FLOOD DAMAGE ASSESSMENT ALLYN RIVER SYSTEM ~ JUNE 2011 FLOOD EVENT

By Noel Jupp **OAM, Dip Hort, QP Dept Ag & Fisheries.**

The June 2011 flood event that occurred on the Allyn River system did not peak as high as the June 2007 event, however it did far more damage. WHY?

There is one simple point of difference between the two events. In June 2007, the flood event on both the Paterson & Allyn Rivers was the result of a sudden but significant rainfall event creating a "two day wonder" that can best be described as flash flooding *(both rivers were up one day and down the next and it was over and done with)*. In June 2011 there was a period of extended rainfall before the flood which resulted in the river banks being quite well saturated. Isolated incidences of heavy rain in that preliminary week also resulted in several fluctuations in river heights which repeatedly inundated the riparian zone *(Bankers" in local terminology.)* The result of this succession of "bankers" was a heavily saturated riparian zone.

During the final flood event the Allyn River once again rose significantly on Day 1 and inundated the banks and although it fell overnight and maintained a moderate level on Day 2, it rose again to major flood levels overnight. This final assault on the already fully saturated river banks literally resulted in liquefaction of those banks and as the river levels dropped the banks simply collapsed and flowed away with the receding flood waters.

At the nursery, we have been inundated with reports of damage on both the Allyn & Paterson River systems and requests for help and advice on what to do to mitigate the damage and prevent it happening again. The common theme of these reports is the observation that the devastation to the river banks has occurred without discrimination between rehabilitated areas and non rehabilitated areas of the river banks. It is my belief that we need to seize the opportunity that this flood event has provided to have a good hard look at the success and or failure of what we have been doing to our riverbanks. The following article documents the changes (predominantly in the Allyn River) in our treatments of the riparian zones of our waterways.

I firmly believe that all levels of Environmental Administration must get together and work out the way forward to achieving sustainable outcomes.

ALLYN RIVER CHANGES OVER TIME

Prior to European settlement the banks of waterways had quite a steep grade with a single continuous slope from the upper river flats down to the toe of the bank as is illustrated in Figure 1. This same natural bank formation can still be seen in Figure 3 below, which is a photo of Allyn River bank area taken shortly after the flood of June 2011. Some flood debris can be seen caught on the branches of the Casuarina in the foreground which gives some indication of the water levels although it should be noted that the flood peaked well above that level. Note that the Casuarinas in Figure 3 are growing at least one metre above the water level and that these Casuarinas are growing in a significant depth of soil as indicated by the yellow arrow.

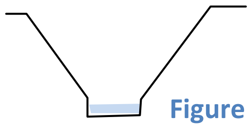


Figure 1

After extensive clearing, creation of battered banks for river crossings, livestock access to water, and the countless floods over the years, many banks on our waterways have a distinctively lesser grade and a more tiered effect (Figure 2) which we now refer to as the low bank and the high bank.

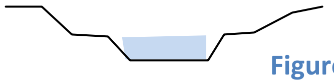


Figure 2

Figure 3

Past & current planting practises have seen a tendency to plant trees (Casuarinas in particular) on the Toe of the bank where there is only 30cms or so of “silty soil” over a bed of river gravel. The effectiveness of this practise is evident in Figure 4 below. This Casuarina was planted on the Southern bank of the Allyn River, slightly downstream of the Camyr Allyn Bridge. You will note the level of root formation is dense but shallow. The density of the root system is indicative of the fact that it was not a sapling that was dislodged before it had time to develop a good root system, however the shallowness of the root system is indicative of the fact that the roots of this tree did not have to venture deep into the soil to find enough water to sustain and promote a high growth rate.

Figure 4

Figure 5 is 50m downstream of Figure 4. Although this particular specimen was not growing on the toe of the bank it was certainly growing in the same shallow gravelly conditions with ready access to water.

Figure 5

When we have a major flood, the pressure on the trees lining the bank is enormous. Regardless of whether the specific flood event is a result of sudden torrential rain creating flash floods or the result of an extended rain period that sees the waters rise gradually, the watercourse and its vegetation are subject to high velocity water flows and accumulation of debris carried by that flow. The weight of the debris that collects in and around the deluged foliage of a tree adds a significant amount of stress to that tree. This combination of velocity & debris puts enormous strain on the stability of any tree.

