This fact sheet is developed with funding support from the Land Protection Fund.

Restricted invasive plant

Rat’s tail grasses

Sporobolus pyramidalis, S. natalensis, S. jacquemontii and *S. fertilis*

Rat’s tail grasses are invasive grasses that can reduce pasture productivity, out-compete desirable pasture grasses and cause significant degradation of natural areas. They are often referred to as weedy *Sporobolus* grasses.

These species were originally introduced and trialled as pasture grasses and for soil conservation and have been unintentionally spread from these initial introductions and other accidental introductions as contaminants in pasture seed, fodder, on vehicles and machinery and in and on livestock. Rats tail grasses have now adapted well to large areas of northern, eastern and southern Australia. They have low palatability when mature, are difficult to control and can quickly dominate a pasture, especially following drought, overgrazing or soil disturbance. They can affect cattle health and productivity reducing weight gain and growth rates and weaning percentages and weights. These grasses are a significant threat to the broader environment given they are well adapted to Australia, difficult to control and form dense almost mono-specific stands where conditions allow.

Queensland Government

Four species of introduced Sporobolus grasses are invasive plants in Queensland:

- giant rat's tail grass *(Sporobolus pyramidalis and Sporobolus natalensis*)
- American rat's tail grass *(Sporobolus jacquemontii)*
- giant Parramatta grass *(Sporobolus fertilis)*.

Legal requirements

Giant, American and giant Parramatta rat's tail grasses are category 3 restricted invasive plants under the *Biosecurity Act 2014*. A person must not release these invasive plants into the environment, give away or sell as a seed, plant or something infested with its seeds. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description and distribution

Rat's tail grasses are robust, perennial tussock grasses growing up to 2 m high. They are difficult to distinguish from other pasture grasses before maturity. However, their leaves are noticeably tougher than those of any other species.

They can also be difficult to distinguish from native *Sporobolus* grasses; however, the native grasses tend to be shorter and softer and have less dense seed heads than giant rat's tail grass. The seeds of all species are indistinguishable in pasture seed samples using current identification techniques.

Giant rat's tail grass

Giant rat's tail grass grows up to 2 m high, with a seed head of up to 45 cm long and 3 cm wide. Seed head shape changes from a 'rat's tail' when young to an elongated pyramid shape at maturity. Unlike Parramatta grass and giant Parramatta grass, giant rat's tail grass does not develop 'sooty spike' on its seed heads.

Distribution: Coastal and sub-coastal areas from Cape York (Queensland) to the Central Coast of New South Wales including the Central Highlands of Queensland.

American rat's tail grass

American rat's tail grass grows to 50–75 cm tall, with a seed head of up to 25 cm long and 0.5–3 cm wide. Distribution: Coastal and sub-coastal areas from Cape York to South East Queensland.

Giant Parramatta grass

Giant Parramatta grass grows to 0.8–1.6 m tall, with a seed head of up to 50 cm long and 1–2 cm wide. The branches of the seed head are pressed against the axis and overlap, although lower ones generally spread at maturity. Distribution: Coastal and sub-coastal areas from Cape York to South Coast of New South Wales.

Life cycle and adaptation

Rat's tail grasses flower and seed in the frost-free period of the year, with the main seeding in summer/autumn.

They are prolific seed producers with seed production of 85,000 seeds per square metre recorded in dense stands of giant rat's tail grass in a single year. The viability of rat's tail grass seed is about 90% with asignificant proportion of seed remaining viable for up to 10 years.

Rat's tail grasses are well adapted to a wide range of soils from low to high fertility, acid to alkaline and sandy to heavy clay soils in high and low rainfall locations. This includes the seasonally dry monsoonal tropics, wet and dry tropics, subtropical and temperate regions of Australia. They also tolerate saline soil conditions.

Methods of spread

Rat's tail grasses are spread in the gut and manure, and the coat and hooves of livestock, on the coat of invasive and native animals and in mud, hay, and untested pasture seed. Vehicles and machinery are also important spreaders of seed. Rivers, watercourses and any fast-flowing water can also move significant amounts of seed over long distances particularly where there are low levels of ground cover.

Control

Managing rat's tail grasses

The GBO requires a person to take reasonable and practical steps to minimise the risk of spreading rat's tail grass seed and the establishment of new infestations. This fact sheet provides information to assist with minimizing spread and a summary of options for controlling rat's tail grasses.

Prevention and early detection

Maintain competitive pastures with high levels of ground cover as this reduces the risk of rat's tail grass establishment. Heavy grazing does not control rat's tail grasses —research indicates that continuous heavy grazing actually favours its spread.

When moving stock from infested areas into clean areas, spell the stock in yards or a small holding paddock for at least seven days to allow rat's tail grass seed to pass thought the gut of the animal. Similarly, quarantine new stock in yards or small holding paddocks before releasing them into large paddocks to minimize the risk of rats tail grass seed spread and enable early detection and control of any rat's tail grass plants that establish. Move stock when there is no dew or rain, to decrease the amount of seed sticking to their coats (see Table 1).

Establish weed-free buffer strips along boundary and internal fences where necessary, drainage lines and roadsides to restrict the spread of rat's tail grasses. When practical, **regularly** controlling rats tail grasses in riparian zones will reduce the movement of seed by water and limit spread. Always clean machinery thoroughly after working in infested areas. Follow integrated control strategies using herbicides, pasture management practices that maintain high levels of ground cover and property hygiene practices that limit the risk of seed spread.

