Managing erosion from vessel wash on a reach of the Murray River

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Introduction

Boating on the River Murray has long been an important part of the commerce and recreational lifestyle for many people who live in or visit the Riverina area. The River Murray is one of Australia's most attractive sites for recreational boating activities such as water skiing and wakeboarding, due to its relatively high water level over the warmer months, a result of sustained regulated flow, and its smooth water surface.

The Murray–Darling Basin Authority (MDBA) is responsible for regulating flow along the River Murray to provide water for downstream water users. It is recognised that the significant change in the flow regime due to river regulation contributes to bank erosion between Hume Dam and Lake Mulwala. In response, State and Federal Governments financially contribute to a River Works Program through the MDBA, to mitigate the detrimental geomorphic and ecological impacts of flow regulation in that section of the river. This works program is overseen by the Advisory Group for Hume to Yarrawonga Waterway Management (AGHYWM), which consists of representatives from NSW and Victoria state agencies, local councils and local landholders.

During the last 17 years, more than $25 million has been spent to implement physical bank protection works and to monitor bank erosion along the Hume to Lake Mulwala reach (the reach) in response to the impact of regulated flows. In most bank protection sites, the use of log revetment and revegetation is favoured over rock beaching due to the ecological benefits for habitat and because it allows the river to naturally migrate across the floodplain.

The River Works are generally accepted as an effective means of reducing the accelerated erosion associated with river regulation, stock impacts and vegetation clearance. However, in areas where boating activity is particularly high, vessel wash can undermine the bank protection works, inhibiting their ability to perform as designed. In many instances, this has resulted in the bank protection works requiring repair or replacement. Where vessel wash is not as high, the bank protection works generally continue to perform as designed.

In recent years however some bank protection works, particularly log revetment works, previously installed to mitigate the effects of regulated flow have begun to fail in areas of river identified as experiencing high recreational boat use. For example, in 2010, the works program constructed approximately 800 metres of bank protection works to address actively eroding river banks at Corowa, a high boat traffic area. The technique initially comprised of log revetment and machine placed Common Reed (*Phragmites australis*) rhizomes. This has become the preferred river bank protection work mitigation technique within the reach. The technique is generally effective at addressing erosion caused by river regulation and has an estimated design life of >30 years. However, after only five years the log revetment had effectively failed due to undermining thought to be largely caused by exposure to high levels of vessel wash. In 2016 a further $235,000 was spent to repair the damaged river bank protection works and to reinforce the river banks with rock beaching to protect against boat wash.

The MDBA has received numerous formal and informal representations from a range of stakeholders regarding the impacts of powered boating within the reach over many years. The concerns have mostly focused on vessel wash causing bank erosion and environmental degradation, however safety

and amenity issues have also been raised. In 2010, these representations led the Advisory Group for Hume to Yarrawonga Waterway Management to encourage MDBA to convene a Boating Issues Forum. MDBA hosted this forum as a first step towards achieving a balanced and pragmatic management approach to minimising the effect that powered boating has on the river banks.

While enjoyment of the river by the boating community is encouraged, rivers should be managed for safety, fairness, and with consideration for the environment, in order to avoid a deterioration to both their environmental and recreational qualities and to ensure the river can be enjoyed by everyone for generations to come. To achieve this, a sound management strategy is a necessity for the majority of high-use waters.

Vessel wash enhancing activities

In recent years, the increased popularity of wake-sports has led to significant technological developments in purpose-built wake-sport vessels with higher displacement (>7.5 metres length overall and up to 3 tonnes dry weight) and load carrying capacity (up to 19 people) than the previous generation of ski boats. Many of these vessels have a range of additional wake enhancing accessories including specialised hull design technology, wake gates, hydrofoils and automatic ballast (which can fill tanks on either side of a vessel with >1200 litres of water while the vessel is operating at speed). One new wake enhancing vessel released in 2017 by a popular manufacturer now on Australian waters measures almost 8m in length and has a beam of 2.6m. It weighs 2800kg, carries 350ltrs of fuel, 2500kgs of ballast and seats 18 people.

During slow towing activities, such as wake sports, a vessel is generally operated in a *transitional* mode, where the vessel's hull is between its displacement mode and being on the plane. This mode of operation creates the largest wash. Waves generated during this transitional phase have been recorded to reach 40-50 cm (Asplund, 2000). In recent years, advancements in wake enhancing technology have improved the operational outcomes of these vessels, and it is expected this figure may now be significantly higher. These waves are typically associated with high amplitude and velocity resulting in high energy waves with the greatest potential to impact on the shoreline compared to other forms of recreational boating activity, such as water skiing (Gourlay, 2011).

