

Darwin River Cabomba Eradication Program Summary

FEBRUARY 2017



Contents

Executive summary.....	4
Background	5
Risk to the Territory.....	5
Darwin River Cabomba Eradication Program 2004-15.....	6
Darwin River Cabomba Eradication Program 2016-17	8
New equipment.....	8
New survey techniques.....	9
New herbicide.....	10
Rationale for half billabong treatment.....	10
Treatment Schedule for half Billabong applications of Shark™ Aquatic Herbicide	11
Mitigation of potential environmental impacts.....	13
Bund wall construction and deconstruction	15
Waste discharge licence	15
Results.....	15
Spread Risk - Quarantine Zone	16
Results	17
Herbicide application results	19
One week post application	19
Eight Weeks post application.....	19
Three months post application (18 January 2017)	19
Expert advice	20
Unavoidable postponement of the Second Half Billabong Treatment	20
Outcomes and recommendations.....	21

List of Maps

Map 1: Reduction in cabomba since 2004 and location of infestations relative to Darwin River Dam.....	7
Map 2: Cabomba Treatment Zones, Lok Landji Darwin River	12
Map 3: Lok landji Billabong showing cabomba infestation and treatment area relative to water depth ..	18

List of Tables

Table 1: Ideal treatment schedule relative to achieving cabomba eradication	11
Table 2: Proposed action 2017 to 2019 (refer to Map 2 for Zone information).....	21

List of Plates

Plate 1: Physical attributes and implications of cabomba	5
Plate 2: Cabomba infestation in Lok landji before (2004)	6
Plate 3: Boat previously used for herbicide application in known salt water crocodile habitat.....	6
Plate 4: Booms used to catch cabomba fragments	6
Plate 5: 'Carolin', the new cabomba eradication program vessel	8
Plate 6: Detection of cabomba using underwater camera	9
Plate 7: Physical sampling and monitoring of cabomba at depth using the rake set up	9
Plate 8: Baseline riparian vegetation survey being undertaken with drone	14
Plate 9: Bund wall construction at Cox Peninsula Bridge.....	15
Plate 10: Eradication Program Poster 2016.....	16
Plate 11: Half billabong treatment and associated monitoring, October 2016	17
Plate 12: Cabomba Eradication Officers applying Shark™	18
Plate 13: No healthy cabomba eight weeks post-treatment.....	19
Plate 14: First sign of healthy cabomba three months post treatment - only in untreated zone.....	19
Plate 15: Cabomba survey being undertaken after first half billabong treatment.....	20

Executive summary

Cabomba (*Cabomba caroliniana*) is an aquatic plant native to the Americas. In Australia this highly invasive weed can rapidly outcompete native aquatic plant species, alter water chemistry, increase siltation and stagnate freshwater systems.

Cabomba was first reported in Darwin River in 2004 and surveys established that an 11km stretch of the river was affected by cabomba. Significant control efforts by the Department of Environment and Natural Resources (DENR) resulted in an estimated reduction of up to 95 percent of the original infestation. However, eradication of cabomba had still not been achieved by 2015 despite concerted efforts. A resilient infestation of cabomba has persisted in a 1.2km stretch of the Darwin River, known as Lok Landji Billabong.

In 2016 funding was received enabling the temporary recruitment of two staff with operational support, including vehicles, 'high tech' monitoring equipment and herbicide (funding was for one year). Commendable progress has been made since July 2016, however there is a significant risk that positive control results may be compromised if adequate follow up control is not achieved.

The funding also enabled an initial treatment program using the aquatic herbicide; Shark™. This program was supported by an extensive aquatic and riparian monitoring program and measures to mitigate off-target impacts including the construction of a temporary downstream bund wall at the Cox Peninsula Bridge.

Shark™ is not registered for use on cabomba in flowing waterbodies. Given the level of risk posed by cabomba, the Australian Pesticides and Veterinary Medicines Authority (APVMA) issued the Department with two permits authorising spot spraying and limited large scale applications. In accordance with permit conditions, only one major treatment could be applied in 2016. This application was prior to rainfall events that may have compromised results through increased river flow, volume and turbidity levels.

Despite early rains precluding a follow up treatment, early monitoring results indicate that the treated upstream area of cabomba has been severely impacted by the herbicide. While no healthy cabomba can be detected in treated areas, experience indicates that some recovery is likely. Some downstream areas still require treatment as these exceeded APVMA permit conditions relative to the treatment area. One strand of healthy cabomba was detected in this area in January 2017.

If cabomba were to spread from the current infestation area the cost to the environment and tourism would be immense but difficult to quantify. Should cabomba infest Darwin River Dam, the cost of a water treatment plant for the dam has been estimated to cost approximately \$80 million.