Consider the attributes of replacement pasture grasses when deciding what to sow. If possible, choose grasses that are:

- well adapted to local environmental conditions and soil types
- stoloniferous or rhizomatous in growth habit
- resistant to heavy grazing
- palatable and productive
- competitive all year (i.e. do not open up in late winter/spring)
- not inclined to decline as soil fertility decreases
- fast to establish.

If a sown pasture species does not contain most of these attributes, it is unlikely to be successful as part of a rat's tail grass control program.

Some pasture species, while providing strong competition once established, are weak competitors with rat's tail grasses in their early stages of establishment (e.g. Koronivia grass and Bisset creeping blue grass). These grasses are most successful against rat's tail when sown with other grasses that are vigorous when young and provide early competition against rat's tail grasses (e.g. Rhodes grass).

Biological control

Biosecurity Queensland is investigating potential biological control agents. To date no agent has been approved for the control of rat's tail grasses.

Management strategies

Always commence control programs in areas of light infestation, and work towards the denser infestations.

If, after considering the management options set out below, you choose to use a herbicide option, ensure you apply all herbicides strictly according to the directions on the label and the directions of any Australian Pesticides and Veterinary Medicines Authority (APVMA) permit. You **must** read APVMA permit *9792* if you wish to prepare or use products for the control of rat's tail grasses in situations other than those specified on the product label.

Some herbicides permitted or registered for giant rat's tail grass control have withholding periods and significant ongoing management requirements in grazing and dairy farming. If you have or may have dairy or beef cattle on your property at any stage in the future, carefully consider these requirements when choosing herbicides for use on your property.

Some details of management options are provided below.

Scattered plants and light infestations

Choose **one** of the following options:

(a) spot spray with glyphosate
(b) spot spray with flupropanate
(c) use glyphosate through a pressurised wick wiper
(d) hand chip, bag and remove stools from the paddock and burn them.

Dense infestations on arable land

(a) Cropping option

First summer (early)

1. Boom spray with glyphosate as per label or permit directions and burn prior to ploughing.
2. Spot spray or hand chip fence lines, headlands, drainage lines, shelter belts etc. for weedy rat's tail grasses missed in cultivation. Plant a long-season forage sorghum variety using a recommended pre-emergent herbicide.
3. Spot spray or hand chip any surviving rat's tail grasses to prevent reseeding.

Second summer

1. Boom spray with glyphosate to control new seedlings and crop regrowth prior to cultivation.
2. Follow the same procedures and similar cropping as for the first summer.

Third summer

1. Boom spray with glyphosate to control crop regrowth and any rat's tail grass seedlings.
2. Plant paddocks with improved pastures using minimum tillage techniques to restrict bringing buried seed to the surface. Use a direct drill planter or surface broadcasting and rolling techniques. Plant fast-growing pasture grasses at triple the standard sowing rates to compete with rat's tail grass seedlings.
3. Fertilise the pasture for fast pasture establishment.
4. Spot spray or hand chip rat's tail grass seedlings.

(b) Pressurised wick wiper option

To be effective, this option requires three treatments over an 18-month period.

First treatment (midsummer)

1. Make sure there is a 30 cm height difference between rat's tail grasses and other pasture plants by selective grazing of the 'good' pasture.
2. Wick wipe rat's tail grass using glyphosate as per label or permit directions.
3. Graze using increased stocking rates after wick wiping.

Second treatment (late summer or autumn)

Wick wipe rat's tail grass using glyphosate as per label or permit directions.

Third treatment (next summer)

Wick wipe rat's tail grass using glyphosate as per label or permit directions.

Dense infestations on non-arable land

Choose **one** of the following options:

(a) In summer, apply glyphosate through a pressurised wick wiper (if terrain and timber allow).

(b) In summer, boom or blanket spray with glyphosate in split applications as per label or permit directions (see Table 2) and replant the pasture using fast-growing pasture grasses at double the standard sowing rates.

(c) In winter or spring, boom or blanket spray with flupropanate as per label or permit directions.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Best practices for management for rat's tail grass infestations

