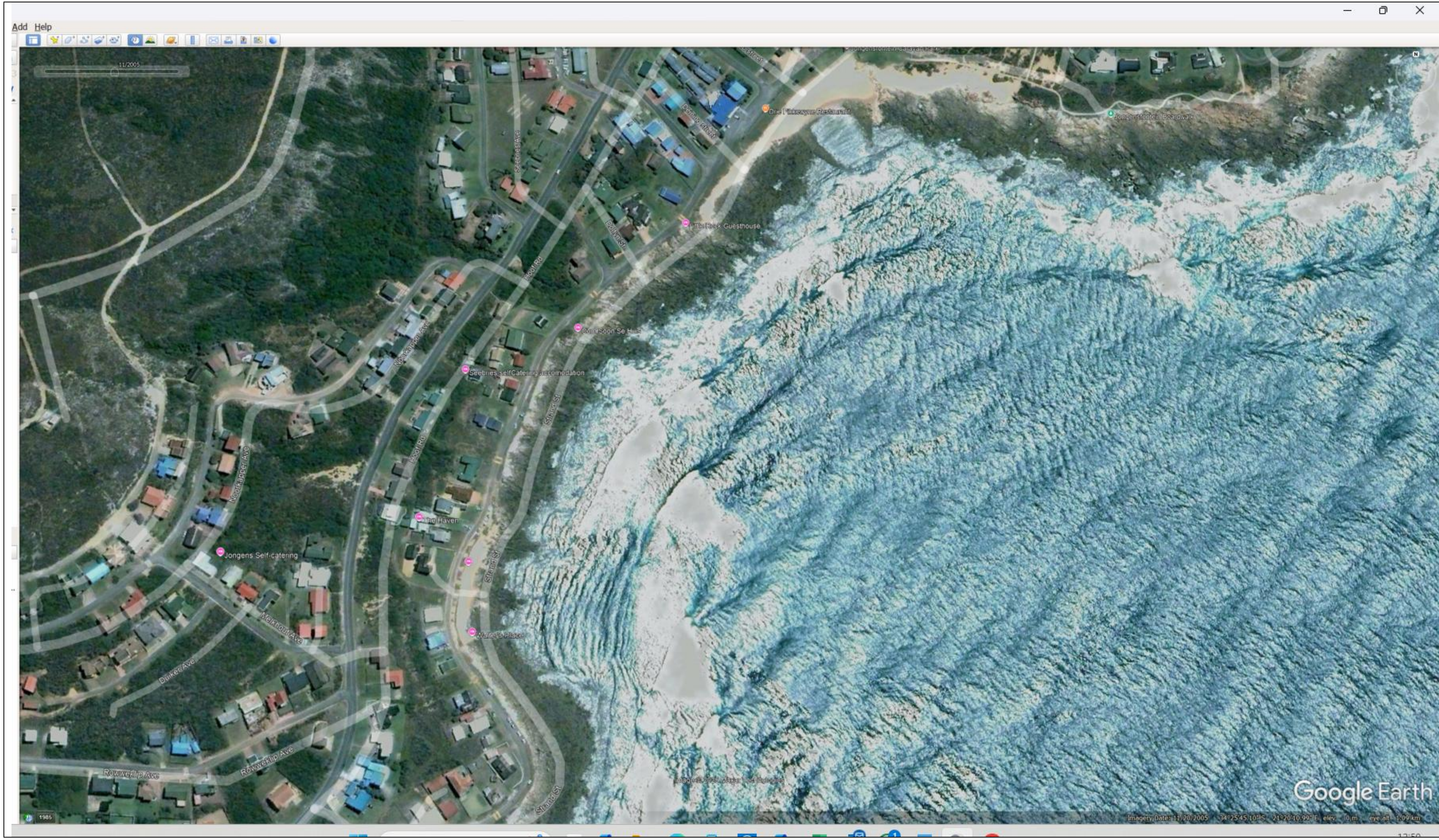
Google Earth satellite images for the study area are available for a 20-year period: from March 2004 to April 2024. Only images which are relatively clear have been extracted to provide a means of viewing changes over time. Note that there is difference in image clarity dependent on the prevailing weather conditions and time of day a particular image has been taken.