Background

Cabomba (*Cabomba caroliniana*) is an aquatic weed native to the Americas and was most likely introduced to Australia via the aquarium industry. It is a declared Class A weed in the Northern Territory (NT) and is to be eradicated. It is also a Weed of National Significance.

Cabomba grows in slow moving or still water to depths of over 5m and forms dense columns that outcompete native aquatic vegetation and impedes the movement of aquatic fauna. Left unmanaged, cabomba can choke out the entire water body below the surface. In this situation, cabomba infestations generally die back with seasonal change which deoxygenates the water, suffocating fish and other aquatic life.

In the NT cabomba spreads by seed and floating fragments. The NT is the only region in Australia where cabomba produces viable seed. This is a significant risk factor for spread to other water bodies as seeds are very small and can be moved inadvertently by people or animals. Cabomba also fragments easily and can be spread via fishing equipment and boats.

There have been a number of cabomba infestations found in the NT, most have been limited to small man-made ponds or aquariums. The two most significant infestations have occurred at Marlow Lagoon in Palmerston and in Darwin River.

The Marlow Lagoon infestation was discovered in 1996. The last cabomba plant found in the lagoon was in 2002 after significant management efforts were undertaken for its eradication. This infestation has been deemed eradicated as more than ten years has passed since the last plant was found.

The only known remaining cabomba infestation in the NT lies in a 1.2km stretch of Darwin River, downstream of Darwin River Dam. This infestation remains under an eradication program.

Risk to the Territory

Freshwater rivers and water bodies in the NT are at a significant risk to the adverse effects of cabomba as they provide ideal habitat conditions for its growth. Cabomba could decimate freshwater fishing and other recreational activities if it were to spread from Darwin River (Plate 1).

If cabomba were to spread into Darwin River Dam, Power and Water estimate a water treatment plant would cost around \$80 million to build with additional funds required indefinitely to run and maintain.

Cabomba infestations taint water and are a threat to potable water sources as treatment of the water is required to maintain palatability. It can also decrease the volume of water bodies and cause significant siltation as the plants trap any sediment in suspension.



Plate 1: Physical attributes and implications of cabomba

Darwin River Cabomba Eradication Program 2004-15

By the time it was discovered in 2004, this cabomba infestation spanned over 10km of the Darwin River. Immediate eradication efforts were undertaken by the Weed Management Branch (Plate 2). As no registered herbicides were available for use in Australia to control cabomba, an off label permit was issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for the use of an aquatic herbicide (2,4-D ester) (Plate 3). This herbicide was used successfully as part of integrated control program (Plate 3) for over 10 years; however it is now deregistered for use in Australia and is no longer available for purchase.

Consistent management efforts by the Weed Management Branch have reduced the Darwin River cabomba infestation to a 1.2km section, locally known as Lok Landji Billabong (Map 1). No cabomba plants have been found upstream of Lok Landji since 2007.

As cabomba had not been eradicated, a formal review of the Cabomba Eradication Program occurred in 2015 which identified significant changes were required to maintain the eradication target for cabomba.



Plate 2: Cabomba infestation in Lok landji before (2004)

