Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

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1. Introduction

The *Biosecurity Act 2014* came into force on 1 July 2016, and is underpinned by the Biosecurity Regulation 2016. While the Act addresses a wide range of activities, this paper focuses on activities relevant to stakeholders involved in the management of aquatic ecosystems such as local government, property developers, infrastructure providers, and the mining and gas industries, and discusses their obligations under the Biosecurity Act. While our focus is on aquatic ecosystems, the basis of this paper applies equally apply to terrestrial ecosystems.

This paper explains key provisions of the Act, and provides simple examples of how its application may affect land-holders and proponents alike. The paper is presented in 3 parts,

- an introduction to the concept of invasive species
- an explanation of key elements of the Act, and
- case studies of invasive fish and water weeds.

2. Invasive species: what are they and why are they a threat?

In an ecological context, an **invasive species** is a species that is found beyond its natural distribution, and which threatens valued environmental, agricultural or other societal resources. Invasive species of fish are commonly referred to as 'noxious' species.

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Has the bar to development been raised again?

Queensland's *Biosecurity Act 2014* applies a more specific (if less straightforward) definition[1]:

invasive animal—

(a) means a species of animal that has, or is likely to have, an adverse impact on a biosecurity consideration because of the introduction, spread or increase in population size of the species in an area, and

(a) includes a species of animal that is prohibited matter or restricted matter.

invasive plant—

(a) means a plant species that has, or is likely to have, an adverse impact on a biosecurity consideration because of the introduction, spread or increase in population size of the species in an area, and

(a) includes a plant species that is prohibited matter or restricted matter.

- where a **biosecurity consideration** may be human health, the economy or the environment.[2]

While single celled organisms (e.g. bacteria and viruses) also pose a significant threat to environmental, agricultural and societal resources, and are included in the provision of the Biosecurity Act they are not dealt with in this paper.

The damage caused by invasive species (in the context of the Act) includes:

- Competitive impacts, where the invasive species can reproduce more rapidly, or otherwise out-compete native species, to the extent that a native species declines or is threatened. For example, fish such as eastern gambusia *(Gambusia holbrooki)* and tilapia *(Tilapia mariae* and *Oreochromis mossambicus)* displace native fish, while aquatic weeds such as water hyacinth *(Eichhornia azurea)* and water milfoil *(Myriophyllum spicatum)* displace native aquatic plants.
- Degradation of habitat, where feeding or other behaviours result in the degradation of habitat that supports native species. For example, water hyacinth and water milfoil choke waterways and can reduce the concentration of dissolved oxygen in the water, making it unsuitable for native fauna; carp *(Cyprinus carpio)* increase water turbidity through their feeding behaviour; and feral pigs *(Sus scrofa)* can create mud wallows that adversely impact waterways and associated aquatic ecology.
- Predatory impacts, where an invasive species reduces the population size and / or threatens the survival of native species by predation. For example, the consumption of loggerhead turtle eggs by feral pigs has a significant impact on the turtle population, and
- Herbivory impacts, where an invasive species consumes native plants, causing a population decline.

The introduction of invasive species may be encouraged, and impacts from invasive species exacerbated, by particular land (and water) use practices. Impacts from invasive species may also be cumulative, where compounding damage to natural (or agricultural) assets is affected by more than one invasive species.

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[1] Schedule 4
[2] Section 5

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

3. Queensland's *Biosecurity Act 2014*

3.1 An Introduction to the Act

Invasive aquatic species, including fish and water weeds, are declared under Queensland's *Biosecurity Act 2014*.

This Act replaces or amends the many separate pieces of legislation[3] previously used to manage biosecurity, and seeks to provide a framework to minimise biosecurity risks and to support a 'risk-based' approach to biosecurity management.

The Act specifically seeks to manage risks associated with exotic pests (plants and animals, including noxious and invasive species) and diseases that impact plant and animal industries including aquaculture and wild capture fisheries, tourism, infrastructure including water supply, shipping, biodiversity, and the natural environment.

