

## **The Environmental Impact of increasing Boat access to the Peel- Harvey Estuary with particular reference to the effect of Hull type, draught and displacement.**

By Peter H Forrest. (July 2012)

*This Paper is a detailed expansion of one issue included in- 'Development Alert – A critical independent Review, Peel-Harvey Mandurah Region' (by the same writer) (Nov 2011)\* see Appendix 2 below on page 14. It is not presented as a scientific study but is descriptive in non-technical language, based on observable and easily accessible facts for the purpose of drawing attention to issues that if acted upon, can have an immediate beneficial effect. However failure to act will hasten the already seriously threatened condition of the Estuary.*

### Context.-

The Peel-Harvey Estuary is the most valuable future Tourism and commercial asset to the City of Mandurah, also to the Shires of Murray and Waroona. Its value lies essentially in its unique shallow water and marshland landscape accompanied by rich and varied wildlife. It has been internationally recognised through the Ramsar Treaty as a sanctuary for thousands of rare and some endangered long distance migratory bird species. Its existence is however threatened by some commercial operators and property developers who do not comprehend that the long-term future prosperity of the Region lies in conserving the delicate ecological balance of that landscape.

Part of the problem is their quest for short-term financial gain accompanied by sheer ignorance of the principles of natural landscape evolution and interrelationship of species that is embodied in the principles of natural ecology.

This Estuary is currently therefore at another vital turning point in its history, being faced not only with heavy population growth pressures associated with low-density urban sprawl southward from the Perth metropolis; some increase in salinity and associated man-made pollution, but by largely unmanaged laissez faire recreational uses. One of these uses, leisure boating, is rapidly becoming unknowingly destructive of the very environment people seek to access.

It is noted that the Department of Transport is preparing in 2012/13 to review the Aquatic Use Plan for the Peel Area, also that major urban development is currently proposed that would permit access by larger power-boats to the Estuary. This Paper is intended as both,-

- a) An independent **contribution to that Aquatic Use Review** and also -
- b) A further Alert offered to the **WA Government and Environmental Protection Authority** about increasing risks associated with **substantial new aquatically linked urban development**

being proposed by the WAPC and Property Developers around the Estuary that will have some severe environmental impacts, with as yet unplanned and apparently unforeseen implications.

### Essential Characteristics of the Peel-Harvey Estuary.

This Estuary comprises a very large area of enclosed and sheltered water that appears at first sight to the uninitiated recreational boat user as an attractive water sport 'playground'.

In fact, for power boating it is **just not that at all**, because it is **extremely shallow throughout and a large proportion unsuitable for free-range exploration by power boat**.

Most initial water users approaching this Estuary are quite unaware of the local conditions and natural environmental features. First time tourist and visiting power-boat users would most likely rely totally on signage at ramps and visible markers. A large proportion may not be aware before arriving at a ramp that they would need **both** the current **Boating Guide (Mandurah Inland Waters) leaflet and the Navigation Chart** for this Estuary, but would probably not know where to readily obtain them at short notice – that is even though they would have understood navigation marker meaning through their 'Captains Ticket'. They would therefore have to rely on any signage and information posted at the local point of entry. (According to the Department of Transport, apparently for legal reasons the **current Boating Guide** does not show depth soundings.)

In fact existing signage with descriptive cautions and explanations about the Estuary on Boat Ramps, appropriate channel markers and proper exclusions from islands and wild life reserves is at present miserably inadequate.

**These that can be found are poorly presented visually, rudimentary, give very little information and are quite inadequate to adequately grab the attention of recreational users.**

Taking the boat ramps along the north west rim of the Estuary as an example.- from **Dawesville to Mandurah** (see photos attached) no areas of especially shallow water are notified. Speed cautions are only inferred by yellow patches designating areas for water ski-ing. The only noticeable environmentally-related signage has been placed by Fisheries Dept. and concerns crabbing limits and seasons. Descriptive environmental information is only present on one ramp, but that is marginally informative, faded and visually insignificant.