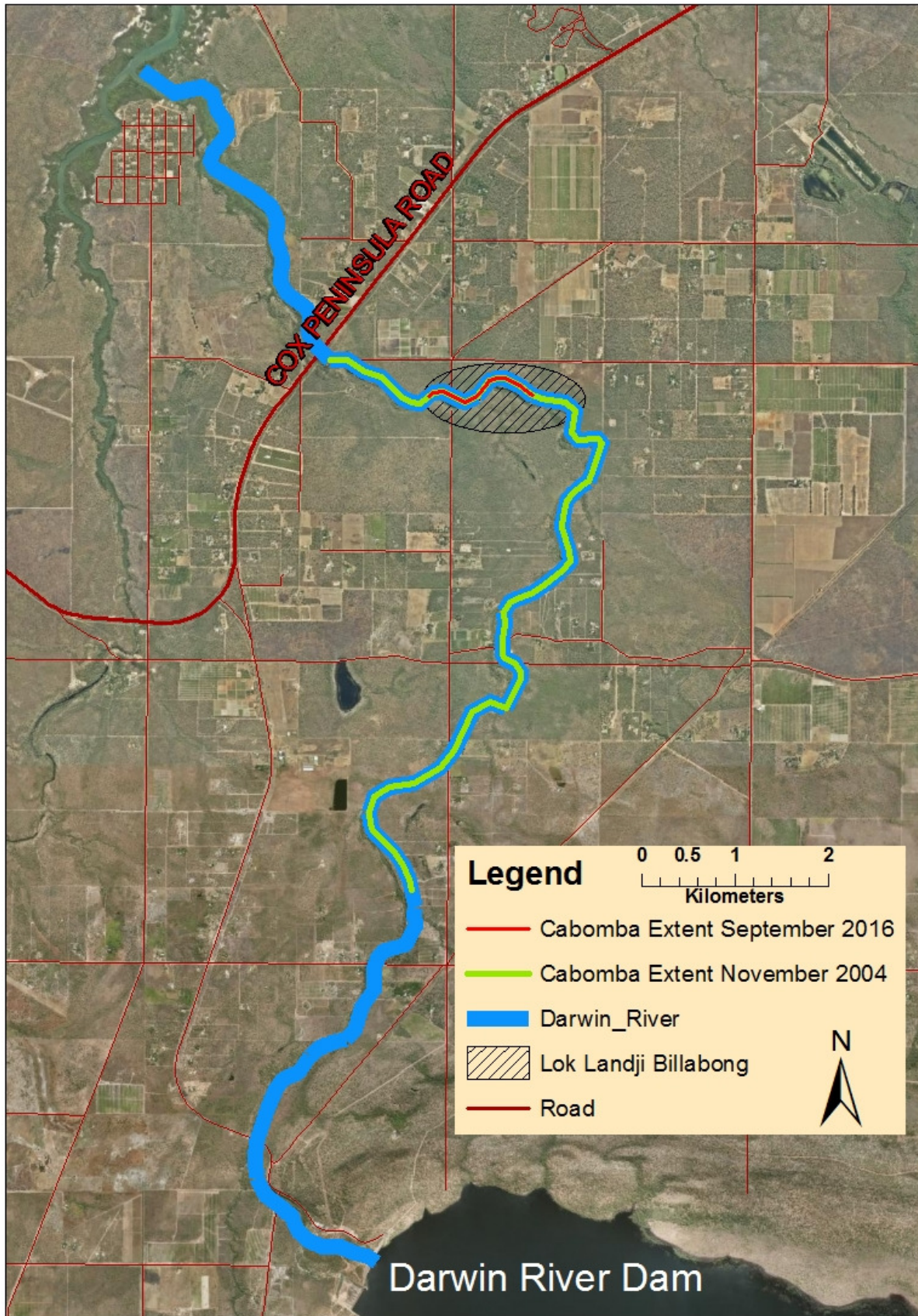


Plate 3: Boat previously used for herbicide application in known salt water crocodile habitat (left)



Plate 4: Booms used to catch cabomba fragments (right)

Map 1: Reduction in cabomba since 2004 and location of infestations relative to Darwin River Dam



Darwin River Cabomba Eradication Program 2016-17

The 2015 review of the eradication program, including a visit from Victorian aquatic weed expert Dr Tony Dugdale, identified issues in the program that needed addressing, including:

- Greater concentrated program efforts
- Requirement for dedicated staff
- New herbicide
- Better survey techniques
- Safer equipment
- Upgrade to boat ramp
- Risk mitigation of enhancing the program

In response to these recommendations the Department received \$850 000 in 2016 to improve the program to finally eradicate the persisting infestation from Darwin River.

The funding provided for two dedicated Weed Management Branch staff with full operational support for 12 months.

New equipment

The additional funding received by the Department allowed the purchase of a more appropriately sized vessel with level floatation for enhanced buoyancy for officer safety and also for better carrying capacity of herbicide and seaworthiness. The new vessel (Plate 5) was also fitted with a GPS enabled trolling motor (Minn Kota®) to allow the vessel to stay stationary for the purposes of survey and monitoring.



Plate 5: 'Carolyn', the new cabomba eradication program vessel

New survey techniques

An underwater camera with live feed back to the surface was purchased in December 2015. This camera was used extensively during 2016 to observe the river bed in real-time to identify cabomba. The camera revealed cabomba growing at depths and locations within Lok Landji that it had previously not been known to occur, Plate 6.



Plate 6: Detection of cabomba using underwater camera

Under advice from Dr Dugdale, a simplistic approach was used to get samples of cabomba up from the river bed for assessment. Two rake heads were fastened back to back on a length of chain and rope. This apparatus was able to be thrown into the water, dragged along the bottom then retrieved with cabomba fragments attached. Weed Officers could visually inspect treated cabomba to determine the level of health post herbicide application (Plate 7).



Plate 7: Physical sampling and monitoring of cabomba at depth using the rake set up

New herbicide

In 2014, a new aquatic herbicide, SharkTM Aquatic Herbicide, registered for cabomba control became available for use in Australia. This herbicide was only registered for use in contained, non-flowing, water bodies. SharkTM could only be used in Lok Landji with an appropriate permit due to it being a flowing water body. In 2015, the Weed Management Branch applied to the APVMA for an off label permit to use SharkTM for spot treatment of cabomba in Lok Landji. In November 2015 the permit was granted.

