COMMERCIAL-IN-CONFIDENCE

EXPERT REPORT ON DEATH OF ROSS WARREN

Report prepared and written by

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Coastal Geomorphologist

for

NSW SPECIAL COMMISSION OF INQUIRY INTO LGBTIQ HATE CRIMES

24/5/2023

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QUALIFICATIONS AND EXPERTISE

1 I am a Professor and coastal geomorphologist in the School of Biological, Earth and Environmental Sciences, University of New South Wales (UNSW Sydney). I have been studying, researching and teaching aspects of coastal landforms and processes since 1988 (35 years).

2 My specific area of scientific expertise is in the field of coastal morphodynamics (involving mutual interactions between waves, currents, tides and nearshore topography) and coastal hazards. I have written 84 published scientific articles, 15 book chapters, and one book on these topics.

3 My broad area of scientific expertise relates to the action of waves, currents, tides and sediment transport that occur within the nearshore zone along coastlines. The nearshore zone extends from the upper beachface, which is impacted by waves and wind, seaward to where waves first start to interact with the bottom of the ocean, typically at depths of 10 – 20 metres. Both boundaries are variable at any given time depending on wave conditions.

4 My specific area of expertise involves the behaviour of rip currents, which are strong, narrow seaward flows of water which extend from the shoreline offshore through the surf zone to the extent of breaking waves, and at times, some distance beyond. The surf zone is the region dominate by breaking waves. Rip currents are primarily related to beaches and do not occur along long stretches of rocky coastlines, and or within bays and harbours.

5 Since 2001, I have run a beach safety community education program called the Science of the Surf (SOS), which is designed to educate the public on beach safety and coastal hazards. This program has been presented to over 50,000 members of the community, including thousands of primary and high school students. SOS has received significant mainstream media attention and both State (NSW) and National Community Safety related awards.

6 In January 2023 I was appointed as a Member to the Order of Australia (AM) for my service towards beach safety research and education. My full CV is attached as Appendix A.

7 I am a Life Member and former caretaker (resident member) of the Tamarama Beach Surf Life Saving Club.

8 I have previously been involved as an expert witness involving the death of Mr Ross Warren, which is part of this Special Commission. I provided a Statement on 1 August 2001, a report on 5 April 2002, a statement on 11 April 2002, gave oral evidence on 3 April 2003 and provided a further statement on 31 January 2017.

9 I have previously provided an expert report involving the death of Mr Simon Blair Wark, which is part of this Special Commission. I provided a report on this case to the Special Commission on 23 March 2023.

10 I took part in a video conference call with members of the legal team assisting the Special Commission inquiry in regards to the death of Mr Warren and Mr Gilles Mattaini on 30 January 2023.

I have previously provided an expert report involving the death of Mr Gilles Mattaini, which is part of this Special Commission.

EXECUTIVE SUMMARY

11 Mr Ross Warren was last seen around 2:00 am on 22 July 1989 driving his vehicle on Oxford Street, Sydney in an easterly direction. On 23 July 1989, Mr Warren's vehicle was located in Kenneth Street, near Marks Park, Tamarama. His keys were subsequently located on 24 July 1989, in a rock 'pocket' below the cliff near the water's edge. Mr Warren's body has never been found and the exact circumstances of his disappearance remain unknown.

12 This supplementary expert report provides a synthesis and re-evaluation of my previous expert reports relating to the disappearance of Mr Ross Warren in order to provide greater clarity and potential new insights for the Special Commission.

13 This supplementary report describes conditions during the period between 22 – 28 July 1989 and the coastal region between Mackenzies Bay and Mackenzies Point, which represents the southern coastline of the Marks Park Headland. Particular emphasis is placed on the hours between 2:00 am and 9:00 am on 22 July 1989.

14 The period between 22 – 24 July 1989 was characterised by low-energy wave energy conditions from the south-east. Rip current activity in the region of interest during this time, if present, would have been minimal and the dominant direction of water movement in this region was likely offshore into Mackenzies Bay due to wave reflection and turbulence in the vicinity of the rock platforms. Some offshore surface drift may have occurred due to the light westerly (offshore) winds during this period.

15 The period between 25 – 28 July 1989 was characterised by a significantly large wave event that would have been associated with extreme turbulence, wave reflection and wave overtopping and inundation in the vicinity of the rocky coast in the region of interest. The dominant direction of water movement would have been offshore due to the likely presence of mega rip currents in Mackenzies Bay and Tamarama Beach.

16 Without knowing Mr Warren's swimming ability, it is my opinion that if Mr Warren had entered the water alive and injured in the region of interest between July 22 – 24 1989 that he would have been able to float for a period of time and call for help. However, this length of time would depend on the amount of clothing Mr Warren was wearing given the cold weather conditions. However, despite the low wave energy conditions, it is my opinion that Mr Warren would have found it difficult to swim to safety either back onto the rock platforms in the area or nearby Tamarama Beach.

17 It is my opinion that if Mr Warren was either unconscious or deceased and entered the water in the region of interest between July 22 – 24 1989 his body would have either: i) drifted slowly offshore if it was floating on the surface due to offshore

westerly winds and potentially been visible during daylight hours from elevated vantage points; or ii) remained offshore of the rock platforms if it was floating or submerged at possible distances ranging from several metres to potentially up to 30 – 40 metres due to wave reflection off the rock platforms and a lack of strong current activity. It is possible that if Mr Warren's body had entered the water and become submerged that it could have been caught or snagged in the irregular subaqueous rock topography in the region. It is my opinion that if Mr Warren's body had been floating at the surface that it would have been visible from an elevated vantage point.

18 It is my opinion that regardless of whether Mr Warren's body was floating on the surface or submerged in the region of interest, the large wave event from July 25 – 28 1989 would have transported his body significant distances (hundreds of metres) offshore due to the presence of extreme turbulence, wave reflection and mega rip currents. In this case it would be subject to deeper ocean currents and it would be unlikely that his body would have subsequently been transported back towards the shoreline along the Eastern Suburbs coastline, either above or below the water surface. Assuming that Mr Warren's body had entered the water in the region of interest between July 22 – 24 1989, this is likely the primary reason why it has never been recovered.

1. INTRODUCTION

19 This report has been prepared at the request of the Special Commission of Inquiry into LGBTIQ hate crimes in relation to the death of Mr Ross Warren.

20 Mr Warren was last seen around 2:00 am on 22 July 1989 driving his vehicle on Oxford Street, Sydney in an easterly direction. On 23 July 1989, Mr Warren's vehicle was located in Kenneth Street, near Marks Park, Tamarama. His keys were subsequently located on 24 July 1989, in a rock 'pocket' below the cliff near the water's edge. Mr Warren's body has never been found and the exact circumstances of his disappearance remain unknown.

21 I have been provided with a copy of the Uniform Civil Procedure Rules 2005 – Schedule 7 – Expert witness code of conduct.

22 I, Professor Robert Brander, acknowledge for the purpose of Rule 31.23 of the Uniform Civil Procedure Rules 2005 that I have read the Expert Witness Code of Conduct in Schedule 7 to the said rules and agree to be bound by it.

23 On 13 April 2023 I was asked to prepare a supplementary expert report in relation to the disappearance of Ross Warren and have been provided with the following materials: 1. My previous statements and reports relating to disappearance of Mr Warren; 2. Weather, synoptic and rainfall observations for Tamarama for 1989; 3. Sea level observations (tidal information) at Fort Denison for 1989; 4. Sydney offshore wave data for 1989; 5.Topographic map of Marks Park. 5. A video and transcript of a walkthrough video interview between Detective Senior Constable Dagg and Craig Ellis at Tamarama on 2 August 2001.

24 On 18 May 2023, I was provided with a copy of a report by Dr L.E. Iles, a forensic pathologist, in relation to the buoyancy and decomposition of bodies in water post-mortem.

25 I have been asked to address the following matters in my report:

26 **1.** Please set out my observations in relation to this new data.

27 **2.** Whether this new data affects any opinion I have expressed in my previous reports in relation to Mr Warren's disappearance, and, if so, what my changed opinion is and the basis for that changed opinion.

28 In this report I have combined material and findings of my previous reports on 5 April 2002 and 31 January 2017 with additional analysis and description regarding environmental conditions. This synthesis benefited from having all of the relevant environmental data and other information provided to me together for the first time.

29 The motivation for this synthesis is to provide a more comprehensive, detailed, cohesive and robust report that I hope will provide more clarity and potential new insights to assist the Special Commission in their Inquiry.

30 My knowledge, findings and opinions based on the material I have been provided with and the queries above are contained within this report.

31 In this report, I have made the following assumptions:

- The weather data from Sydney Observatory Hill and Sydney Airport provides a reasonable approximation of weather conditions in the location of interest.

32

- Fort Denison tidal data provided by the Bureau of Meteorology provides accurate estimates of water level and time at the location of interest.

- The offshore wave data provided by the NSW Department of Environment and Planning Manly Hydraulics Laboratory from the Sydney offshore wave rider buoy provides an approximation only of wave conditions at the location of interest.

- Meteorological synoptic charts from the Bureau of Meteorology (sourced from the Sydney Morning Herald) for the period of interest provide an approximation of wave direction at the location of interest based on my own interpretations.

- That Mackenzies Bay represents the region between Tamarama Point and Mackenzies Point.

POINT 1: OBSERVATIONS IN RELATION TO AVAILABLE DATA

33 Section 1.1 provides an overview of the coastal geomorphology of the region between Tamarama Beach and Mackenzies Point.

34 The summary of environmental conditions in Sections 1.1 – 1.7 focusses on various periods between 21 to 29 July 1989. This allows for consideration of environmental conditions the day before and a week after Mr Warren's disappearance where relevant. Where applicable and relevant, implications towards the disappearance of Mr Warren are given at the end of each section.

35 Particular focus is given to the period between 2:00 am and 9:00 am on 22 July 1989 as this is likely the most critical period in relation to Mr Warren's disappearance.

36 Larger versions (raw files) of all Figures are available upon request.

37 1.1 Coastal Geomorphology

38 The coastline from Tamarama Beach around Tamarama Point, Mackenzies Bay to Mackenzies Point (Marks Park headland) can be considered to be a predominantly rocky coastline as shown in Figure 1. The rocky coast in this area is characterised by a complex geologic geometry including rock platforms of varying widths, elevations, slopes and orientation and the presence of eroded sandstone boulders of varying sizes, angularity and shapes both above and below the waterline. There are also numerous overhangs and ledges at various elevations due to the stratigraphy of the sandstone and the weathering processes that lead to joint block erosion.