Furthermore, there has been an increase in large heavy wake enhancing vessels over recent years as a proportion of all vessels. With increasing vessel size there is often an associated increase in the size and energy of vessel wash.

A study conducted by Nanson et.al (1994) found that the maximum wave height is the simplest measure and is associated with a major threshold in erosive energy on unconsolidated sand alluvium at wave heights of 30-35 cm. The study also found that at maximum wave heights above 35 cm all but the most resistant bank sediments erode and that reducing maximum wave heights to below 30 cm (e.g. by limiting slow towing activities) caused a dramatic decline in bank erosion along the river.

Vessel wake waves and erosion

The erosive action of vessel wash is dependent on a range of factors, for example the type and consistency of the soil on the bank, bank profile (shape), presence or absence of vegetation and extent of previous erosion. In some situations, a bank may be inherently stable even in the face of a variety of natural and human-related processes but then be pushed over an erosion threshold by vessel wash. In other cases, vessel wash can act on an already unstable bank face, accelerating rates of erosion. In other instances, vessel wash can help to prevent the re-establishment of a bank already eroded as a result of another factor, by preventing revegetation. It is likely that the full spectrum of scenarios outlined above exists along the identified reach of the River Murray, albeit through a range of mechanisms, making simple characterisation of the issue problematic.

Nonetheless, while vessel wake waves may not in themselves be the primary cause, they can have the ability to exacerbate existing causes of erosion and intensify the effects.

Monitoring

The River Murray Works Program undertakes several different types of erosion and asset monitoring annually within the reach. However, until recently, none of these were specifically set up to monitor the impact of vessel wash. The pertinent types of monitoring include:

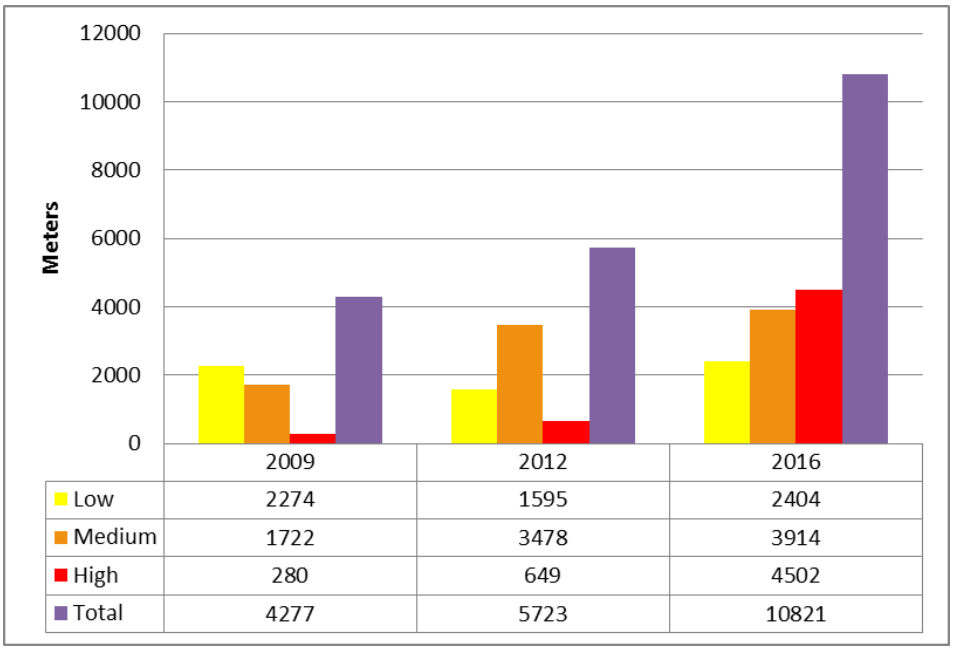
1. Bank condition monitoring – assessing the condition of all banks in the reach;
2. Boat count surveying and erosion pin monitoring – targeted monitoring of boat use and subsequent erosion in the Bundalong/Corowa area.
3. Collection of full-width cross sections and single bank partial cross sections.