Dos	Don'ts
Cattle	
• Manage the grazing and stocking rate to maintain high levels of ground cover. • Where possible muster only in the afternoon when the dew has dried to minimise seed plants and seeds are dry. • Restrict cattle to a small paddock or a laneway free of rat's tail grasses with sufficient feed for seven days after grazing the rat's tail grass paddock to minimize seed spread in manure.	• Don't overgraze, as this will reduce ground cover to a low level which will promote rat's tail grass seedling emergence and to emerge. • Where possible avoid mustering on wet days or when the soil is muddy. • Don't deliberately overstock paddocks infested with rat's tail grass as this generally promotes rats tail grass.
Machinery	
• Provide a specific hose-down tarmac/area to clean contaminated machinery. • Keep roadways, laneways, stock routes and machinery corridors free of rat's tail grass to minimise risk of seed movement by machinery/vehicles. • If necessary in rats tail grass infested areas operate machinery when plant material and soil are dry to minimise seed movement.	• Don't slash areas infested with rat's tail grasses unless slashing is part of an integrated control program. • Don't knowingly drive vehicles through rat's tail grass infestations as contaminated vehicles are a major source of seed spread.
General hygiene	
• Enclose specimens for identification in tied bags or closed containers while transporting to prevent seed spread.	• Don't drive around the farm with a loose suspected rat's tail grass specimen in the cabin or in the back of a vehicle as this spreads seed.
Pasture management	
• Maintain sown pasture vigour with a maintenance fertiliser program. • Use planting methods that minimise soil disturbance when planting legumes into an infested pasture. • Plant the recommended competitive pasture grasses suitable for your climate and soil type.	• Don't allow soil fertility run-down as this reduces the competitiveness of sown pasture species and favours rat's tail grass. • Don't renovate an infested pasture as soil disturbance will favour rats tail grasses. • Don't burn the pastures infested with rat's tail grasses unless burning is part of an integrated control program such as a wick wiping, pre-cropping pasture
Hay and pasture seed	
• Determine the origin of hay to ensure there is a minimal risk of contamination with rat's tail grasses. • Feed hay in a yard, feedlot or small holding paddock so any rats tail grass plants introduced in the hay can be readily detected and controlled. • Only purchase seed from a reputable seed merchant.	• Don't knowingly purchase hay or seed contaminated with rat's tail grass. • Don't buy seed without knowing its origin.
Control strategies	
• Choose the most suitable control strategy based on your situation and the rat's tail grass population before starting the job. • If dairy or beef cattle will be in the paddock at any time in the future, carefully consider the exclusion and withholding requirements of the herbicides and the long-term implications before commencing treatments. • If spot spraying with glyphosate, operate close enough to spray downwards on to the plant to limit off target damage. • Use low-pressure spraying equipment to reduce the risk of off target damage.	• Don't spot spray with glyphosate using a high-pressure gun from the cabin of a vehicle as this results in off target damage increasing the risk of rats tail grass establishment. • Don't overspray with glyphosate past the point of spray run-off.

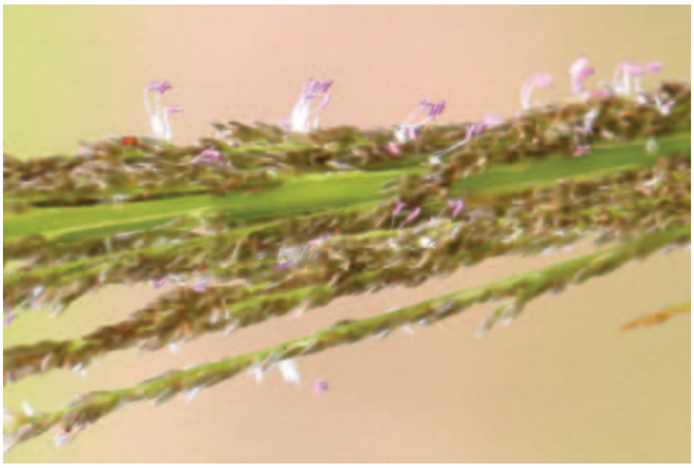
Table 2. Herbicides for the control of rat's tail grasses

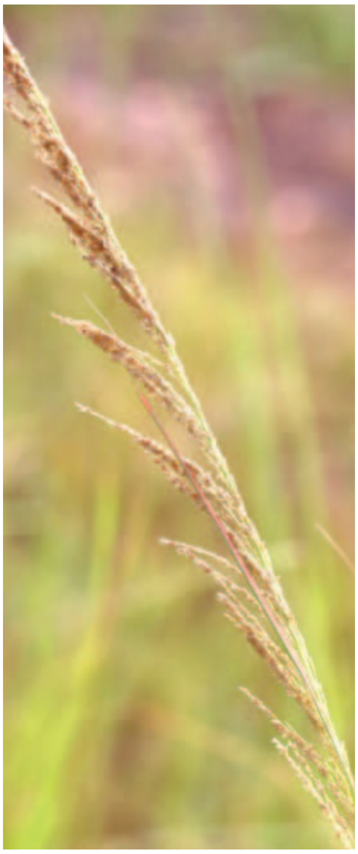
Situation	Application method	Herbicide[1]	Rate	Comments
Pasture, grazed woodlands and agricultural situations prior to sowing, tree and vine crops, lucerne and agricultural non-crop situations	Boom spraying	Glyphosate 360 g/L (e.g. Roundup Biactive, Weedmaster Duo)	6 L/ha	
Wasteland, forest and conservation areas, margins of aquatic areas, roadsides and easements, rights-of-way, commercial and industrial areas and public service areas	Boom spraying Double knockdown split application		3 L/ha + 3 L/ha	Follow up the first treatment with a later knockdown treatment such as herbicide or tillage
Pasture, grazed woodlands and agricultural situations prior to sowing, tree and vine crops, lucerne and agricultural non-crop situations Wasteland, forest and conservation areas, margins of aquatic areas, roadsides and easements, rights-of-way, domestic, commercial and industrial areas, turf, playing fields, golf courses, public service areas and areas surrounding agricultural buildings	Spot spraying		1 L per 100 L water	
	Double knockdown split application		1 L + 1 L per 100 L water	Follow up the first treatment with a later knockdown treatment such as herbicide or tillage
	Wick wiping		3.3 L per 10 L water	
Pasture, grazed woodlands, agricultural non-crop situations	Boom spraying	Flupropanate 745 g/L (e.g Tussock, Taskforce)	1.5–2 L/ha	**Do not** use in channels, drains or watercourses **Do not** reseed treated areas until at least 100 mm of leaching rain has fallen **Do not** spray near desirable susceptible trees **Do not** apply above 3 L/ha to steeply
Wasteland, forest and conservation areas, roadsides and easements, rights-of-way,	Suppression of seedlings in improved		0.5–2 L/ha	
Pasture, grazed woodlands and agricultural non-crop situations	Spot spraying		200 mL per 100 L water	
Wasteland, forest and conservation areas, roadsides and easements, rights-of-way, commercial and industrial areas, golf courses, public	Wick wiping		500 mL per 10 L water	

[1]Read APVMA permit PER9792 for rates for products containing glyphosate 450 g/L or glyphosate 540 g/L.