Following the issue of the spot spray permit and subsequent use of SharkTM for spot spraying, it was apparent the herbicide showed reasonable results but spot spraying the cabomba in Lok Landji would not be sufficient for eradication. In 2016, another application was submitted to the APVMA for SharkTM, this time to treat 50% of the volume of Lok Landji in one application. This permit was approved in July 2016 with the conditions that:

- Only two treatments are permitted per calendar year with each treatment not to exceed 50% by volume of the water body.
- 90 days must pass between treatments (however due to tropical conditions and late application of the first treatment, 50 days between treatments was approved by the APVMA for the second treatment in 2016 only).
- Apply as late in the Dry season as possible, or at other times when the flow rate of water through the billabong is at its lowest.
- Do not apply once the Wet season commences.

The Water Resources unit of the Department of Environment and Natural Resources conducted a bathymetry (water volume) survey and calculated the entire Lok Landji Billabong volume to be approximately 170 mega litres. As per the APVMA permit, only 85 mega litres could be treated per application, some 25 mega litres short of the total infested volume of nearly 110 mega litres. The upstream infestations was deemed the most important and therefore targeted first for treatment.

700 litres of herbicide would be required to treat half the billabong volume as per the permit conditions.

Approximately \$85 000 was spent on the herbicide for the initial half billabong treatment and a further \$85 000 for the second proposed half billabong treatment.

Rationale for half billabong treatment

To be effective, aquatic herbicides require a minimum exposure time on the weed at a minimum concentration. Lethal exposure times for cabomba to SharkTM herbicide are at least a few hours if not longer at a concentration of 2ppm of the active ingredient. Spot spraying patches, the previous technique utilised, was assumed to be under dosing the infestations due to the movement of the water through the billabong due to input from springs. This flow would move the herbicide off the infestations in a relative short time period reducing the exposure time and diluting the concentration.

With improved cabomba survey and surveillance techniques implemented in late 2015 and 2016, Weed Management Branch Officers concluded that it would be nearly impossible to find and then spot spray every infestation in the infestation zone. The infestation zone is about 1.3 kilometres long and on average about 20 to 30 metres wide with depths down to nine metres. It would be physically impossible to accurately survey every square metre of river bed as cabomba does not always reach the surface as previously assumed. The only way to be sure to get every infestation would be to treat the whole infestation zone in one application. This would eliminate missing any infestations that would otherwise go undetected and untreated.

Treatment Schedule for half Billabong applications of Shark™ Aquatic Herbicide

The ideal treatment schedule, as shown in Table 1, would incorporate six half billabong treatments over three years. Two treatments in 2016 before the Wet and two follow up treatments in 2017 and 2018 if needed. Note that 2016 was limited to only one treatment, making the follow up in 2017 critical.

Treatments are to be timed to coincide with ideal treatment conditions, those being healthy and actively growing cabomba and high sunlight penetration in to the water. Best results from the herbicide are achieved under high light conditions with clear water and low water flow through the billabong.