**The current result is that the characteristics of the Estuary are not understood; frequent groundings occur; shoreline and waterbed damage has followed; the ecological balance of fringe and waterbed natural wild-life habitat is currently being disturbed at all levels of the food chain and avoidable decline in all aspects of the Estuary is accelerating today as power-boat ownership increases.**

There is therefore an urgent need for a **new round of investigative collaboration** between the WA Department of Transport (Marine Division) and the WA Department of Environment and Conservation with regard to **Navigational routes** and **Access** to assist both users and genuine conservation of resources. This should be arranged in cooperatively with the **Local Authorities that have sections of the Estuary within their jurisdiction**. (Environmental information at water access points is in any case an invaluable aspect of Tourism promotion). Presentation should be attractively educational; professionally designed to command attention; properly located; regularly inspected and maintained.

**The water bed and fringe vegetation damage problem is not necessarily willful on the part of users, but ignorance certainly plays a major role.**

**It is therefore Recommended that new Directive signage to re-define limitations on types of craft permissible be put in place on all boat ramps. Exclusion zones should be researched and redefined, indicating areas unsuitable for boat use. All existing Navigation routes should be re-considered and re-aligned as appropriate to maintain better controlled access.**

These actions will contribute significantly to reducing the current negative environmental effects of power-boat access and therefore the long-term ecological survival of this RAMSAR TREATY internationally recognized valuable and unique Estuary, for a wide range of tourism and recreational uses.

#### Some general descriptive facts about the Estuary.-

This is a large body of water that drains a vast almost flat land plain to the West of the Darling Scarp. That drainage, being from up to 50Kms north towards Perth, via the Serpentine River system and from the east via the Murray River. – Both feed into the Peel Inlet portion that is approx. 10km in diameter. Also land drains from the south via the Harvey River into the longer and narrower Harvey Estuary, that is approx. 20km long and 2 to 3kms wide.

Both portions of the Estuary are linked together at a 90 degree angle in vicinity of Dawesville. Overall the Estuary is land-locked by intermittently and naturally sedimenting connections to the Indian Ocean - at the natural entry to the Ocean at Mandurah and by the recent man-made 1.3km Dawesville Cut. Both connections are kept open by frequent dredging of sand-bars at entry to the Indian Ocean, but salinity is noticeably increasing with this greater exposure to the Ocean and gradually rising sea-levels..

On-going sedimentation of the Estuary results from both the natural Influx of sediment from the inland catchment and the external sand bars reducing outflow that result from sand-drift northward along the Ocean shoreline. Evidence shows natural silting is in fact progressively continuing to further reduce the depth.

The Estuary overall is deceptively shallow. According to the most recent official surveyed Navigation Chart the deepest areas at low water throughout the Peel Inlet are only approx. 1.4 metres and the Mandurah entry 'Sticks Channel' is dredged to that same level. The Harvey Estuary section is similar in depth and even at the connection between the two sections around Point Grey adjacent to the excavated Dawesville Cut, only a very short section totaling approx. 0.7 kms of the 2.5km crossover is that depth, the remainder being less than 1.4 meters deep.

#### Shoreline Vegetation.-

The natural shoreline fringe of this very shallow water is typically outer Reed-beds grading into Samphire and then into low bush with low, mainly Paperbark trees. A large area to the north close to Mandurah known as the Creery Wetland Reserve is intermittently flooding low and predominantly Samphire vegetation, with an inner Reed-bed fringe. Some areas of exceptionally shallow fringe have formed into inaccessible lagoons, especially in the vicinity of the Len Howard Reserve on the north western edge of the Peel Inlet section. These, together with exposed waterbed on the fringe of the few very shallow islands during tidal and annual water level fluctuations, are essential foraging zones for thousands of migrating water-birds required to be protected by the legally enforceable Ramsar Treaty.

The fringing Reed-beds and the lower vegetation are natural breeding and refuge habitat for thousands of smaller water-birds. There are several very shallow islands in the Peel Inlet close to Mandurah that have been formed, or raised in profile, by spoil dumping over several decades from channel excavation. These, due to natural acidity of subsurface spoil have less fringe Reed vegetation. Some areas close to Mandurah show mixed sand and shells deposits that have been excavated from more saline waterbed deposits during excavation to construct canals and channel dredging in that locality.

#### Causes /Avoidable damage ?

Some stretches of Estuary Fringe, especially along the Western Shoreline today have the appearance of a natural sandy shoreline. However, (\*ref. notwithstanding ancient Chenier formations with receding ocean) this is in fact substantially the result of bow-wave wash erosion over a comparatively short and recent time-scale by power-boat use. (see photo illustrations pp 8-12)

The natural Reed bed fringe has in fact been washed away and the higher sandy land behind it exposed after destruction of the reed-bed fringe.

