

Successful fish habitat protection and rehabilitation projects: case studies without a funding application in sight

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Abstract

Degradation of fish habitat limits the resilience of coastal ecosystems and impacts on the community's use and enjoyment of the coastal zone. Consequently there is broad acceptance of the need for Government funding sources, such as the Catchment Action NSW, Environmental Trust or funds from the NSW Recreational Fishing Trust be directed toward rehabilitation projects to address this degradation. However, maintaining and re-establishing resilience within the coastal zone also requires the use of other tools to improve the effectiveness of rehabilitation outcomes.

Some development and land use change can be a catalyst to address a legacy of poor past practice and thereby contribute to an improvement in the resilience of coastal aquatic ecosystems on the NSW North Coast.

Over the last ten years on the North Coast of NSW many fish habitat rehabilitation works have been initiated and successfully completed using development as a catalyst and without relying on 'government environment funding'. Several case studies from this work are presented to highlight the range of approaches that can be used to initiate rehabilitation activities. These include:

- Negotiating targeted rehabilitation planning into development proposals;
- Use of approval conditions to require impacts of development to be offset via either establishment and management of compensatory habitats or positive permanent actions such as removal of orphan infrastructure;
- Use of Court or Ministerial remediation orders, and
- Legislative and policy change.

Use of these different triggers for initiating rehabilitation outcomes generally involves working with different groups to those targeted by traditional 'government environment funding'. However, the skills and project management based approach remains essential to achieve on ground environmental outcomes regardless of the funding source.

Introduction

Degraded fish habitat on the NSW North Coast

Many fish habitats on the North Coast of NSW are degraded. The area of coastal saltmarsh plant communities in estuaries between Tweed Heads and Evans Head has halved since the 1940s (Saintilan & Williams, 2000, Russell, 2005). Saltmarsh has since been declared an endangered ecological community (NSW Scientific Committee, 2004_a) along with the hydrologically linked Swamp Oak Floodplain Forest (NSW Scientific Committee, 2004_b). Despite considerable inter-decadal variability, (Rogers *et al.* 2003) the area of seagrass is considered to be in decline (Russell, 2005).

More than 50% of the North Coast's 204 subcatchments in the North Coast Stressed Rivers Assessment were identified as having *high environmental stress* (DLWC, 1999₁ and 1999₂).

Fish passage within North Coast waterways is fractured by over 524 known road crossing barriers (NSW DPI, 2006), some 100 plus weirs and over 700 floodgates when including the Manning catchment (Walsh *et al.*, 2002).

Drainage of floodplain wetlands via installation and operation of floodgates on natural creeks and constructed drainage canals is a primary factor in changes to the hydraulic regime on the coastal floodplain (Johnston, 2003). The impacts on aquatic ecosystems of draining acid sulphate soils are well documented (Johnston, 2003, Kroon *et al.*, 2004). Less acknowledged amongst the broader community is the long-term impact of chronic acid drainage, which does not necessarily cause major fish kills, but may affect the successful recruitment of many species (Kroon *et al.*, 2004).

The subsequent growth of dryland vegetation over drained floodplain wetlands exacerbates the frequency and intensity of very large fish kills as, intolerant to flooding, the dryland vegetation rots and strips oxygen from overlying floodwaters (DPI, 2009). Operating at a more localised scale, the release of Monosulphatic Black Ooze associated with flushing of drains also contributes to the consumption of available oxygen within the water column (Bush, 2004).

With regard to the Tweed and Brunswick catchments Lampert *et al.* (1999) found the tidal reaches to have been significantly impacted through loss of riparian vegetation. Immediately upstream of the tidal reach, the 'meandering fine grained' Riverstyle of both the Tweed and Richmond were found to exhibit bank erosion and poor bed structure (Lampert *et al.*, 1999). These impacts are common to most North Coast rivers.