The most significant observation is the steady increase in the number of dwellings – not surprising.

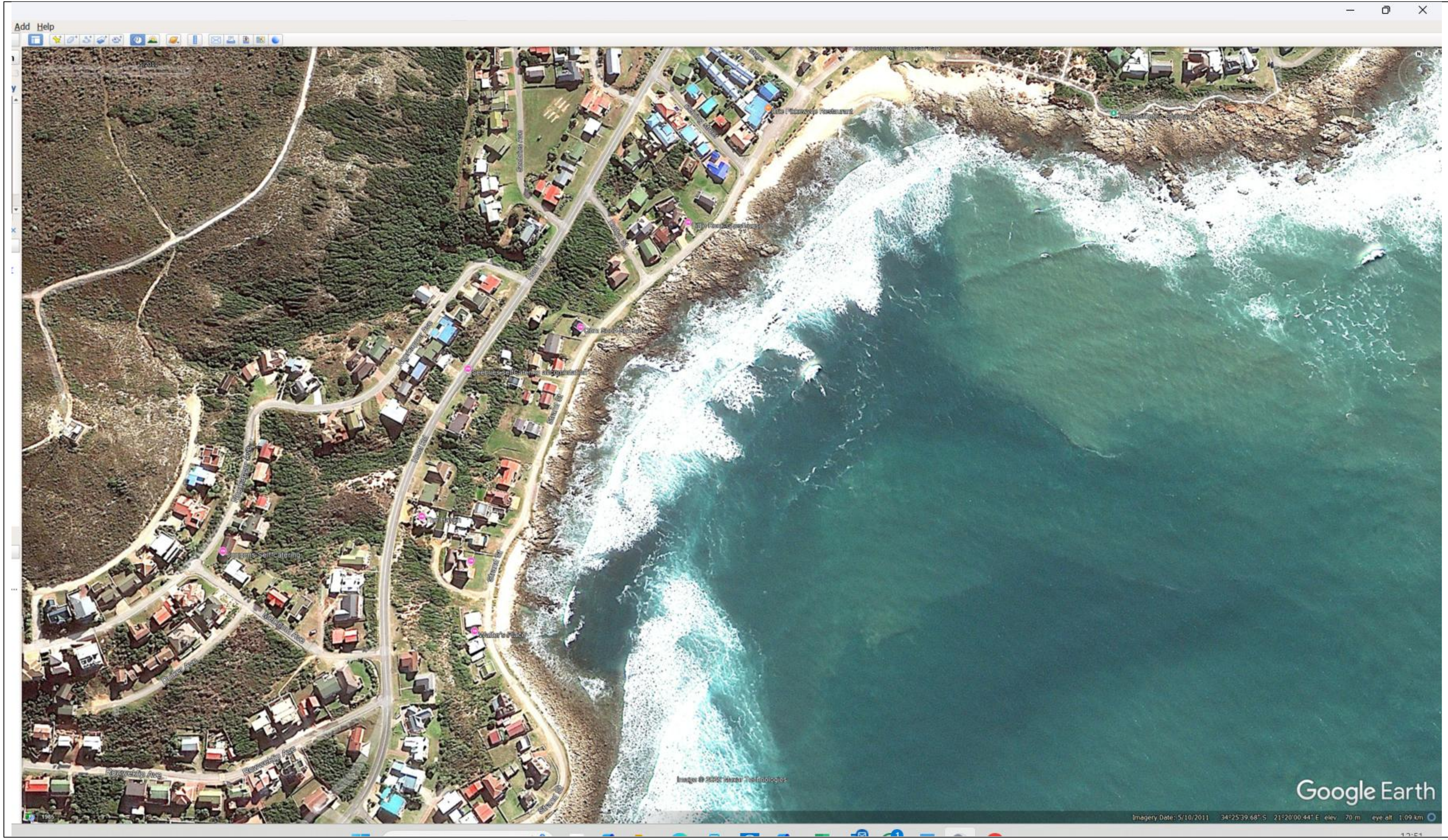
On the ocean side the differences in wave patterns are obvious, dependent on the prevailing wave conditions at the time the satellite image was taken. Also, images were taken at different tidal levels, hence there is difference in the water line from image to image. Differences in the sizes of sandy beach areas, if they do occur, are of such a limited extent that no particular trends are evident.