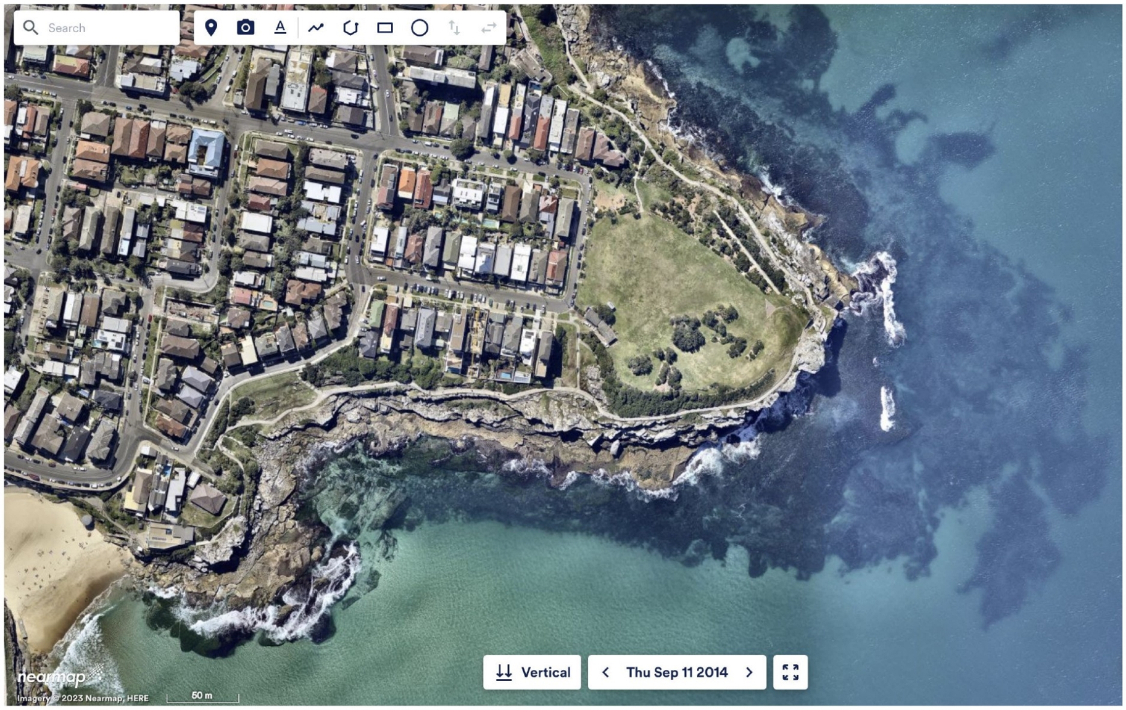
39 

Figure 1. The rocky coastline from Tamarama Beach to Mackenzies Point. This image was taken on 11 September 2014 during a period of reduced sediment volume in the area. The extent and complexity of a sub-aqueous rock platform/terrace is evident by the darker areas. The box indicates the region shown in Figure 2. (Source: Nearmap).

40 This rocky coastline is geologically stable with extremely slow erosion rates. The primary form of erosion is through weakening of the rock surface through salt water corrosion (from sea spray), which can lead to honeycomb weathering and through the collapse of joint blocks of various sizes, which is very infrequent. It is unlikely that there has been any significant change in the geomorphology in this region since July 1989 and the geomorphology of the rocky coast shown in Figures 1 and 2 can therefore be considered representative of conditions in July 1989.

41 

Figure 2. The rocky coastline where Mr Warren's keys were found as indicated by the boxed area. This is based on the transcript and video of Craig Ellis. The image was taken on 11 September 2014, but conditions are likely similarto those experienced on 22 July 1989 (Source: Nearmap).

42 Figure 2 shows the area that Craig Ellis described where he found Mr Warren's keys. The highlighted box area is based on where he was interviewed and his suggestion that he found the keys '*thirty or forty metres either side of where we are standing was the general area*'. This region is characterised by a narrow and irregular rock platform along the shoreline that can be sporadically covered by water (inundated) and impacted by wave action during periods of higher tides and/or large waves, as shown in Figure 3.

43 

Figure 3. The rocky coastline from Tamarama Beach to Mackenzies Point showing wave overtopping and inundation of areas of the rock platform. Prominent offshore flowing boundary rip currents are also evident from the northern end of Tamarama Beach and Mackenzies Bay. The image was taken on 11 April 2018 and indicates conditions under slightly higher than average wave conditions. (Source: Nearmap).

44 Having lived in the area between 1993 – 1998 and 2000 – 2005, including living on Kenneth St., I am quite familiar with this section of coast and this lower platform is easily accessible during smaller wave conditions and lower tidal levels. There are also many overhangs, notches, and caves at different levels.

45 Having also snorkelled in this area during calm periods, there is also a mostly vertical drop off of several metres from the seaward edge of the lower rock platform to the seabed, which is also rocky as shown in Figures 1 and 2. This sub-aqueous rock terrace is always submerged and how much rock is exposed is dependant on the sand volumes in the region, which can vary over days, months, and years depending on the wave climate.

46 Tamarama beach is a small 80 m long embayed sandy beach that is typically characterised by boundary rip currents at one, if not both ends, but most commonly the northern end (Figure 3). Based on monthly topographic surveys I conducted at Tamarama Beach between August 2000 and June 2004, the shoreline position can fluctuate by up to approximately 100 metres based on periods of accretion (sand deposition) and erosion (sand loss).

47 Mackenzies Bay is a very small embayment to the north of Tamarama Beach. On occasion it fills with sand to create a very small ephemeral pocket beach that is sensitive to erosion through wave action. It usually only develops during an extended period of beach recovery, typically associated with extended El Niño weather and wave climate cycles. As shown in Figure 4, July 1989 occurred within a strong La Niña phase, which is characterised by larger wave heights associated with frequent storm waves. Along the Sydney Coast, La Niña conditions are associated with offshore sediment transport, beach narrowing and beach erosion.

48 It is therefore highly unlikely that a beach was present at Mackenzies Bay in July 1989. Further evidence for this is provided in Point 93.

49 The La Niña conditions would also likely have resulted in a reduction of sand volumes immediately offshore of the rock platforms and may have exposed the irregular subaqueous rock topography shown in Figures 1 and 2.

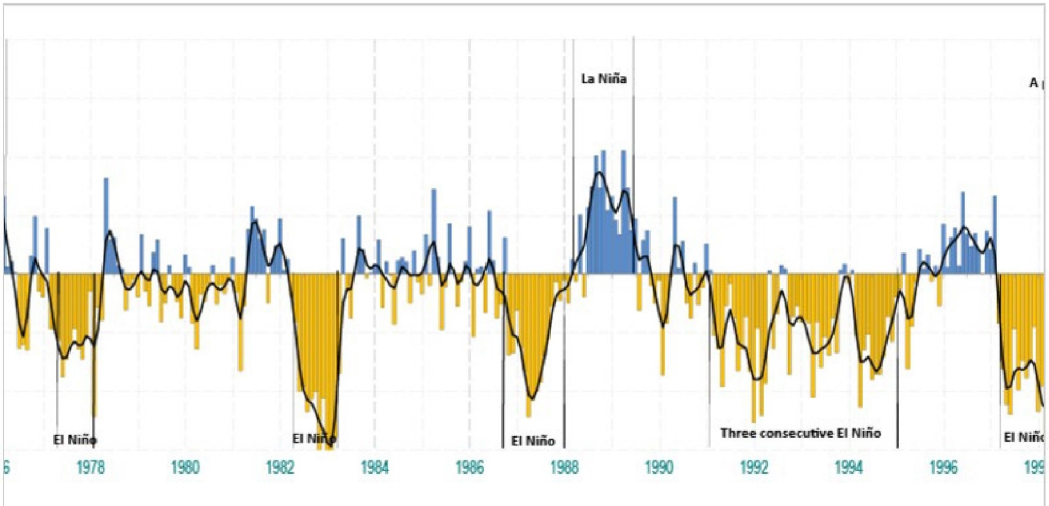


Figure 4. El Niño (yellow shading) and La Niña (blue shading) periods between 1978 and 1996. July 1989 was in the middle of a La Niña period with more storms (Source: Bureau of Meteorology).

50 A large coastal embayment exists between the headland at Ben Buckler, at the northern end of Bondi Beach and the headland to the south between Clovelly Beach and the Waverley Cemetery. Within this larger embayment are two smaller embayments: i) between the southern end of Bronte Beach and Mackenzies Point (end of Marks Park headland), which contains Bronte Beach, Tamarama Beach and Mackenzies Bay/Beach; and ii) between Mackenzies Point and Ben Buckler to the north, which contains Bondi Beach.

51 There is minimal sand transport between these two sub-embayments. Sediments are largely contained within each of the embayments or transported offshore. The implication here is that a floating or submerged object would exhibit similar behaviour.

52 **1.2 Weather**

53 Temperatures on the 22nd and 23rd July 1989 in Sydney were cold with daytime maximums of 11.2 and 11.0 degrees Celsius and minimums of 5.2 and 6.6 degrees Celsius respectively at Sydney Observatory Hill. The coldest temperatures were recorded between the hours of midnight and 9 am.

54 Maximum temperatures at Sydney Observatory Hill increased to 15.6 degrees Celsius on 24 July 1989 and remained mild, reaching 19.4 degrees Celsius on 29 July 1989. Minimum temperatures between 26 – 29 July 1989 were milder ranging from 11.3 – 12.6 degrees Celsius.

55 Weather in the early hours of 22 July 1989 between 2:00 am and 9:00 am were fine with no cloud cover. Winds were light (11 km/hr) and from the west (offshore).

56 Of note, as shown in Figure 5 a full moon occurred on 18 July 1989 and on the early morning of Mr Warren's disappearance on 22 July 1989 the moon was 83% visible This suggests that significant moonlight would have been present between 2:00 am to sunrise on 22 July 1989 due to clear skies. Subsequent night-time periods were cloudy and overcast.

57 From 9:00 am on 22 July 1989 conditions became overcast through the day although no rainfall. Wind remained light (4 – 17 km/hr) and from the west for the rest of the day. Moderate gusts of up to 26 km/hr from the west were recorded on 22 July 1989 at 9:30 am at Sydney Observatory Hill.

58

59 **Figure 5.** Phases of the moon from 17 to 30 July 1989 (source: www.calendar-12.com/moon_calendar/1989/july

60 The weather on 23 July 1989 was cloudy to overcast with 2 mm of rain recorded in the early afternoon. Winds were calm to light (0 – 18 km/hr) and predominantly from the west. Moderate gusts of 22 km/hr from the north-west were recorded at Sydney airport. No rainfall was recorded at the nearby Rose Bay weather station.

61 24 July 1989 experienced cloudy to overcast conditions. Winds were from the west and were light to moderate (11 – 21 km/hr) becoming lighter from mid-afternoon. Maximum gusts of up to 39 km/hf from the northwest were recorded at Sydney Airport. The Rose Bay weather station recorded 1.8 mm of rain in the early morning.

62 A change in the weather occurred on 25 July 1989 with wind shifting to the south (from the south) and while average winds were light (11 – 18 km/hr) some very strong gusts of up to 93 km/hr were recorded at Sydney Airport. Rainfall occurred during the day with totals of 8 to 10 mm in the Rose Bay and Sydney Observatory Hill region.

63 Periods of rain ended by the morning of 26 July 1989 and no further rain was recorded for the rest of the month. Winds became calm to light varying from the west to northwest to north through 29 July 1989. Conditions were mostly fine.

64 It is my opinion that temperature and rainfall conditions between 22 to 29 July were not factors in the disappearance of Mr Warren.

65 It is my opinion that the westerly winds during the period 22 – 24 July 1989 could have caused a floating object on the surface of the water, such as a human body, to move further offshore during this period. However, it is noted that these winds were light in strength.

66 It is my opinion that the southerly winds during the period 25 – 26 July 1989 could have caused a floating object on the surface of the water, such as a human body, to drift in a northerly direction. However, it is noted that these winds were light in strength.

