

Appendix 2: Zoo enclosure guidelines for containment area design

Introduction

These guidelines are an updated version of Part 1 of the draft enclosure guidelines prepared by the Zoo and Aquarium Association New Zealand (ZAA NZ) – *Guidelines for Containing Zoo Animals in New Zealand, 2013*. They form Appendix 2 of the *MPI Guidance Document – Generally Accepted Practice in New Zealand Zoo Containment Facilities*.

The following zoo enclosure guidelines for each category of new organism are considered to be generally accepted practice based upon the rationale and / or references that are provided. These specifications are often based upon enclosures currently used in New Zealand zoo containment facilities that have successfully contained various specimens of a new organism without breach for at least the last seven years.. In these cases, the rationale identifies the zoo containment facilities in which the enclosures are located and the year constructed.

The guidelines may be used when designing a zoo containment area for new organisms. It is generally accepted that there will be supporting evidence for the chosen design, including but not limited to:

- Animal husbandry guidelines published by international zoo and aquarium associations, such as
 - Australasia – Zoo Aquarium Association (ZAA), www.zooaquarium.org.au
 - Europe – European Association of Zoos and Aquaria (EAZA), www.eaza.net
 - North America – Association of Zoos and Aquariums (AZA), www.aza.org
- Examples of zoo enclosures where the chosen design has already been used successfully – a good resource is Zoolex, the Zoo Design Organisation, www.zoolex.org
- Designs and recommendations provided by a zoo design expert.

It is important to note that the specifications below are subject to change as generally accepted practice within the New Zealand zoo industry evolves over time. Also note that enclosure specifications for some species mentioned here may be on the conservative side where there are limited New Zealand examples available. Operators may propose alternative enclosure specifications to MPI, but will be required to provide evidence to support their claim that these enclosures will achieve the outcomes of containment. For examples of the types of supporting evidence that can be provided, refer to s2.3 of this guidance document.

Key to the Tables

Unclimbable Barrier: An unclimbable containment barrier usually has a smooth surface that ensures animals are unable to gain any foot or limb holds, e.g. glass, smooth concrete vertical walls. Care is needed to ensure that vegetation does not reduce the effectiveness of these.

Climbable Barrier: Mesh or netting fences are the most common type of climbable barrier. They are suitable for non-climbing species, such as hoofed animals. They are not suitable for species capable of climbing unless fully enclosed with a mesh or solid roof, or when used in combination with an internal overhang and / or electrified wires.

Electrified Wires: Electric fencing is useful as an additional psychological deterrent but is generally not used as the primary containment method. Uses of electrified wires include, but are not limited to, the following:

- To discourage animals from climbing or getting too close to containment barriers
- To deter animals from direct contact with containment barriers to minimise damage
- To protect plants or other items within a containment area.

Wet Moat: These enclosure guidelines refer to water-filled moats. Dry moats are also an effective barrier but are not referenced in these guidelines.

Wet moats will often be gently sloping from the animal area, down to at least the minimum depth given for the species in the following tables, to minimise the risk of drowning if an animal falls in. Sloping wet moats may not be suitable for all taxa.

The visitor viewing side of the moat is finished with either an unclimbable barrier or a barrier with electrified wires, which should meet or exceed the minimum dimensions provided for the barriers for the species in the following tables.

Foundation: Minimum foundations are recommended for animals that dig and do not replace requirements for engineered foundations based upon structural design and local subsoil structure and conditions (geotechnical requirements).

The enclosure barrier (fence mesh, etc.) can be fixed to a solid foundation, such as concrete or treated timber.

Alternatively, digging can be prevented by joining a mesh apron (anti-dig mesh) to the fence mesh inside the enclosure and burying it at least 200mm below the surface, or by using another anti-dig material, such as a concrete path. Always consider the longevity of buried mesh, noting that stainless steel will last longer than galvanised mesh.

Fixings used to connect mesh together need to be strong and fit for purpose. Wire edges can be fully laced together with wire or fixed at no greater than 300mm intervals with gabion basket clamps or twisted stainless steel wire. Galvanised hog rings and similar products are not recommended as they are not strong enough for this purpose.

Building Materials: Some references are provided to assist with the choice of building materials that are suitable for the containment of the named species of new organism, and may be used to show that building materials are fit for purpose. It is intended that information on the impact strength of materials will be added in the future.

Rationale: This part of the table includes examples drawn from animal husbandry guidelines published by international zoo and aquarium associations or where the containment method has been successfully used in New Zealand zoo containment facilities for at least seven years without breach (AZ = Auckland Zoo, HZ = Hamilton Zoo, WZ = Wellington Zoo, OWP = Orana Wildlife Park).

Containment Area Recommendation: A containment area recommendation is provided for each species. The definitions of the recommendations in the tables are:

1. The entire facility, where the perimeter fence is suitable to contain the animal
2. One or more containment areas, including:
 - a. Animal enclosures and associated areas, such as overhead tunnels or overhead non-enclosed and non-descendible transfer ropes for arboreal primates
 - b. Buildings, e.g. butterfly house
 - c. Walk-through exhibits
3. Specified conditions, such as being under direct handler control (e.g. dingo being walked on a lead inside a zoo containment facility).