The erosion of sand fringe poses perhaps less of a problem in the body of the Harvey Estuary due to restricted power-boat use that is enforced by lack of depth over a wide area (and currently limited close road access). However this shoreline erosion poses a major current and future problem generally in the Peel Inlet in the vicinity of Point Grey, where uncontrolled power-boat use is increasing at a substantial rate due to major encroachment of urban

development. (The effects of severe power-boat shoreline erosion can be seen/ inspected easily in the immediate vicinity of Mandurah Quay, discussed below)

One of the most obvious and accessible areas to inspect this fringe deterioration caused by power-boat use, is close to Mandurah Quay between the Len Howard Water-bird Conservation Park and the location of the newly erected Aqueous Apartments. This is where the dredged Sticks Channel passes very close to the shore and a narrow off-shoot channel currently allows access via a navigationally marked channel very close to the fringe along to the fairly shallow Mandurah Quay Marina entry.

Close inspection will readily reveal hardened areas of black 'mud' with remnants of old reed roots in them, amongst the sand fringe and now exposed tree roots and undermined fallen trees. This now hardened black mud having been exposed to air, was in fact the natural bed material of much of the Estuary (formed over millennia). Areas of shoreline previously covered by reed-bed in this locality have been washed away only relatively recently. However, sampling almost anywhere in the bed of the Estuary reveals that underneath a very thin layer of sandy mud, a very thick black anaerobic 'mud' or 'ooze' exists and that is the primary source of acidity that occurs in excavated material.

In the case of the example quoted adjacent to Mandurah Quay, there is no doubt whatsoever that the major fringe erosion is continuing and rapid, visibly caused by frequent power boat transit immediately adjacent. This is causing substantial loss of natural shoreline and water-bird habitat and is now very difficult to halt unless this navigable channel is closed and boats kept further out from the water-edge using the Sticks Channel - before, if required, entering or exiting from the Mandurah Quay Marina a short distance away but around the low island opposite the Marina (Recommended).

Limestone rocks have been recently tipped in to form short groins perpendicular to the shoreline in this vicinity but these have been largely ineffective and simply resist some surface sand drift, but are not halting the continuing erosion between them because the prevailing wind is from one direction and boat bow-wave wash from the other. (Groins typically form slower rotating water eddies, on the downwind or side opposite to water drift that then allow solid particles to settle out, but the effect is minimal unless both wind and water flow are consistently from one major direction).

Apart from the substantial progressive shrinkage of water-bird habitat that will certainly continue to occur as a result of this additional boat-use; damage to fringe shoreline (contrary to RAMSAR Treaty obligations), all around the Estuary will require substantially wider setbacks that hitherto contemplated. That is even notwithstanding sea level rises that some scientists are predicting as being likely to occur in the future due to warming world climate.

This pattern of shoreline damage as described above could undoubtedly be repeated in the vicinity of Point Grey and Dawesville, but in that case more dramatically because the deepening

channel proposed to be dredged in the waterbed across from the Dawesville Cut is expressly for the purpose of permitting larger ocean-capable boats to access a marina that is proposed to be cut deeply into the land above water level at Point Grey.

#### Boat Characteristics that cause shore-line fringe damage to this Estuary.-

Very few power boats used on this Estuary have a low speed 'displacement' (non-planing) hull formation where the depth of the keel remains more or less constant and horizontal relative to the water surface across their whole speed range capability.

Almost all have 'planing' hull form with variable lateral 'dead-rise' with a deep vee water entry at the bow and broad low shallow-vee at the stern. This type of hull when stationary and at very low speed, of say less than 4 knots runs almost horizontally and moves water sideways almost like a displacement hull but leaving a turbulent wake. However when motive power is increased and forward speed rises, the bow lifts appreciably and much more water is displaced sideways. This gets more violent as speed rises up to the point where the flatter stern of the hull begins to rise and then the whole craft becomes more level as it speeds over the surface. This transition occurs at what is called 'planing' speed.

Larger Ocean-capable or 'blue water' power craft have a deep-vee bow design to cut through waves and lessen the pitching effect. At low non-planing speeds these craft with greater weight (heavy displacement) move large amounts of water sideways and produce a large 'bow wave' that rolls out away from the craft laterally and in a multiple pattern of parallel waves towards the shore. These moderate in height only slowly, as the energy dissipates.