The Act does this primarily by:

- defining biosecurity matters [4]
- establishing a general biosecurity obligation [5]
- establishing obligations in relation to prohibited matter and restricted matter including reporting the presence of these matters [6]
- specifying what are notifiable incidents [7]
- providing for mechanisms to manage emergency biosecurity events such as Biosecurity Emergency Orders [8]
- empowering the chief executive administering the Act to issue Movement Control Orders [9] and inspectors and authorised persons to have entry, search and seizure powers in specified circumstances [10]
- empowering the State and local governments to authorise surveillance programs, compliance agreements and prevention and control programs [11], and
- providing for the issue of prohibited matter or restricted matter permits [12] or biosecurity certificates to indicate compliance or exemption from particular requirements in the Act.

The Act distinguishes between species:

- not yet present in Queensland (termed **prohibited matter** and listed under Schedule 1), and
- species currently present (termed **restricted matter** and listed under Schedule 2).

[3] The *Biosecurity Act 2014* replaces the *Agricultural Standards Act 1994*, the *Apiaries Act 1982*, the Diseases in *Timber Act 1975*, the *Exotic Diseases in Animals Act 1981*, the *Plant Protection Act 1989* and the *Stock Act 1915; and amends the Chemical Usage (Agricultural and Veterinary) Control Act 1988*, the *Fisheries Act 1994* and the *Land Protection (Pest and Stock Route Management) Act 2002.*

[4] Chapter 1

[5] Section 23

[6] Chapter 2 Parts 2 and 3

[7] Section 47

[8] Chapter 6 Part 1

[9] Chapter 6 Part 2

[10] Chapter 10

[11] Chapter 9

[12] Chapter 8

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

While many plants and animals, including fishes and water weeds, are identified as **invasive biosecurity matter** on both Schedules 1 and 2, the categories of matter presented within these schedules commonly confuse (through inconsistent and tautological terminology) and contradict the definitions of 'invasive animal' and 'invasive' plant' provided in Schedule 4 of the Act. For example, in Schedule 1 (Prohibited Matter), Part 4 lists 'Invasive biosecurity matter – invasive animals', while Parts 5 and 6 list 'Marine animals and plants' and 'Noxious fish', without noting that both categories are also 'invasive' [13]. In Schedule 2, all fishes are listed under the heading Part 1 – 'Restricted matter – other than invasive security matter' even though each species listed meets the Act's definition of an invasive animal. In contrast, the water weed Cabomba, that meets the Act's definition of an invasive plant, is listed under Part 2 – 'Restricted matter – invasive security matter'. These inconsistencies and anomalies are at times likely to undermine the stated purpose of the Act, and make its application difficult.

The Act [14]:

- imposes a **general biosecurity obligation** (see discussion below), and
- adopts a **precautionary principal** approach in risk-based decision making - that is, the lack of full scientific certainty should not be used as a reason to postpone taking action to prevent a biosecurity event or to postpone a response to a biosecurity risk.

3.2 General Biosecurity Obligation

By law, individuals and other entities[15] who deal with biosecurity matter or carry out an activity, and knows or ought reasonably to know, that the biosecurity matter or the carrier or activity poses, or is likely to pose, a biosecurity risk are obliged to:

- take all reasonable and practical measures to minimise the likelihood of causing a biosecurity risk, and / or
- do whatever is reasonably required to minimise the adverse effects of dealing with a biosecurity matter or carrier.

Specifically, they may not keep or possess, whether intentionally or otherwise, the biosecurity matter or carrier, or propagate, raise, distribute or transport the biosecurity matter or carrier.

A **biosecurity risk** is a risk of any adverse effect on a biosecurity consideration caused by, or likely to be caused by –

- a biosecurity matter
- dealing with a biosecurity matter or a carrier, or
- carrying out an activity relating to a biosecurity matter or a carrier.

For example, there is a general biosecurity obligation to take reasonable and practical steps to minimise risks associated with invasive fish and water weeds, by everyone who deals with fish or water weeds, or who does an activity knowing that fish or water weeds may be a biosecurity risk.

Increasing or otherwise altering the habitat and / or connectivity provided by a waterway that is likely to support noxious fish or water weeds, would be deemed a biosecurity risk.