The herbicides in Table 2 are permitted under PER9792 (expires 30 November 2025). You **must** read the permit if you wish to prepare or use products for the control of rat's tail grasses in situations other than those specified on the product label. The permit is available on the APVMA website apvma.gov.au

Read the label carefully before use and always use the herbicide in accordance with the directions on the label.





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Restricted invasive plant

Rubber vine

Cryptostegia grandiflora and *Cryptostegia madagascariensis*

Rubber vine's ability to quickly spread and colonise areas makes it a threat to many areas of northern Australia. Due to this ability, rubber vine is listed as a Weed of National Significance.

Rubber vine generally invades waterways first, where the seeds germinate in moist silt layers after rain. The plant smothers riparian vegetation and forms dense, sometimes impenetrable, thickets.

This decreases biodiversity and prevents access to both stock and native animals. It also creates habitat for feral animals. Infestations expand outward from waterways, hillsides and pastures, resulting in loss of grazing land and increased difficulty in mustering stock.

Rubber vine is poisonous to stock, though seldom eaten. Most deaths due to rubber vine occur after stock have been stressed, or when other feed is scarce.

Queensland Government

Legal requirements

Rubber vine (*Cryptostegia grandiflora*) and ornamental rubber vine (*Cryptostegia madagascariensis*) are category 3 restricted invasive plants under the *Biosecurity Act 2014*. They must not be given away, sold, or released into the environment. The Act requires everyone to take all reasonable and practical measures to minimise the biosecurity risks associated with invasive plants under their control. This is called a general biosecurity obligation (GBO). This fact sheet gives examples of how you can meet your GBO.

At a local level, each local government must have a biosecurity plan that covers invasive plants in its area. This plan may include actions to be taken on certain species. Some of these actions may be required under local laws. Contact your local government for more information.

Description

Rubber vine is a vigorous climber with twining, whip-like shoots that can grow unsupported as an untidy, multi-stemmed shrub 1–2 m high, or it can scramble up to 30 m high in trees. The stems, leaves and unripe pods exude a white, milky sap when broken or cut.

Leaves are dark green and somewhat glossy, 6–10 cm long, 3–5 cm wide, and in opposite pairs. Flowers are large and showy, with five white to light purple petals arranged in a funnel shape.

The seed pods are rigid and grow in pairs at the end of a short stalk. The pods are 10–12 cm long, 3–4 cm wide and each can contain up to 450 brown seeds. Each seed has a tuft of long, white, silky hairs, which enable easy dispersal by wind and water.

Ornamental rubber vine (*Cryptostegia madagascariensis*) is a shrub up to 3 m tall, if unsupported and stems can climb to 10 m if supported. Bark is sparsely dotted with corky patches. Leaves are dark green, glossy, with pale underside, 2–11 cm long, 1.5–5.5 cm wide, arranged in opposite pairs. Plant produces milky latex sap when leaves, fruit or branches are cut.

Flowers are pink-purple, 4–6 cm long, found near branchlet ends. Pods are 7–9 cm long, contain seeds 5–5.9 mm long, 1.8–3.5 mm wide, topped with silky tuft of white hairs.

Life cycle

Rubber vine flowers at any time of year if sufficient moisture is available. Usually, June and July are the only non-flowering months. Plant stem diameter must be approximately 20 mm before flowering can occur.

Seed pod formation occurs from spring to late autumn, with peak seed production corresponding to maximum flowering. Eventually, pods dry out and split open, with pod-splitting occurring approximately 200 days after formation.

Seeds are scattered by wind, but also carried downstream by water. Approximately 95% of seed is viable, although germination requires favourable temperature and soil moisture conditions.

Methods of spread

Rubber vine seeds spread by wind and water.

Habitat and distribution

Rubber vine is native to Madagascar, but is now widely distributed throughout tropical and subtropical regions of the world.

The plant was introduced to Australia as an ornamental shrub in 1875 or earlier, and was popular in north Queensland mining settlements due to its luxuriant growth even under harsh conditions. Weedy infestations were recorded around Charters Towers early this century.

Rubber vine prefers areas where annual rainfall is 400–1400 mm, and is well adapted to a monsoonal climate.

Infestations of rubber vine are now found throughout river systems of southern Cape York and the Gulf of Carpentaria, south along the coast to the Burnett River, and isolated infestations occur as far south as Gatton and as far west as the Northern Territory border.

Infestations are common throughout central Queensland, while in western Queensland there are infestations in the Mount Isa, Longreach and Aramac areas. Isolated infestations have been reported in Western Australia.

Control

Managing rubber vine

The GBO requires a person to take reasonable and practical measures to minimise the biosecurity risks posed by rubber vine. This fact sheet provides information and some options for controlling rubber vine.