Large power craft with planing hulls thus tend to cause more shore damage than wind driven waves especially when driven parallel to the shoreline.

The other feature causing shoreline damage is during the speed transition phase when the boat is either approaching planing speed or dropping down from planing speed. During this phase the bow wave is at a maximum, the maximum of water is displaced violently sideways and the deck or keel angle to the horizontal can be up to say 15 degrees. Furthermore, many of these boats have a high power to weight ratio and when the 'throttles are opened' and forward power is applied they momentarily 'pump' a large 'hole' in the water and the stern sinks into it well below the normal surrounding water-level. The thrust of the propellers then causes a large volume of sub-surface water to be displaced at a steep downward angle to the horizontal and substantial waterbed scouring can occur in relatively shallow water over a considerable area. (Many areas of this Estuary today actually show the effect of this scouring as well as visible propeller marks on the waterbed – for example close to the entry to Mandurah Quay.)

Yet another factor is the recent tendency for large outboard motors to be mounted externally outward of the stern rather than as traditionally, on the transom. (This has benefits of speed/economy by allowing the motors to operate in water less disturbed by the hull, etc.) However, it also has the effect of steepening the planing transitional angle due to moving the centre of gravity of the craft rearward.

The combined effects of hull type, overall length and displacement and boat speed need to be carefully re-assessed/ researched against the following specific characteristics of this Estuary. – i.e. fragility of shorelines, disturbance of (benthic) waterbed wild-life habitat, food-chain dependencies and long term ecological sustainability.

Considering the characteristics of power boats outlined above, it is obvious that new practical limits must be set for operation in the shallow water of the Peel-Harvey Estuary. Despite superficial appearances, this Estuary is today exceptionally vulnerable to deterioration of its ecosystems and will easily be destroyed altogether for Recreational Boating and Tourism - if not better understood by the boating public and properly managed by the responsible Government instrumentalities.

**It is Recommended that:-**

- a) A new limit be set for both keel and skeg at a maximum draught of one metre.**
- b) Speed limits be re-set for power-boats of all types and sizes as appropriate to avoid all potential water-bed and shoreline damage.**
- c) Navigation channels be altered to keep power boats further away from shorelines.**
- d) Areas of roaming access be re-designated throughout the Estuary to exclude all types of craft that may cause water-bed (benthic) damage.**
- e) Dredging be legally prohibited throughout, within the Estuary in any area that will fracture the existing sand overlay to disturb the black 'ooze' material underlying it.**

Otherwise it is obvious shoreline damage will increase. Waterbed damage will also become more frequent and widespread. The black 'ooze' that is ever present, close to the surface of the waterbed, will be extensively stirred and re-distributed over a wide area and will cause permanent loss of 'benthic' habitat essential to maintain the ecological balance of the Estuary as a whole. (Note: This damage has already occurred and is accelerating)

Local empirical experiments with this ooze have shown that if stirred it goes into long term suspension and can alter habitat by excluding sunlight for long periods of time. Vacuum excavation of waterbed in areas where this ooze is present (which almost everywhere in the Estuary away from the saltwater entry points) should therefore be prohibited; and in any case technically will contravene the Ramsar Treaty conditions.

The Marine Section of the Department of Transport, following a recent Review of Boat use on the Swan River has already concluded that the current 8km/hr speed limit (that also applies to sections of the Peel-Harvey Estuary) is "the worst possible speed for wake production" and proposes to change that. However, in the case of this Estuary the situation is much more critical due to the much more uniform shallow depth and intense traffic in very narrow channels. It is also impossible to control short-term speeding up and slowing down to avoid other craft in these channels with a maximum dredged depth at low water of only 1.4 meters. Clearly the

conclusion, if Boat use is to be prevented from environmentally damaging the Estuary, must be the imposition of more and general exclusions.

Recreational Visitors spend large sums of money on power-boats often initially in complete ignorance of how unsuitable this Estuary is for free roaming high speed boating. The Departments of Transport, Environment and Conservation and the Local Authorities together all have a moral duty to protect the Estuary from further decline by inappropriate uses as well as to publicise and educate much more extensively by all available means the environmental qualities and fragility of this Estuary.