67 It is my opinion that these westerly (offshore) winds were not strong enough to induce localised coastal upwelling, where deeper water is brought to the surface.

68 **1.3 Tides**

69 Tidal data was sourced from the Bureau of Meteorology tidal station at Fort Denison within Sydney Harbour. Tidal conditions recorded at Fort Denison are

representative of tidal conditions along the open ocean coast throughout New South Wales (Short, 2007).

70 Sea level observations at Fort Denison for the period 22 – 27 July 1989 are shown in the Table below:

Table 1. Tide characteristics for Sydney between 22 and 27 July 1989.

Day (1989)	Time	Low Tide Water Level (m)	High Tide Water Level (m)	Tide Range (m)	Tidal Phase
July 22	1:00 am		1.38		
				0.98	Falling
	7:00 am	0.40			
				1.34	Rising
	1:00 pm		1.74		
				1.5	Falling
	8:00 pm	0.24			
				1.19	Rising
July 23	1:00 am		1.43		
				0.96	Falling
	7:00 am	0.47			
				1.08	Rising
	2:00 pm		1.55		
				1.21	Falling
	8:00 pm	0.34			
				1.17	Rising
July 24	2:00 am		1.51		
				1.05	Falling
	9:00 am	0.46			
				1.01	Rising
	3:00 pm		1.47		
				1.07	Falling
	9:00 pm	0.40			
				1.11	Rising
July 25	3:00 am		1.51		
				1.02	Falling
	10:00 am	0.49			
				0.74	Rising
	4:00 pm		1.23		
				0.91	Falling
	10:00 pm	0.32			
				1.15	Rising
July 26	5:00 am		1.47		

	11:00 am	0.4		1.07	Falling
	5:00 pm		1.06	0.66	Rising
	11:00 pm	0.34		0.72	Falling
July 27	6:00 am		1.44	1.10	Rising
	1:00 pm	0.35		1.09	Falling
	7:00 pm		0.99	0.64	Rising
July 28	01:00 am	0.4		0.59	Falling

71 Tidal conditions (water levels) are important because they can indicate the potential times of inundation (coverage by water) and wave overtopping along the rocky coast in the region of interest.

72 Tidal conditions between 22 – 27 July 1989 occurred during a period of decreasing spring tides, where tidal ranges (the difference in sea level elevation between low and high tide) are maximised. During spring tides, high tides are higher than usual and low tides are lower than usual. Spring tides occur for several days around each full moon and new moon period. As shown in Figure 5, the full moon occurred on 18 July 1989.

73 Peak spring tide range occurred on 19 July 1989 (not shown in Table 1) and on 22 July 1989 a falling tide with a tide range of 0.98 metres occurred between 1:00 am (high tide = 1.38 metres) and 7:00 am (low tide = 0.4 metres).

74 This suggests that some wave inundation and overtopping could have occurred at the boundary of the sea and the rock platform between 2:00 am to 4:00 am on 22 July

1989, but as the tide continued to fall this would have become much less likely. It also suggests that most of the rock platforms would have been fully exposed (and not affected by wave action) between 5:00 to 9:00 am on 22 July 1989.

75 The morning of 22 July 1989 was characterised by a rising tide with a high tide of 1.74 metres occurring at 1:00 pm. This suggests that there was likely to be some wave inundation and overtopping occurring at the boundary of the sea and rock platform between 10:00 am and 1:00 pm. Of note, the potential for inundation and wave overtopping would have been higher than the previous high tide at 1:00 am due to the higher water level (1.74 metres compared to 1.34 metres). The afternoon and early evening of 22 July 1989 was characterised by a falling tide reaching a low tide of 0.24 metres at 8:00 pm.

76 Based on the tidal conditions on 23 July 1989, the rock platforms along the shoreline in the region of interest were more likely to be inundated and/or affected by wave action between midnight and 3 am and between 11 am to 4 pm. They were more likely to be fully exposed between 6 – 9 am and 7 – 10 pm.

77 On 24 July 1989, the day that Mr Warren's car keys were found, tidal conditions suggest the rock platforms along the shoreline of interest were more likely to be inundated and/or affected by wave action between 1 – 4 am and 2 – 4 am. They were more likely to be fully exposed between 8 – 10 am and 8 – 10 pm.

78 It should be noted that in this context 'inundation', 'exposure to wave action', and 'fully exposed' refers to the shoreline region between the ocean and the rock platforms and not necessarily the entire rock platform landform.

79 1.4 Waves

80 Offshore wave data was supplied from the Sydney offshore Waverider buoy by the Manly Hydraulics Laboratory (MHL) operated by the NSW Department of Planning and Environment. This buoy is located approximately 9-10 km offshore of Long Reef, on Sydney's Northern beaches where the water is approximately 85 metres in depth. In July 1989, the buoy provided hourly averages of: i) significant wave height (H_s), which is the average of the highest 1/3 of wave heights recorded during each time interval; ii) maximum wave height (H_{max}), which is the highest wave recorded in that time interval; and iii) wave period (T_p), which is the mean of wave periods (time between two waves) over the time interval.

81 Wave direction was not available from the offshore buoy in 1989.

82 It is acknowledged that wave conditions at this offshore location only provide an approximation of wave conditions occurring along the Sydney open ocean coastline. Wave heights (but not wave period) will vary between offshore deepwater locations and shallow water coastlines due to processes of wave shoaling (slowing down of the waves), wave refraction (bending of the wave crests and direction due to variable bathymetry and topography), and wave breaking.

83 Based on long-term determination of the Sydney wave climate (Short and Trenaman, 1992), the mean significant wave height in the month of July is 1.54 m and the mean wave period is 8.0 s. These values are close to the yearly averages experienced in Sydney.

84 Daily average significant wave heights recorded at the offshore buoy were 1.33 metres on 21 July 1989, decreasing to 1.25 and 1.00 metres on the 22nd and 23rd July 1989 respectively before slightly increasing again to 1.31 metres on 24th July 1989. The maximum recorded wave height during this period was 1.83 m on 24 July 1989. These wave heights are well below average values indicating that lower energy wave conditions prevailed during this time. Daily average wave periods ranged from 7.6 to 9.4 seconds, which were in the range of normal conditions.

85 Given the lower wave energy conditions, it is probable that the degree of wave overtopping and inundation of the rock platforms in the region of interest mentioned in Points 75 – 78 was minimal.

86 Given the predominantly calm to light offshore westerly winds present, ocean conditions between 22 – 24 July 1989 would have been manifest as small, clean swell waves without wind chop/whitecapping present.

87 Significant wave heights increased dramatically on July 25 and 26 1989 with daily average values of 4.1 and 3.9 metres respectively with a maximum wave height of 5.1 metres recorded on 25 July 1989. Wave periods were also longer with daily averages ranging from 10 – 11.7 seconds on the 25th and 26th July respectively.

88 The dramatic increase in wave height is highlighted by the black box in Figure 6

89 Significant wave heights of over 4 metres represent a large storm wave event. According to the wave storm history for Sydney provided online at www.mhl.nsw.gov.au/Station-SYDDOW by the Manly Hydraulics Laboratory, the wave event between 25 and 28 July 1989 was the second most powerful of 1989.

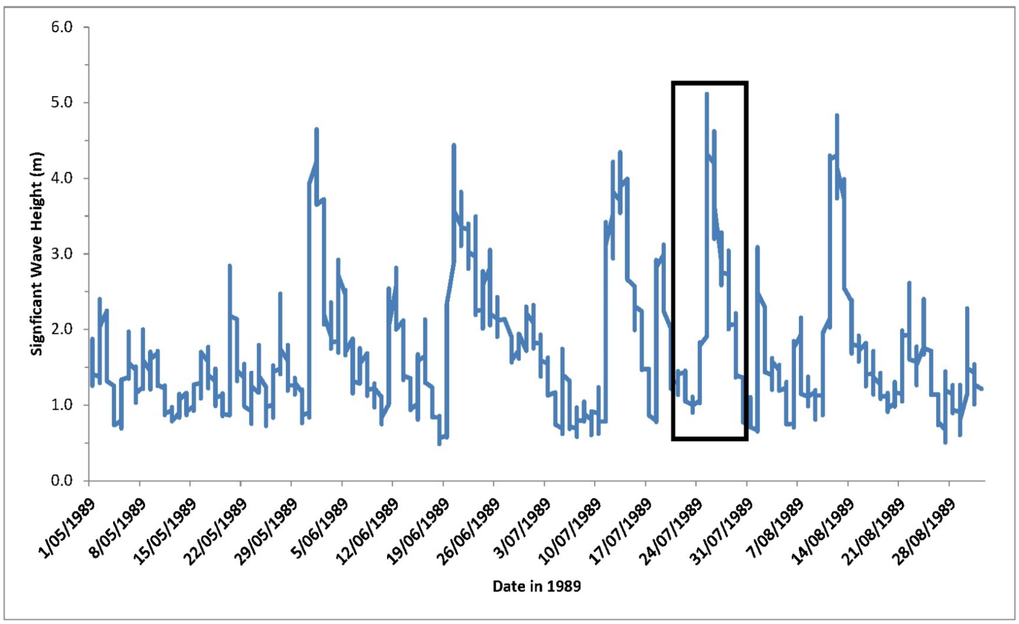
90 

Figure 6. Time series of offshore Sydney Wave Buoy significant wave height data from 1 May 1989 to 31 August 1989. Black box highlights the period July 21 – July 31, 1989 (data courtesy of Manly Hydraulics Laboratory).

91 Daily average significant wave heights recorded offshore decreased steadily from 3 metres on 27 July 1989 to 0.9 metres on 31 July 1989. This is also evident from the black box in Figure 6.

92 It is also evident from Figure 6 that numerous storm wave events with significant wave heights greater than 4 metres occurred in the months leading up to July 1989. This is typical of a La Niña climatic cycle which occurred in 1989 and is further evidence to support the absence of a sandy beach at Mackenzies Bay in July 1989 (Point 49).

93

94 1.5 Wave direction

95 The offshore wave rider buoy did not record direction and local winds do not determine the direction of swell waves.

96 In the absence of directional wave data from the Sydney wave rider buoy, I have estimated wave direction during the period of interest from interpreting the provided meteorological synoptic charts.

97 It is my opinion that the combination of a weakening and distant low pressure system in the Tasman Sea towards New Zealand would have generated low energy swell waves approaching the Sydney coast from a southeasterly to easterly direction on 22 – 24 July 1989.

98 It is my opinion that a new low pressure system located off the NSW coast and rapidly moving east from the 24 – 27 July 1989 created large swell waves approaching the Sydney coast from 25 – 28 July 1989 from a south-easterly direction.

99 According to the wave storm history for Sydney provided online at www.mhl.nsw.gov.au/Station-SYDDOW by the Manly Hydraulics Laboratory, the

wave event between 25 and 28 July 1989 was from the south southeast (from 151 degrees True North). It is unclear how this was determined as the offshore Sydney wave rider buoy did not record direction in 1989.

100 **1.6 Currents and Water Movements**

101 There are several types of water movements that could have existed in the area of interest between 22 – 29 July. These include: i) surface wind drift; ii) tidal currents; iii) wave breaking induced headland drift; iv) turbulence and reflection of wave energy off of rocky shorelines; v) bed return flow; and v) rip currents.