Effective control of rubber vine can be achieved by a number of methods, alone or in combination depending on the situation and the severity of infestation. All areas treated must be periodically checked and any regrowth treated or the initial treatment efforts will be wasted.

Rubber vine seed is most commonly spread by wind and running water.

It is thus difficult to prevent seed coming onto uninfested land if there is rubber vine anywhere in the area. Your goal should be to prevent rubber vine from establishing and forming dense infestations. It is essential to regularly inspect all areas of your property, paying particular attention to creeks and gullies.

This is most important where prevailing winds are known to blow from infested areas, or where infestations occur upstream.

Any isolated plants located should be treated promptly.

All control of rubber vine will require follow-up treatments to keep your property clean. As rubber vine spreads quickly, small infestations should be controlled first to prevent them from becoming major problem areas. Dense infestations are difficult and costly to treat.

Follow-up treatment must be budgeted for within the overall control program. Techniques need to be integrated for successful rubber vine management. Consideration should be given to coordinating control over a catchment area.

Five suggested strategies for controlling rubber vine in scattered, medium, and dense infestations are outlined in Table 2.

Fire

Rubber vine infestations can be very effectively controlled by burning. Preparing and managing fuel load prior to burning, and following up in a timely manner after the fires, are critical to the overall success of the program.

It is recommended that you perform two successive annual burns. The first fire will open up the infestation to increase grass growth (fuel load) while killing rubber vine plants. The second fire will clean up the regrowth that occurs after the first fire.

An appropriate fire regime is an effective tool for managing rubber vine over the long term, as well as being an effective follow-up to other control methods.

Mechanical control

Several mechanical techniques are effective in controlling rubber vine. The type of infestation will determine the technique required.

- Scattered or medium-density infestations: Where possible, repeated slashing close to ground level is recommended.
- Dense infestations: During winter, stick-raking or blade-ploughing reduces the bulk of the infestation. Pasture should be sown and windrows burned to kill residual seed. Follow-up treatment is essential. It is important to comply with the relevant state and/or local government native vegetation legislation, and it should be noted that causing even accidental death of vegetation can be a breach of this legislation.

Biological control

Two biological control agents are successfully established, and their impact depends on abundance. Both agents cause abnormal defoliation, creating an ‘energy sink’, which appears to reduce seed production. These agents usually do not kill established rubber vine plants.

Diseases

Rubber vine rust (*Maravalia cryptostegiae*) is established over a wide area. Yellow spores form under the leaves and are spread mainly by the wind.

It is most active over summer, abundance being directly related to leaf wetness, which is dependent on rainfall and dew. Over summer, a generation is completed every seven days. Rust activity is reduced over the dry season.

Continued heavy infection causes defoliation, appears to reduce seed production, can kill small seedlings and causes dieback of the whip-like stems. Established plants are not killed.

Insects

Also established is the moth *Euclasta whalleyi*, whose larvae are leaf feeders. Observation indicates the moth prefers stressed plants, either from limited soil moisture or high levels of rust infection.

The moth’s period of activity is the dry season. A native fly parasite and a disease can reduce the localised abundance of the *Euclasta* larvae.

The larvae are tapered at both ends, grow up to 30 mm long, and are grey-brown with orange dots along their sides. Fine silken threads and black, bead-like droppings are often found near the larval feeding damage.

The creamy-brown moths are active at night and rest at a 45° angle from a surface, with their wings folded. The life cycle from egg to adult takes 21–28 days.

Defoliation reduces the smothering effect on other vegetation and causes an increase in leaf litter and promotes increased grass growth amongst rubber vine, increasing fuel loads required for fire management. Decreased flower and pod production should reduce the ability of rubber vine to spread.

Biological control is also important because it impacts on other control methods.

Herbicide control

Herbicides recommended for use on rubber vine are listed in Table 1 (overleaf). Preference ratings (taking account of effectiveness and cost) are shown.

Aerial application

Three herbicides are currently registered for aerial application (refer to Table 1. Two of these are foliar herbicides and the other is a soil-applied herbicide. As a result, the necessary conditions that apply to foliar and soil applications is also applicable to the respective chemical when aerially applied.

People considering aerial application are advised to contact 13 25 23 for current advice on use of this technique.

Foliar spray

The following points should be followed carefully:

- There must be little to no rust present as it affects the health of the plant and its ability to take chemical up through its leaves.
- It is critical that plants be actively growing and NOT water-stressed, yellowing or bearing pods.
- A wetting agent should be used with foliar herbicides.
- Thoroughly spray bushes to the point of run-off, wetting every leaf.
- Avoid spraying when hot and dry (e.g. over 35 °C), or when windy—especially with Agricrop Rubber Vine Spray.
- Foliar spraying is most effective on plants less than 2 m high; large plants with a stem diameter greater than 8 cm may not be killed.

Herbicide control

Basal bark spray

This method gives a high level of control although it is not as effective on multi-stemmed plants as it is difficult to spray each stem completely around the base.

Thoroughly spray around the base of the plant to a height of 20–100 cm above ground level, spraying higher on larger plants.

Optimum results are attained when the plant is actively growing.

Cut stump treatment

This is the most successful method of herbicide control, but also the most labour intensive. The following points should be followed carefully:

- cut the stem off as close to the ground (within 15 cm) as possible; for smaller plants use a machete or similar; larger plants may require a chainsaw
- make sure the cut is horizontal
- immediately spray or swab the cut surface
- a cost-effective method for scattered to medium-density infestations is the use of a brush-cutter.