Contingency Plan: A contingency plan recommendation is provided for each species. The definitions of the recommendations in the tables are:

1. Shoot to kill, unless the Operator authorises a recapture attempt where staff and public safety can be guaranteed
2. Recapture the animal unless there is an immediate risk to humans or the environment.

Table 1 Carnivores C1: Bears, Big Cats and Hyenas

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Ursidae									
Brown Bear <i>Ursus arctos</i>	-	4.5 4m welded mesh fence with 1m internal overhang at 45°	4.5 4m mesh fence with 1m internal overhang at 45° and at least three electrified wires at varying heights	3m wide, 4m deep moat with 2m unclimbable barrier	1000mm deep solid foundation, or 500 mm deep solid foundation with lower edge joined to buried 1m wide anti-dig mesh	Suggested reference for wire diameter and apertures for welded mesh: <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	Based on <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	2	1
Sun Bear <i>Helarctos malayamus</i>	3.5	3.5 2.8m welded mesh fence with 1m internal overhang at 45°	3.5 2.8m mesh fence with 1m internal overhang at 45° and at least three electrified wires at varying heights	3m wide, 2.5m deep moat with 2m unclimbable barrier	1000mm deep solid foundation, or 500 mm deep solid foundation with lower edge joined to buried 1m wide anti-dig mesh	Suggested reference for wire diameter and apertures for welded mesh: <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	Based on <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	2	1

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Giant Panda <i>Ailuropoda melanoleuca</i>	2.5	-	2.5 With at least three electrified wires at varying heights	3m wide, 2m deep moat with 1.5m unclimbable barrier	1000mm deep solid foundation, or 500 mm deep solid foundation with lower edge joined to buried 1m wide anti- dig mesh	-	Based on enclosure built at Adelaide Zoo in 2009	2	1
<i>Felidae</i>									
Tiger <i>Panthera tigris</i>	4.5	4.5 4m mesh fence with 900mm internal overhang at 35-45°	4 3.6m mesh fence with 900mm mesh internal overhang at 35-45° and minimum of three electrified wires at varying heights	5m wide, 1.8m deep moat with: 2m unclimbable barrier, or 1m unclimbable barrier plus 800mm wide electrified in-rigger with minimum five wires	500mm deep solid foundation, or 500mm anti-dig material	Suggested reference for mesh wire apertures: <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i> Suggested reference for viewing window glazing: <i>AZA Tiger Species Survival Plan® (2016). Tiger Care Manual. Association of Zoos and Aquariums, Silver Spring, MD</i>	Barrier heights exceed known maximum jump height of just under 3.7m for wild Bengal tiger, which is a larger sub-species (Reference: YouTube tiger attack of mahout at Kaziranga National Park, India in 2004) Climbable barrier with electrified wires and wet moat dimensions based on OWP tiger enclosure built in 2007	2	1

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
African Lion <i>Panthera leo</i>	4	4 3.6m mesh fence with 900mm internal overhang at 35-45°	3.6 3m mesh fence with 900mm mesh internal overhang at 35-45° and minimum of two electrified wires at varying heights	4m wide, 1.8m deep moat with: 2m unclimbable barrier, or 1m unclimbable barrier plus 800mm wide electrified in-rigger with minimum five wires	500mm deep solid foundation, or 500mm anti-dig material	Suggested reference for mesh wire apertures: <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	Climbable barrier with electrified wires – OWP built prior prior to 1980 and another in 2006 Wet moat dimensions – AZ enclosure built in 1998	2	1
Clouded Leopard <i>Neofelis nebulosa</i> Leopard <i>Panthera pardus</i> Puma <i>Puma concolor</i> Snow Leopard <i>Uncia uncia</i>	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	500mm deep solid foundation, or 500mm anti-dig material	Suggested reference for mesh wire apertures: <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	Based on <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	2	1
Hyaenidae									

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Spotted Hyena <i>Crocuta crocuta</i>	2.7 2.4 m wall with 900mm internal overhang at 45°	-	3 2.7m mesh with 900mm internal overhang at 45° and minimum of four electrified wires at varying heights At least 1.2m of lower part of mesh fence should be weld mesh	-	1500mm deep solid foundation and 1200mm anti-dig wire	-	Based on enclosure built at Monarto Zoo, South Australia, in 2007 Perth have used unclimbable barrier successfully for 15 years	2	1