[13] That is, they meet the definition of invasive provided by the Act.
[14] Section 4
[15] Acts Interpretation Act 1954 (Qld)

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

A person can discharge their biosecurity obligation by complying with relevant requirements of the Act, the Biosecurity Regulation 2016, a code of practice, a guideline, or by entering into and meeting the terms of a compliance agreement.

3.3 Awareness of Relevant Biosecurity Risks

The Act places an onus on individuals and other legal entities to be aware of the biosecurity risks associated with activities they undertake.

In the guidelines to the Act[16] , the Department provides examples of biosecurity obligations, for example:

- graziers are expected to know about, and manage serious diseases of livestock such as anthrax and Johne's disease, and the weeds and feral animals present in their area, and
- aquaculturists are expected to know about noxious fish and water weeds that should not to be released into rivers or creeks.

These examples suggest that an entity (such as an infrastructure provider, mining company or property developer) altering the character of waterways would be expected to know about the likelihood of those waters supporting noxious fish and water weeds, and the impact they may have on these species.

3.4 Responsibility, Management and Reporting of Biosecurity Risks

The general biosecurity obligation further requires individuals and others to ensure that activities with the potential to introduce or spread a pest, disease or contaminant ('biosecurity risks') are reasonably managed to prevent and / or minimise the likelihood and consequences of a **biosecurity event** (i.e. an event that has, or may have, a significant harmful effect on human health, the economy or the environment).

Noxious fish classified as restricted matter under Schedule 2 of the Act are assigned to categories 3, 5, 6 and 7 of the Schedule (with some species assigned to more than one category).

- species listed under Category 3 (including eastern gambusia) must not be distributed (given, sold, traded or released into the environment)
- species listed under Category 5 (including common carp) must not be kept or held in possession, and
- species listed under Category 6 (including carp, eastern gambusia and tilapia) must not be fed.

Anyone in possession of species listed under Category 7 (including noxious fish such as carp, weatherloach, climbing perch, eastern gambusia and tilapia) is required to kill those fish, and either bury the carcasses or place them in a waste receptacle.

The duty to report prohibited matter or a category 1 or 2 restricted matter[17] (and the consequential offence provisions) apply to occupiers of a place, owners of a place (where there is no apparent occupier) and those in possession or control of the biosecurity matter. However, unlike a notifiable incident (see below), these duty and offence provisions do not apply to all members of the public. Never-the-less, a third party can report the presence of a prohibited or restricted matter.

[16] Department of Agriculture and Fisheries Biosecurity Queensland. 2015. New Biosecurity Laws for Queensland
[17] Sections 36 and 42

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

To '**possess**', a thing, is defined in the Act to mean:

(a) have custody of the thing, or

(a) have control of it at any place, whether or not someone else has custody of it.

'**Release**', '**control**' and '**custody**' are not defined in the Act or Biosecurity Regulation. These words should consequently be determined by reference to their context, and by their ordinary and natural meaning.

The Macquarie Dictionary defines:

- 'release' to mean *'to free from confinement, etc…let go'*;
- 'control' to mean *'to exercise restraint or direction over, dominate, command'*; and
- 'custody' to mean *'keeping, guardianship or care'*.

In the context of the Act, the concepts of possession, custody and control have a broad reach. The language potentially contemplates having present custody or control but could also extend to the ability to obtain or claim custody or control. Such broad construction is consistent with the purposes of the Act and how to achieve those purposes in sections 4 and 5, which enshrine the notion that all persons have an obligation to minimise biosecurity risks and contribute to effective biosecurity management in Queensland.

It is noted that section 140 of the Act identifies when, for the purposes of Chapter 7 of the Act, a person 'holds' a designated biosecurity matter. That section refers to concepts such as day-to-day control and who at law has title to the biosecurity matter. The Act's definition of 'possess' does not refer to the word 'hold'. This section therefore does not assist in the interpretation of concepts such as 'custody' or 'control' for the purposes of sections 36 and 42 of the Act. The notion of 'hold' as defined in section 140 appears to be one unique to Chapter 7 of the Act relating to the registration of biosecurity entities and designated animal identification (with no relevance to invasive animals or plants).