Overall, the images indicate a stable nearshore and coastal domain.

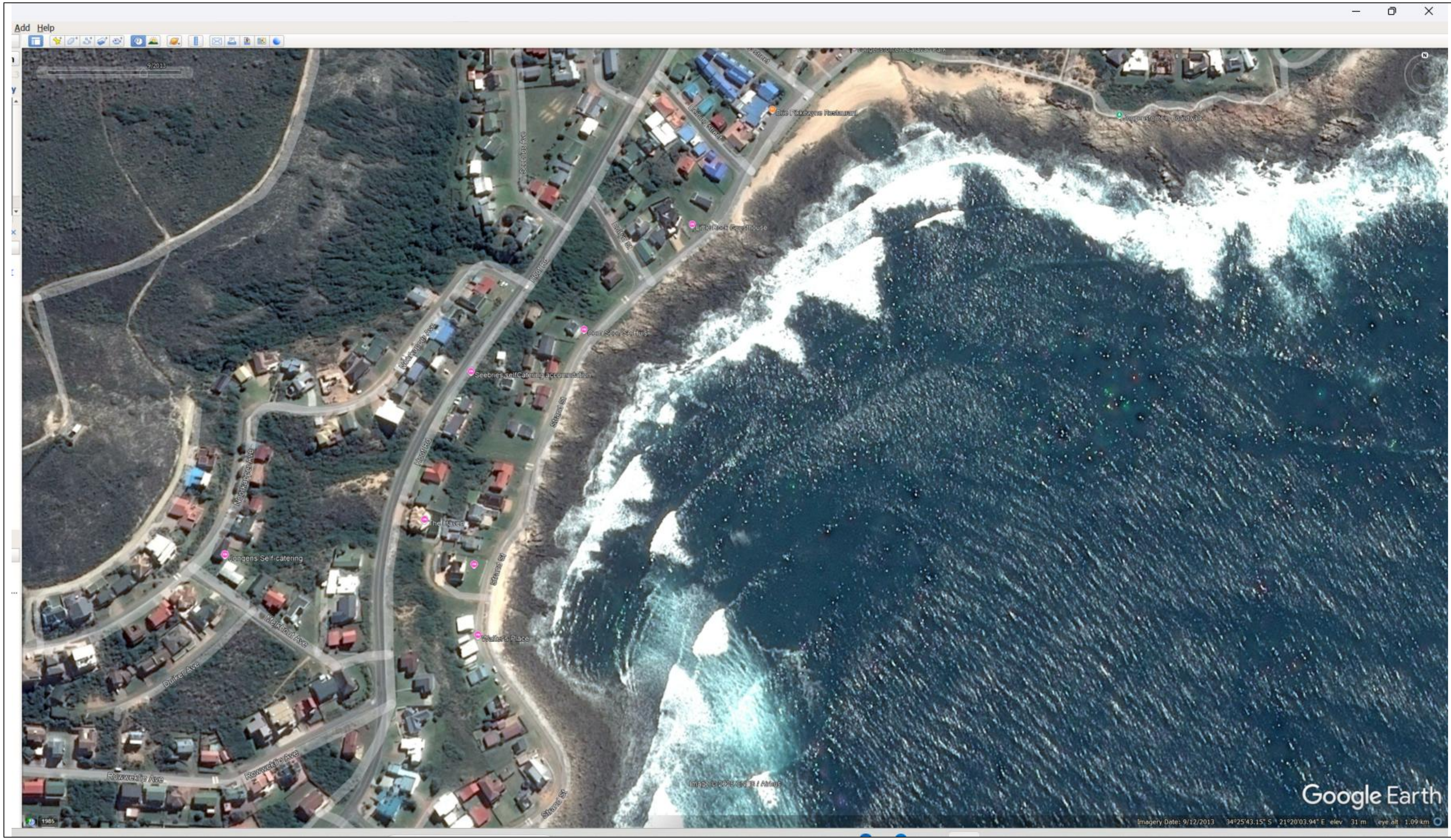
Mar 2004



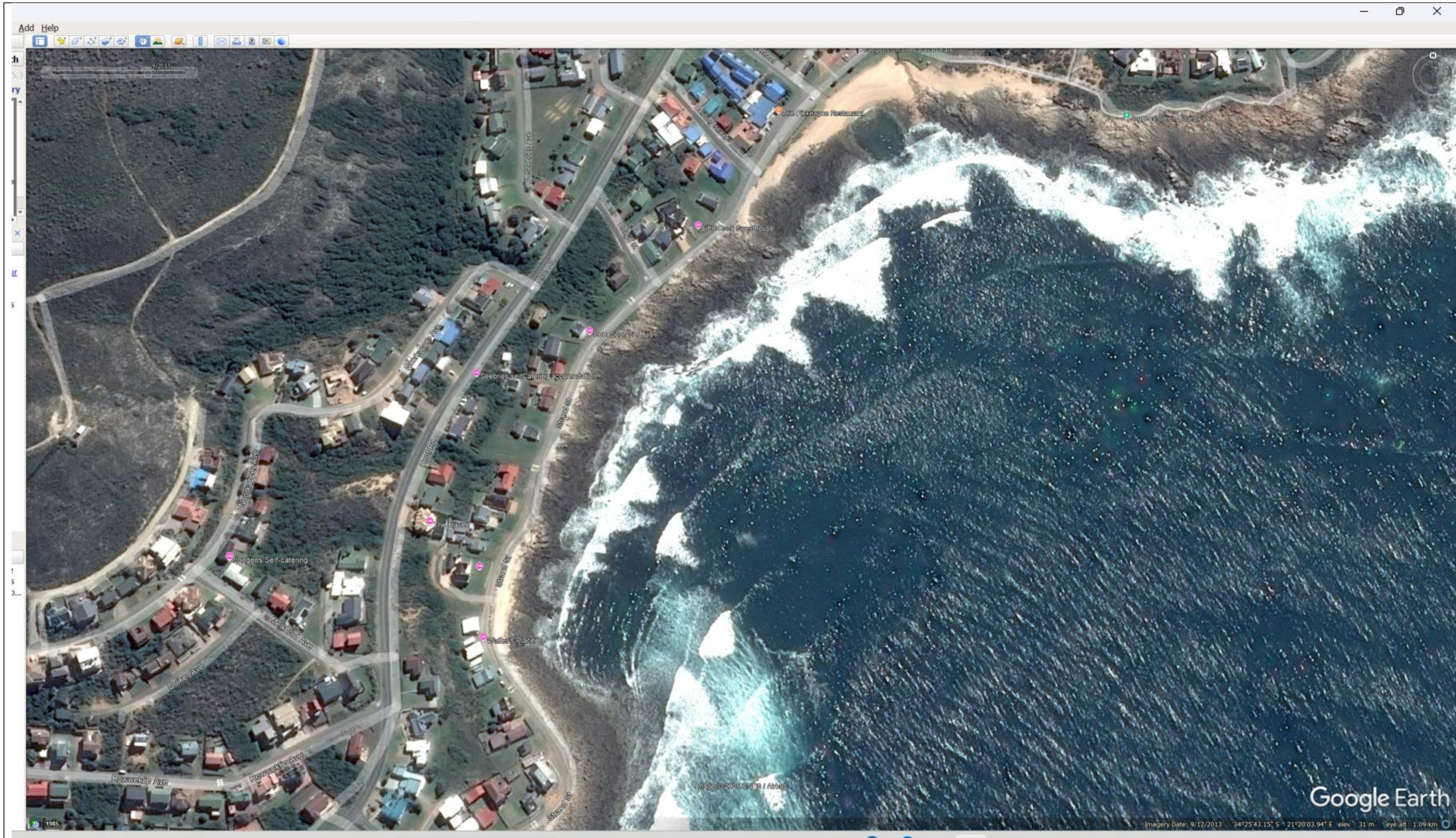
Nov