Table 2 Carnivores C2: Small to Medium Predators and Cheetah

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Felidae									
Serval <i>Leptailurus serval</i> Bobcat <i>Lynx rufus</i> Fishing Cat <i>Prionailurus viverrinus</i> Asiatic Golden Cat <i>Catopuma temmincki</i>	2.9 2.5 m wall with 900mm internal overhang at 45°	Not suitable without electrified wire or unless fully enclosed	2.9 2.5m mesh with 900mm internal overhang at 35-45° faced with at least four electrified wires (usually alternated with four earthed wires) spaced no more than 100mm apart, and minimum of two electric wires at varying heights on the vertical barrier	2m wide, 1.8m deep moat with: 2m unclimbable barrier, or 1m unclimbable barrier plus 800mm wide electrified in-rigger with minimum five wires	500mm solid foundation, or 250mm anti-dig material	-	Climbable barrier with electrified in-rigger used in serval enclosure – AZ built 2004 Has contained serval for more than 10 years although one individual breached containment prior to 2008	2 3 if hand raised and kept on a lead under handler control when out of enclosure	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Caracal <i>Caracal caracal</i> Small cats <i>Felis</i> spp. Ocelot <i>Leopardus pardalis</i> Margay <i>Leopardus wiedii</i> Leopard Cat <i>Prionailurus bengalensis</i>	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	500mm solid foundation, or 250mm anti-dig material	-	No rationale required as species should be kept fully enclosed	2 3 if hand raised and kept on a lead under handler control when out of enclosure	2
<i>Acinonyx</i>									
Cheetah <i>Acinonyx jubatus</i>	2.5	2.5 2m mesh fence with 500mm internal overhang at 45°	2 1.8m mesh fence topped with at least 3 electrified wires (maximum 250mm apart) and at least one electrified wire on the mesh fence	4m wide, 1.8m deep moat with: 2m unclimbable barrier, or 1m unclimbable barrier plus 800mm wide electrified in-rigger with minimum five wires	Fence must finish flush with ground, preferably with 300mm solid foundation	Suggested reference for guidance: <i>EAZA Best Practice Guidelines – Cheetah 2018</i>	Climbable barrier with electrified wires (2m finished height) – OWP built prior 1980 Climbable barrier with electrified wires (2.5m finished height) – AZ built 2006	2 3 if hand raised and kept on a lead under handler control when out of enclosure	2
<i>Canidae</i>									

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendation	Contingency Plan
Wolf <i>Canis lupus</i> Maned wolf <i>Chrysocyon brachyurus</i>	2.5	2.5 2m mesh fence with 500mm internal overhang at 45°	2 1.8m mesh fence topped with at least 3 electrified wires and at least one electrified wire on the inside of mesh fence	2.5m wide moat, 2m deep with: 2m unclimbable barrier, or 1m unclimbable barrier with 800mm wide in- rigger with at least 5 electrified wires	1m solid foundation or 1m anti-dig material	-	Based on Standards for Exhibiting Carnivores in New South Wales, 2016	2 3 if hand raised and kept on a lead under handler control when out of enclosure	2
African Wild Dog <i>Lycaon pictus</i>	3	2.5 2m mesh fence with 900mm internal overhang at 45°	2 1.8m mesh fence topped with at least 4 electrified wires and at least two electrified wires on the inside of mesh fence	4m wide moat, 2m deep with: 2m unclimbable barrier, or 1m unclimbable barrier with 800mm wide in- rigger with at least 5 electrified wires	1m solid foundation or 1m anti-dig material	Suggested reference for housing African wild dogs: <i>African Wild Dog – EEP Husbandry Guidelines, European Association of Zoos and Aquaria, 2009</i>	Climbable barrier with electrified wire – HZ 2003 Climbable barrier based on <i>Standards for Exhibiting Carnivores in New South Wales, 2016</i>	2	1
Dingo <i>Canis lupus dingo</i>	2.5	2.5 2m mesh fence with 500mm internal overhang at 45°	2 1.8m mesh fence topped with at least 3 electrified wires	3m wide moat, 1.8m deep with: 2m unclimbable barrier, or 1m unclimbable barrier with 800mm wide in- rigger with at least 5 electrified wires	1m solid foundation or 1m anti-dig material	-	As used at WZ since 2008 and approved by DSEWPaC (Australia)	2 3 if hand raised and kept on a lead under handler control when out of enclosure	2

Table 3 Carnivores C3: Small Carnivores and Red Panda

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Ailuridae</i>									
Red Panda <i>Ailurus fulgens</i>	1.8	Not suitable unless fully enclosed	Not suitable	Not suitable	250mm solid foundation or 500mm anti-dig material	-	As used at HZ since 2008, after a red panda was observed to jump higher than 1.5m	2	2
<i>Herpestidae</i>									
Meerkat <i>Suricata suricatta</i>	1	Not suitable unless fully enclosed	Not suitable	Not suitable without a 1m unclimbable barrier beyond moat	Entire ground area of enclosure must be covered with buried anti-dig mesh with aperture small enough to contain all specimens		Unclimbable barriers have been used for meerkats at AZ, HZ, OWP and WZ for over 7 years (designs vary)	2	2
<i>Mustelidae</i>									
Small-clawed Otter <i>Aonyx cinerea</i>	1.2	Not suitable unless fully enclosed	Not suitable	Water feature can form part of containment barrier with: 1.2m unclimbable wall, or 400mm unclimbable in-rigger at 45°	200mm solid foundation or 500mm anti-dig material		Unclimbable barriers have been used for otters at AZ, OWP and WZ for over 7 years (designs vary)	2	2

Table 4 Large Primates P1: Great Apes and Baboons

Common name Latin name	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Hominidae									
Chimpanzee <i>Pan troglodytes</i>	4	Not suitable unless fully enclosed	4 3.8m mesh fence with at least 11 electrified wires, no more than 320mm apart, for full height of barrier, and 1.2m in-rigger at top of barrier, 30° from vertical, with at least 10 electrified wires, about 12mm apart, and 1m horizontal in- rigger between 2.5m and 3.5m on barrier, with at least 8 electrified wires about 100mm apart	2m wide moat, 1m deep, with an unclimbable barrier protruding 2m above maximum water level, and at least one electrified wire and earth on unclimbable barrier	300mm concrete	-	Unclimbable barrier used at WZ since before 1990 Climbable barrier with electrified wires used in HZ enclosure built in 2006 with no breach of containment even during bouts of aggression Climbable barriers with electrified wires are not suitable for small exhibits (less than 2,000 m ²) as adequate space needed to allow animals to avoid each other during times of tension when electric fences cannot guarantee containment	2	1