The Act requires a person to advise an inspector of a '**notifiable incident**'[18] . A 'notifiable incident' is defined to include a biosecurity event. A **biosecurity event** is an event comprising something that:

(a) has happened, is happening or may happen, and

(a) has had, is having or may have a significant adverse effect on a biosecurity consideration, and

(a) was or is being caused by, or may be or may have been caused by, biosecurity matter.

The discovery of a species listed in Schedule 1 of the Act is a notifiable incident.

The discovery of noxious fish or water weeds listed on Schedule 2 of the Act by a land-holder is potentially a notifiable incident, as it has, or may have, a significant adverse effect.

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

3.5 *Prohibited and Restricted Matter Permits and Permit Plans*

Under the Act, it is an offence to deal with or possess (whether intentionally or otherwise) prohibited matter and / or restricted matter unless in possession of a **prohibited matter permit** and / or a **restricted matter permit**.

An application for a prohibited matter permit and / or a restricted matter permit[19] must be accompanied by a 'permit plan' (an 'invasive species management plan' for invasive plants and animals) detailing how the biosecurity risk will be minimised.

The Chief Executive may grant an application for a prohibited matter or restricted matter permit only if satisfied:

(a) the applicant is a suitable person to hold the prohibited matter or restricted matter permit, and

(a) the potential biosecurity risks posed by the proposed dealings under the permit can be managed under the permit plan in a way that has appropriate regard to biosecurity considerations.[20]

A prohibited matter or restricted matter permit cannot be for more than 3 years.[21]

Overall, there is a strong focus in the Act on requiring all stakeholders to take an active role in managing and responding to biosecurity risks. This extends to landowners having strategies to minimise the spread noxious fish and water weeds, and to minimise adverse impacts.

The development and implementation of 'invasive species management plans' are increasingly likely to be required to address a land-holder's or proponent's obligations under the Act in the context of land disturbance and development. The objectives and actions specified in such plans will depend on the structure and hydrologic regime of the effected waterbodies, the likelihood of occurrence of threatened species, and the likely presence and control of other alien fishes (especially predatory fishes).

3.6 *The Role of Local Government*

The Act provides for the co-operative management of invasive biosecurity matter.

Under the Act all local governments must have a biosecurity plan that sets out the objectives, strategies, activities and responsibilities for managing invasive species within their local government area.

3.7 *Offences and Orders Under the Act*

It is an offence for a person, without reasonable excuse, to fail to discharge their general biosecurity obligation.[22] The maximum penalties for this offence are significant and can include a term of imprisonment for an individual (even in circumstances where the offence is not an aggravated offence).

An offence is an aggravated offence for the purposes of the Act if it causes significant damage, or is likely to cause significant damage, to human health, the economy or the environment. To prove an aggravated offence, it must be proved that the person who committed the offence did so with intent, or was reckless.[23]

[19] Chapter 8
[20] Section 220(1)
[21] Section 222
[22] Section 24
[23] Section 27

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

The offence provision of the general biosecurity obligation in the Act can be contrasted with the general environmental duty found in section 319 of the *Environmental Protection Act 1994* where a breach is not an offence per se, but rather acts as a defence to other offence provisions of that Act.

In a proceeding for an offence against the general biosecurity obligation offence provision, it is a defence for a person to prove that they took all reasonable precautions and exercised proper diligence to prevent the offence.[24] This due diligence defence might be enlivened in circumstances where a person makes reasonable enquiries and relies on information supplied by, or checks carried out by another.

What steps are reasonable and practicable will depend on the risk and the specific circumstances. Generally, the greater likelihood of risk, the more onerous the action required.

If an authorised officer reasonably believes that a person has failed, or may fail, to discharge the person's general biosecurity obligation at a place, the authorised officer may give the person a **biosecurity order**.[25] A biosecurity order may require the recipient to take a range of actions, such as disposal or destruction of a biosecurity matter in a stated way, or to stop using the place or part of the place for a stated purpose or for a stated period. It is an offence to fail to comply with a biosecurity order unless the recipient has reasonable excuse.[26]

4. Invasive Species Management

4.1 Introduction

The spread of invasive species is recognized as one of the major factors contributing to ecosystem change and instability throughout the world.