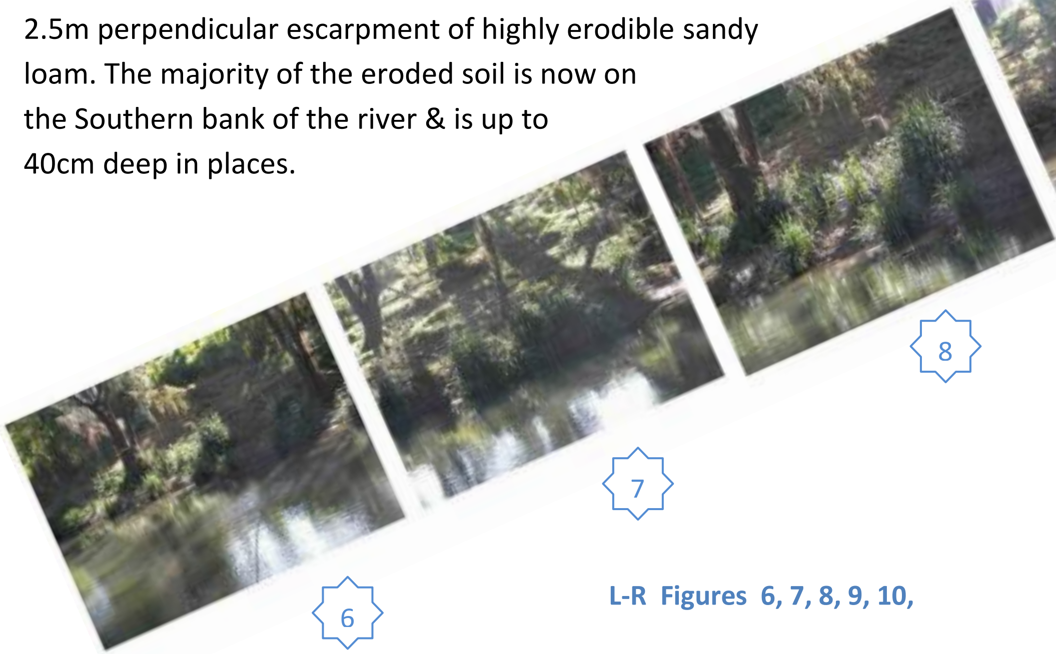
The trees evident in Figure 3, and the trees in Figure 4 & 5 all occur on relatively straight portions of the river just downstream from the Camyr Allyn Bridge. There are no bends or rapids in either section of the river where they are growing that would affect one site more than the other. The predominant difference between these trees and their relative stability is the topography of the river bank where they are growing and the subsequent growing conditions that those sites create.