It is recognised that additional relevant factors (e.g. sedimentology, vessel wash dynamics and riparian vegetation condition) that are likely to play a role in the relationship between vessel wash and bank erosion have not been assessed in detail as part of this monitoring program.

Bank condition monitoring

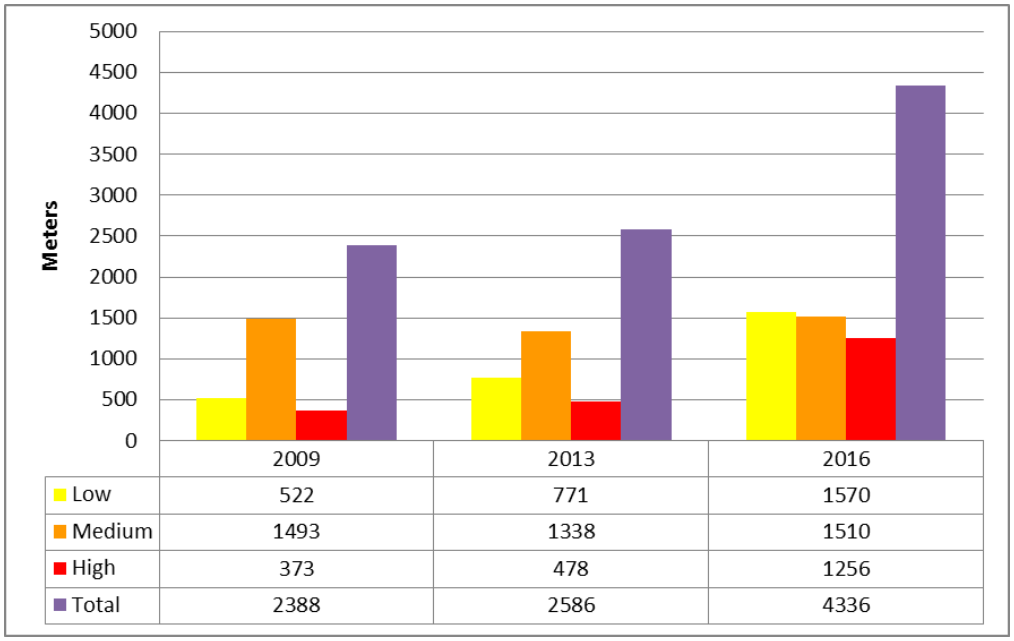
Bank condition assessments are undertaken (by boat) during low flow periods on a bi-annual basis in order to determine both the extent and severity of erosion within the 200 km reach from Hume Dam to Lake Mulwala. The reach is further broken down into 15 manageable sub reaches.

In recent years there has been a significant increase in erosion along sections of two high boat use sub-reaches. Sections of river banks in the Ovens sub reach (Upstream of the Bundalong township) have significantly deteriorated in the past seven years. In 2009, approximately 4.2 km of erosion was identified and only 280 metres of this was classified as ‘high’ severity (Figure 1). However, in 2016 there was more than 10 km of erosion identified in the same section of river with 4.5 km of this categorised as ‘high’ severity. This represents a doubling in extent of all erosion and a 16-fold increase in high severity erosion in this area. The recent increase in erosion is not isolated to the Ovens reach. 17 km upstream of the Ovens reach is the Corowa Common sub reach. This high boat use area also exhibits a similar trend between 2009 and 2016 with significant increase in high severity erosion sites recorded (Figure 2).



	2009	2012	2016
Low	2274	1595	2404
Medium	1722	3478	3914
High	280	649	4502
Total	4277	5723	10821