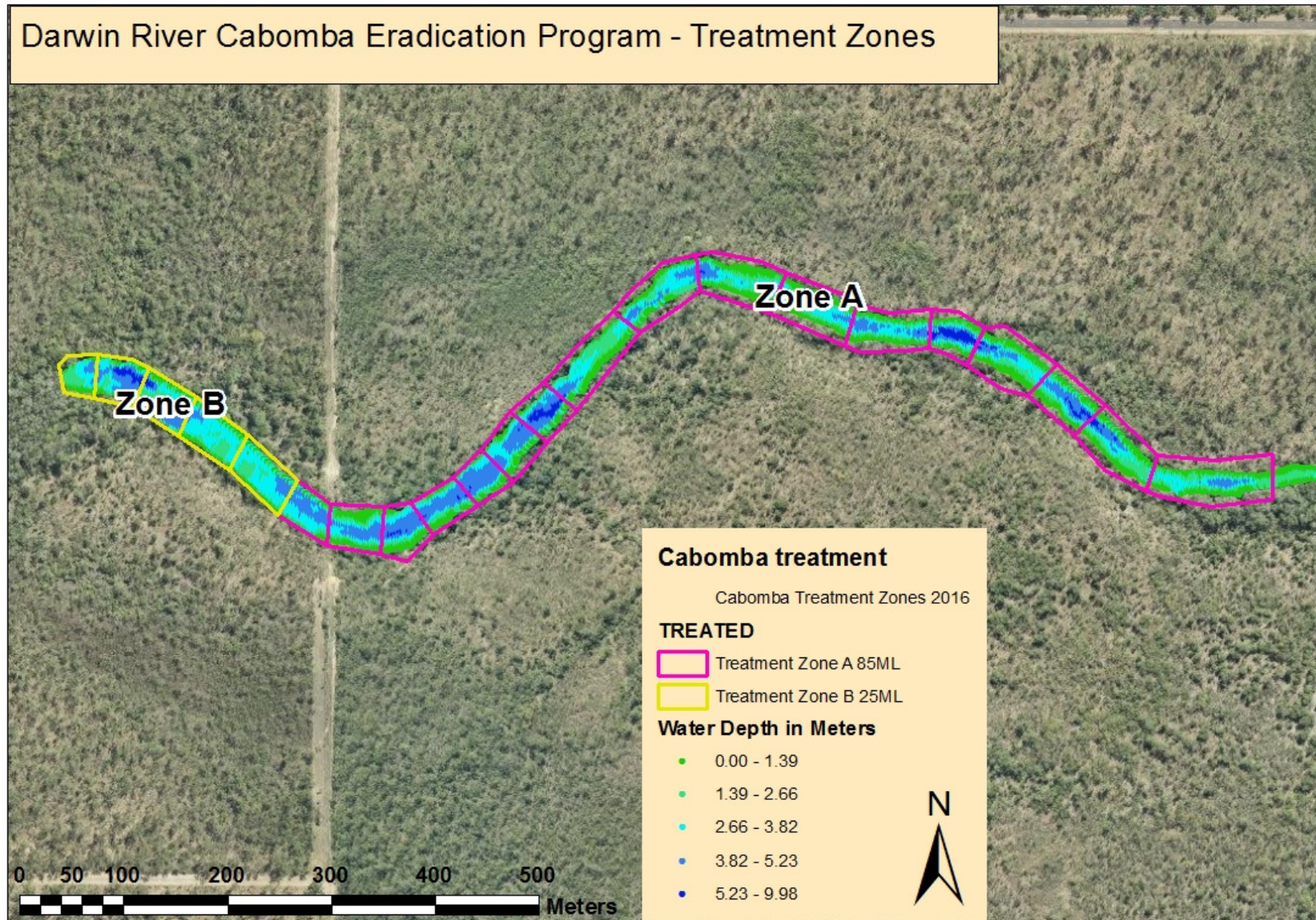
Upstream areas (Zone A as shown in Map 2) must be treated first to completely remove the risk of upstream reestablishment.

Table 1: Ideal treatment schedule relative to achieving cabomba eradication

Treatment	Zone	Year	Month
N/A	A	2016	July (not undertaken)
1	A	2016	October (completed)
2	A	2017	June
3	A or B	2017	September
4	B	2018	June
5	B	2018	September
6	B	2019	June (if required)

Only one half billabong application of herbicide was applied during 2016 due to permit requirements and time taken to build the bund wall as part of the risk mitigation of off target damage. This makes the follow-up treatments in 2017 and 2018 essential.

Darwin River Cabomba Eradication Program - Treatment Zones



Map 2: Cabomba Treatment Zones, Lok Landji Darwin River

Mitigation of potential environmental impacts

Given the intended broad scale application of herbicide to over one kilometre of Darwin River, a taskforce was formed to discuss the proposed treatment, the likely off target impacts, what should be monitored and what could be done to minimise those impacts. The members comprised individuals from the Department of Environment and Natural Resources (DENR) Water Resources Division, Flora and Fauna Division and Weed Management Branch (Rangelands Division).

The Eradication Program incorporated a range of factors to mitigate impacts on local aquatic and riparian environments, human health and downstream reaches of the Darwin River including:

- The use of Shark™, a broad leaf selective contact herbicide with little or no residual activity
- Shark™ is moderately stable at pH 7 and has a relatively short half-life of 8.6 days at this pH
- No more than 50% (by volume) of Lok Landji will be treated in a single application. This enables mobile vertebrates to actively leave treated areas, limiting local fauna impacts
- Only two applications of Shark™ are permitted per year, these must be separated by at least 90* days to limit off-target impacts and maximise efficacy on any cabomba regrowth (*a reduced period of 50 days was permitted by the APVMA in 2016 only)
- A monitoring program that assesses baseline values and changes on cabomba infestation levels, water quality, fish populations, crocodiles, terrestrial, riparian (Plate 8) and aquatic vegetation was administered.
- The three current holders of water extraction licences in the downstream estuarine extent have been contacted with respect to the transition to Shark™. All three have advised they are not currently extracting water
- A temporary bund wall was constructed to prevent movement of treated Darwin River water to Darwin Harbour during periods of herbicide application or high deoxygenation
- Impacts on river flow were minimised as the bund wall was only temporary
- The bund wall was required to remain in position for less than two months at a time that correlated with lowest annual river flow rates
- The construction of the bund wall was within a road reserve on a natural rock bar, this limited impacts on vegetation and soil disturbance

During the previous eradication program, the following was also undertaken for risk mitigation purposes:

- Prior to the commencement of herbicide application in 2004, all landholders drawing water from the river were contacted and provided with alternative water sources. This included the provision of bores to some land holders
- All pumping infrastructure in the river was physically disconnected to ensure that no inadvertent use of treated water occurred



Plate 8: Baseline riparian vegetation survey being undertaken with drone - pre herbicide treatment

Bund wall construction and deconstruction

A bund wall was a precautionary measure that recognised the application of Shark™ on this scale was unprecedented in tropical flowing water bodies in Australia (Plate 9). While the break down rates of Shark™ could be estimated, they could not be guaranteed. The construction would also provide members of the public with visible assurance that downstream environments were being protected from herbicide impacts.