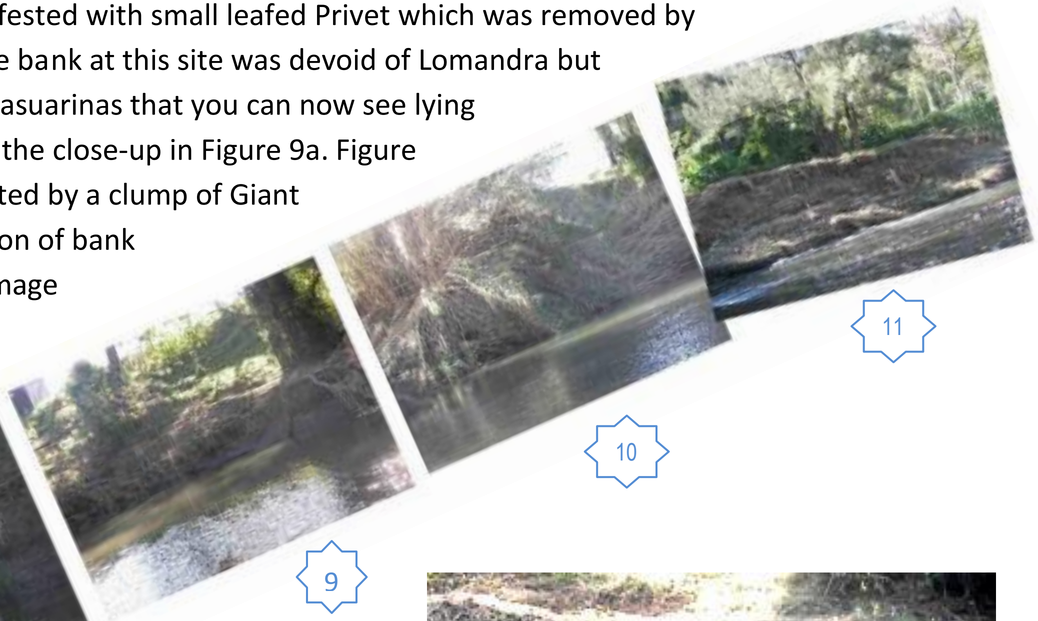
The necessary growing conditions for any plant to establish itself successfully includes the ability of the root-ball to source enough moisture from the surrounding soil to sustain the existing foliage AND root system in the short term PLUS have some extra moisture left over to allow the roots to grow and connect with the soil around it to source additional moisture to promote and support new growth in the long term. Figure 3 is planted in a location with a good deep soil profile that is well above the natural water table and as a result the roots of this tree have had to venture further and further away from the tree to find enough moisture to sustain the tree and also promote growth, in other words - the growth of the tree is proportional to the growth of its root system. In contrast to this, the development of the root systems of the trees in Figures 4 & 5 where an over abundance of water was available to sustain the tree, is quite disproportionate to the growth rate of the actual trees, as a result their root system is inadequate to provide any measure of stability against flood waters or for that matter, high winds.

Obviously once a problem is identified, the next logical step is to look at how to address that problem and to offer solutions. The following pages contain a series of photographs covering both the Northern & Southern banks of the Allyn River on the downstream side of the Camyr Allyn Bridge. The distance covered by these photos is only around 250m, however the changes in the condition of the bank is quite dramatic and illustrates the effectiveness and ineffectiveness of various treatments including weed control and rehabilitation projects over the years.

THE NORTHERN BANK

The collage of photos below is a reasonable flow chart type of representation of the progression and status of the Northern Bank of the Allyn River beginning just below the Camyr Allyn Bridge and extending 250 - 300m downstream to finish on a bend in the river. All these photographs were taken on the same day shortly after the June 2011 flood event and they tell the story better than I can. In the first instance all you have to do is play “Spot the Difference” between the first three photos and the last three. The plants on the toe of the bank in Figures 6, 7 & 8 are Lomandra hystrix and the majority of the trees are set well back from the edge of the water. This section of the river had no erosion problems. Moving on to Figure 9 - this section of bank was infested with small leafed Privet which was removed by the cut & paint method of weed control some 4 years ago. The toe of the bank at this site was devoid of Lomandra but well vegetated by Casuarinas too close to the water line and it is those Casuarinas that you can now see lying dead & upprooted in front of the 1m high bank of eroded sandy loam in the close-up in Figure 9a. Figure 10 is a section of bank 10m downstream of the Privet site and is dominated by a clump of Giant Reed which has been there for at least the past 30 years or so. This section of bank where the Giant Reed has been left untouched also escaped erosion damage however 30m downstream, Figure 11 shows a section of bank where another clump of Giant Reed was removed. This site is now a 2.5m perpendicular escarpment of highly erodible sandy loam. The majority of the eroded soil is now on the Southern bank of the river & is up to 40cm deep in places.





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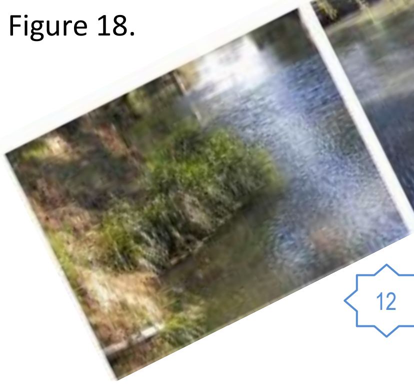
9a