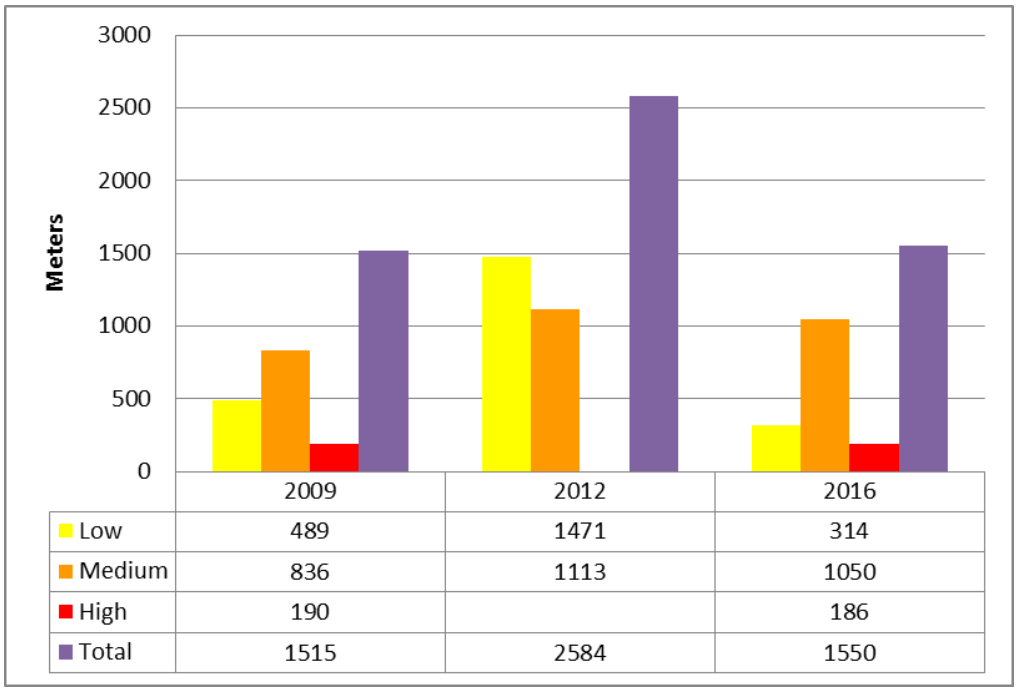
Figure 1. Extent (length in metres) of erosion severity (low, medium and high) identified in the Ovens sub reach of the River Murray (Bundalong area – high boat use area) during bank condition assessments undertaken in 2009, 2012 and 2016.



	2009	2013	2016
Low	522	771	1570
Medium	1493	1338	1510
High	373	478	1256
Total	2388	2586	4336

Figure 2. Extent (length in metres) of erosion severity (low, medium and high) identified in the Corowa Common sub reach of the River Murray (Bundalong area – high boat use area) during bank condition assessments undertaken in 2009, 2013 and 2016.

Conversely, sub-reaches identified as ‘low boat use’ do not exhibit similar accelerated rates of erosion over the same time period. In fact, some low boat use sub-reaches, such as Dights sub-reach, indicate a reduction in total erosion between 2012 and 2016 (Figure 3).



	2009	2012	2016
Low	489	1471	314
Medium	836	1113	1050
High	190		186
Total	1515	2584	1550

Figure 3. Extent (length in metres) of erosion severity (low, medium and high) identified in the Dights sub reach of the River Murray (low boat use area) during bank condition assessments undertaken in 2009, 2012 and 2016.

Boat count surveying and erosion pin monitoring

Six sites were selected for boat count and type of activity monitoring in the Bundalong and Corowa areas of the Murray River. Each site was surveyed on six individual days over the 2017-18 boating season (November to April) to determine the current boat use patterns in areas identified as experiencing accelerated rates of erosion. Boat count surveying consisted of observers categorizing each vessel pass at the survey location based on the vessel type and the activity being undertaken by the vessel. Boat count surveying determined that, over the 2017-18 boating season, 52.3% of vessel passes in the Bundalong area, and 23.2% in the Corowa area, were classified as 'wakeboard' boats. Additionally 20.5% of vessel passes in the Bundalong area, and 7% in the Corowa area, were considered to be undertaking a 'wake enhancing activity' – ie. wakeboarding or wake surfing. Over the surveying period it was determined that the holiday period (January to December) was the busiest period with the majority of boat passes observed at all sites during this time. One survey site, located at the Bundalong boat ramp, observed 507 vessel passes between 10:00am and 6:00pm on the 6th of January 2018, 407 of these vessel passes were identified as 'wakeboard boats'.

In addition to boat count surveying, erosion pin monitoring was undertaken at six separate locations in the Bundalong area. Erosion pin monitoring consists of driving pins perpendicular to the bank face in line below and above water level so that the top of the pin gives a reference point from which changes can be measured (Figure 4). Three erosion pin monitoring sites were adjacent to boat count survey locations, two additional erosion pin monitoring sites were selected nearby. The final erosion pin monitoring site was selected in the Ovens River where wakeboarding, wake surfing and wake enhancing activities are currently prohibited. Erosion pin monitoring was undertaken overnight (low boating activity period) and during the following day (high wake enhancing activity period) when boat count surveys were conducted. Due to logistical constraints erosion pin monitoring overnight and during the day was undertaken only twice during the 2017/2018 boating season.