Resourcing the change

The 2007-08 Annual Report for the Northern Rivers Catchment Management Authority (NRCMA) reports that "since 2002 an estimated \$59 million had been invested by the NSW and Australian Governments, and third parties such as local government and utility managers, in the delivery of NRM outcomes in the Northern Rivers region" (NRCMA, 2008).

The budget for the NRCMA (comprising Catchment Action NSW and Commonwealth Caring for Our Country grants) has steady risen over the last three years:
2008-09 \$7.3 million;
2009-10 \$7.7 million; and
2010-11 \$9 million (pers comm. Peter Boyd).

These funds, when applied to projects generally are leveraged (attract additional funding) at a rate of approximately 4:1 (NRCMA, 2008).

Some of the funds leveraged by the CMA were from the NSW Recreational Fishing Trust Habitat Rehabilitation grants which commenced with a two year, \$120,000 trial of projects in the Clarence estuary during 2002-2004 (Recreational Fishing Trusts, 2006). Each year since 2008-09, the Recreational Fishing Trust Habitat Rehabilitation grants have provided \$400,000 to funded coastal projects (pers comm. Charlotte Jenkins).

The NSW Environmental Trust (ET), an independent statutory body established by the NSW government is another significant source of funding. The ET supports

exceptional environmental projects that do not receive funds from the usual government sources and had a 2011 budget of \$6.65 Million.

Environmental levees and other specific charges paid in some local government areas on the NSW North Coast. Councils work alone or with other partners to address environmental degradation.

LGA	Env Levy	Stormwater Levy	On-site system (septic) mgt charge / yr
Tweed	no	no	\$31.50
Byron	no	no	no
Ballina	no	no	\$25
Lismore	no (waste levy \$33)	\$25 residential houses in urban Area based \$25 / 350m ²	\$34.50
Richmond Valley	no	no	\$35
Coffs	Base rate \$18.50 Plus 0.0000977c based on value of property	\$25 urban zoned areas	\$25 low risk zone \$50 med risk zone \$150 high risk zone
Bellingen	no	no	\$120 (charged at time of inspection approx every 4-5yrs)
Nambucca	\$35 (seeking extension of 5yr trial)	no	\$131 inspection fee. Class 1 locations inspected yearly, Class 2 inspected every 3 yrs Class 3 inspected every 7yrs
Kempsey	\$37 (not itemised on rates notice) commenced at \$30 & increases \$1/yr	no	\$50
Port Macquarie	Long established \$19.70 rises with CPI	\$25 residential houses & \$12.50 for strata in urban areas \$25 - \$500 depending on sq metre area for businesses in urban areas	\$33.10

Table 1: Specific levies and charges to fund environmental management activities undertaken by various North Coast councils.

Over the last ten years many excellent outcomes have been achieved with this money however there is still more to do – how do we effect this change and ensure these funds are achieve the best outcomes?

Change is already happening

The coastal zone generally and the North Coast in particular are high growth centres. The Regional Strategy Update Report (Department of Planning 2009) reports population growth of 1.56% on the North Coast (Richmond Valley to Tweed LGAs) and 1.21% on the Mid North Coast (Great Lakes to Clarence Valley LGAs).

Councils between Port Macquarie Hastings to the Tweed approved 6362 development applications worth \$1.1 billion dollars in the 2009-10 financial year (NSW Department of Planning 2011₁). DPI Fisheries were referred 38 of these development applications as they triggered sections of the *Fisheries Management Act 1994*. DPI Fisheries provided input on nine major project (EP&A Act Part 3A) applications that were managed by the then Department of Planning.

Some development and land use change can be a catalyst to address a legacy of poor past practice and thereby contribute to an improvement in the resilience of coastal aquatic ecosystems on the NSW North Coast. Conditions of approval by DPI Fisheries for some of the development applications referred during 2009-10 resulted in the construction of fish friendly crossings, removal of fish barriers, mangrove and saltmarsh rehabilitation, re-establishment of riparian vegetation and the incorporation of buffers to aquatic habitat into the layout of urban subdivisions. All of which were unlikely to have been undertaken without the 'encouragement' of legislative processes.