102 As described in Point 64 there is a possibility that the calm to light westerly winds between 22 – 24 July 1989 could have caused an offshore drift of surface water.

103 Tidal currents are negligible on open ocean coastlines in micro-tidal environments (tide ranges less than 2 meters), such as the Sydney coastline and the region of interest. They are generally restricted to inlets, rivermouths, estuaries and the areas immediately surrounding any constricted opening to the ocean (such as a tidal inlet or harbour entrance – both natural and engineered). Tidal currents were therefore not a factor in the region of interest.

104 Rocky coast headlands represent a natural focus for wave energy due to patterns of wave refraction – the bending of wave crests as they travel from deeper to shallower water. This causes larger, more energetic wave breaking conditions at the seaward extremity of the headlands with smaller, less energetic wave breaking conditions along the sheltered/lee sides of the headland. This difference in wave breaking

generally produces a net drift of water from the seaward extremity of the headland along the rock coast towards the more sheltered areas. In general, the larger the waves, the stronger this drift will be. However, few, if any, measurements of this drift exist in the scientific literature.

105 However, the existence of such a headland drift on either side of Tamarama Point in the onshore direction is minimised and can be considered negligible due to the small size of Tamarama Point and the presence of a persistent boundary rip current at the northern end of Tamarama Point. More information on boundary rip currents is given in Points 112 and 114.

106 Similarly, the existence of such a headland drift towards Mackenzies Bay on the southern side of Mackenzies Point (Marks Park headland) is minimised by the presence of a boundary rip current, which often flows offshore from the northern end of Mackenzies Bay (Figure 3), and by the orientation and exposure along this stretch of coast to the prevailing south-east waves.

107 The rocky coast stretching from Mackenzies Bay to Mackenzies Point is characterised by semi-continuous rock (or shore) platforms. The region seaward of rock/shore platforms is extremely hydrodynamically energetic and turbulent, even during small wave conditions. This is largely due to a combination of waves breaking against the rock platform as well as the reflection of wave energy from the rock platform (Figure 3). This area of turbulence does not necessarily move objects in a net direction parallel to the rock platform, but can induce a general drift in a direction

perpendicular to the shore platform, which is generally offshore. This distance may vary from several metres to 30 – 40 metres depending on wave conditions.

108 However, if waves are approaching the rocky coastline and shore platform from a strong angle to the orientation of the coastline, it is possible that a general drift may develop in the direction that the waves are moving.

109 Wave breaking causes a mass transport of water at the surface and upper part of the water column that moves in the direction that the waves are breaking, which is towards the shoreline on sandy beaches or embayments. To maintain an equilibrium, this onshore directed mass transport is partly balanced by a gentle offshore flow close to the bottom bed known as bed return flow (sometimes referred to as undertow). Bed return flow is a ubiquitous feature in surf zones when waves are breaking and can flow at speeds of 0.1 to 0.3 metres/second depending on wave conditions. The larger the waves, the strong the bed return flow.

110 Tamarama Beach and Mackenzies Bay are often characterised by strong, narrow offshore flows of water known as rip currents that extend from the shoreline, through the surf zone (region of breaking waves) to variable distances offshore.

111 There are three primary types of rip currents (Castelle et al., 2016): i) channelised rip currents, which occupy deeper channels between sand bars and are persistent in location and time. When present, these rip currents tend to be approximately 5 – 20 metres wide; ii) boundary rip currents, which occur adjacent to headlands and structures and are persistent in location and often occupy deeper channels; and iii)

flash rip currents which are sporadic in occurrence and may only last for a minute or less. Flash rips do not occupy deeper channels, but are formed when several large waves, or a set of large waves, break and the water is forced locally offshore.

112 In general these types of rip currents will flow offshore to the seaward extent of the surf zone and a short distance beyond before they stop – under typical wave conditions, this is usually about 50 – 100 metres from the shoreline.

113 Channel and boundary rip current flow behaviour can exhibit two scenarios: i) the flow may exit beyond the surf zone before slowing down in an expanding region known as the rip head; or ii) the flow may recirculate without leaving the surf zone. It is impossible to predict which pattern of rip current flow behaviour will occur as rip current flow is variable between different types of rip currents, adjacent rip currents, and within the same rip current over time. However, there is some evidence that boundary rip currents are more prone to flowing further distances offshore (Castelle et al., 2016).

114 Channel and boundary rip currents tend to flow fastest (in microtidal environments) approximately 1.5 hours either side of low tide when wave breaking is maximised. It is not uncommon for rip current flow to cease due to greater water depths and reduced wave breaking approximately 1.5 hours around high tide (Brander and Short, 2001).

115 Boundary rip currents are common at the northern end of Tamarama Beach (Short, 2007) and the northern end of the Mackenzies Bay (regardless of whether a sandy

beach exists or not) as shown in Figure 7, but it cannot be assumed with complete certainty that these rip currents were present during the period 22 – 24 July 1989.

Figure 7. An example of a boundary rip current flowing out from Mackenzies Bay and alongside the rock platform towards the area where Mr Warren disappeared. The rip current is evident from the dark gap between breaking waves and the turbulent, streaky water heading offshore. This image was taken on 4 October 2021 during typical wave energy conditions. (Source: Nearmap).

116 However, given the low wave conditions and tidal levels present on 22 July 1989, it is likely that any boundary rip current flow at these locations would not have extended a great distance offshore and that flow would have been minimised from midnight to approximately 3:00 am and maximised approximately between 5:00 and 8:00 am.

117 Another type of rip current is a 'mega-rip' which forms in pocket and embayed beaches during extremely large wave conditions where significant wave heights are greater than 3 metres (Castelle et al., 2016). Mega rip currents can flow up to half a kilometre offshore (McCarroll et al., 2016).

118 Both Tamarama Beach and Mackenzies Bay are prone to mega rip currents during very large swell events with significant wave heights greater than 3 metres and it is highly likely that mega rips occurred in these areas during the large wave event from 25 to 28 July 1989.

119 **1.7 Drift Scenarios**

120 It is my opinion that if Mr Warren's body had entered the water in the region of interest and, specifically, along the rock platform on the southern side of the Mark's Park headland between July 22 – 24 1989 it would have either: i) drifted slowly offshore if it was floating on the surface due to offshore westerly winds; or ii) remained offshore of the rock platforms at possible distances ranging from several metres to potentially up to 30 – 40 metres due to wave reflection off the rock platforms and a lack of strong rip current activity. This scenario is depicted in Figure 8a.

121 It is my opinion that it is possible that if Mr Warren's body had entered the water and become submerged that it could have been caught, snagged or lodged in the irregular subaqueous rock topography in the region between July 22 – 24 1989.

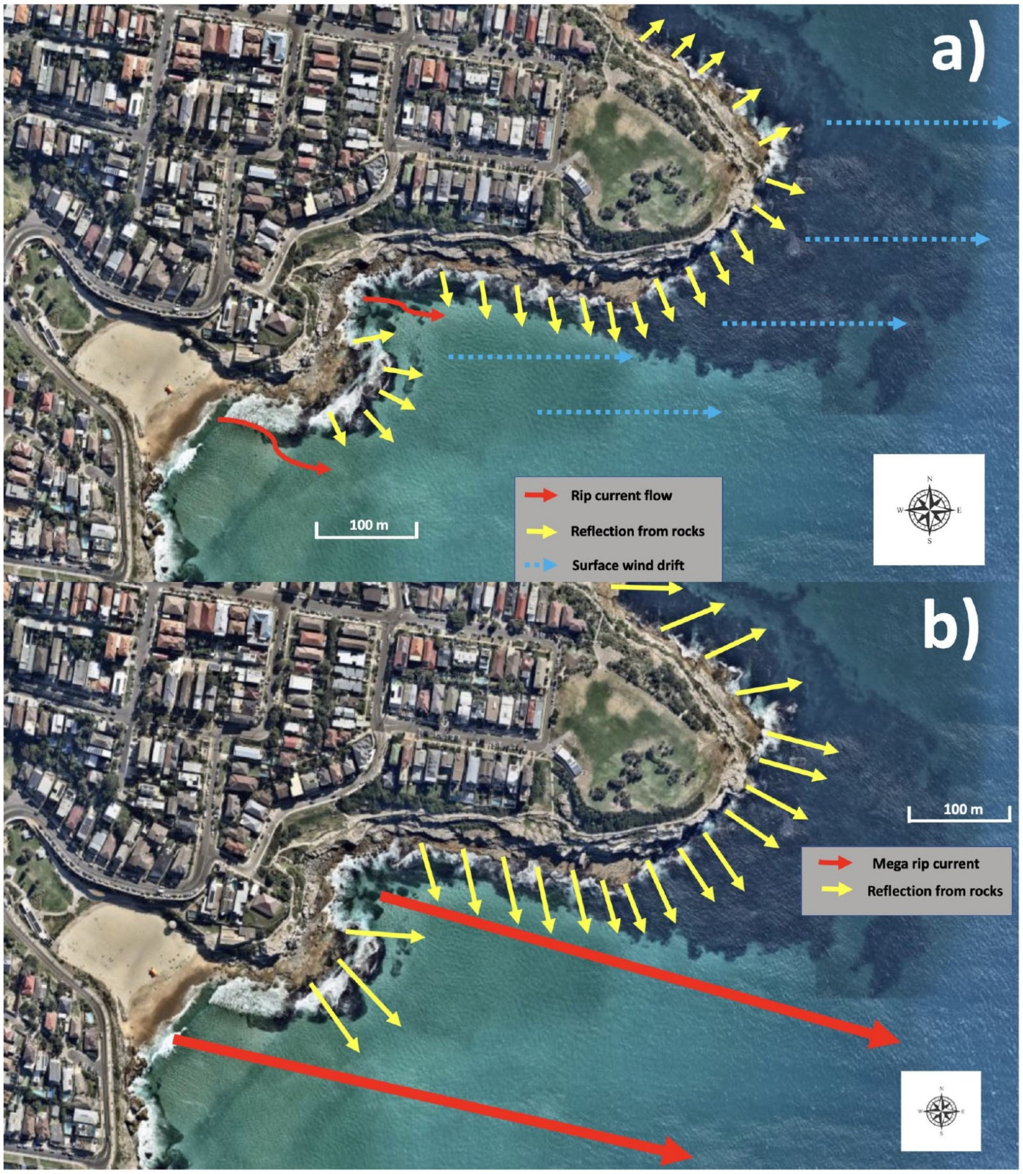
122 

Figure 8. Potential direction of water movement between Tamarama Beach and the rocky coastline extending from Tamarama Point to Mackenzies Point based on wave, wind and currentl conditions over two time periods: a) July 22 – 24 1989; and b) July 25 – 28 1989. (Source: Nearmap).

123 It is my opinion that regardless of whether Mr Warren's body was floating on the surface or submerged in the region of interest, the large wave event from July 25 – 28 1989 would have transported his body significant distances (hundreds of metres) offshore due to the presence of extreme turbulence, wave reflection and mega rip

currents. This scenario is depicted in Figure 8b. In this case, Mr Warren's body would be subject to deeper ocean currents and it would be unlikely that he would have subsequently been transported back towards the shoreline along the Eastern Suburbs coastline, either above or below the water surface.