Common name Latin name	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Gorilla <i>Gorilla gorilla</i>	4	Not suitable unless fully enclosed	Not suitable for containment but electrified wires can be used as additional security for unclimbable barriers or to deter access to parts of an enclosure, e.g. planted areas	6m wide moat, sloping to 2m deep, with a 1m marsh area on the animal side (slows animals from rushing into moat) and mesh or netting on moat floor to enable animals to get back into exhibit if they fall in Unclimbable visitor barrier required	300mm concrete	Suggested reference for housing gorillas: <i>EAZA Best Practice Guidelines, Great Ape Taxon Advisory Group – Gorilla, European Association of Zoos and Aquaria, 2017</i>	-	2	1
Orang-utan <i>Pongo pygmaeus</i>	4	Not suitable unless fully enclosed	Not suitable for containment but electrified wires can be used as additional security for unclimbable barriers or to deter access to parts of an enclosure, e.g. planted areas	6m wide moat, sloping to 1.5m deep, with mesh or netting on moat floor to enable animals to get back into exhibit if they fall in Unclimbable visitor barrier required	300mm concrete	Suggested reference for housing orang-utan: <i>EAZA Best Practice Guidelines, Great Ape Taxon Advisory Group – Orang-utan, European Association of Zoos and Aquaria, 2018</i>	Unclimbable barrier used at AZ for over 20 years	2	1
Papio spp									

Common name Latin name	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Baboon <i>Papio hamadryas</i>	2.8 Topped with 400mm in-rigger at 45° with at least six electrified wires	Not suitable	2m with 1m unclimbable sheet metal plus 0.5 unclimbable overhang at 45 degrees. As well as electric wire at bottom of unclimbable section and top of barrier	4m wide and 1.2m deep moat with: 1.6m unclimbable barrier or 1m unclimbable with an electric wire	300mm anti-dig material (can be vertical)	-	Climbable barrier with electrified wire used at WZ since 2003 AZ enclosure built in 2001 uses climbable barrier with electrified wires and wet moat	2	1

Table 5 Primates P2: all primates except great apes and baboons

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Hylobatidae</i>									
Gibbons <i>Hylobates</i> spp <i>Symphalangus</i> spp	4 no climbable vegetation or furnishings in enclosure within 4m of barrier	Not suitable	3 2.5m mesh / solid fence topped with 1m internal overhang at 45° with at least 10 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart, and no climbable vegetation or furnishings in enclosure within 8m of fence	4m wide and 1.2m deep moat, and no climbable vegetation or furnishings in enclosure within 8m of outer edge of moat	Barriers should finish flush with ground as these species do not dig	-	Island exhibits surrounded by wet moats used for siamang at OWP since 2006 and for gibbons at WZ since 1999 with breaches from both exhibits (WZ from overgrown vegetation, OWP with previous shallower moat) Climbable barrier with electrified wire and wet moat used in HZ siamang exhibit in 2015 with similar techniques used in Tierwelt Herberstein, Austria prior to 2012	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Cebinae</i>									
Capuchin <i>Cebus paella</i>	3.5 no climbable vegetation or furnishings in enclosure within 4m of barrier	Not suitable	3.5 3m mesh fence topped with 1m internal overhang at 45° with at least 5 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart	4m wide and 600mm deep moat	300mm	-	Wet moat used at WZ since 1999	2 3 if hand-reared, conditioned and under handler control	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Atelinae</i>									
Spider Monkeys <i>Ateles spp.</i>	3.5 no climbable vegetation or furnishings in enclosure within 4m of barrier	Not suitable	3.5 3m mesh fence topped with 1m internal overhang at 45° with at least 5 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart	4m wide and 600mm deep moat	300mm	-	Wet moat used at OWP since 1980 and WZ since 1999 Unclimbable barrier used at AZ since 1997 Climbable barrier with electrified wires used at HZ since 2000	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Squirrel Monkeys <i>Saimiri sciureus</i> <i>Saimiri boliviensis</i>	3.5 no climbable vegetation or furnishings in enclosure within 4m of barrier	Not suitable	3.5 3m mesh fence topped with 1m internal overhang at 45° with at least 5 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart	4m wide and 600mm deep moat	300mm	-	Species has capabilities similar to Spider Monkeys	2 3 If hand reared, conditioned and under keeper control.	2
<i>Galagonidae</i>									
Bush Babies <i>Galago</i> sp. <i>Otolemur</i> sp.	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Not suitable, should be fully enclosed	Barriers should finish flush with ground as these species do not dig	-	Species should be kept fully enclosed	2 3 If suitably conditioned and under handler control	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Lemuridae									
Ring Tailed Lemur <i>Lemur catta</i> Black Lemur <i>Eulemur macaco</i> Black and White Ruffed Lemur <i>Varecia variegata</i>	3	Not suitable	2.5 2m mesh fence topped with 800mm overhang at 45° with at least 5 electrified wires about at 60mm spacing, and additional in-rigger at least 1.8m above ground level with minimum of two electric wires at 100mm spacing	3.5m wide and 600mm deep moat	300mm	-	Wet moats used at OWP since before 1990 with a breach of one ruffed lemur during major earthquake (another drowned in moat at same time) Climbable with electrified wires and wet moat have been used at AZ since 1997 and HZ since 2008	1 Where perimeter matches climbable barrier with electrified wire 2 3 If hand- reared, suitably conditioned and under handler control	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Cercopithecidae</i>									
Macaque <i>Macaca</i> spp. Mandrill <i>Mandrillus</i> <i>sphinx</i>	3	Not suitable	3.5 3m mesh fence topped with 1m internal overhang at 45° with at least 5 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart	3.5m wide, 1.2m deep moat with: 2m unclimbable barrier or 1.5m unclimbable barrier with an electric wire at top of barrier	300mm and 1m anti-dig material	-	AZ used climbable with electric wires and wet moat for over 14 years	2	2
Black and White Colobus <i>Colobus</i> <i>guereza</i>	Not suitable	Not suitable	Not suitable	4.5m wide and 1.2m deep moat	300mm	-	Species not currently held in NZ	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Francois Leaf Monkey <i>Trachypithecus francoisi</i>	Not suitable	Not suitable	Not suitable	4m wide and 1.2m deep moat	300mm	-	Species not currently held in NZ	2	2
Vervets	3.5	Not suitable	3.5 3m mesh fence topped with 1m internal overhang at 45° with at least 5 electrified wires about 100mm apart (top of overhang is clad in 500mm mesh from fence top), and 500mm horizontal in-rigger on barrier, about 1.9m from ground, with at least 4 electrified wires about 100mm apart	4m wide and 1.2m deep moat	300mm	-	Species not currently held in NZ	2 3 if hand- reared, conditioned and under handler control	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
<i>Callitrichidae</i>									
Pygmy Marmoset <i>Callithrix pygmaea</i> Emperor Tamarin <i>Saguinus imperator</i> Cotton Top Tamarin <i>Saguinus oedepus</i> Golden Lion Tamarin <i>Leontopithecus rosalia</i>	2	Not suitable	Not suitable	4m wide, sloping to 400mm deep moat	Barriers should finish flush with ground as these species do not dig	-	Reference for wet moat specifications: <i>EAZA Best Practice Guidelines for Callitrichidae, 2017</i> AZ containment using climbable with electric wires and wet moat since 1997	1 2 3 If hand reared, conditioned and under handler control	2