The case studies that follow detail how the following range of approaches can be used to encourage rehabilitate aquatic habitats by:

- Negotiating targeted rehabilitation into development proposals;
- Setting conditions of approval to offset impacts with compensatory habitats or positive permanent actions such as removal of orphan infrastructure;
- Use of Court or Ministerial remediation orders, and
- Legislative and policy change.

Case studies

Case Study 1: Negotiating targeted rehabilitation into development proposals

A proposal for a 62 lot subdivision was received for comment under 3A of the *Environmental Planning and Assessment Act 1979*. The layout of the subdivision, depicted in Plate 1A, afforded a small riparian buffer to Bilambil Creek. However, the buffer was compromised by the subdivision layout as private lots backed onto the proposed reserve. 'Privatisation' of the public land by adjacent landowners and dumping of garden refuse are two common problems that often arise.

DPI Fisheries' submission noted that the initial proposed layout limited the ability to effectively rehabilitate the riparian zone as part of the development proposal currently or into the future. DPI Fisheries highlighted that the Coastal Design Guidelines (NSW Coastal Council, 2003) and DPI Fisheries Policy and Guidelines (Smith & Pollard, 1999) were widely available reference documents that provided a clear example of best management practice regarding the establishment of buffers to waterways. The proximity of Priority Oyster Aquaculture Areas and the special protection afforded these areas (SEPP 62) was also raised to further demonstrate the wider benefits of a subdivision layout more in line with the Coastal Design Guidelines.

The comments made by DPI Fisheries on the subdivision layout were reinforced by Tweed Shire Council, the Department of Planning, Department of Lands and the Department of Environment and Climate Change.

Further liaison between Tweed Shire Council staff, Department of Planning and the developer resulted in an improved proposal with 52 residential lots depicted in Plate 1B. The final proposal for 49 residential lots was approved on 8 July 2010.



The aquatic habitat outcome that was achieved primarily relates to the new road defining the public open space and the river frontage being dedicated into public ownership. The improved layout provides a better opportunity for improved ecological links along the waterway to be established. An initial riparian planting was required of the developer as a condition of consent.

Case Study 2: Conditions of approval to off-set aquatic habitat loss

DPI Fisheries consider 'environmental compensation or off-sets' to be the creation or enhancement of aquatic habitats in order to compensate for anticipated adverse or actual environmental effects of proposed developments' (Smith & Pollard, 1999). DPI Fisheries calculates environmental compensation at a ratio of 2:1 (Smith & Pollard, 1999).

In December 2000 DPI Fisheries issued Tweed Shire Council a Part 7 Fisheries Permit to undertake dredging and reclamation, and to harm marine vegetation associated with the construction of Black Rocks Bridge over Mooball Creek, Pottsville. The site for the Black Rocks residential subdivision and the Black Rocks Bridge at Pottsville was originally used for cattle grazing. A condition of the permit was that a compensation plan be prepared for the loss of 30m² of saltmarsh, 20m² mangroves and 20m² seagrass at a ratio of 2:1.

Compensatory plans were prepared by Tweed Shire Council (Tweed Shire Council, 2003_a, 2003_b, 2003_c) and agreed to by DPI Fisheries in September 2002. Bridge construction occurred between November 2002 and August 2003. The three compensatory projects were assessed a year after the completion of the rehabilitation works and considered successful (Cranney, 2005_a 2005_b 2005_c). Appendix 1 outlines, using extracts from the various plans how the loss of 30m² of saltmarsh was compensated with permanent enhancement of a 60m² area and the 20m² of

mangroves off-set by the creation of 190m² area. Works to improve the quality of seagrass within Wommin Lagoon resulted in a 2042m² increase in seagrass (Tweed Shire Council, 2003_a, 2003_b, 2003_c and Cranney, 2005_a 2005_b 2005_c). DPI Fisheries do not support proposals to compensate the loss of seagrass via transplant due to limited success (Ganassin & Gibbs, 2008).