124 It is my opinion that while it is possible that these large waves and high energy wave activity could have resulted in Mr Warren's body potentially being snagged, caught or lodged in the subaqueous rock topography in the area of interest, it is more likely that the intense wave energy associated with wave breaking and reflection would have dislodged his body if it had previously been caught in the rock, and subsequently transported it offshore.

125 **1.8 Post-Mortem Buoyancy**

126 The direction that a human body floating on the surface of the ocean would travel is influenced by the action of wind, wave action and the presence of currents.

127 The direction that a human body at the bottom of the ocean would travel is influenced by sub-surface currents/drift and post-mortem buoyancy.

128 The implication here is that depending on whether a human body is floating at the surface, or submerged, travel directions and pathways may differ under the same environmental conditions.

129 On 18 May 2023 I was provided with a copy of a report by Dr L.E. Iles, a forensic pathologist, in relation to the buoyancy and decomposition of bodies in water post-

mortem. I will not repeat the full details of the report here, but will identify salient points relevant to the disappearance of Mr Warren.

130 Dr Iles states that in general a deceased person immersed in seawater will float for a period of time until buoyancy decreases to a point with the body sinks. The body may then be vertically displaced downwards in the water and moved about until such time that the production of gases of decomposition increases the buoyancy to a point where the body resurfaces again. As decomposition increases and gases are released from the body, the buoyancy is reduced and the body remains will sink again.

131 However, Dr Iles states that this is an idealised scenario and the actual occurrence of these stages of buoyancy and the time frames involved is extremely difficult to determine given the number of uncontrolled variables relating to the individual and the environment.

132 However, based on the report of Dr Iles, it is likely that if Mr Warren's body had initially been floating in the water, at some point it would have become submerged.

133 Dr Iles describes a measure called the Post-Mortem Submersion Interval (PMSI) which is an estimate of how long a body has been in the water from when it first entered the water until it was discovered. As Mr Warren's body was never recovered, the PMSI is not applicable here, but Dr Iles reports research that suggests that the length of immersion in water is longer in colder water, but acknowledges that this immersion time may include both time spent floating at the surface and time submerged. However, given cooler ocean water temperatures in Sydney in July, if Mr

Warren's body had become submerged quickly after entering the water, it may have remained submerged longer due to the colder water temperatures.

134 Dr Iles also describes a measure described as Accumulated Degree Days (ADD) which is the sum average daily water temperature in degrees Celsius for the period in which the body is immersed. Dr Iles refers to research conducted in Portugal which suggests that an ADD range of 100 – 140 hours (approximately 4 – 6 days) correlates with a human body resurfacing once submerged. However, Dr Iles acknowledges the small sample size and the site specific nature of the Portuguese study.

135 However, if the ADD range reported above is assumed to be representative, this suggests that if Mr Warren's body had entered the water and become submerged between 22 – 24 July 1989, it likely would not have resurfaced before the large wave event which began on 25 July 1989, the implications of which are described in Point 124.

POINT 2. WHETHER THIS NEW DATA AFFECTS ANY OPINION I HAVE EXPRESSED IN MY PREVIOUS REPORTS IN RELATION TO MR WARREN'S DISAPPEARANCE, AND, IF SO, WHAT MY CHANGED OPINION IS AND THE BASIS FOR THAT CHANGED OPINION.

136 With all of the relevant and complete environmental data and information available to me simultaneously I was able to conduct a more holistic and detailed analysis in

this report compared to my earlier reports and statements relating to Mr Warren's disappearance. This new analysis has affected some of my opinions that I expressed in my earlier reports.

137 It should be noted that the background science relating to nearshore currents, waves and my description of the coastal geomorphology of the region of interest in my earlier statements and reports was robust, although I have updated some terminology to reflect advances in the field.

138 In this report I have discounted the possibility given in the report of 5 April 2002 of the occurrence of localised surface upwelling, where water is brought up to the surface, caused by strong and sustained offshore westerly winds between 22 and 24 July 1989.

139 In this report I have modified my description of the tides given in the report of 5 April 2022 to note that tidal conditions between 22 and 24 July coincided with a period of waning spring tides and not peak spring tide ranges.

140 In this report I have modified my description of La Niña and El Niño conditions from the report of 31 January 2017 as the latter had several mistakes involving mixing up the two climatic cycles (possible typographic errors). However, the fundamental finding that Mackenzies Bay most likely did not have a sandy beach present did not change.

141 In my previous reports of 5 April 2022 and 31 January 2017, I did not fully take into consideration the occurrence and potential implications of mega rip currents, which almost certainly would have occurred between 25 – 28 July 1989 in the region of interest due to the very large wave heights. It is my new opinion that these mega rip currents would have transported Mr Warren's body, whether it was submerged, floating, or lodged in subaerial or subaqueous rocks, hundreds of metres offshore into deeper water and that this is likely the primary reason why his body has never been found.

142 In this report I have modified my diagrams of drift directions given in the report of 5 April 2022 to suit specific time periods of interest (22 – 24 July 1989 and 25 – 28 July 1989) as they represent distinctly different wave conditions. In Figure 8a in this report I have provided greater emphasis on the offshore directed movement of water from the rock platform caused by wave reflection and turbulence and reduced the offshore extent of rip current flow based on the low wave energy conditions present between 22 – 24 July 1989. In Figure 8b in this report I have emphasised the dominance of offshore directed mega rip current flow.

CONCLUDING FINDINGS AND OPINIONS

143 I am a coastal scientist with expertise in coastal morphodynamics, the rip current hazard and beach safety.

144 It is my opinion that tidal and wave conditions, wave overtopping and inundation of the rock platform would not have restricted access to the rock platform or

contributed to Mr Warren's body entering the ocean in the region of interest between 2:00 am and 9:00 am on 22 July 1989 or during subsequent time periods.

145 It is my opinion that if Mr Warren's body entered the water in the region of interest between 22 July – 24 1989 that is unlikely that his body would have been transported by waves or currents towards the shoreline at Tamarama Beach, Mackenzies Bay or back onto the rock platform along the southern coast of the Marks Park headland.

146 It is my opinion that if Mr Warren's body entered the water in the region of interest between July 22 – 24 1989 and was floating at the surface it would have remained in the vicinity of the rock platforms (possibly several metres to 30 – 40 metres offshore from the rock platforms) and could have drifted slowly offshore due to light westerly winds.

147 It is my opinion that if Mr Warren's body entered the water in the region of interest between July 22 – 24 1989 and became submerged and sank to the bottom that it would have remined in the vicinity, but at possible distances ranging from several metres to potentially up to 30 – 40 metres offshore due to wave reflection off the rock platforms and a lack of strong current activity. It is also possible that if Mr Warren's body had entered the water and become submerged that it could have been caught or snagged in the irregular subaqueous rock topography in the region.

148 It is my opinion that regardless of whether Mr Warren's body was floating on the surface or submerged in the region of interest, the large wave event from July 25 – 28 1989 would have transported his body significant distances (hundreds of metres)

offshore due to the presence of extreme turbulence, wave reflection and mega rip currents.

149 It is my opinion that once transported into deeper water, Mr Warren's body would have been subject to deeper ocean currents and it would be unlikely that he would have subsequently been transported back towards the shoreline along the Eastern Suburbs coastline, either above or below the water surface. It is my opinion that this is why Mr Warren's body was never recovered.

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Professor Robert W. Brander

BSc, MSc, PhD, AM

APPENDIX A

CURRICULUM VITAE

ROBERT W. BRANDER BSC MSC PHD

CAREER SUMMARY & HIGHLIGHTS

RESEARCH

- **PhD in Coastal Morphodynamics with significant international research profile & publication record**
- **Google Scholar *h*-index = 34; *i10*-index = 69; Citations = 4189 as of May 2023**
- **15 scholarly book chapters, 87 international refereed journal papers and 32 internationally refereed conference papers/abstracts**
- **> 1,000,000 in external research funding including Australian Research Council (ARC) funding ($676,000).**
- **36 years research experience in coastal geomorphology and beach safety science**
- **Director UNSW Beach Safety Research Group (ww.beachsafetyresearch.com)**
- **2012 Australian Government *Eureka Prize* winner for *Promoting Understanding of Australian Scientific Research***

TEACHING

- **Consistently high undergraduate teaching and course evaluation scores**
- **Course co-ordinator of major first year Physical Geography/Environmental Science course (100+ students) since 1998**
- **$120,000 of UNSW Strategic Educational Development Funding since 2015**
- **UNSW Faculty of Science Excellence in Teaching Award 2011**
- **Supervision of 6 HDR & 27 Honours students**
- **Post-Graduate Co-ordinator UNSW Sydney School of BEES 2014-2016**

SERVICE & OUTREACH

- **Appointed as a Member of the Order Australia (AM) on January 26, 2023 for service to coastal science, and to the community, through beach safety research and education**
- **Facilitator of the multi-award winning community education program 'Science of the Surf (SOS) since 2001. SOS presentations given to over 50,000 people.**

- **Significant mainstream and social media profile in promoting public understanding of rip current science and beach safety hazards. Known as '*Dr Rip*'.**
- **Educational beach safety related YouTube videos with > 2.2 million views**
- **2018 National Geographic documentary 'Rip Current Heroes' and 2022 US PBS documentary 'Rip Current Rescue' and associated Study Guides**
- **Author of 2010 bestselling book *Dr Rip's Essential Beach Book***
- **Rip current education websites at www.scienceofthesurf.com and www.ripcurrentsafety.com**

PRESENT WORK DETAILS

Professor, School of Biological, Earth and Environmental Sciences (BEES), UNSW Sydney, Sydney, NSW 2052, Australia.

Tel +61 2 9385 2899; Fax +61 2 9385 1558; Mobile 0401 420 962; Email rbrander@unsw.edu.au

Present Roles and Associated Research Centres:

- Director of UNSW Beach Safety Research Group (UNSW BSRG)
- Member of UNSW Centre for Marine Science and Innovation (CMSI)
- Member UNSW Earth and Sustainability Science Research Centre (ESSRC)

EDUCATION

PhD in Marine Science – *Field Observations on the Morphodynamics of Rip Currents* (1993 – 1997), Department of Geography, University of Sydney, Australia

MSc in Geography – *Bedform Constraints on Sediment Re-suspension and Transport under Shoaling and Breaking Waves* (1989 - 1991), University of Toronto, Canada

BSc in Geography – (1984 - 1989), University of Toronto, Canada

EMPLOYMENT HISTORY

1) PROFESSOR *NOV 2018 – ONGOING*

School of Biological, Earth and Environmental Sciences, UNSW Sydney

2) ASSOCIATE PROFESSOR *SEPT 2013 – NOV 2018*

School of Biological, Earth and Environmental Sciences, UNSW Sydney

3) ADJUNCT ASSOCIATE PROFESSOR *OCT 2016 – ONGOING*

College of Public Health, Medical and Veterinary Sciences, JCU

4) SENIOR LECTURER *JAN 2008 – SEPT 2013*

School of Biological, Earth and Environmental Sciences, UNSW

5) NEW SOUTH WALES DEPARTMENT OF EDUCATION SCHOOL PERFORMER

JUNE 2006 - DEC 2007

On Leave Without Pay from UNSW

6) GHD CONSULTING, NEWCASTLE, NSW *JAN 2006 – MAY 2006*

On Leave Without Pay from UNSW

7) SENIOR LECTURER *JUNE 2004 – DEC 2005*

School of Biological, Earth and Environmental Sciences, UNSW

8) LECTURER *JULY 2000 – MAY 2004*

School of Geography; School of Biological, Earth and Environmental Sciences

9) LECTURER *JULY 1998 – JUNE 2000*

School of Earth Sciences, Victoria University of Wellington, New Zealand

10) ARC Research Associate *Jan 1997 – June 1998*

Department of Geography, University of Sydney

11) CASUAL LECTURER AND TUTOR *FEB 1993 – DEC 1996*

Department of Geography, University of Sydney

12) Teaching Assistant Sept 1989 – Sept 1991

Department of Geography, University of Toronto

Additional Supporting Material

INTERESTS & EXPERTISE

Who am I and what do I do?