L-R Figures 6, 7, 8, 9, 10,

THE SOUTHERN BANK

The Southern bank of the Allyn River has been subject to significant modification as a result of human intervention over the years. Its topography still reflects the remnants of the original river crossing and its access road. Its vegetation was modified in the 60's when the Water Resources came through and removed one species of willow and replaced them with another and removed all the "snags" from the river bed. Various agencies have come through periodically over the past 30 years and implemented new strategies designed to improve the water flow or limit the erosion. Many discussions have been held regarding the success or more often the failure of these various strategies over the years with each new generation usually criticising and condemning the actions of the previous generation yet each generation makes the same basic error as the previous one - they all expound the virtues of radical modification based on theoretical models that will only work on the pages of a text book where Mother Nature does not get to add her comments. Figure 12 below is slightly upstream of the majority of these human modifications and is holding it own in terms of erosion problems. Figures 13, 14 & 15 have received the highest level of attention & modification and the success of that modification is plainly evident. Figure 16 is where the modifications end and Figure 17 is a vast expanse of gravel that has been slowly growing in depth and width since the 1955 flood. This gravel bed forms the inner edge of a bend in the river and when the flood waters recede they drop their heavy rocks here and carry the lighter sediment/silt around the corner to Figure 18.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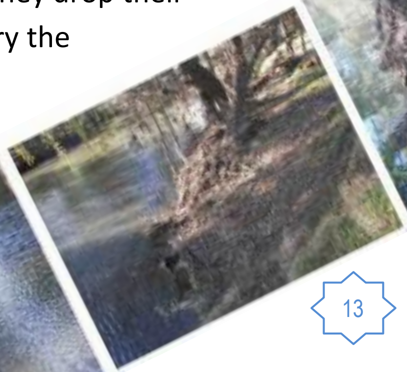
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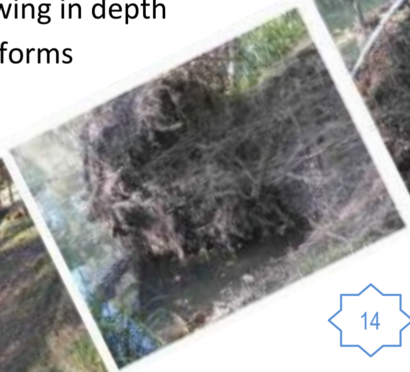
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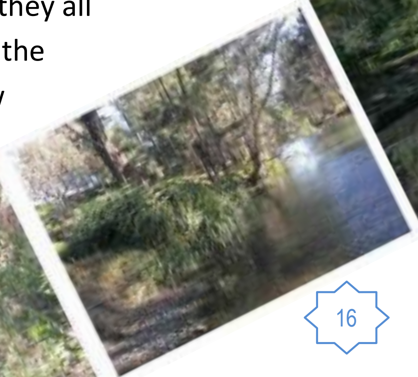
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THE DIFFERENCE BETWEEN THEORY AND REALITY

The theory of nominating Giant Reed, Willows & Privet as environmental weeds that must be eradicated as a priority action on our rivers and stream banks is a valid theory; however, in reality that priority action has created an environmental disaster.

Mother Nature does not read theory notes about weeds, rehabilitation and stabilisation and she is most certainly not renowned for her moderation. The current practise of wholesale removal of these weeds is achieving nothing more than an immediate and dramatic visual satisfaction that a good environmental deed has been done today.

Figure 19

But what about tomorrow? The theory lays out a clear path to success

1. Expend enormous amounts of funding on radical modification and removal of these large weeds like Willow, Giant Reed and Privet.
2. Expend more funds to plant those sites with native vegetation.
3. Sit back and watch it flourish.

Points No 1 & 2 of the theory worked OK but instead of watching these sites flourish we have had to watch those sites (not just the seedlings that we planted but the entire site) wash away to parts unknown leaving us to not only contemplate the colossal waste of money that was spent but the creation of an environmental problem worse than the one we started with.

Figure 20

THE STORY OF ALICE

Alice is a specimen of Lomandra hystrix that germinated and grew on a hummock of gravel and roots left behind in the centre of the river by the 1955 flood. Her tenacity in hanging on to her little island and keeping it in one piece through every flood event since then has earned her our respect and admiration (which is why we gave her a name).

In a major flood event Alice is covered with at least 7 metres of raging flood waters. She is battered by every bit of debris that those flood waters can carry and she emerges triumphant and unscathed every time.

Alice is not a theory, she is a fact and more than that she is living proof of the solution to the problem of bank stabilisation and erosion control.