Table 6 Ungulates (except pachyderms)

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Tapir <i>Tapirus terrestris</i>	1.8	1.8	1.5 With at least 2 electrified wires – one at top of fence and one about 750mm above ground level	Sloping to 1.5m deep as tapirs require access to water, and with 500mm unclimbable wall above maximum water level	Barriers finished close enough to ground to prevent animals crawling underneath	-	HZ has contained tapir behind 1.8m climbable fence for 20+ years.	2	2
Antelope species (excluding waterbuck)	1.8	1.8	Electrified wires can be used as an additional safeguard on 1.8m high fences, or Can be used in front of densely planted slopes, or For management purposes within a fenced paddock but should not be used alone for containment	Minimum of 4 m wide and 1.2 m deep	Barriers finished close enough to ground to prevent animals crawling underneath	-	OWP have successfully contained most antelope species for over 40 years using wet moats, 1.8 m fences and electric fences in front of densely planted slopes HZ and AZ have successfully contained antelope behind 1.8m barriers for over 20 years	1 if not hand reared males, and not males of large antelope species such as Oryx or Sable 2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Waterbuck	1.8	1.8	Electrified wires can be used as an additional safeguard on 1.8m high fences, or Can be used in front of densely planted slopes, or For management purposes within a fenced paddock but should not be used alone for containment	Minimum of 4 m wide and 1.2 m deep, and fenced at outer edge with at least one electric wire	Barriers finished close enough to ground to prevent animals crawling underneath	-	OWP has successfully contained this species with measures described for over 30 years	2	2
Zebra	1.8	1.8	Electrified wires can be used as an additional safeguard on 1.8m high fences, or Can be used in front of densely planted slopes, or For management purposes within a fenced paddock but should not be used alone for containment	Minimum of 4 m wide and 1.2 m deep	Barriers finished close enough to ground to prevent animals crawling underneath	-	AZ, HZ, OWP and WZ and AZ have successfully contained this species with measures described for over 15 years	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Camel	1.4	1.4	Electrified wires can be used as an additional safeguard on 1.8m high fences, or Can be used in front of densely planted slopes, or For management purposes within a fenced paddock but should not be used alone for containment	Minimum of 4 m wide and 1.2 m deep	Barriers finished close enough to ground to prevent animals crawling underneath	-	AZ, HZ, OWP and WZ and AZ have successfully contained this species with measures described for over 12 years	2 3 if conditioned, on a halter and under handler control	2
Giraffe	1.8	1.8 or 2m steep stone bank, at least 45° from horizontal	Electrified wires can be used as an additional safeguard on 1.8m high fences, or Can be used in front of densely planted slopes, or For management purposes within a fenced paddock but should not be used alone for containment	Minimum of 4 m wide and 1.2 m deep	Barriers finished close to ground	Though not required for containment, electrified wires are recommended for fences less than 2.5m high and around moats to minimise the risk of animals harming themselves on these barriers	OWP has successfully contained giraffes for over 40 years using wet moats, 1.8 m fences and electric fences in front of densely planted slopes AZ and HZ have successfully contained giraffe behind 1.8m barriers for over 15 years.	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Lesser Malay Chevrotain <i>Tragulus javanicus</i>	1.8	1.8	Not suitable	Not suitable	Barriers finished close enough to ground to prevent animals crawling underneath	-	Species not currently held in NZ	1 2	2