Some of the increase in coverage and density can be attributed to the season in which sampling was undertaken. In nearby Cudgen Creek Bucher (2006) found the overall mean seagrass leaf extension rate during a two year study period to be 2.13cm/day with growth rates highest during spring. The surveys did find an increase in the area of seagrass and so the work is largely considered a success.

Case Study 3: Use of a court or Ministerial order

The offence

During late 2008 DPI Fisheries staff identified a newly constructed earthen track measuring 99 metre, 5 metre wide, 0.5 metre high and intersecting a mangrove wetland. Construction of the track would have triggered three approval requirements under the *Fisheries Management Act 1994*, specifically:

- Section 201(1) of the Act by undertaking the reclamation of a wetland;
- Section 205(2) of the Act by causing harm marine vegetation (mangroves), and
- Section 219(1) c of the Act by creating an obstruction across or around a flat so that the free passage of fish was or could have been obstructed

DPI Fisheries policies would not approve a proposal for the works that the landholder undertook.

Compliance investigations were undertaken including the preparation of a statement outlining the impact of the works on key fish habitats. The matter proceeded to the local court where the landowner pleaded guilty in February 2011. While the maximum fine for a dredge and reclamation and harm marine vegetation offences by an individual is \$110,000. The local court is limited to imposing a fine of \$10,000 for each offence.

DPI Fisheries requested the court delayed sentencing for three months and order that the site be remediated. It was the courts intention that during that time the landholder would work together with DPI Fisheries and undertake actions to satisfy the court ordered remediation.

The rehabilitation

The court's rehabilitation order required the following works be completed:

- A 60m length of the 5 metre wide earthen track located in the wetland be removed to natural ground level;
- The 60 x 5 metre wide area (300m²) area be planted out with native endemic wetland plant species and maintained for 5yrs by an appropriately qualified bush regenerator;
- The 1,100m² wetland area isolated from tidal inundation by the earthen road be weeded and maintained for 5yrs by an appropriately qualified bush regenerator;
- A stock proof fence be installed around the wetland; and

- Stockpiles of rock and earth located on public land within and adjacent to the wetland be removed.

Ensuring that works were undertaken with relevant approvals was an important factor for DPI Fisheries, whilst satisfying the three month window until sentencing was an important motivator for the landholder.

The content of the rehabilitation order was crafted to focus on physical works. Removal of the road barrier was critical as it blocked tidal inundation. Returning tidal inundation was needed to facilitate natural recruitment of mangroves and other wetland plants from the adjacent areas and arrest the incursion of weeds into the area. Furthermore, these works and the construction of the fence could realistically be undertaken within the three month period structure of the order. Establishment and signing of a contract with a qualified bush regenerator, consistent with the court's rehabilitation order, was another action possible to complete within the three month window.

Obtaining relevant approvals within the three month window was challenging as some of the works undertaken by the landholder had been undertaken on Crown land and land owned by an absentee landowner. Obtaining landholder's consent for rehabilitation works necessitated writing to the landholders explaining firstly that the offence that had taken place, secondly that the court had ordered specific action and thirdly how this work was to be managed. The letters which were jointly signed by DPI Fisheries and the landholder who had committed the offences. The letters included a construction and environmental management plan prepared by DPI Fisheries which explaining the proposed works and the environmental protection measures to be used and who was responsible for ensuring that they were undertaken effectively. Landholder's consent was obtained and a commitment made to continue to inform these landholder's of the rehabilitation as it progressed.

Plate 5 an annotated aerial view of the wetland and the road incursion identifies some of the remediation works to be undertaken.