Soil application

Because of the high risk of killing non-target vegetation, including trees and pasture plants, soil-applied herbicides play a role in controlling rubber vine only in specific situations.

It is important to comply with the relevant state and/or local government native vegetation legislation, and it should be noted that causing even accidental death of vegetation can be a breach of this legislation.

The following points should be followed carefully:

- do not use residual herbicides within a distance of two or three times the height of desirable trees
- do not use Graslan along waterways or land with greater than a 20^0 slope
- a minimum of 50–80 mm of rainfall is required before residual herbicides are taken up by the plant.

Further information

Further information is available from your local government office, or by contacting Biosecurity Queensland on 13 25 23 or visit biosecurity.qld.gov.au.

Table 1. Herbicides for the control of rubber vine

Situation	Herbicide	Rate	Comments
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 300 g/L + Picloram 100 g/L + Aminopyralid 8 g/L (Grazon Extra) or Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror)	350–500 mL/ 100 L water	High volume spray Actively growing plants not infected with rust Use the higher rate for dense stands higher than 1.5 m tall at flowering (consult label)
Native pastures, rights-of-way, commercial and industrial areas	Metsulfuron-methyl 600 g/kg (e.g. Associate, Ken-Met 600)	15 g/100 L water	High volume spray on actively growing plants Apply to actively growing bushes up to 3 m tall, October through April Wetting agent is critical Complete coverage is essential May damage pasture legumes (consult label)
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	2,4 D 300 g/L + Picloram 75 g/L (e.g. Tordon 75-D, Commander 75-D)	1.3 L/100 L water	Treat actively growing plants Thoroughly wet leaves and soil around base of plant Less effective than other treatments
Around agricultural buildings and other farm non-crop situations, commercial, industrial, and public service areas, rights-of-way and waster land, away from desirable vegetation	Imazapyr 250 g/L (e.g. Unimaz 250 SL)	4 mL/L water	High volume application to actively growing plants (consult label)
Non agricultural areas (native pastures) commercial and industrial areas and rights-of-way	Aminopyralid 375 g/kg plus Metsulfuron-methyl 300 g/kg (e.g. Stinger)	30 g/100L water plus wetting agent (consult label)	Apply to bushes up to 3 m in height Apply from October to April when bushes are actively growing. Ensure thorough spray coverage of all foliage and leaders Incomplete coverage will result in regrowth
Native pastures, rights-of-way, commercial and industrial areas	Triclopyr 75 g/L + Metsulfuron-methyl 28 g/L (e.g. Zelam Brush Weed)	375 mL/100L	Spray actively growing plants up to 3 m tall, from October to April. Thoroughly spray all foliage and leaders. Incomplete coverage will result in regrowth
Agricultural non-crop areas, commercial and industrial areas, fencelines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Basal bark plants up to 5 cm basal diameter Treat at any time Thoroughly spray around base of plant
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 600 g/L (e.g. Garlon 600, Triclopyr 600)	1 L/60 L diesel	Basal bark Treat at any time Thoroughly spray around base of plant
Agricultural non-crop areas, commercial and industrial areas, fencelines, forestry, pastures and rights-of-way	Triclopyr 240 g/L + Picloram 120 g/L (e.g. Access)	1 L/60 L diesel	Cut stump Apply immediately cut is made
Agricultural non-crop areas, commercial and industrial areas, forests, pastures and rights-of-way	Triclopyr 600 g/L (e.g. Garlon 600, Triclopyr 600)	1 L/60 L diesel	Basal bark size and larger plants
Non-crop areas, including: native vegetation, conservation areas, gullies, reserves and parks	Picloram 44.7 g/L + aminopyralid 4.47 g/L (Vigilant II)	Undiluted	Cut stump as close to the ground as possible. Apply immediately according to label instructions
Pastures, rights-of-way and industrial	2,4-D as amine 700 g/L (e.g. Amicide Advance 700)	145 mL/10L water	Cut stump Apply immediately
Other formulations of 2,4-D are also registered for cut-stump treatment of rubber vine. Consult labels for registration details, rates and critical comments.			
	Hexazinone# 250g /L (e.g. Bobcat®SL, Velpar®L)	2 mL/spot, 3 spots for each bush (tree)	Soil application# prior to rain See warning below. #Must place spots around bush. Less effective on sandy soils
	Tebuthiuron# 200 g/kg (e.g. Graslan, Tebuthiuron 200)	1.5 g/m^2	Soil application# prior to rain Application prior to rain by hand or backpack spreader
	Triclopyr 300 g/L + Picloram 100 g/L+ Aminopyralid 8 g/L (Grazon Extra) or Triclopyr 300 g/L + Picloram 100 g/L (e.g. Conqueror, Grass-up)	3–5 L/ha	Aerial application (helicopter only) to actively growing plants Triclopyr 300 g/L + Picloram 100 g/L
	Tebuthiuron# 200 g/kg registered for aerial application (e.g. Graslan)	7.5–15 kg/ha	Aerial application prior to rain Triclopyr 300 g/L + Picloram 100 g/L

Warning: Soil testing is highly recommended prior to application of these herbicides, as rate and efficacy are dependant on soil type.
DO NOT USE SOIL APPLIED HERBICIDES (HEXAZINONE AND GRASLAN) WITHIN A DISTANCE OF TWO TO THREE TIMES THE HEIGHT OF DESIRABLE TREES.
DO NOT USE GRASLAN NEAR WATERWAYS OR LAND WITH GREATER THAN A 20° SLOPE.