Table 7 Monotremes, Marsupials and Rodents

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Macropods	1.5	1.5	Not suitable	Not suitable	Barriers finished flush with ground	-	OWP has successfully contained Red and Grey Kangaroos for 30+ years behind 1.8 m barriers	1 2	2
Wombats	1.2m	1.2m	Not suitable	Not suitable	Entire enclosure must be covered with anti-dig mesh with aperture small enough to contain all specimens	-	Successfully contained behind 1.2m barrier by AZ for 10+ years. Based on NSW standard	2	2
Tasmanian Devil <i>Sarcophilus harrisii</i>	1.2m	Not suitable	Not suitable	Not suitable	0.5 m deep solid foundation or 1 m wide anti-dig mesh with aperture small enough to contain all specimens	-	Based on current ZAA and Save the Tasmanian Devil Program Husbandry Guidelines for Tasmanian Devil	2	2
Koala	1.2	Not suitable unless fully enclosed	Not suitable	Not suitable	Barriers finished flush with ground	-	Based on "Australian Mammals: Biology and Captive Management" by Stephen Jackson	1 2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Feathertail Glider <i>Acrobates pygmaeus</i>	Not suitable	Not suitable unless fully enclosed	Not suitable	Not suitable	Barriers finished flush with ground	-	Based on “Australian Mammals: Biology and Captive Management” by Stephen Jackson	2	2
Long Nosed Potoroo <i>Potorous tridactylus</i>	1.8	1.8 with 300mm internal overhang	Not suitable	Not suitable.	300 mm	-	Based on “Australian Mammals: Biology and Captive Management” by Stephen Jackson	1 2	2
Short Beaked Echidna <i>Tachyglossus aculeatus</i>	900mm	Not suitable	Not suitable	Not suitable	Entire enclosure must be covered with anti-dig mesh with aperture small enough to contain all specimens	-	Based on “Australian Mammals: Biology and Captive Management” by Stephen Jackson	2	2
Rodents- Digging Species e.g. African Crested Porcupine	1	Not suitable	Not suitable	Not suitable	Entire enclosure must be covered with anti-dig mesh with aperture small enough to contain all specimens	-	OWP has contained porcupine for over 20 years using these measures	2	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Climbable Barrier with electrified wire: minimum height (m)	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Rodents – Non-digging species e.g. Capybara, Mara and Agouti	1	1.5m high chain-link fence with 600mm internal mesh overhang at 45°	Not suitable	Not suitable	300mm concrete or 300 mm anti-dig material	-	As used by AZ to contain Mara and HZ to contain Brazilian Agouti for over 10 years	1 2	2

Table 8 Pachyderms (elephant, rhinos, hippos)

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Pole Barrier: minimum dimensions	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Asian & African Elephant (males with / without females)	2.5	2.5 with single electric wire at top of barrier	2.5m high at 500mm spacing	Not suitable	1m solid foundation. Foundations must be made of suitable materials to avoid snapping failure due to weight of animals		Meets ZAA regional guidelines for elephants	2	2
Asian & African Elephant (females only)	1.9	1.9 with single electric wire at top of barrier	2.5m high at 500mm spacing	Not suitable unless supported by an additional containment barrier	1m solid foundation. Foundations must be made of suitable materials to avoid snapping failure due to weight of animals		Meets ZAA regional guidelines for elephants Used at AZ since 1995 (2003 containment breach occurred in an area that did not meet this standard at that time)	2 3 appropriately conditioned and with a qualified handler	2

Common name <i>Latin name</i>	Unclimbable Barrier: minimum height (m)	Climbable Barrier: minimum height (m)	Pole Barrier: minimum dimensions	Minimum Wet Moat Specifications	Foundation	Building Materials	Rationale	Containment Area Recommendations	Contingency Plan
Hippopotamus Pygmy Hippopotamus	1.6	2m steep stone bank, at least 45° from horizontal	1.5m if pole and cable construction 1.5m high at 500mm centres if pole only	Minimum 1.6m depth with: unclimbable wall of 1.6m above maximum water level, or 700mm above maximum water level with an electric wire at top of barrier	Foundations must be made of suitable materials to avoid snapping failure due to weight of animals	-	AZ successfully contained for Common hippos since 2001 using a combination of all of these containment methods	2	2
White Rhinoceros Black Rhinoceros	1.6	2m steep stone or soil bank, at least 45° from horizontal	1.5m if pole and cable construction 1.5m high at 500mm centres if pole only	5m wide and 1.5m deep, but consider animal safety as there has been one rhino that drowned in New Zealand	Foundations must be made of suitable materials to avoid snapping failure due to weight of animals	Recommended reference for diameter of posts (150mm to 300mm): <i>EAZA Husbandry Guidelines for White Rhinoceros 2012</i>	AZ has contained rhino since 1999 using unclimbable wall, pole and rail fence, unclimbable embankment and pole and cable methods HZ has contained rhino since 1999 using pole and cable method OWP has contained rhino since before 1990 using densely planted slopes with electric wires and wet moat (fenced to prevent rhino access)	2	2 (