Figure 4. Erosion pins located at water level, 10cm above water level and 20cm above water level. Note the erosion of 1.1cm behind the middle pin in the photo (located at 10cm above water level).

Erosion pin monitoring undertaken overnight (during low boating activity) showed negligible change, with no erosion recorded at any site. Conversely erosion pin monitoring undertaken during the day identified erosion at all six sites at and above water level. Erosion rates differed at all six sites, however a maximum retreat of 5cm was observed in a notch at water level between the two busiest boat count survey locations.

It is interesting to note that the erosion pin monitoring site located in the Ovens River, where wakeboarding, wake surfing and wake enhancing activities are currently prohibited, observed only minimal erosion (0.2cm) at one erosion pin located 20cm above water level. Neither erosion nor accretion was observed during any other monitoring period at this erosion pin monitoring site.

Erosion pin monitoring and boat count surveying showed no clear causal link between bank erosion and wake-enhancing activities. This is to be expected given the multitude of factors involved in the interaction of vessel wake waves and their interaction with river banks. However, there was a correlation between frequency of wake boarding boats and boats engaged in wake enhancing activities and higher rates of erosion.

Safety and amenity

In addition to environmental impacts, the increase of large displacement vessels capable of producing a large enhanced wake on the River Murray, has also raised significant safety and amenity issues.

The New South Wales Roads and Maritime Service (NSW RMS) is responsible for marine safety, specifically the regulation of commercial and recreational vessels and their operations and the protection of the environment in connection with the use of vessels in NSW waters.

The NSW RMS considers there to be safety and amenity implications related to the increase in numbers of wake-enhancing vessels frequenting the Bundalong and Corowa areas of the Murray River. These implications specifically relate to the impacts on other waterway users such as smaller powered and passive craft. However, the limited data available at present hinders a full appreciation of this aspect of recreational boating in this area.

Management options

In order to reduce the current impact of vessel wash and to ensure that all river users can continue to enjoy the River Murray, the MDBA with support from the Advisory Group Hume to Yarrawonga Waterway Management (AGHYWM) approached the NSW RMS to consider restricting wake enhancing activities along a section of the river south of Corowa to the Ovens River Junction.

As part of the process, RMS and MDBA established a new joint agency management committee. The purpose of the Committee, known as the Murray River Erosion Management Plan Committee (MREMPC), is to advise on the development, implementation and review of a plan to address the impacts of vessel wash along this section of the river.

The Committee oversaw the development of a River Murray (Corowa to Ovens River) Erosion Management Plan (the Plan). The Plan outlined several proposed actions to address the impacts of vessel wash on the reach. The objectives of the proposed management actions in the Plan complement each other. They are to balance the protection of the environmental values of the river and adjacent riparian environments, ii) promote responsible and equitable enjoyment of the river by local communities and tourists, iii) enable growth of local businesses and economies and iv) reduce spending on river bank repair and protection.

The proposed range of management actions were developed using the river bank monitoring data provided by the MDBA, expert Roads and Maritime boating knowledge, strategic management advice and public and stakeholder consultation and feedback.

The main action proposed in the draft Plan would see the restriction of wake enhancing activities from a 32 km reach of the Murray River. This would assist in the protection of remedial river bank works to the value of $2,497,000 that have been implemented to mitigate the impacts of regulation along this section of the river. The proposal recommends other vessels, including water skiing, fishing boats, personal water craft and other powered vessels are allowed to continue to use the river where the current rules permit.

This plan follows similar actions to those implemented along other NSW waterway regions impacted by boat wake issues, including the Clarence River, Tweed River, and the Upper Williams River.

The Plan formed the basis for discussion during a comprehensive stakeholder and community consultation process which was undertaken between 1 December 2017 to 17 March 2018. This was undertaken to ensure the opinions of all key stakeholders and the general community were considered before the Plan is finalised and implemented. Three public information sessions were held which were attended by several hundred people and over three hundred detailed submissions on the proposed plan were received.

The MDBA and RMS are in the process of reviewing the submissions and working with the Committee to review and amend the Plan as necessary following that process. The final actions shall form the key component of the final Plan, and will be implemented on a trial basis. The final Plan will be socialised to key stakeholders and the community prior to implementation.

References

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