- I'm an internationally recognised coastal geomorphologist, rip current and beach safety scientist and science communicator.
- My fieldwork in beach surf zones and coral reef environments has led to key advances in the understanding of rip current and coral reef island morphodynamics.
- More recently I have attempted to combine a physical understanding of surf zone processes and natural hazards, such as rip currents, with a social science approach in order to improve understanding of human interactions with these processes/hazards. This has resulted in my pioneering of a new field of coastal research termed 'Beach Safety Research'
- I run an extremely successful community based beach safety education program called 'The Science of the Surf' and have now managed to incorporate that into active research.
- The goals of my work are to:
  - ✓ Explore and develop the interface between physical geoscience and social research in the context of beach and surf zone hazards;
    Improve understanding of beach and surf zone processes in relation to hazards in order to reduce the incidence of drowning and injury along coasts; and
  - ✓ Develop meaningful and appropriate beach and coastal safety education interventions via research outcomes.

Research Interests & Expertise

- **Coupled human-environment systems** (interactions between beach hazards and socio-demographic and behavioural systems, assessing understanding of public knowledge of coastal hazards)
- **Beach and surf zone safety** (hazard assessment, hazard and human interaction, development and assessment of public education interventions, effective communication strategies)
- **Coastal hazards** (rip currents, waves, storms and storm erosion)
- **Coastal geomorphology and processes** (beach and surf zone morphodynamics, coral reef island and reef morphodynamics, field based studies)
- **Communicating and promoting science to the public**

PART ONE - RESEARCH

1.1 PUBLICATIONS

BOOKS, REFEREED BOOK CHAPTERS & BOOK REVIEWS (n = 15)

Short, A.D.**, Brander, R.W. (**Eds.) (2020). Stories from the Field: 50 Years of Coastal Fieldwork 1970-2020. Journal of Coastal Research, Special Issue No. 101. Allen Press, Lawrence KS, 432 p. https://meridian.allenpress.com/jcr/issue/101/SI

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Williamson A, Hatfield J, Sherker S, **Brander R**, Hayen A. (2010). Improving beach safety: The Science of the Surf research project Stages 1 & 3: Collection of baseline data to inform a tailored intervention and Evaluation of the effectiveness of the "Don't get sucked in by the rip" campaign. *1st International Rip Current Symposium*, Miami, February, 2010.

Williamson A, Hatfield J, Sherker S, **Brander R,** Hayen A. (2009). Improving beach safety: The Science of the Surf research project Stage 1: Collection of baseline data to inform a tailored intervention. *Be Active '09* (2009 Australian Conference of Science and Medicine in Sport, 7th National Physical Activity Conference and 6th National Sports Injury Prevention Conference), Brisbane, October 2009.

Hatfield J, Williamson A, Sherker S. **Brander R**, Hayen, A. (2009). Improving beach safety: The Science of the Surf research project Stage 2: Development and process evaluation of the "Don't get sucked in by the rip" campaign. *Be Active '09* (2009 Australian Conference of Science and Medicine in Sport, 7th National Physical Activity Conference and 6th National Sports Injury Prevention Conference), Brisbane, October, 2009.

Williamson A, Hatfield J, Sherker S, **Brander R**, Hayen A. Improving beach safety: The Science of the Surf research project Stage 3: Evaluation of the effectiveness of the "Don't get sucked in by the rip" campaign. *Be Active '09* (2009 Australian Conference of Science and Medicine in Sport, 7th National Physical Activity Conference and 6th National Sports Injury Prevention Conference), Brisbane, October, 2009.

Williamson, A., Hatfield, J., Sherker, S., **Brander, R.** and Hayen, A. (2009). Improving beach safety: the Science of the Surf research project. Stage 1- Collection of baseline date to inform a tailored intervention. *Be Active 09*, Brisbane, Australia.

Williamson, A., Hatfield, J., Sherker, S., **Brander, R.** and Hayen, A. (2009). Improving beach safety: the Science of the Surf research project. Stage 3 – Evaluation of the effectiveness of the "Don't get sucked in by the rip" campaign". *Be Active 09*. Brisbane, Australia.

Brander, R.W. (2009). Keynote Address: Challenges and future directions for beach safety education. *Australian Professional Ocean Lifeguard Conference*, Coffs Harbour, Australia

Williamson, A., Hatfield, J., Sherker, S., **Brander, R.** and Whibley, B. (2008). Science of the Surf (SOS); The development and evaluation of a national educational campaign for beach safety. *Australian Water Safety Conference*, Sydney, Australia.

Brander, R.W., 1998. Sediment transport in low-energy rip current systems. 8th Meeting of the Australia-New Zealand Geomorphology Group (ANZGG), Goolwa, South Australia.

Brander, R.W., 1997. Field monitoring of low-energy rip current systems. Proceedings of the Institute of Australian Geographers and New Zealand Geographical Society Second Joint Conference. Hobart, Tasmania.

Brander, R.W., 1994. Field investigations on the dynamics of rip currents. 6th Meeting of the Australia-New Zealand Geomorphology Group (ANZGG), Hanmer Springs, N.Z.

REPORTS (n = 2)

Cooney, N., Daw, S., Brander, R.W., Ellis, A., Lawes, J., 2020. Coastal Safety Brief: Rip Currents. Surf Life Saving Australia, Sydney, Australia, 15 p.

Attard, A., Brander, R.W., Fitzgerald, T., 2019. MyCoast NSW: New South Wales Community Perceptions of Coastal Erosion and Inundation. UNSW Sydney, 126 p.

1.2 RESEARCH GRANT INCOME

Career total income AUS $1,455,658

<u>Research grants (external) = $1,203,323</u>

AUS**$10,000** – December 2022. Float to Survive. Randwick City and Waverley Councils. Role – Lead Investigator.

AUS**$20,000** – July 2022. Beach Safety Research. Surf Life Saving Australia (SLSA) Internal Research Project. Role – Lead Investigator.

USD**$46,000** - December 2021. Improving water safety at risky Instagram hotspots via targeted information campaigns. Instagram Community Safety Grant. Role – Co-Investigator.

AUS**$28,000** – November 2021. 'Surfers Rescue 24/7: Evaluating the social impact and benefit of a rescue training program for surfers'. UNSW Science Social Good Seed Funding and Surfing NSW.. Role – Lead Investigator

AUS**$10,000** – August 2021. Surfers Rescue 24/7 Project. Surfing NSW Internal Research Project. Role – Lead Investigator

AUS**$32,000** – July 2021. Beach Safety Research. Surf Life Saving Australia (SLSA) Internal Research Project. Role – Lead Investigator

AUS**$23,000** – March 2021. Safeguarding the next generation: evaluating the effectiveness of beach safety interventions for teenagers. UNSW Science Industry Network Seed Fund and Lake Macquarie City Council. Role – Lead Investigator

AUS**$32,000** – July 2020. Beach Safety Research. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Lead Investigator**

AUS**$32,000** – July 2019. Beach Safety Research. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Lead Investigator**

AUS**$99,180** – March 2019. Identifying Rip Currents and Beach Usage at Unpatrolled Beach Locations. NSW Department of Justice – Office of Emergency Management/State Emergency Management Water Safety Funds. Role – **Lead Investigator**.

AUS$**32,000** – July 2018. Beach Safety Research. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Lead Investigator**

AUS$**154,448** – December 2016. Community Understanding of Coastal Erosion: Improving Resiliency and Preparedness to Coastal Storms and Sea Level Rise. NSW Department of Justice – Office of Emergency Management/State Emergency Management Projects (SEMP). Role – **Lead Investigator**.

AUS$**30,840** – December 2016. Improved Bystander Coastal Rescue Capability. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Lead Investigator** (with 2 others).

AUS$**42,864** – August 2013. The Rip Buoy Project. Australian Government Research in Business (RiB) Grant. Role – **Lead Scientist**.

AUS$**396,000** – June 2011. Rip currents: an evidence based approach to managing the greatest beach hazard. Australian Research Council, *Linkage* Program LP110200134. Role – **Lead Chief-investigator** (with six others).

AUS$12,116 – June 2010. Measurements of rip current flow and swimmer behaviour in Australian rip current systems using low-cost GPS. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Lead Investigator**

AUS$12,272 – June 2010. Demographics, surf knowledge and behavioural response to rip current rescue victims. Surf Life Saving Australia (SLSA) Internal Research Project. Role – **Co- Investigator.**

AUS$**278,593** – June 2007. The Science of the Surf: the development and evaluation of a national campaign to reduce the risk of coastal drowning. Australian Research Council, *Linkage* Program LP0774843. Role –**Chief-investigator** (with 3 others).

AUS$**3,000** – November 2003. Waves and currents around a coral cay. *Australian Geographic*. Role – **Chief Investigator**

Other programs and activities (internal) =$169,335

AUS$**28,000** – March 2022. Surfers rescue 24/7: evaluating the social impact and benefit of a rescue training program for surfers. UNSW Science Social Good Seed Fund 2021.

AUS$**23,000** – Feb 2021. Safeguarding the next generation: evaluating the effectiveness of beach safety interventions for teenagers. UNSW Science Industry Network Seed Funding. Role – **Lead Investigator**

AUS$**10,840** – Feb 2005. Impact of the 2004 Boxing Day Tsunami on the Maldives. University of New South Wales Vice-Chancellor Discretionary Funds.

AUS$**8,600** – February 2005. Wave characteristics across a fringing reef, Lizard Island, Qld. University of New South Wales, Faculty of Science Research Grant Program

AUS$**17,895** – November 2004. Rip current flow and sediment transport monitoring. University of New South Wales, Faculty of Science Research Grant Program

AUS$**15,000** – November 2003. Coral reef island morphodynamics. University of New South Wales, Faculty of Science Research Grant Program

AUS$**15,000** – March 2002. Coral reef island morphodynamics. University of New South Wales Goldstar Research Award

AUS$**8,000** – November 2001. Rip current morphodynamics. University of New South Wales Research Support Program

AUS$**20,000** – July 2001. University of New South Wales Core Standards Start-up Program.

NZ$**3,000 (AUS$1,800)** – July 1999. Rip current morphodynamics. Victoria University of Wellington Summer Research Grant.

NZ$**20,000** (**AUS$12,500**)– July 1998. Victoria University of Wellington Internal Grant Committee Start Up Funds.