Bund wall construction was a major undertaking with inter departmental and agency assistance and advice coming from a suite of Northern Territory Government business units.

It was necessary to deconstruct the bund wall once it was determined, through water quality testing, that no downstream impacts were likely to occur as a result of the herbicide treatment. Its physical removal prevented 'blow out' during intensive rain events and the associated risk of sedimentation of the estuary.

The bund wall budget was approximately \$250 000 to build and deconstruct. All material used for the bund wall had to be safely transported and then stockpiled to avoid any inadvertent spread of cabomba seed.

Waste discharge licence

To enable limited release of potentially herbicide-contaminated upstream water to avoid overflow (through a 900mm pipe in the bund wall), the Weed Management Branch applied to the Northern Territory Environment Protection Authority (NT EPA) for a Waste Discharge Licence.

The NT EPA stipulated that water could not be released from the bund wall until the herbicide reached a concentration of 100 micrograms per litre of water, equivalent to 0.1 parts per million (ppm). For comparison, sea water has a salt concentration of 35 000 ppm, the average person can taste salt in water at a concentration of 2000 to 3000 ppm. The NT EPA also stipulated a significant monitoring program of water quality be developed and carried out, over and above what Weed Management Branch had intended to do.



Plate 9: Bund wall construction at Cox Peninsula Bridge

Results

Water quality testing showed that within three days of treatment a very low concentration (2.05 micrograms per litre or 0.002ppm) of the herbicide was detectable at the downstream end of the untreated zone. By ten days after treatment no herbicide was detectable anywhere in the river and at no time was any herbicide detected outside of the infestation zone, including the water held back by the bund wall. These results indicated that water could be released at the bund wall to avoid overflow and/or destruction from Wet season flows. **Results show the future requirement for a bund wall is negated.**

Spread Risk - Quarantine Zone

Cabomba can be spread by seed or plant fragments. Fishing and boating pose significant risk of spread. Lures and propellers can dissect cabomba stems, enabling fragments to be transported to new waterways on equipment or trailers. Cabomba cannot survive in saltwater.

A quarantine zone under the *Weeds Management Act* has been in place since 2004 to prevent any spread of cabomba from Darwin River while the infestation remains under active treatment. The quarantine order has been in place since 2004 and prohibits the movement of people and any object, including boats, vehicles and fishing equipment, into or out of this section of river and within the five metres of land adjacent to the water's edge.

Evidence of quarantine zone breach, including destruction of fencing and locks has been common; indicating the threat of spread remains high while cabomba is growing. As part of the intensified Eradication Program, the Department has installed and monitored surveillance cameras in the area to identify offenders.

In 2016, two fishermen were caught in the declared quarantine area of Darwin River, resulting in a fine for a third party who launched the recreational fishing boat.

Extension materials regarding the quarantine zone and the ongoing nature of the eradication program formed a major part of the 2016-17 Program (Plate 10).

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Darwin River aquatic weed control **CABOMBA** ERADICATION PROGRAM

The Weed Management Branch is eradicating the only known infestation of cabomba in the Territory

WARNING!
Aquatic herbicide applications in progress

Don't Risk it!

- Cabomba threatens our waterways, drinking water quality, recreational fishing and outdoor lifestyle
- The quarantine zone is still in place and fines do apply
- A bund wall has been constructed to protect Darwin Harbour
- Environmental monitoring is occurring
- If you see it - report it!

DON'T SPREAD CABOMBA
Protect our Top End Waterways!

For more information call 8999 4567 or go to www.nt.gov.au/cabomba

NORTHERN TERRITORY GOVERNMENT

The poster features a skull and crossbones warning symbol, a list of risks, and icons for no entry, no boating, no fishing, and no swimming. It includes a photograph of a boat on the water and a bund wall.

Plate 10: Eradication Program Poster 2016

Results

The first treatment was not undertaken in July as planned due to the delayed construction of the bund wall. The first half billabong treatment for cabomba using the aquatic herbicide Shark™ was completed mid October 2016 under permit PER82571 issued by the APVMA.