2005



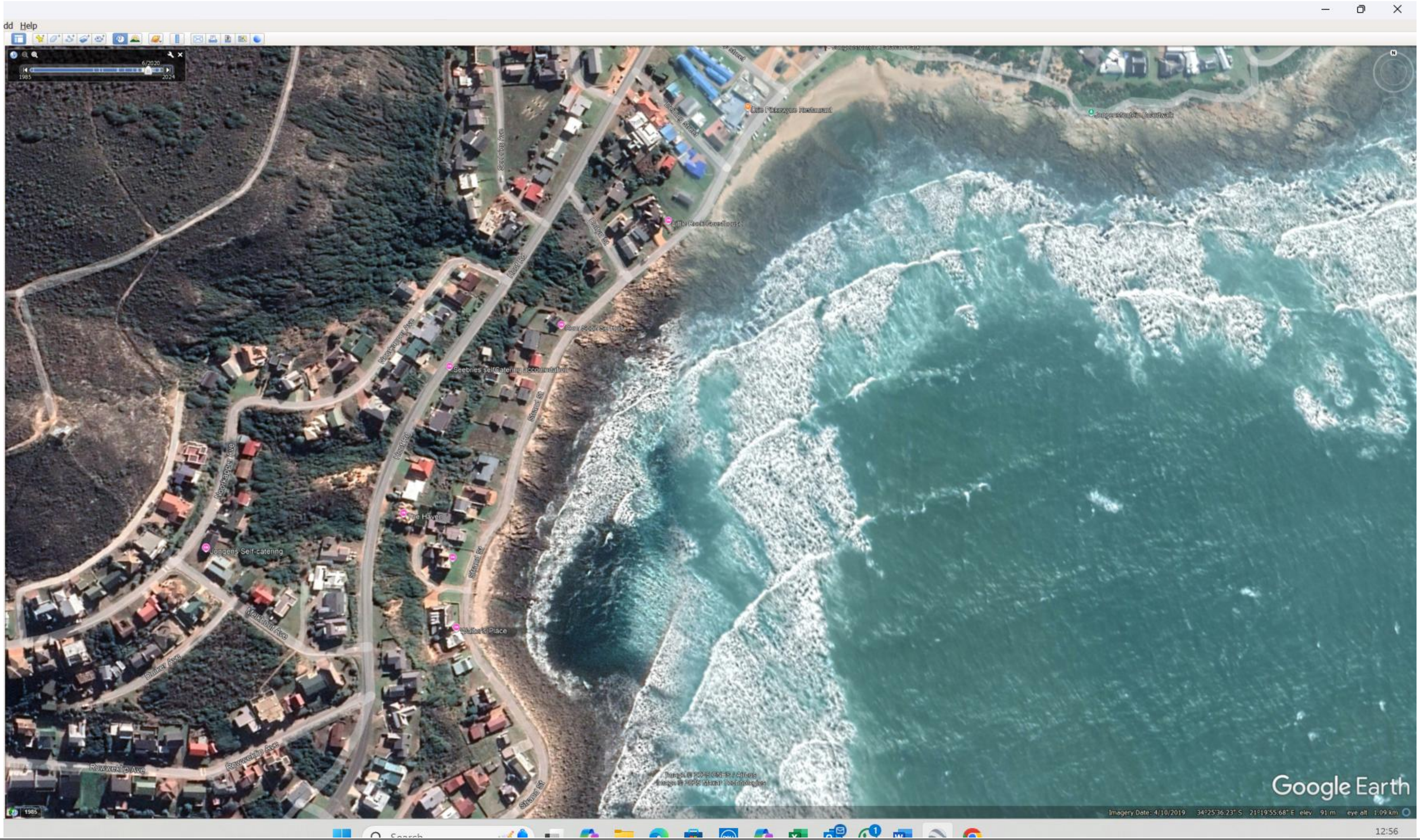
May 2011



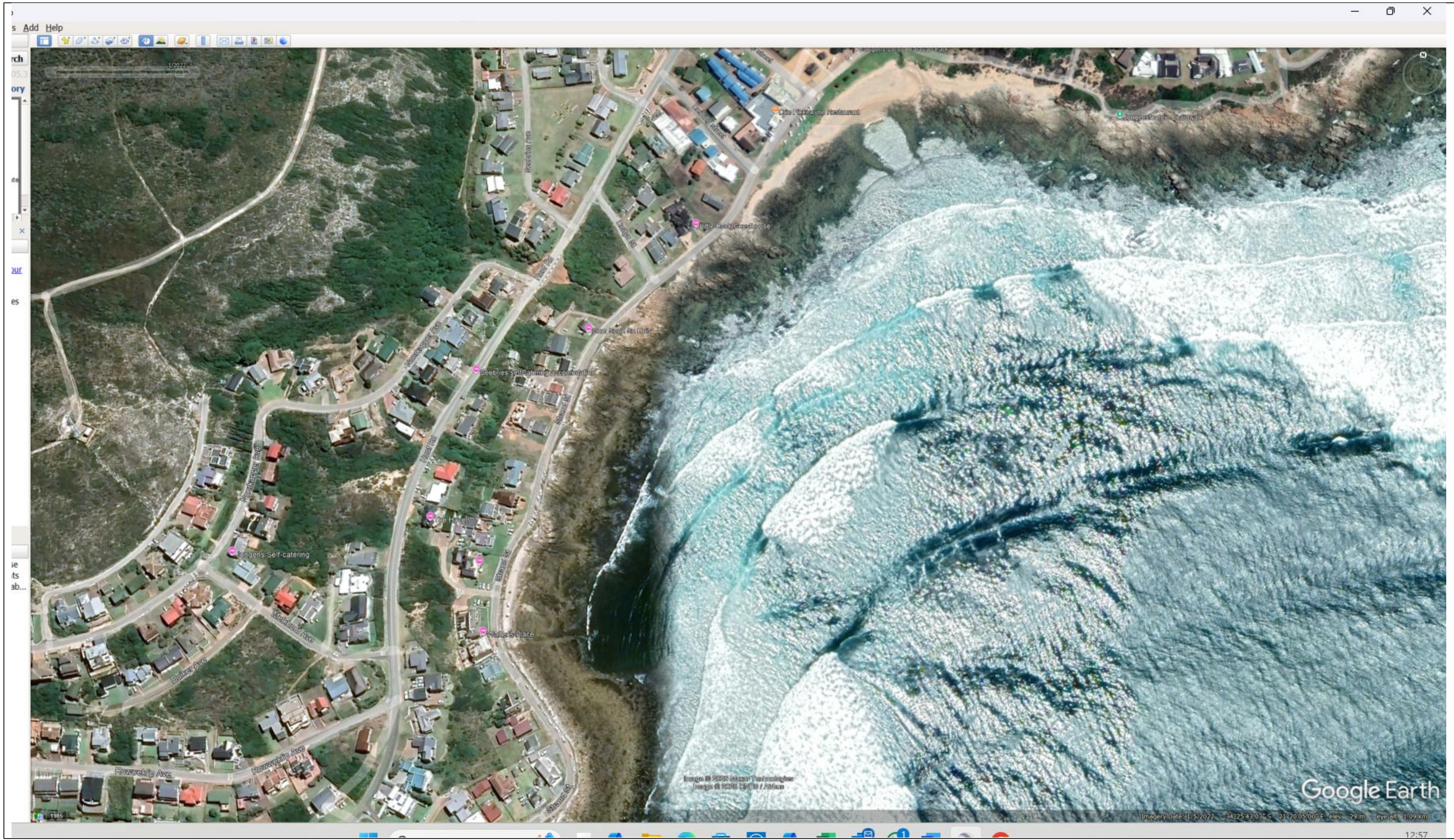