Table 9 Birds and Flying Mammals

Taxa	Barrier Height	Foundation	Rationale	Containment Area Recommendations	Contingency Plan
Flying birds and flying mammals	Not applicable, must be fully enclosed with double door / gate system for all access (public and staff)	Ensure netting/mesh is secured to concrete foundation to prevent rodent infestation compromising containment	Species must be kept fully enclosed	2	2
Non-flying birds (naturally flightless, pinioned or otherwise unable to fly)	<p>Cranes, flamingos – 1.2m</p> <p>Ostrich, rhea and emu – 1.8m</p> <p>Emus and other species that are not a threat to public can be contained by perimeter fence</p>	Barrier flush to ground	<p>AZ has used 1.2m barriers to contain broilga since about 1990 and flamingos since 2002</p> <p>WZ used 1.8m barriers to contain rhea for over 25 years</p> <p>OWP has used 1.8m barriers to contain ostrich and emu for 30+ years and emu have been successfully free-ranged with boundary fence containment only</p>	<p>1</p> <p>2</p> <p>3</p>	2

Table 10 Reptile species

Taxa	Barrier Height	Foundation	Rationale	Containment Area Recommendations	Contingency Plan
Small lizards with body length (snout to vent) of 130mm or less, and all gecko species of any size	Not suitable, should be fully enclosed	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	All species should be kept fully enclosed to minimise risk of containment breach via external predators	2 3 Conditioned and under handler control	2
Lizards with a snout to vent length of more than 130mm	Unclimbable barrier height of at least 1.5 x snout-vent length of average adult of species (minimum height of 900mm) with an overhang of 0.5 x snout-vent length Climbable barriers not suitable	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	Requirements vary for each species Holders should provide evidence that containment methods are suitable	2 3 conditioned and under handler control	2
Testudines with a carapace length of 100mm or less	Unclimbable barrier height of at least 600mm, although best kept in enclosed environment Climbable barriers not suitable	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	Keeping all species fully enclosed allows for climate control and minimises the risk of containment breach via theft	2 3 Conditioned and under handler control	2

Taxa	Barrier Height	Foundation	Rationale	Containment Area Recommendations	Contingency Plan
Testudines with a carapace length of over 100mm	Unclimbable barrier height of at least 600mm Climbable barriers not suitable	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	Requirements vary for each species Holders should provide evidence that containment methods are suitable	1 2 3 Conditioned and under handler control	2
Crocodylians with snout to vent length of 1m or less	Fully enclosed or unclimbable barrier height of at least 1m Consider also using an overhang Climbable barriers not generally suitable (climbing ability of species varies greatly therefore, what constitutes a climbable barrier will be species and specimen age dependent)	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals	Requirements vary for each species Holders should provide evidence that containment methods are suitable	2 3 Conditioned and under handler control	2
Crocodylians with snout to vent length of 1m to 3m	Fully enclosed or unclimbable barrier height of at least 1.5m. Consider also using an overhang and/or stand-off fence for public safety Climbable barriers not generally suitable (climbing ability of species varies greatly therefore, what constitutes a climbable barrier will be species and specimen age dependent)	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	Requirements vary for each species Holders should provide evidence that containment methods are suitable	2 3 Conditioned and under handler control	2

Taxa	Barrier Height	Foundation	Rationale	Containment Area Recommendations	Contingency Plan
Crocodilians with snout to vent length of 3m or more	Fully enclosed or, unclimbable barrier height of at least 2.0m. Consider also using an overhang and/or stand-off fence Climbable barriers not generally suitable (climbing ability of species varies greatly therefore, what constitutes a climbable barrier will be species and specimen age dependent)	Ensure netting/mesh/glass is secure to foundation to prevent digging out Anti-digging material/mesh should be used with strong digging species Drain points of ponds should be covered with mesh to prevent escape by any individuals (including juveniles if breeding is possible)	Requirements vary for each species Holders should provide evidence that containment methods are suitable	2 3 Conditioned and under handler control	2

Table 11 Amphibians

Taxa	Enclosure Type	Other Containment Measures	Rationale	Containment Area Recommendations	Contingency Plan
Terrestrial amphibians					
All terrestrial or semi-aquatic amphibian species (for aquatic larvae of these species see requirements for aquatic amphibians)	<p>Maintain in fully enclosed tanks/vivariums – including lids</p> <p>A reminder that alternative enclosure specifications may be proposed by operators – see introduction to this appendix and s2.3 of the guidance document.</p>	<p>All containment structures used should be suitable to contain the smallest individuals, and to eliminate the possibility of viable eggs, larvae or juveniles leaving the containment area including:</p> <p>all joints being sealed, and suitable mesh covering of all ventilation and drains</p>	-	<p>2</p> <p>3 Specified individuals can potentially be removed from containment areas within a containment facility for handling and encounters by trained handlers</p>	2
Aquatic amphibians					
All aquatic amphibian species and aquatic larvae of terrestrial amphibians	<p>Maintain in fully enclosed tanks/aquariums – including lids</p> <p>A reminder that alternative enclosure specifications may be proposed by operators – see introduction to this appendix and s2.3 of the guidance document.</p>	<p>All containment structures used should be suitable to contain the smallest individuals, and to eliminate the possibility of viable eggs, larvae or juveniles leaving the containment area including:</p> <p>all joints being sealed, and suitable mesh covering of all ventilation and drains</p> <p> Holders should demonstrate that discharged waste water does not present any risk to the environment, e.g. by accidental release of juveniles, larvae or eggs. This may be demonstrated through the route of discharge, e.g. into a septic tank, or via treatment prior to discharge, e.g. with 1% sodium hypochlorite</p>	-	2	2