In total, it took four Weed Management Branch Officers six days to treat 85 mega litres of the billabong, using two boats to subsurface inject over 700 litres of herbicide along a linear distance of just over 1 kilometre (refer to Plates 11 and 12 and Map 3).

Before the first half billabong treatment, cabomba fragments were readily found floating on the surface throughout the infestation zone. Cabomba infestations growing from the river bed where also reaching the surface in at least ten sites. Three months post treatment; not a single cabomba fragment can be found in the treated zone. One healthy fragment has been found in the untreated zone downstream of where the herbicide was used.

Initial off target affected some small fish and pandanus trees. A fish survey was completed post treatment by Fisheries NT and they believe the levels and species of fish found indicate that fish stocks were not adversely affected. The pandanus population is likely to recover given that most were unaffected by the herbicide.

Plate 11: Half billabong treatment and associated monitoring, October 2016



Map 3: Lok landji Billabong showing cabomba infestation and treatment area relative to water depth (and subsequently volume)

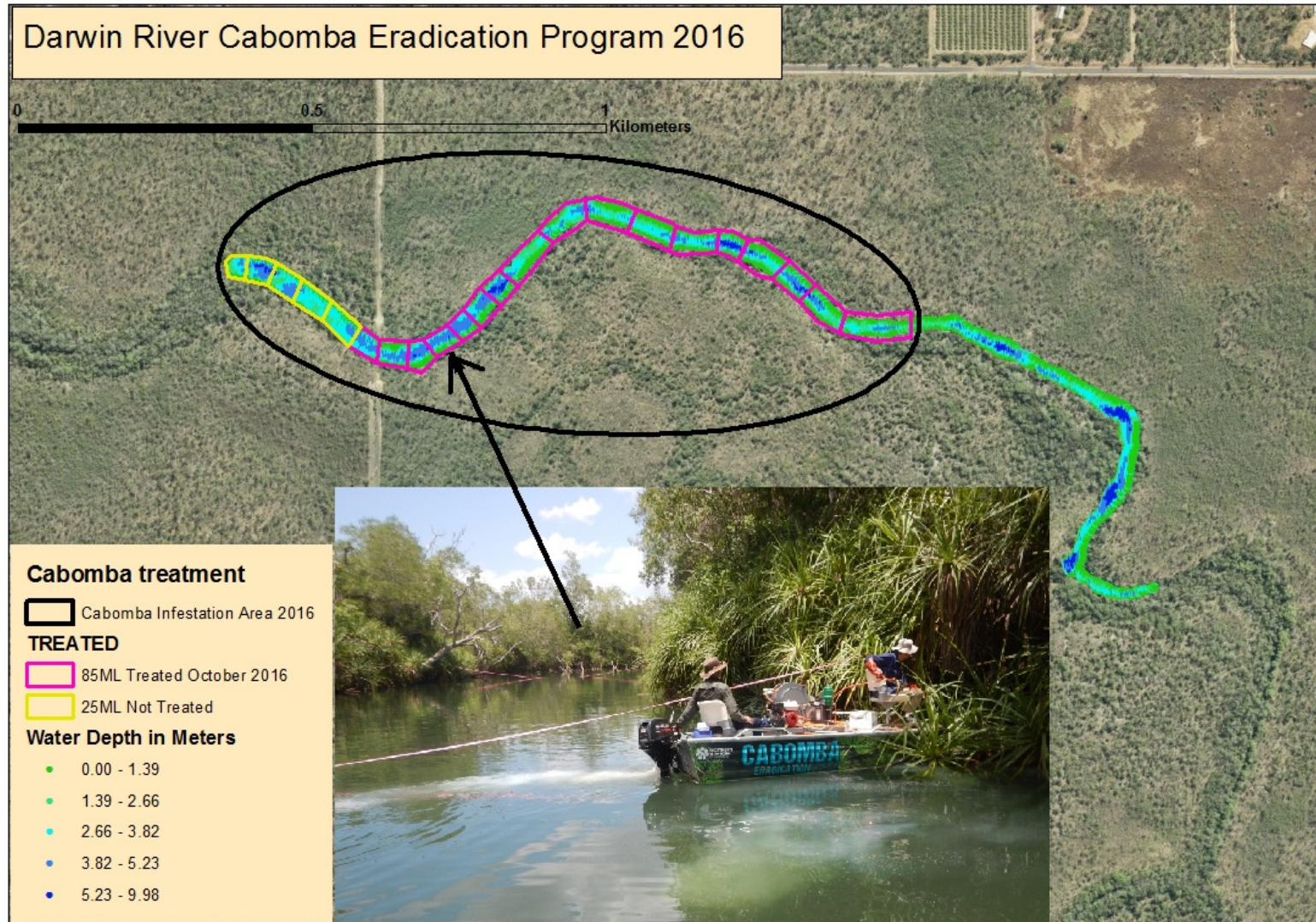


Plate 12: Cabomba Eradication Officers applying Shark™ in one of the defined quadrats during the first half billabong treatment

Herbicide application results

One week post application

- Cabomba fragments were readily found floating on the surface in both the treated and untreated zones.
- The cabomba growing from the river bed had begun to show some herbicide effect and was starting to lay flat on the river bed.