Sept 2013



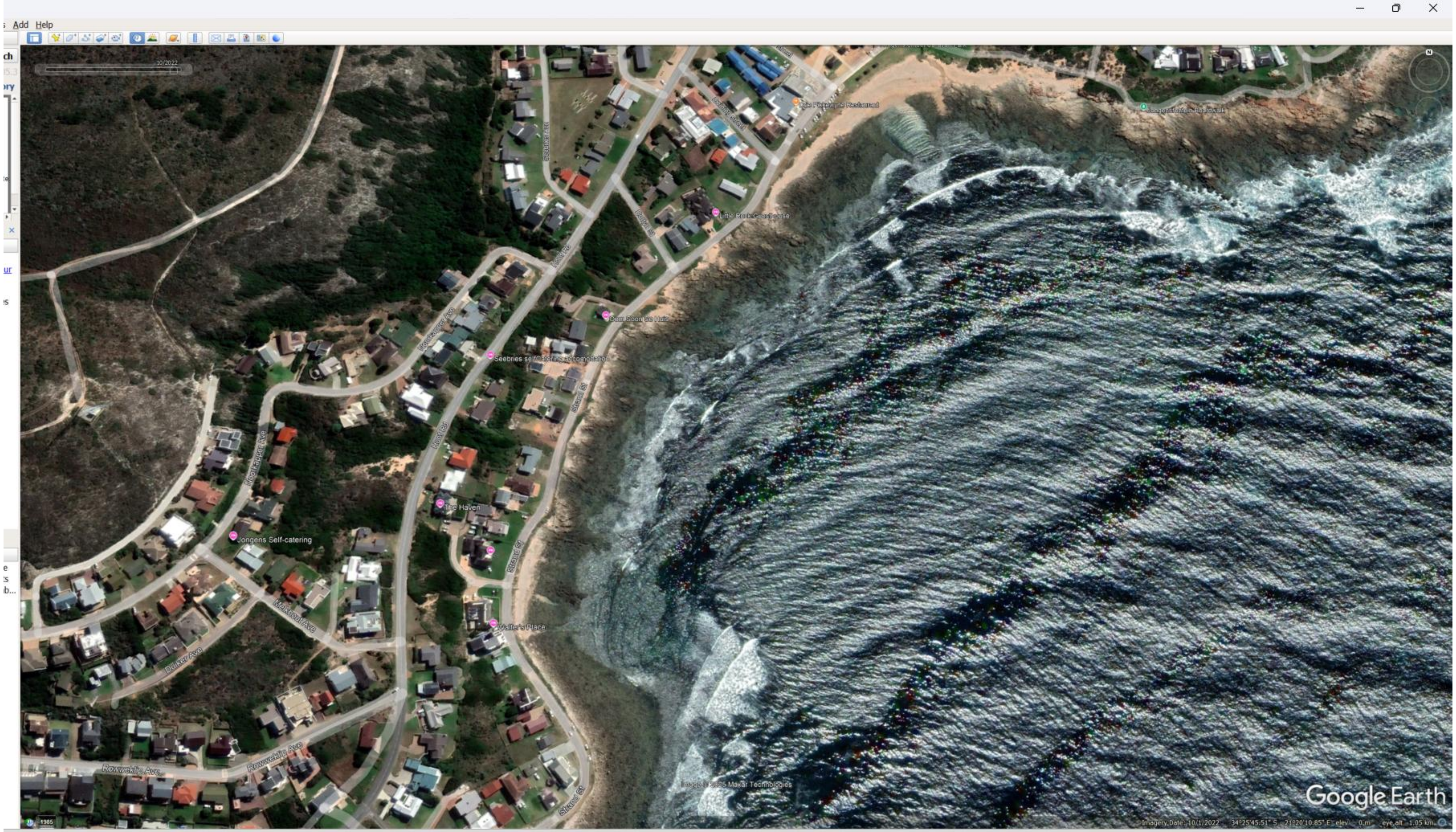
April 2017