Read the label carefully before use. Always use the herbicide in accordance with the directions on the label.

Table 2. Suggested strategies for the control of rubber vine

Situation	Initial treatment	Follow-up	Comments
Scattered infestations	Basal bark/ cut stump	Follow-up with basal bark/ cut stump as necessary	Cut stump method preferred where possible
	Foliar spray	Follow-up basal bark/ cut stump/foliar spray as necessary	Only foliar spray when there is nil to little rust on the leaves of the plants
	Fire	Follow-up basal bark/ cut stump/foliar spray as necessary	For scattered infestations usually recommended only if herbicides not desired, or if have other weeds can be controlled by fire or if fire is utilised to improve pastures
	Repeated slashing		
Medium infestations	Foliar spray	Treat regrowth, seedlings with basal bark/cut stump/ foliar spray	Fire and follow-up with basal bark/cut stump/foliar spray as necessary
	Fire	Fire 1 year later and follow-up basal bark/cut stump/ foliar spray as necessary	If fuel load is sufficient **CAUTION:** There are some native tree species which are susceptible to fire Check before burning
	Repeated slashing		
Dense infestations previously cleared areas	Stick rake or blade plough	Sow pasture – basal bark/ foliar spray – fire and basal bark/cut stump/foliar spray as necessary	First treatment clears bulk of rubber vine and kills roots; any regrowth or seedlings can then be treated; when grass growth allows fuel build up, fire used as control and individual plants later treated
	Fire	Fire one year later and follow-up basal bark/ cut stump/foliar spray as necessary	If fuel load is sufficient **CAUTION:** There are some native tree species which are susceptible to fire Check before burning
	Aerial spray	Fire 1–2 years later or follow-up with basal bark spray	Bulk of rubber vine killed with aerial spray; allow build up of fuel for fire or treat remaining plants with basal bark spray Contact 13 25 23 before use of this method
	Graslan		Where situation and soil type are suitable
Dense infestations along creeks and rivers	Basal bark/ cut stump	Fire or basal bark/cut stump/foliar spray	When bulk of rubber vine killed, allow fuel build up for fire or treat remaining plants individually
	Fire and sow pasture	Fire one year later and follow-up basal bark/cut stump/foliar spray as necessary	If there is a sufficient fuel load to carry a fire, it can open up dense infestations **CAUTION:** There are some native tree species which are susceptible to fire Check before burning

This fact sheet is developed with funding support from the Land Protection Fund.

Fact sheets are available from Department of Agriculture and Fisheries (DAF) service centres and our Customer Service Centre (telephone 13 25 23). Check our website at biosecurity.qld.gov.au to ensure you have the latest version of this fact sheet. The control methods referred to in this fact sheet should be used in accordance with the restrictions (federal and state legislation, and local government laws) directly or indirectly related to each control method. These restrictions may prevent the use of one or more of the methods referred to, depending on individual circumstances. While every care is taken to ensure the accuracy of this information, DAF does not invite reliance upon it, nor accept responsibility for any loss or damage caused by actions based on it.

Appendix H Decommissioning and Rehabilitation Plan

DECOMMISSIONING AND REHABILITATION MANAGEMENT PLAN

Gilmour Space Technologies Pty Ltd

202108

Decommissioning and
Rehabilitation Management Plan

14/09/2022

Document status

Project No	Version	Document name	Client	Author	Reviewer	Review date
202108	Draft	Decommissioning and Rehabilitation Management Plan	Gilmour Space Technologies Pty Ltd	A. Fitzgerald	L. Liessmann	14/09/2022

Approval for issue

Approver	Signature	Approval date
A. Fitzgerald		14/09/2022

Prepared by:	Prepared for:
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1 INTRODUCTION

This Decommissioning and Rehabilitation Management Plan (DRMP) was prepared by Terra Solutions Pty Ltd (Terra) for Gilmour Space Technologies (Gilmour) for the Bowen Orbital Spaceport (BOS) Launch Operations located on Lots 8, 9 and 10 on SP295408 (the site) in the Abbot Point State Development Area (Figure 1).

The Office of the Coordinator General (OCG) approved a material change of use (MCU) for a high impact industry (launch facility) in accordance with section 84E of the *State Development and Public Works Organisation Act 1971*. The MCU provides this approval from the date of obtaining Commonwealth approval pursuant to the *Space (Launches and Returns) Act 2018,* for a launch facility licence to operate a launch facility on the site.

Relevant conditions of the OCG approval require that a DRMP be implemented to demonstrate compliance with the Development Approval are presented in Section 2.

1.1 Objectives

The objective of the DRMP is to provide a framework that will ensure appropriate decommissioning and rehabilitation is undertaken at the end of the Project's operation life in accordance with legislative requirements, conditions of approval, stakeholder interests and industry best practice.