Figure 21 - Alice

Note the Casuarina sapling on the riverbank behind Alice, its branches are full of debris and it is at a rather precarious angle. Although it has managed to hang on, its lateral position indicates that its roots have been dislodged or damaged. Figure 22 is a close -up of the root area of that sapling, note the portion of the bank that has slumped where the roots of that sapling have been dislodged. Both Alice and the Casuarina sapling were subjected to the same flood force and Alice has obviously survived in a better condition that the Casuarina. Furthermore - if Alice had been growing alongside the Casuarina, it would have literally ripped the ground out from beneath her roots and dislodged her as well.

Figure 22

BUILDING ON THE OBVIOUS

We need to get from this DISASTER to...

this stability & we can't do it overnight. Rushing so we could see an immediate result in time for the next budget allocation is how we created this disaster in the first place.

THE CURRENT SYSTEM

The current system of environmental rehabilitation must be reviewed as a whole package and needs to include the allocation of funding and the terms and conditions of that funding. The current system of project funding is closely allied to our fiscal calendar. Availability of funds starts with budget allocations and ends with project applications that nominate milestone dates for completion of projects to trigger the release of funds to pay for the project.

Figure 23

Allocation of individual project funding simply requires that a landholder firstly indicate that they want to transform their riverbank into some resemblance of Figure 23 and then provide a decent overview of the project which usually follows the well trodden path of FENCE IT OFF → REMOVE THE WEEDS → PLANT IT OUT WITH LOCAL PROVENANCE NATIVES (any will do) and providing the entire project can be completed in a timely fashion, it gets approval for funding.

All too often we receive requests from landholders for the supply of native tubestock to comply with these approved projects that consist of nothing more than a list of local provenance species that have been assigned a percentage value to indicate the proportion of that species that should be included in the project planting.

These proportions are based on that good old text book theory that specifies that in order to emulate the natural make-up of a well balanced site, that site should contain 20% of this kind of vegetation and 10% of that kind of vegetation & 5% of another kind.

Figure 24

The site shown in Figure 24 has been fenced off from stock for several years, it had a clump of giant weed removed and in theory should be well on its way to emulating a natural well balanced vegetated site with its predetermined 20% of this and 10% of that native species growing and flourishing happily.

These projects have not achieved what the text book said they would and they never will whilst ever we try and rush the end result based on an annual fiscal calendar. We are allocating grant funding for projects that are based on a landholders willingness to rip out huge weeds and stick in as many trees & shrubs as he can keep alive until the relevant CMA officer does a headcount on those trees and authorises payment for his work and it is achieving nothing to stabilise the river banks, it is making it worse and we need a better system.

FUNDING ALLOCATION AS IT SHOULD BE

STEP 1 – Submit a site for assessment of funding suitability - funding allocation should be made on the basis of whether or not a site is actually in need of attention, not on the basis that we happen to have an application from someone that lives on a river and is prepared to plant a few trees to help the environment and knows that the CMA will pay for those trees. If necessary the CMA should be actually surveying, locating and identifying potential sites along all the rivers and streams and then approaching the landholder with an offer to fund and implement legitimate stabilisation projects instead of literally handing over money just so people will pull weeds out and plant trees on their riverbanks with no regard for the consequences of inappropriate planting practices.

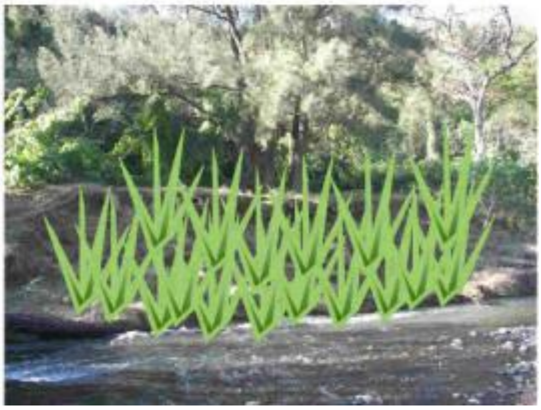
SITE	ASSESSMENT
	This site is relatively stable and although it could support additional plantings, there is no clear or present danger of any problems that would be detrimental to the site. Funding assessment level - LOW
	Forget the giant reed for the time being – this clump has been here for over 30 years. These clumps of giant reed have not spread uncontrollably over the rest of the river bank for the past 30 years and they are not likely to start now. Their progression is slow and so should be their removal, section by section & bit by bit. Funding assessment level – MEDIUM
	This site obviously has a problem and needs attention as soon as possible. It should be agreed that this site is eligible for immediate funding and it should be progressed to Step 2 which would be to develop a plan for that site that will address the specific problems of that site. Funding assessment level - HIGH to APPROVED