June 2020

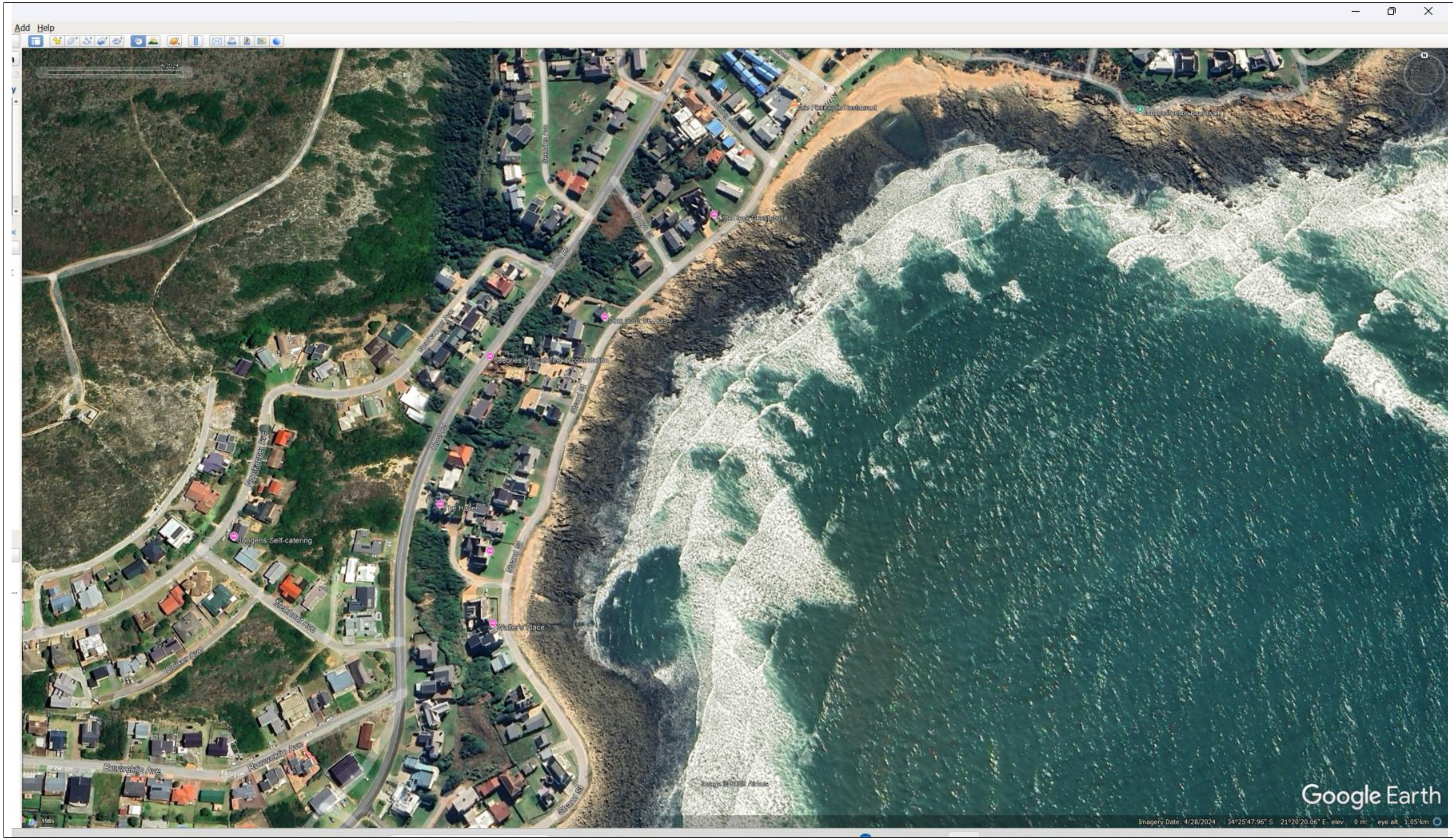


Jan 2022


Add
Help
Jongens Self-catering
The Haven
Walter's Place
Google Earth

Oct 2022

	Dec 2023



April 2024