1.3 SUPERVISION OF HIGHER DEGREE RESEARCH STUDENTS

Successful student completions

2021 Anna Attard (MSc) – Community understanding of coastal erosion

2015 Ben Van Leeuwen (MSc) – Rip current escape strategies

2014 Jak McCarroll (PhD) - Morphodynamics of embayed beaches

2014 Todd Walton (PhD) - Australian surf culture and hazards.

2001 Richard Jennings (PhD) – Morphodynamics of gravel beaches

1999 Matthew Paterson (MSc) –Sediment sorting on gravel beaches

1999 Samuel Barrow (MSc) –A wave climate for Titahi Bay, NZ

Current students

William Koon (PhD) – Coastal drowning and safety interventions in Australia

Nick Mulcahy (PhD) – Drowning and rescue relationships with beach type

Sam Cornell (PhD) – Interventions for Instagram related selfie-related drowning

1.4 SUPERVISION OF 4TH YEAR HONOURS RESEARCH STUDENTS

2021 Alva Lane (BSc Hons 1st Class) – Surf Zone Injuries in New South Wales Australia

2021 Mark Woods (BSc Hons 1st Class) – Beach Safety Knowledge of Multicultural Communities

2017 Kirsten Clifford (BSc Hons 1st Class) – Beach Safety Knowledge of International Students

2017 Scarlet Davis (BSc Hons 1st Class) – Community Perceptions of the Shark Hazard

2016 Nicola Warton (BSc Hons 1st Class) – Educational Impacts of 'Bondi Rescue'

2014 Ben Aggar (BSc Hons 1st Class) – The Rip Buoy Project

2014 Anna Attard (BSc Hons 1st Class) – Surfers as bystander rescuers

2014 Felicity Bain (BSc Hons 1st Class) – Video imaging of Bondi Beach

2013 Campbell McKay (BSc Hons 1st Class) – Beach drowning in Ghana

2012 Ben van Leeuwen (BSc Hons 1st Class) – Measurements of topographic rip currents.

2012 Lara Edwards (CivEng Hons) – Remote video imagery analysis of the morphologic behaviour of topographic rip currents.

2011 Erica Davey (CivEng Hons) – A global analysis of rip current spacing.

2010 Ben Jones (CivEng HOns) – Lagrangian measurements of rip current flow at Bondi Beach, NSW.

2010 Warren Jones (**Honours-CivEng**) – A physical analysis of swimmer escape strategy in rip currents

2009 Will Broadfoot (BSc Honours) – An analysis of lifeguard rescues at Bondi Beach, NSW.

2005 Cameron Weller (BSc Honours) – Morphodynamics of low energy beaches in Jervis Bay, NSW.

2005 Celia Cameron-Smith (BSc Honours) – Assessment of beach erosion at Narrabeen Beach, NSW using video imagery.

2005 Michael Daly (BSc Hons 1st Class) – Wave characteristics across fringing reefs.

2004 Elpiniki Joseph (BSc Hons) – Rip current morpodynamics at Bennetts Beach, NSW.

2004 Tim Jamieson (Hons 1st Class) –Long term assessment of beach erosion at Wamberal Beach, NSW.

2003 Chris Bourne (BScHons) – Bioclastic sediment characteristics of coral cay islands.

2003 Nicole White (BSc Hons 1st Class) – Beach profiles of coral sand and shingle cay islands.

2003 Kurt Plambeck (BSc Hons) – Temporal behaviour of a high-energy embayed beach, Tamarama, NSW.

2003 Sherlin Ng (BSc Hons) – Shoreline dynamics on a coral shingle cay.

2002 Ashley Robinson (BSc Hons 1st Class) – Morphological change on a coral shingle cay, Lady Elliot Island, Great Barrier Reef, Australia

2002 Bronwyn Rutherford (BSc Hons 1st Class) – Blowout dune formation and morphology at Hawks Nest, NSW.

2001 Stephanie Ballango (BSc Hons) – Wave setup as a forcing mechanism of rip current flow.

2001 Raymond Low (BSc Hons) – Impact of sand mining on vegetation, Tomago, NSW.

2001 Andrew Murrell (BSc Hons) – Impact of storm drain at Tamarama Beach, NSW

External PhD Examinations

2019 Peter Kamstra. PhD School of Geography, University of Melbourne – *Risk perceptions and behaviour of rock fishers.*

2016 Edward Beetham, Doctor of Philosophy in Geography, School of Environment, The University of Auckland – *Field and numerical investigations of wave transformation and inundation on atoll islands.*

2014 Thomas Murray, PhD Griffiths University, School of Environment, QLD, Australia – *Morphodynamics of transient rip currents, Gold Coast, QLD Australia*

2012 Hiroki Ogawa, Doctor of Philosophy in Geography, School of Environment, University of Auckland, New Zealand – *Wave Characteristics and Transformations on Sub-Horizontal (Type B) Shore Platforms on the East Coast of the North Island, New Zealand.*

2009 Timothy Scott, PhD School of Geography, University of Plymouth, United Kingdom – *Rip Currents on Macrotidal Beaches, South-East United Kingdom.*

I have also examined approximately 15 MSc theses internally and externally since 1998.

1.4 ACADEMIC AWARDS AND SCHOLARSHIPS

2012 – Australian Government Eureka Prize for Promoting Understanding of Australian Scientific Research

2012 – 'Best Conference Presentation Award' at the 2012 Australian Water Safety Conference for a presentation entitled "The RipSafe Project – a holistic approach to understanding the rip current hazard"

2010 – NSW Government/AusSwim Water Safety Award for Research Project of the Year

2009 – NSW Sports Safety Gold Award for Outstanding Achievement in Applied Research in Sports Medicine by a Research Team

1997 – Award for 'Outstanding Student Conference Presentation'. Institute of Australian Geographers (IAG) Conference, Hobart, Tasmania.

1993–96 – Overseas Post Graduate Research Scholarship; University of Sydney

1993–96 – University Post Graduate Research Award; University of Sydney

1990–91 – Post Graduate Scholarship, Natural Sciences and Engineering Research Council, Canada.

1989–90 – Ontario Graduate Scholarship

1989 – Undergraduate Research Scholarship, Natural Sciences and Engineering Research Council, Canada

1989 – University of Toronto Ali Tayyab Geography Award

1989 – Dean's List, Scarborough College, University of Toronto

1988 – Undergraduate Research Scholarship, Natural Sciences and Engineering Research Council, Canada

PART TWO - TEACHING EXPERIENCE

2.1 Learning and Teaching Awards and Grants

2015 UNSW Strategic Educational Development Grant (SEF#2) for '*The UNSW Field Companion A Virtual 'App' for Stage 1-2 Science Students*' ($99,880)

2015 UNSW Learning and Teaching Innovation Grant (SEF#2) '*The 24/7 Lab: Immersing First Year Environmental Science Students in their own Personal Learning Environment*' ($20,000)

2011 University of New South Wales Faculty of Science Award for *Excellence in Teaching*

2.2 Teaching Experience & Responsibilities

I have always carried a high teaching load at each academic institution I have taught at and have consistently received some of the highest student teaching and course evaluations at those institutions. Examples of student feedback and evaluation are available on request.

Courses taught:

UNSW Sydney (2000 – present)

GEOS 1701 Environmental Systems, Processes and Issues (Convenor)
ENVS 1011 Environmental Science
SCIF 1021 Advanced Science Seminar
GEOS 2721 Australian Surface Environments and Landforms
MSCI 2001 Introductory Marine Science
GEOS 3731 Coastal Processes and Hazards (Convenor)
GEOS 3921 Coastal Resource Management
MSCI 0501The Marine Environment
SCIF 2041 Research Internship (Supervisor)
BEES 0006 Special Topics (Supervisor)

Victoria University of Wellington (1998 – 2000)

GEOG114 Environments and Resources: The Foundations (Convenor)
GEOG213 Physical Environmental Processes
GEOG319 Atmospheric and Coastal Systems (Convenor)
GEOG323 Advanced Physical Environmental Processes
PHYG401 Geomorphology and its Application
PHYG403 Special Topic (Convenor)
PHYG413 Coastal Processes and Management (Convenor)

University of Sydney (1994 – 1998)

IMS2 Introductory Marine Science
GEOGIIP Mega Geomorphology
GEOGIIIP Coastal Depositional Environments

University of Toronto (1989 – 1991)

GGRB19Y General Geomorphology
GGRB24Y Hydrology, Land Use and Water Quality
GGRC28Y The Hydrology of Surface and Subsurface Waters

2.4 CURRICULUM DEVELOPMENT AND TEACHING INNOVATION

Curriculum development at University of New South Wales (2000 – present)

- I have revamped several courses offered with the BSc major in Physical Geography at UNSW and developed one new 3rd year course in the School of BEES, UNSW.

GEOS1701 – Environmental Systems, Processes and Issues. I revamped and modified this course upon my arrival at UNSW in 2000 in my role as Course Co-ordinator. Since my arrival, the course evaluations have increased dramatically and it has always been one of the most successful courses offered in the School of BEES. The course was subsequently modernised and updated with a new title, new core themes, new laboratory exercises, and a new field trip in 2016.

GEOS3731 – Coastal Geomorphology. I developed this new advanced level, field based course in coastal processes and landforms as an entry level course for Honours and PhD students. The course was first offered in July 2011.

Curriculum development at Victoria University of Wellington (1998 – 2000)

- I completely revamped an existing course GEOG114 Environments and Resources including all lectures, labs, assignments and a field trip and turned it into one of the most successful undergraduate courses in the School of Earth Sciences, VUW.
- I developed, introduced and co-ordinated a new 3rd year undergraduate course GEOG314 Atmospheric and Coastal Systems.

PART THREE – SERVICE, ADMINISTRATION, MANAGEMENT & OUTREACH

3.1 Service to UNSW Sydney

- 2017 – 2021 – Deputy Head of School, School of BEES
- 2015 – 2017 – Postgraduate Co-ordinator (Candidature) School of BEES
- 2008 – 2014 – Co-ordinator of the School of BEES Seminar Series
- 2008 – present – School of BEES Undergraduate Teaching Committee

- UNSW TV YouTube videos with over 2 million views combined
- UNSW Faculty of Science 'Rip Current Survival Guide' posters and DVDs

I have given numerous university and faculty 'promotional' lectures on behalf of UNSW to staff, international students, high school students and members of the community.

3.2 Service to Society

On January 26, 2023 I was appointed as Member of the Order of Australia (AM) for significant service to coastal science, and to the community, through beach safety research and education.

'Science of the Surf (SOS)' Community Education Program

In 2001 I initiated a program called 'The Science of the Surf (SOS)' by giving free community presentations to members of the public at coastal locations in Sydney's Eastern Suburbs. Since then, the program has expanded into primary and high schools, surf life saving clubs, community and corporate groups. The aim of the program is to educate people about beach and surf hazards through an understanding of the basic science of beaches, waves and rip currents. To date, I have given hundreds of talks to over 50,000 people.

The program has garnered numerous community safety awards and media attention and has since expanded into various forms of social media including a dedicated website www.scienceofthesurf.com and numerous YouTube videos including 'How to Survive Beach Rip Currents' which has over 1.4 million views and has won National Australian Government Safer Community Awards.

The program also has freely available material including rip current survival guide posters and dvds.