STEP 2 – DEVELOP A PLAN THAT WILL ACTUALLY ACHIEVE SOMETHING WITHOUT MAKING IT ALL WORSE IN THE MEANTIME –

Our sights should not be on the "goal posts" at this point in time, they should be concentrated on undertaking and fixing the immediate problems and ensuring that the solution has really solved the problem before we take the next step. Emulating the natural environment just the way Mother Nature made it 100 years ago is going to take time (possibly another 100 years), and it is foolish to think it can be done over the course of a fiscal year.

Perpendicular eroded banks like this one have traditionally been planted out with a high density of trees, shrubs and groundcovers based on the theory that their roots will hold it all together. In reality, that practise has had a 100% failure rate because vegetation of that nature requires at least 4 -5 years growth in-situ to have any kind of binding effect on the soil around it.

This bank need to be battered as indicated by the yellow arrows so that the overhang of unstable soil does not collapse any further. Small scale lateral terracing of the slope should also be considered to minimise erosion channels forming on the slope. The entire slope should then be immediately sown with a native grass such as Microlaena stipoides or Hermarthria uncinata.



At the same time the toe of the bank should be planted with Lomandra hystrix, at a density of 4 plants per sqm and extending at least 2m up the slope. Plans should include adequate irrigation of the site to ensure a quick germination of the grass seed and survival of the Lomandras.

And then......we need to walk away, let the soil settle, give the grass & Lomandra time to grow & bind before we add the pressure of vegetation.

STEP 3 – FIND ANOTHER PROBLEM AND DEVISE A SOLUTION

What about those huge expanses of gravel deposits on every inside bend of the river? These river rocks are Mother Nature's toys; she picks them up, plays with them for a while & then drops them in a pile somewhere when she gets tired of them. These piles of discarded rocks are growing and can be up to 1.5m deep and you cannot plant them out to stabilise them ......

or can you?

This is the site of a direct seeding experiment using Lomandra & Casuarina to try & stabilise the gravel bed. In hindsight the Casuarina is not a good idea & will be replaced by a better species choice, however their germination has shown that the technique is sound. That technique simply involved placing small branchlets of Casuarina with seed capsules or entire seed heads of Lomandra on top of the gravel bed, anchored in place with a rock or two. The small branches were left with their leaves and seed stalks intact to shade the seed from the intense heat generated by the sun on the gravel, or in the case of the Lomandra, the entire seed head. Nature was then allowed to take its own course and as soon as we had a bit of cool showery weather, the seed germinated successfully and not only have the plants been thriving ever since, they did not budge during the recent flood event.