Commonly, invasive species are managed through a suite of strategies that may include: cooperation and collaboration, inventory and monitoring, prevention, early detection and rapid response, treatment and control, and restoration.

The effective management of invasive species commonly requires government to partner with community groups and land owners in order to achieve 'buy-in', deploy the resources required, and to make best use of local knowledge.

Monitoring is integral to the detection of invasive species, and to understand their impacts on native flora and fauna. Monitoring is also critical in guiding an effective management program, helps to identify what works and where effort is most required.

Efforts to prevent the introduction and / or spread of invasive species commonly require a combination of regulation, education and enforcement; while early detection and rapid response offer the best chance of eradication.

Once an invasive species has been eradicated, or the infestation has been brought under control, the ultimate goal of invasive species management is to restore functioning ecosystems.

The following case studies, illustrate the challenges posed by 2 aquatic species introduced to Queensland, each listed as restricted matter on Schedule 2 of the Act.

[24] Section 28
[25] Sections 373-376
[26] Section 377

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

4.2 Case Study – Eastern Gambusia (*Gambusia holbrooki*)

Eastern gambusia *(Gambusia holbrooki)* is a member of the 'tooth-carp' family (Poeciliidae – related to the guppies and platys of the aquarium trade) and is native to south-eastern USA. It was deliberately introduced to Australia in the 1920s, as it was thought to eat mosquito larvae, and could consequently reduce mosquito populations, and hence malaria. They are now common in coastal and inland waters from South Australia to north Queensland, with populations known also from southern Western Australia, Port Headland, Broome, Alice Springs and Darwin. In South East Queensland they are the most abundant and second most wide-spread species.

Eastern gambusia have up to nine broods per year with an average of 50 young per brood. They are livebearers, with fertilised eggs developing inside the female parent, and with larval fish being born from the parent. Maturation can take as little as two months. Eastern gambusia is omnivorous, and their diet includes aquatic macro invertebrates, micro-crustacea and larvae of native fish and frogs. The species prefers still or gently flowing water, is tolerant of a wide range of temperatures, and of low concentrations of dissolved oxygen. In many streams, especially highly modified streams, eastern gambusia is significantly more abundant than native species, and can dominate fish communities. Coupled with aggressive behaviour (i.e. fin-nipping of native species) and predation of native fish larvae, the introduction of eastern gambusia has led to the localised decline of native freshwater fish in many streams across Australia. Ironically, several native species that are adversely impacted by the presence of eastern gambusia are more proficient predators of mosquito larvae.

Under the Queensland *Biosecurity Act 2014*, eastern gambusia is a class 3, 5, 6, and 7 restricted matter, meaning that:

- it must not be released or distributed (class 3)
- it cannot be kept or possessed (class 5)
- it cannot be fed (class 6), and
- it must be destroyed if it is in anyone's possession, with the carcass disposed of by burying in the ground above high-water mark (class 7).

The general biosecurity obligation requires management of biosecurity risks, and in the case of eastern gambusia, is reasonably interpreted to mean that where development or governance places the species under the 'control' of an entity (i.e. developer, local government authority), then the associated biosecurity risks must be managed, and specifically for this species, it must:

- not be released or distributed by any action, and must
- be destroyed if it is in an entity's possession or control.

This suggests that where a development (in the case of industry) or management plan (in the case of local government) involves a waterbody (whether natural or artificial) that has, or is likely to have, eastern gambusia, then the developer / local government authority is legally obliged to implement practicable measures to destroy the local population of this species. Further, control may be required to prevent distribution; for example, where floods may distribute gambusia to another water body, then eradication of eastern gambusia from the 'controlled' waterbody is the only certain way of preventing the release or distribution of this species.

Approaches to minimising the impact of invasive freshwater fish usually involve lowering their numbers, through culling, and by reducing the impact per individual, for example through habitat restoration. Control measures may include chemical eradication, exclusion (e.g. using physical and / or behavioural screens), direct removal (e.g. trapping, netting), habitat drying and commercial harvest.