Eight Weeks post application

- No floating fragments were found in the treated zone or downstream in the untreated zone.
- No healthy cabomba was able to be found on the river bed in either the treated or untreated zone (Plate 13).



Plate 13: Unhealthy cabomba eight weeks post-treatment

Three months post application (18 January 2017)

- No floating fragments could be located in either the treated or untreated zone.
- Surveillance techniques used in the treated zone could not locate any cabomba on the river bed in any of the previously known infestation sites.
- In the untreated zone a single small, but healthy fragment was located on the river bed (Plate 14). This healthy stem indicates that while some herbicide effect was observed in the untreated zone, it will require targeted management once the river stops flowing in the coming 2017 Dry season.



Plate 14: First sign of healthy cabomba three months post treatment – only in untreated zone.

Expert advice

Weed Officers contacted interstate experts to discuss the results from the spray. One expert, involved with cabomba management in the Great Lakes region of NSW, confirmed that the results observed in the treated zone of Lok Landji compared favourably with what they observed with the Shark™ treatment of their cabomba. They conducted one 50% treatment of a lake in 2012 and have not seen a single cabomba plant since; effectively eradicated. This result in NSW is promising for the NT but the situations are quite different with our water body having flow and the fact that nowhere else in Australia, besides the NT, does cabomba produce viable seed.



Plate 15: Cabomba survey being undertaken after first half billabong treatment

Unavoidable postponement of the Second Half Billabong Treatment

Due to the later than planned construction of the bund wall, the first treatment was completed mid-October 2016. With the APVMA's permit conditions requiring no treatment to be undertaken once the river begins flowing or Wet season rains start and 90 days between treatments, the second treatment could only be done in mid-January 2017. The second spray would not be undertaken if this was the case.

Not wanting to miss the opportunity for a second treatment, the Weed Management Branch applied to the APVMA to reduce the 90 day requirement between sequential half billabong treatments to 50 days. The intention was to enable two treatments in 2016.

Despite the APVMA approving the time reduction between treatments (for the 2016 calendar year only), by early December 2016 it became apparent that early Wet season rains would prohibit a second treatment. In addition it was determined that cabomba infestations had not sufficiently recovered from the first application to actively take up herbicide from a second spray. The second 2016 treatment was abandoned.

Outcomes and recommendations

Ongoing support for the Cabomba Eradication Program is required to ensure that the significant investment made during 2016-17 is capitalised upon. Early results show significant reductions in both cabomba density and location with the infestation area of Lok Landji due to the intensified chemical control, with minimal off-target impacts.

Cabomba's rapid growth rates and ability to produce viable seed would likely facilitate complete recovery within one to two years if efforts are not made to detect and destroy surviving plants. Current results indicate that continuous investment may enable complete eradication within two to three years. A continued commitment to enforce the quarantine area at Darwin River is also required to protect the Territory from inadvertent spread of this high biosecurity risk during ongoing treatment.

With only one half billabong treatment able to be completed before the 2016 Wet season commenced, there are at least two more treatments required for Treatment Zone A to be undertaken in the 2017 Dry season. Herbicide for the planned second treatment in December 2016 was purchased in November 2016. Cabomba surveys, river flow and turbidity levels in the 2017 Dry season will determine when this herbicide can be applied.

Treatment Zone B will most likely be sprayed in 2018 and 2019 once efforts in Zone A have been finalised. Herbicide applied to the A Zone in October 2016 drifted into the B Zone substantially affecting the cabomba in this zone. This cabomba was significantly impacted and will most likely continue to be with subsequent A Zone treatments. This fact is likely to lead to a short management period for B Zone cabomba for eradication to be achieved.

Table 2 summarises the proposed management program for the next two years with ongoing investment in the longer term focused on survey:

Table 2: Proposed action 2017 to 2019 (refer to Map 2 for Zone information)

	2017	2018	2019 Onwards	2029
January	High Rains, turbidity and river flow	High Rains, turbidity and river flow	High Rains, turbidity and river flow	
February				
Mach				
April				
May	Survey	Survey	Survey	Survey
June	Chemical application Zone A	Chemical application Zone A or B	Chemical application Zone B	Quarantine Zone Lifted
July				
August	Survey	Survey	Survey	
September	Chemical application Zone A	Chemical application Zone A or B	Chemical application Zone B	
October				
November	Survey	Survey	Survey	
December				