STEP 4 – LETS HAVE ANOTHER LOOK AT THAT GIANT REED PROBLEM

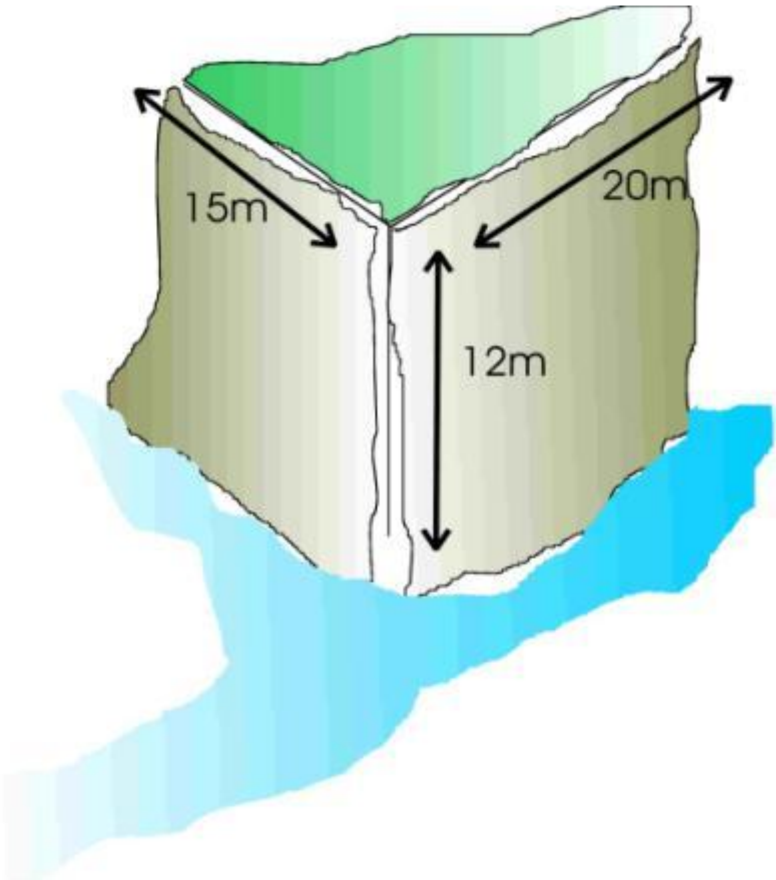
Quoting from a document entitled “Weed Risk Assessment – Giant Reed - Arundo donax” produced by Queensland DPI in 2009 the following facts are relevant –

1. A. Donax has existed in Australia for at least 100 years. *“Over this time, the species has failed to develop extensive infestations, remaining localised and generally benign.”*
2. *“Seeds are rarely produced. John et al (2006) examined more than 36,000 florets and found only 5 ovules that may have been viable.”*
3. *“There is molecular evidence that naturalised populations of A. Donax in the USA & France are a single genetic clone”........This confirms that dispersal is vegetative* (ie bits break off and take root) *and that a single genetic clone has been cultivated in multiple regions of the world”.......”However no studies have been undertaken to determine whether the Australian material is the same clone as material in the USA”*
4. *“A. Donax is a hydrophyte and grows best where water tables are near the soil surface”....... “When growing along banks of fresh water ditches, creeks & rivers, A. Donax is generally most abundant and dominant in open sites (full sun) where the original native vegetation has been recently damaged or removed.”*

A quick inspection of sites where clumps of Giant Reed are established will usually reveal the exact conditions mentioned in Dot Point 4 above – somewhere that the “*original native vegetation has been recently damaged or removed.”*

The topography of the bank behind the arching stems of the clump of Giant Reed pictured on the left (indicated by the yellow arrow) is a 12- 15m vertical eroded wall of soil created by previous flood events. It should be noted that this erosion occurred <u>before</u> the clump took up residence. The rhizomes of the clump itself do not extend up the entire bank; they are limited to the toe of the bank where the moisture is constant, however the fragile walls are protected by the dense tangle of stems. This vertical wall of exposed soil extends further to the left behind the Giant Reed & takes a sharp turn Northward to form the Eastern bank of a large eroded hole created when the waters from a tributary gully/creek ploughed a channel to the river. That bank is also a 12m vertical wall of pure soil.

The last clump of Giant Reed that was removed from this river bank resulted in the loss of approximately 200 cubic metres of soil.



If the clump of Giant Reed that is protecting both sides of this fragile soil embankment is removed it is highly likely, if not a certainty that anything up to 1,000 cubic meters of unsupported soil will collapse into the river when the first minor flood waters come in contact with it. We must be able to come up with a better plan to avoid disaster instead of creating it. Simply removing the Giant Reed does not solve the problem; it simply exposes the original & possibly bigger problem that has remained hidden & protected behind that tangle of canes for many years.

I will leave you pondering a solution to that problem with one last comment - by the time someone comes up and implements a better and more viable solution to the Giant Reed removal problem, it should almost be time to go back to our original rehabilitated site and start planting out the stabilised grassy slope with shrubs like Callistemons viminalis & seiberi, Ficus coronata & Commersonia fraseri that have binding roots and supple stems that will bend to the mercy of the flood waters instead of trying to stand up against them and snapping in two or getting pushed out of the way like the hapless Casuarinas at the start of this article. *Please think about and then act on it in a positive way.*