Sentencing

Sentencing occurred in May 2011. DPI Fisheries provided a statement outlining the works that had been undertaken and the landholder provided receipts demonstrating costs approximating \$20,000. In passing sentence, the magistrate found that the defendant's contrition and remorse were demonstrated by his attempts to return the land to its original condition. He found that there were negligible prospects of the defendant re-offending and that he had good prospects of rehabilitation

The landholder was fined \$1,000 for each of the three offences along with \$79 court costs. The magistrate made a further remediation order to ensure that the ongoing weeding and care of the site by the qualified bush regenerator would occur for the required five years.

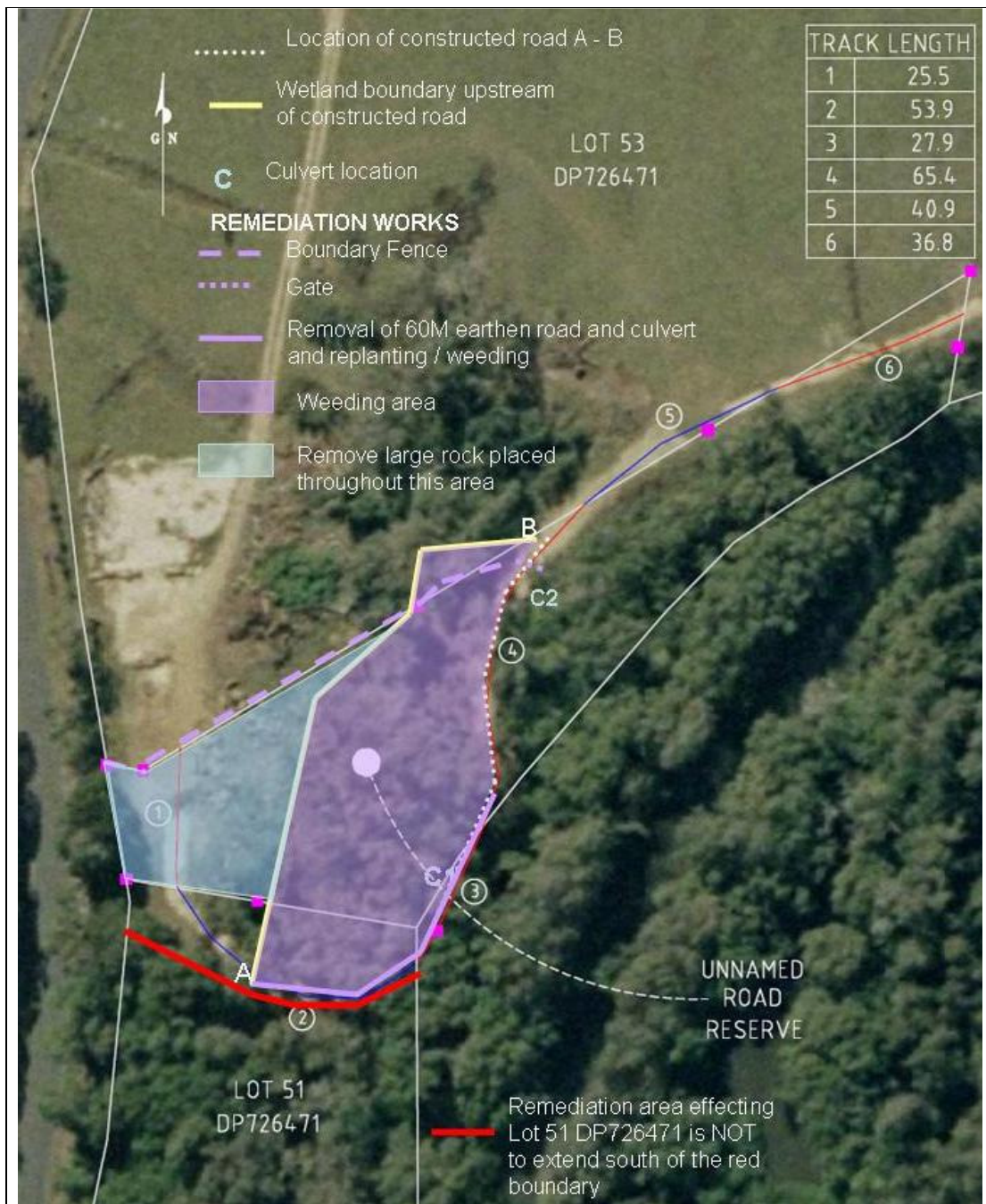


Plate 5 Annotated aerial photo depicting an illegal earthen road constructed through a mangrove wetland and detailing components of the local court remediation order

Case Study 4: Legislation and policy

The last 10 years have seen an excellent improvement in fish passage (I&I NSW, 2009). Concern about the impact of barriers to fish movement, and the need to accommodate fish passage is not new:

“ . . . more and more dams will be erected, until there will be many hundreds of such throughout the length and breadth of the land. Without the provision of fish-passes there is a grave danger of fish fauna being cut up into isolated colonies . . . ”

Furthermore section 117 in the *Fisheries and Oyster Farms Act 1935* included fish passage provisions which were amended on and from 18 May 1979 to enable:

any person who constructs or erects or causes to be constructed or erected over or upon any tidal or inland river or creek, or over any flowing water, any dam, weir or reservoir to carry out within the time specified in the order, such works as may be specified in the order to enable the passage of fish though or over the dam, weir or reservoir

Despite knowledge of the impact of barriers to fish and fish habitat, and the presence of legislation to address the issue there appears to have been little coordinated action to quantify the scope of the problem until the mid 1990s (Williams *et al.* 1996 and Pethebridge *et al.*, 1998). During 1995 a State-wide review of weirs was announced as part of the State Weirs Policy providing a framework for that review and ongoing approval and management of weirs (NSW Government, 1996)