## Appendix 1.

### Illustrations:

The following photographs illustrate the progressive damage that has already occurred to the shoreline fringe vegetation of the Peel-Harvey Estuary mainly through increasing power boat access.

Frame 1



This is a typical example of the original reed bed fringe, backed by low scrub and then trees – that surrounds the Peel-Harvey Estuary - in areas where power boats have **not** been able to get close to the shore-line (and exposure to increasing salinity has not yet taken effect).

Frame 2.



This shoreline was previously and originally exactly similar to the previous photograph (Mandurah Quay shoreline). Note the reed bed has now been wiped out completely by repeated wash from power boat use in the adjacent channel (and the locally increased salinity).

The thin sand covering through which low samphire was also previously growing behind the reed bed has also been washed away. Note the black mud on the left that was under the thin sand foundation of the reed bed (this combination extends throughout the Estuary) has also been broken through then exposed and hardened by exposure to air and sun.

The remaining low scrub vegetation mixed with some taller mature Samphire, is now under attack. With the reed bed and the low Samphire gone, the foreshore has been destroyed now as far back as very close to the tree line.

Frame 3.



Mandurah Quay shoreline again (location close to Frame 3 above) – note the channel markers indicating very close proximity of the inshore branch from the Sticks Channel and the wave-wash from only a small 5metre power boat that has just passed by, probably observing the current 8 knot speed limit.

These waves are multiplied in height and intensity according to increased size and displacement of power boats allowed to enter.

The low breaking waves seen behind and adjacent to this inner channel, indicate zero water depth very close to the line of the southern end of the current Sticks Channel. Already in summer season some 40 power boats of various sizes, pass this vicinity per hour and cause massive water turbulence over a wide area of the shallow water-bed, as well as multiple wave erosion on the shoreline.

Frame 4.



More of e.g. Mandurah Quay shoreline showing gross erosion through power-boat proximity.

Frame 5.



In this photograph the fringe vegetation has been obliterated altogether back to and even through the remaining tree line.

This example shows the Peel-Harvey Estuary fringe where power boats are permitted to pass relatively close to the shoreline (this foreshore is adjacent to the Sticks Channel, that is dredged to 1.4 metres i.e. 1.4 metres is the general low water depth of the Estuary).

Note that repeated Boat wash has torn up the reed bed and also washed away large quantities of the thin sand cover then removed the low scrub and then undermining fringe trees altogether. – Note the remnants of the black mud that was previously covered by reeds is now exposed and hardening with exposure to the air and sun.

If power boat use is allowed to continue increasing at the present rate and even larger boats are permitted to enter (as proposed close to Point Grey) this drastic erosion of shoreline (that is also being exacerbated by increased salinity) - complete removal of the smaller water-bird

habitat will become typical and is completely unacceptable in the Peel-Harvey Estuary and connected waterways.

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## Appendix 2.

Extract referred to at the commencement of this paper: *“Development Alert – A critical independent Review, Peel-Harvey Mandurah Region’ on page 16 (this same writer)”*

“ The **Department of Transport**, being responsible state-wide for licensing of water craft, navigational restriction and signage is **indirectly responsible for allowing further deterioration** of the delicate Estuary ecosystem and likely infringing Ramsar legislation.- It has e.g. permitted the licensing and use of up to 5 air-propeller driven ‘swamp craft’ on the Estuary. These have been observed driven at high speed directly over Samphire reserves through flocks of water-birds, well outside of any navigable channel. **Secondly** it has failed to regularly up-date, survey and delineate the few navigable channels to avoid damage to benthic (waterbed) habitat. **Thirdly** it has not (in conjunction with DEC) marked shallow islands used for water-bird nesting as prohibited landing zones and has not placed signs on slipways explaining the limits of navigable water and reasons for exclusion. **Fourthly** it has not apparently consulted with Environmental Agencies for practical advice concerning speed limits in navigable channels most of which are marginally suitable for even medium sized inshore deep-keel powered watercraft. Bearing in mind the shallowness throughout, and future sustainable water use objectives it is **RECOMMENDED (11) that - all boats with a keel or skeg depth exceeding one metre, be now excluded altogether from the Estuary** to avoid disturbing the waterbed that maintains a profusion of ecologically essential water- creatures. This is especially important as the expansion of surrounding residential development increases the volume of recreational pressure on the Estuary.”

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