Table 12 Marine Mammals

Taxa	Enclosure Type	Other Containment Measures	Rationale	Containment Area Recommendations	Contingency Plan
<i>Pinnipeds</i>					
Californian Sea Lion	2m unclimbable barrier and overhang with electrified wires Electrified wires fixed over solid substrate, such as concrete or rocks	A barrier, 1m minimum height, should separate the public from the animals within the enclosure, where electrified wires are used as the primary barrier	AZ sealion enclosure held this species for over 7 years Suggested reference for general aspects of sealion care: <i>Secretary of State's Standards of Modern Zoo Practice, 2012 (Appendix 8 – Specialist Exhibits)</i> www.defra.gov.uk/wildlife-pets/zoos/	2 3 If conditioned and under supervision of trained handler	2

Table 13 Marine and Freshwater Fishes

Taxa	Enclosure Type	Other Containment Measures	Rationale	Containment Area Recommendations	Contingency Plan
Freshwater fishes					
All temperate, sub-tropical and tropical freshwater fish species	Aquarium – lid not necessary if it can be demonstrated that there is no risk of animals escaping from the tank and/or any wider containment area (see introduction to appendix and s2.3 of guidance document).	Holders should demonstrate that discharged waste water does not present any risk to the environment, e.g. by accidental release of juveniles, larvae or eggs. This may be demonstrated through the route of discharge, e.g. into a septic tank, or via treatment prior to discharge, e.g. with 1% sodium hypochlorite	Suggested reference for structural and operational aspects of fish care: <i>Facility Standard: Ornamental Fish and Marine Invertebrates, MPI 2017</i> Suggested reference for aquarium care: <i>Secretary of State’s Standards of Modern Zoo Practice, 2012 (Appendix 8 – Specialist Exhibits)</i> www.defra.gov.uk/wildlife-pets/zoos/	2	2
Marine fishes					
All temperate, sub-tropical and tropical marine fish species	Aquarium – lid not necessary if it can be demonstrated that there is no risk of animals escaping from the tank and/or any wider containment area (see introduction to appendix and s2.3 of guidance document).	Holders should demonstrate that discharged waste water does not present any risk to the environment, e.g. by accidental release of juveniles, larvae or eggs. This may be demonstrated through the route of discharge, e.g. into a septic tank, or via treatment prior to discharge, e.g. with 1% sodium hypochlorite	Suggested reference for structural and operational aspects of fish care: <i>Facility Standard: Ornamental Fish and Marine Invertebrates, MPI 2017</i> Suggested reference for aquarium care: <i>Secretary of State’s Standards of Modern Zoo Practice, 2012 (Appendix 8 – Specialist Exhibits)</i> www.defra.gov.uk/wildlife-pets/zoos/	2	2

Table 14 Invertebrates: Marine, Terrestrial and Flying

Taxa	Enclosure Type	Other Containment Measures	Rationale	Containment Area Recommendations	Contingency Plan
Marine Invertebrates					
All temperate, sub-tropical and tropical marine invertebrate species	Aquarium – lid not necessary if it can be demonstrated that there is no risk of animals escaping from the tank and/or any wider containment area	Marine systems that discharge their wastewater directly into the environment should have and be able to demonstrate, effective control measures that eliminate the risk of accidentally introducing viable biological material (including eggs and larvae) into the environment	Suggested reference for structural and operational aspects of fish care: <i>Facility Standard: Ornamental Fish and Marine Invertebrates, MPI 2017</i> Suggested reference for aquarium care: <i>Secretary of State's Standards of Modern Zoo Practice, 2012 (Appendix 8 – Specialist Exhibits)</i> www.defra.gov.uk/wildlife-pets/zoos/	2 3 Certain suitable specimens can be removed from containment areas within a containment facility for handling and encounters by trained handlers Other species may be suitable for contact with the public under strictly controlled circumstances, e.g. aquarium touch tanks	2
All Terrestrial Invertebrates					
Terrestrial Invertebrates, including spiders	Not suitable, should be fully enclosed	All foundations and containment structures used should be suitable to contain the smallest individuals, and to eliminate the possibility of viable eggs leaving the containment area	Suggested reference for structural and operational aspects of invertebrate care: <i>MAF Biosecurity Standard 154.02.08: Transitional and Containment Facilities for Invertebrates, 2002</i>	2 3 With suitably conditioned animals under experienced staff control	2 Implement an eradication programme if immediate recapture is not possible
Lepidoptera					
Butterfly and moth species	Not suitable, should be fully enclosed	All foundations and containment structures used should be suitable to contain the smallest individuals, and to eliminate the possibility of viable eggs leaving the containment area	Suggested reference for structural and operational aspects of invertebrate care: <i>MAF Biosecurity Standard 154.02.08: Transitional and Containment Facilities for Invertebrates, 2002</i>	2	2