Development of the new *Fisheries Management Act 1994* and subsequent amendments to the Act provided an opportunity to clarify a process for ensuring that fish passage was incorporated into the design of watercourse road crossings and the operation of floodgates. The release in 1999 by the then NSW Fisheries of *Policy and guidelines for bridges, roads, causeways, culverts and similar structures* (Fairfull & Carter, 1999) was supported by results of research that tested waterway crossings modifications on four streams to demonstrating the better outcomes. The 2003 update with the better title: *Why do fish need to cross the road: Fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003) is available on the 'Developer's Toolkit' component of the DPI Fisheries website.

The model of funding collaboration with local councils has seen many excellent permanent positive outcomes for fish (I&I NSW, 2009). The model of attracting environmental funding can not be relied on exclusively to replace the network of waterway crossings. Furthermore, fish friendly road crossings have since proven to have additional benefits, generally being safer structures, requiring less maintenance and generally reducing scour and other erosive impacts on the waterway. Councils and developers accept fish friendly road crossings in key fish habitats as standard practice.

Improved policy for implementing the legislation has sought to 'contain' the number of poorly designed road crossing and ensured that new road crossings and upgrades to existing crossings in key fish habitats are designed to maintain or improve fish passage.

Conclusion

There would be few things more disheartening to a recreational fishing group to have lobbied and using Recreational Fishing Trust funds to improve a key road crossing barrier to fish on an important waterway, only to have two more non-fish friendly crossings installed in the same waterway.

More broadly, the scale of environmental degradation is too great to rely on funding rehabilitation projects alone. Similarly rehabilitation projects alone do not ensure that new environmental problems through the use of poor practice by developers and landholders are not being created.

The four case studies highlight different approaches that can be used to initiate aquatic habitat rehabilitation projects. They also show the link between sound policy development, rigorous environmental assessment, judicious compliance and rehabilitation project management. These four areas have an ongoing and important role in progressively addressing the numerous environmental problems in the NSW coastal zone. The fish passage at road crossings case study demonstrates that a successful outcome relies on containing the problem by requiring widespread adoption of the new standard.