Habitat restoration includes rehabilitation of both physical habitat and the natural hydrologic regime. Chemical control and / or drying of isolated habitats can be effective for isolated systems, where there are follow-up rounds of monitoring and control. Seine netting can also be used in conjunction with either of these methods to lower numbers in isolated waterbodies, with the efficiency highest when water level is lowest.

Where chemical control and habitat drying approaches are considered, salvage of native species is essential. Where threatened aquatic species are likely to be present, neither of these methods should be used, as they may significantly negatively impact the threatened species.

Control of eastern gambusia in larger open systems is unlikely to be feasible until technologies such as gambusia-specific harvesting or daughterless (genetic) technologies are available. Consequently, minimising their impact, rather than eradication, is typically the most practical management objective. This is achieved via habitat restoration, as systems with more diverse aquatic habitat support more species and individuals of native fish, than areas without diverse habitat. Low water levels increase the impact of eastern gambusia on native fish consequently, provision of environmental water during periods of low water, especially in areas inhabited by threatened species, will minimise impacts.

Where eastern gambusia occurs with other invasive species, such as tilapia[27], control programs need to account for the interaction between these species. For example, in areas of the Murray-Darling Basin where redfin perch and eastern gambusia occur together, both species need to be controlled: — due to their predator-prey relationship, removal of only one can cause higher impacts to native species than if they were both present.

4.3 Case Study – Cabomba (an invasive water weed)

Cabomba caroliniana is a perennial submerged aquatic plant, that was introduced to Australia from South America for the aquarium trade. To ensure supply for the aquarium industry, it has been deliberately grown in natural waterways in Queensland and New South Wales. It is an aggressive coloniser, spreading from small stem fragments. There are now infestations from far north Queensland to Victoria, and also near Darwin. It has become widespread in south east Queensland, with large infestations in Ewen Maddock Dam near Caloundra and Lake MacDonald near Noosa.

Cabomba roots in soft sediment, with its flowers above the water surface. It has multiple stems per plant, that can be up to 10 m long. It has a very high growth rate, and can rapidly choke waterways and water storages, significantly reducing capacity. Many native aquatic species, including native aquatic plants, native water rat and platypus are excluded from infested areas. Further, the decomposition of cabomba as it naturally dies-off (or dies as a result of lowering of the water level) causes dramatic declines in dissolved oxygen levels in water and the potential for eutrophication. The dense stems are a hazard for recreational users, and water treatment costs can be high where it infests water supply dams.

Under the Biosecurity Act, *Cabomba caroliniana* is a class 3 restricted matter, which means it must not be distributed by any means. It is illegal to sell or plant in any waterbody in Queensland. Boat trailers, boats and vehicles, and any other machinery used in waterbodies that have cabomba, must be thoroughly washed to ensure it does not spread.

The Act has yet to be tested, where the release of waters facilitates the release and distribution of cabomba downstream.

[27] Please refer to our white paper 'The Invasion of Australia's Aquatic Ecosystems by Tilapia'

Invasive and Noxious Aquatic Species and the Queensland *Biosecurity Act 2014*

Has the bar to development been raised again?

Where there is cabomba in a waterway subject to a local government waterway management plan, then the plan needs to provide strategies and actions to prevent its spread. While in situ management of cabomba is not specifically required, in many instances in situ management is the only way to safeguard against the release or distribution of cabomba, and thus of complying with the Act's General Biosecurity Obligation. Development proposals that include creation of wetlands adjacent to areas where cabomba is present must ensure that newly created wetlands do not increase the distribution of cabomba.

In situ management options include:

- mechanical harvesting, although this method has a recurrent expense and does not eradicate the species, and unless used frequently has no lasting impact on cabomba infestations
- drying of habitat, as cabomba is sensitive to desiccation. However, drying must be complete, as the species can persist in moist sediments
- shading, as cabomba requires direct sunlight. Shading can include plastic sheeting over small infestations, or the restoration of riparian vegetation
- application of herbicide, noting that herbicides are also harmful to native aquatic plants and may be toxic to aquatic fauna (e.g. macroinvertebrates).

The General Biosecurity Obligation created by the Biosecurity Act requires Biosecurity Management Plans to be developed by development proponents or local government authorities, and that the plans consider strategies and actions to prevent the distribution of cabomba.