National Geographic 'Rip Current Heroes' Documentary

Produced by National Geographic and Markland Media and premiering on the National Geographic Channel during the 2017/2018 summer season, this 50 minute documentary provides a clear, comprehensive and engaging overview of the rip current hazard. The program follows my research and community education efforts as one of its' central themes. It has been shown on Qantas and Jetstar in-flight video channels since March 2018.

Rip Currents – National (Australia) Study Guide for Teachers

In collaboration with Atom Media, Markland Media, I helped design and create a study guide for teachers on the rip current hazard that is closely linked with the National Geographic documentary 'Rip Current Heroes'. This not-for-profit guide is designed for Years 7-10 and is freely available to all teachers around Australia.

United States Public Broadcasting System (PBS) 'Rip Current Rescue' Documentary

Produced by Markland Media in collaboration with NOAA, the NWS and the USLA, this full length 50 minute documentary follows my research in relation to rip current drownings across the United States and is shown on the US television network PBS. An accompanying study guide available to all was developed by Markland Media and myself for the USLA.

Affiliations and Memberships

- Member of the International Lifesaving Federation (ILS) Rip Current Alliance (RipSafe) Committee
- Member of the Surf Life Saving Australia Research Advisory Working Group
- Member of the Australian Coastal Society
- Member of the NSW CALD Water Safety Group
- Member of the Coastal Education Research Foundation (CERF)
- Individual and Organisation (Science of the Surf) membership with the Australian Professional Ocean Lifeguard Association (APOLA)
- Individual Membership with Surf Educators International (SEI)
- Member of Tamarama Beach Surf Life Saving Club since 1993; Life Member since 2016

3.3 Social and Multi Media

I have successfully used social media and multi-media tools to communicate the science of rip currents, an understanding of coastal processes and landforms, and an understanding and awareness of beach hazards to the general public, primary and high school students. This has been achieved through a number of methods, primarily via my Science of the Surf program.

Still Images

- contributed 75 images to the CD-ROM compilation: Slattery, M. (2000). GEOMORPHOLOGY; A Collection of Images
- contributed 1 image of the 12 Apostles on Victoria's Great Ocean Road to the National Geographic Family Reference Atlas of the World (2002; 2006). This has been translated and distributed across the world
- Images contributed to various textbooks and educational books

YouTube Videos (> 3,500,000 views)

- '*How to Survive Beach Rip Currents*'; 1,600,000 views as of Feb 2023 (UNSW TV)*
- '*Where Do Waves Come From?*'; 125,000 views as of Feb 2023 (UNSW TV)
- '*How do Waves Break?*' 82, 000 views as of Feb 2023 (UNSW TV)
- '*Beach Survival Guide*'; 93,000 views as of Feb 2023 (UNSW TV)
- '*Rip Current Time Lapse*' – 420,000 views as of Feb 2023
- '*How Do Tides Work?* 119,000 views as of Feb 2023 (UNSW TV)
- '*Channel 7 News – Rip Currents* 239,000 views of 2023
- '*Something everybody should know about Rip Currents!*' 194,000 views as of Feb 2023

+ many other related videos with total views as of Feb 2023 > 500,000

*This video also has subtitled YouTube versions in Chinese, Spanish, Portuguese, French, Thai

Websites and Social Media

I run the very successful community education website www.scienceofthesurf.com which is a portal for educational material on (primarily) the rip current hazard

My Facebook page 'Dr Rip's Science of the Surf' has over 5500 'followers' as of Feb 2023 and is updated regularly with information pertaining to coastal science and beach safety. I have a Twitter account (@Dr_Rip_SOS), but I don't use it often. Not a fan.

3.4 Community Based Awards

- 2012 Australian Government Eureka Prize for Promoting Understanding of Australian Scientific Research
- 2011 NSW Water Safety Awards High Commendation Community Education Program of the Year

- 2009 Australian Government Attorney General Safer Communities Award for 'Don't Get Sucked in by the Rip' in the Research Bodies Category
- 2009 Australian Government Attorney General Safer Communities Award for 'Don't Get Sucked in by the Rip' in the Education, Training and Research Category
- 2009 NSW Sports and Recreation Safety Award for Science of the Surf
- 2007 NSW Department of Education and Training (DET) Frater Award for Excellence in School Performances
- 2005 NSW Sport and Recreation AustSwim "Water Safety Event of the Year" for Science of the Surf
- 2005 Tamarama SLSC Senior Clubman of the Year Award
- 2003 Australian Government Attorney-General Emergency Management Australia Award for 'Science of the Surf' in the Pre-Disaster Category
- 2002 Tamarama SLSC Senior Clubman of the Year Award
- 2002 Sydney Branch NSW Surf Life Saving Community Event of the Year
- 2002 NSW Surf Life Saving Award of Excellence (Community Education)

3.5 Media Communication, Expertise and Profile

I have a significant media profile in Australia with over 300 radio, newsprint and television appearances across all networks on the rip current hazard and surf science. I provide regular commentary on rip currents, beach safety, and coastal matters for radio, tv and print media and work with journalists to bring science stories to the public.

My significant media profile in Australia is evident by my popular nickname '*Dr Rip*'. While I have lost track of my total number of appearances (*n*) for each category, I have included an accurate estimate and have provided some of the more notable examples of my media exposure below:

****PLEASE NOTE THAT DUE TO VOLUME, I HAVE NOT UPDATED THIS LIST SINCE 2013****

Print (*n* = 50+ since 2000)

I have been quoted and profiled on many stories involving rip currents in both major city, regional and local newspapers. Often articles are syndicated around the country. Some of my recent more prominent, self authored op eds, and longer articles are:

- Australian Magazine (insert with Weekend Australian newspaper) – 10 questions profile 26/1/2013
- Illawarra Mercury (15/9/12 Weekend Ed.) – '*A safety tip from Dr Rip*' (cover photo and story)
- Etihad Airlines Inflight Magazine (Dec 2011 issue) – '*The Surf Doctor*' (full page profile)
- Newcastle Herald (24/1/12) – Op Ed: '*Look to rips for real 'jaws of death*'
- Sydney Morning Herald (24/11/11) – '*Rip theories put to the test*' (full page article in Environment/Science section about my ARC research)
- Sydney Morning Herald (3/2/10) – Op Ed: '*Yes, we can slash the death toll from rips at our beaches*'
- Sydney Morning Herald (20/12/2008) – '*Minutes later this man was dead*' (front page article with photo of Saturday edition)

Radio (*n* = 150+ since 2000)

Most (but not all) of my radio appearances involve discussing rip currents, usually following a drowning and last from 5-10 minutes. The following are longer appearances (30 minutes to 1 hour):

- ABC 702 Sydney (since 2010) – regular '*Sons of Beaches*' segment on Weekends with Gilles Marnie
- ABC National Breakfast with Fran Kelly (10/02/10) – Live panel rip current debate
- ABC Classic FM (29/3/10 and 29/10/10) – Morning Interview with Margaret Throsby
- ABC Triple J FM (5/2/09) – Science on mornings with 'Dr Karl'

Television (*n* =25+ since 2000)

- Foxtel Coast Australia (30/12/2013) – Gold to Sunshine Coast Ep 5 – Rip current segment
- WIN News (3/1/13) – Extended story on rip currents and Illawarra SOS talks
- Bondi Rescue 2012 – Segment on rip currents
- ABC Catalyst (5/4/12) – '*Rip Survivor*'
- Channel 10 The Project (24/1/12) – Live interview discussing rip currents
- Channel 7 Sunrise (24/1/12) – Studio interview discussing rip currents
- Channel 7 Today Tonight (10/1/12) – '*Surviving rips this summer*'
- Channel 9 Today Show (21/11/12) – Studio interview discussing rips
- Channel 9 60 Minutes (7/10/10) – '*The Cruel Sea*'
- ABC Sleek Geeks (7/2/08)
- Channel 9 A Current Affair (24/1/05)
- ABC 7:30 Report (24/3/04) – '*Science could prove life saving in surf*'
- ABC Catalyst (26/2/02) – '*Science of Surf*'
- Channel 10 Totally Wild (15/8/94 and 24/4/02)

3.6 Service to my Discipline

Journal Reviewing

I am a regular reviewer for a wide range of high ranking/profile international journals including:

Australian Geographical Studies, Coastal Engineering, Continental Shelf Research, Earth Surface Processes and Landforms, Geomorphology, Global and Planetary Change, International Journal of Aquatic Research and Education, International Journal of Injury Control and Safety Promotion, Journal of Coastal Research, Journal of Geophysical Research, Marine Geology, Nature Geoscience, Natural Hazards, New Zealand Geographer, Oceanological Studies, Zeitschrift fur Geomorphologie.

International Research Council Grant Application Reviewer

I have been invited to review research grant applications for:

- Australian Research Council (ARC)
- Natural and Environmental Research Council (NERC - UK)
- National Science Foundation (NSF – USA)
- North Carolina SeaGrant

Conference/Workshop Organisation & Conference Session Chair/Convenor

- Abstract Reviewer and Field Trip Leader for the International Coastal Symposium, Sydney, Australia Mar 6-10, 2016
- Organising Committee 2nd International Rip Current Symposium, Sydney, Australia, Oct 30- Nov 1, 2012

- Organiser and Convenor of 1st Australian Beach Safety Education Workshop, Coffs Harbour, May 14, 2009

Conference and Workshop Keynote Speaker Invitations

- 2017 South Australia Coastal Conference, Adelaide, SA
- 2017 Costa Rica Rip Current Workshop, Jaco Beach, Costa Rica
- 2016 1st Asian Water Safety Symposium, Incheon, Korea
- 2015 University of Otago New Zealand Water Safety Symposium
- 2014 2nd International Rip Current System, Busan, Korea
- 2013 Surf Life Saving Queensland 2013 Conference, Surfers Paradise, QLD '
- 2013 Institute of Australian Geographers Conference, Perth, WA '
- 2010 1st International Rip Current Symposium, Miami, FL, USA '

3.7 Consulting and Expert Witness Experience

2020 Gosford City Police Report on Terrigal Beach Fatality

2020 Waverley Council Report on Bondi Beach Grading

2019 *Expert Witness Report* on William Murray vs Parks Victoria

2017 NSW Police Homicide. Report on Marks Park July 1989 Missing Person Case

2016 Shelly Beach Ocean Pool project – Ballina, NSW

2014 *Expert Witness Report* on Phuket rip current drowning

2006 Senior Coastal Geomorphologist for GHD Pty Ltd, Newcastle

2005 *Expert Witness Report* on Giles Baths, Coogee for Novak Vujanic vs Randwick City Council

2005 *Expert Witness Report* on Wanda Beach for Christopher Dryden vs Sutherland Shire Council

2005 Assessment of the Coco Palm Resort Island Erosion Problem, Maldives

2004 Pacific Coast Partners for *A Geomorphological Assessment of Whale Beach*

2003 Expert Witness for NSW Coroners Court

2002 NSW Police Homicide. Report on Marks Park July 1989 Missing Person Case

1999 Marlborough District Council (MDC), New Zealand. Preparation of : *Natural Hazards of the Marlborough Region*, 55 p.

1996 Waverley Council, Waverley, NSW, Australia. Preparation of: *Report on Site of Tamarama Beach Inspectors' Temporary Observation Building.* 3 p.

1990 BEAK Environmental Consultants, Toronto, Canada. Sampling of battery acid Contamination in an urban environment.