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Appendix 1

Saltmarsh compensation




An area of 30m² saltmarsh was to be harmed during the construction of the Black Rocks Bridge necessitating creation or enhancement of at least 60m² of saltmarsh habitat.



The area designated for compensation encompassed approximately 130m² of disturbed saltmarsh due to impacts from trampling and vehicles. The first compensatory action occurred during September 2002 prior to construction work on the bridge. A fence was constructed around the compensation area and a baseline survey of cover was conducted. Nine evenly spaced transects were established along the area using wooden stakes to permanently mark the transect locations. During the baseline survey undertaken in September 2002, an average cover of 34.4% saltmarsh was recorded within the compensation site.

In October 2002, the 30m² area of saltmarsh to be cleared for bridge construction was transplanted by hand-collecting small clumps and planting directly into bare patches within the compensation area.

Plates 2 a-e depict the recovery of saltmarsh at the compensatory site. During the final survey carried out in November 2003 an average saltmarsh cover of 84.6 % was recorded.

The project aimed to create 60m² of saltmarsh within the compensation area is considered successful due to the substantial improvement in the quality of saltmarsh at the 130m² compensatory site. Some of this increase would be attributable to the transplanting of saltmarsh from the bridge construction site however removal of trampling of the saltmarsh by pedestrians, motorbikes and cars is also a key factor. The site has remained fenced to prevent degradation and the land is now within an Environmental Protection (Habitat) Zone.

	<p>Plate 2a Baseline Survey prior to transplanting September 2002</p>
	<p>Plate 2b Survey 1 post transplanting January 2003</p>
	<p>Plate 2c Survey 2 May 2003</p>

	<p>Plate 2d Survey 3 August 2003</p>
	<p>Plate 2e Survey 4 November 2003</p>

- mangrove compensation

During construction of the bridge 20m² of mangroves were to be harmed necessitating the establishment of a 40m² mangrove compensatory area. Two sites along Mooball creek were identified as potential mangrove compensatory habitat areas (Plate 2). Both sites featured eroding creek banks with adjacent mature mangroves and bare sections for planting of mangrove seedlings.

In January 2003, 140 mangrove seedlings (*Avicennia marina*) were collected from a nearby stormwater drain and the Black Rocks Bridge construction site, and transplanted into the southern compensation area. Seedlings were transplanted using a PVC pipe corer, and holes were dug into the mud using a shovel (SPCC, 1988, Harty, 1997). A temporary fence was erected around the site using star pickets and a coarse geotextile. Use of geotextile fencing was intended to encourage mangrove seedling establishment by reducing wind and wave action, and to discourage damage by foot trampling. The area encompassed by the fence was estimated to be 190m² (25m long and 7.5m wide) and seedlings were planted in rows within this area. The fence was not secured to the sediment, so allowed aquatic flora and fauna to pass between the creek and the compensation site. The fence remained in place for the duration of the monitoring period to increase the chances of success. Signage was installed to inform the public about the compensation project.

After the initial 12 month monitoring period it was noted that 238 mangrove seedlings were counted at the site. An addition 98 seedlings had established, perhaps due to protection from wave action from the geotextile temporary fencing.

The project exceeded the 40m² target as establishment of the juvenile mangroves which had reached a height of 1.5m in 2005. The mangroves will assist in reducing erosion of the creek bank and enhancement of the riparian corridor.

Seagrass compensation

An area of seagrass (*Zostra* sp) 20m² was to be harmed during the construction of the Black Rocks Bridge necessitating creation or enhancement of at least 40m² of seagrass. Tweed Shire Council sought to undertake a project to improve the conditions conducive to seagrass growth within part of the Tweed estuary.

DPI Fisheries endorsed a Tweed Council proposal to improve flushing of Wommin Lagoon, located in the lower Tweed Estuary as a previous study of the lagoon had identified the need for increased tidal flushing to improve water quality in the lagoon (WBM, 1996). Furthermore Tweed Council had made considerable effort to inform foreshore residents of the consequence of dumping garden refuse around the Lagoon foreshore.

Plate 3 shows the location of Wommin Lagoon which is a perched lagoon, surrounded by residential housing and only experiencing tidal exchange via a road culvert at the southern end of the Lagoon (Plate 4A).

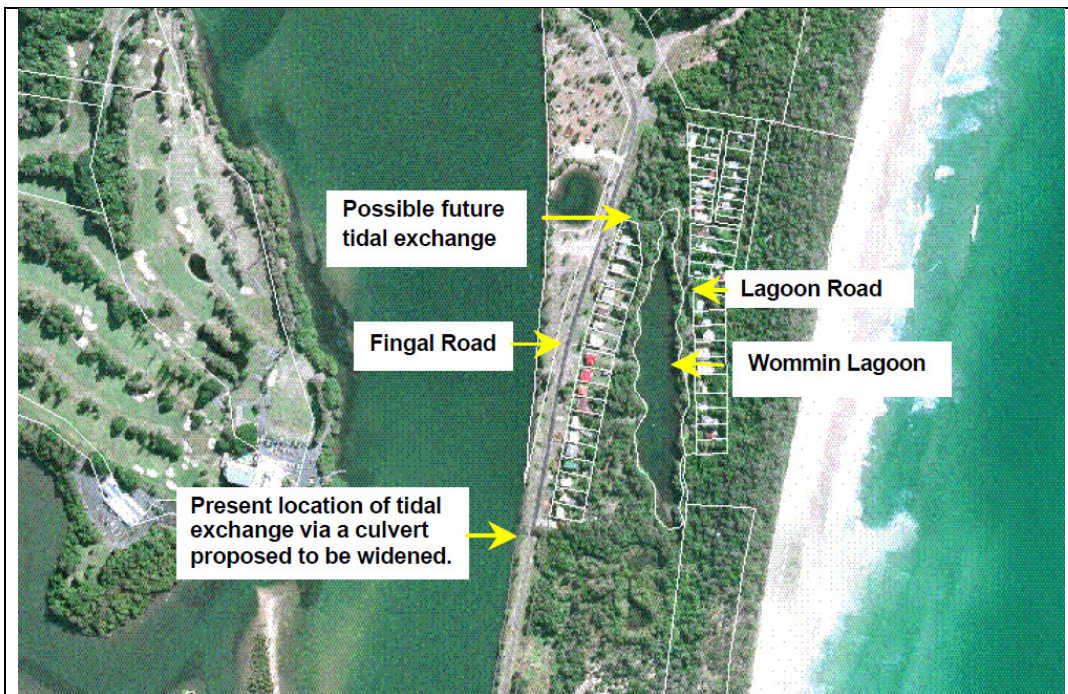


Plate 3 Wommin Lagoon at Fingal Head. The only source of tidal exchange with the Tweed River is via a convoluted channel at the southern end of the Lagoon.



Plate 4A The original 900 mm culvert connecting Wommin Lagoon to the Tweed River

Plate 4B Twin 900 mm culvert installed April 2004

Increased flushing was to be achieved by replacing the deteriorating 900mm diameter pipe with two new 900mm pipes (Plate 4B). The invert of the pipe remained the same to avoid over draining the lagoon. The works were delayed to occur coincident with other upgrade works along Fingal Road which occurred during April 2004 to minimise the costs incurred by Tweed Council.

Prior to the culvert replacement, in July 2003 seagrass cover within the lagoon was surveyed finding 7770m² of mainly *Zostera capricorni* with very small areas of *Halophila ovalis*. After replacement of the culvert a second survey was undertaken in November 2005. Coverage of seagrass had increased by 2042m². Coverage of *Halophila ovalis* had increased and density of *Zostera capricorni* had increased.