The primary objective of this DRMP is to return disturbed areas as close as practicable to pre-disturbed conditions and contours within the construction footprint, which is currently dominated by improved pastures for the purpose of cattle grazing. This incorporates the following requisites:

- Decommissioning and rehabilitation will be undertaken in consultation with the appropriate landholders impacted by the specific activities.
- Conduct a contaminated land assessment at relevant locations. This may involve engaging a suitability qualified person (SQP) approved by DES as a contaminated land specialist.
- Remediation of contaminated land if required.
- Removal (or sale and removal if appropriate) of all infrastructure and any temporary buildings and facilities, unless agreed with the post landowner.
- The establishment and reinstatement of land surface consistent with the surrounding topography.
- The long-term stability of soils, landforms and hydrology.
- Use of local provenance species in the revegetation areas (as defined in pre-disturbance surveys/mapping).
- Rehabilitation areas are self-sustainable and resilient (i.e. require no long-term water and weed management except to control invasive weed species as legally obliged).
- Establish rehabilitated areas that provide appropriate habitat for local flora and fauna recruitment.
- Rehabilitation areas are suitable for location (e.g. regeneration of native vegetation, endemic grass species) while maintaining safety of humans and livestock and the ongoing access.
- The execution of planning, implementation, monitoring and reporting on rehabilitation in a manner consistent with industry best practice.

1.2 Responsibility

Gilmour will be fully responsible for the decommissioning of the project. This is supported by the provisions of the lease agreements which have been executed between Gilmour and the OCG.

1.3 Timing

Should the use cease for a period of more than twelve months, the subject land must be decommissioned and rehabilitated in accordance with this DRMP.

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CLIENT: GILMOUR SPACE TECHNOLOGIES

FIGURE 1: BOWEN ORBITAL SPACEPORT LOCATION

0 1 2 3 4 5 km

1:32,000

DOCUMENT: 202108-3 Site Location

DATE: 08/09/2022

AUTHOR: A.Fitzgerald

Credits:

Coordinate system: GDA2020 / MGA zone 55 EPSG:7855

2 RELEVANT LEGISLATION, GUIDELINES, STANDARDS AND APPROVAL CONDITIONS

2.1 Legislation

Table 1 provides a summary of the key legislation and policies relevant to the decommissioning and rehabilitation of the BOS.

Table 1 Relevant legislation

Legislation	Description
Environmental Protection Act 1994 (EP Act)	The object of the EP Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).
Environmental Protection (Air) Policy 2019 (EPP (Air))	The EPP (Air) addresses the environmental values to be enhanced or protected namely— a) the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems; and b) the qualities of the air environment that are conducive to human health and wellbeing; and c) the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and d) the qualities of the air environment that are conducive to protecting agricultural use of the environment.
National Environment Protection (Ambient Air Quality) Measure 2016 (NEPM (Ambient Air))	The purpose of NEPM (Ambient Air), among other things, is to: a) set ambient air quality goals that minimise the risk of adverse health impacts from exposure to air pollution, and b) guide the formulation of strategies for the management of human activities that may affect the environment c) set standards for consisting of quantifiable characteristics of the air against which ambient air quality can be assessed d) set out the processes to be followed in measuring the concentration of pollutants in the air
Environmental Protection (Water and Wetland Biodiversity) Policy 2019	The purpose of this policy is to achieve the object of the EP Act in relation to waters and wetlands by: a) identifying environmental values for waters and wetlands b) identifying management goals for waters c) stating water quality guidelines and water quality objectives to enhance or protect the environmental values d) providing a framework for making consistent, equitable and informed decisions about waters e) monitoring and reporting on the condition of waters.
Aboriginal Cultural Heritage Act 2003	The purpose of the ACH Act is to provide for the effective recognition, protection and conservation of Aboriginal cultural heritage. The ACH Act contains Duty of Care provisions that require those conducting activities in areas of significance to take all reasonable and practicable measures to avoid harming cultural heritage. Under the Act, cultural heritage includes significant Aboriginal areas in Queensland, significant Aboriginal objects, and evidence of Aboriginal occupation of an area.

2.2 Relevant approval conditions

The permits applicable to the activity include the following:

- Decision notice for AP2021/007 – SDA approval for a material change of use for a high impact industry (launch facility) in the Abbot Point State Development Area (SDA)

Requirements of the approval relevant for the development of the DRMP and sections of the DRMP that address the conditions are detailed in Table 2.

Table 2 Relevant conditions from DA permits

<table>
<tr><th>Condition Number</th><th>Condition</th><th>Section addressed</th></tr>
<tr><td colspan="2">AP2021/007 – SDA approval for a material change of use for a high impact industry (launch facility) in the Abbot Point State Development Area (SDA)</td><td></td></tr>
<tr><td>12.1 -</td><td>Prepare and submit to the Coordinator-General and Whitsunday Regional Council, a detailed project specific Environmental Management Plan (EMP) addressing both the construction and operational phases of the project.
The EMP must be certified by an independent suitably qualified third-party confirming the adequacy of the EMP in accordance with current best practice. The EMP must include the following matters:
(p) decommissioning and rehabilitation management (refer to enclosure 13)</td><td>This document</td></tr>
<tr><td rowspan="2">38 – rehabilitation plan</td><td>Condition 38.1: Should the use cease for a period of more than twelve months, the subject land must be decommissioned and rehabilitated in accordance with the detailed rehabilitation plan required by condition 12.1</td><td>Section 1.3</td></tr>
<tr><td>Condition 38.2: Provide a notice to the Coordinator-General stating the rehabilitation of land has been completed in accordance with the rehabilitation plan together with photographic evidence of decommissioning activities and rehabilitation outcomes.</td><td>Section 10.2</td></tr>
<tr><td rowspan="5">Enclosure 13</td><td>Decommissioning and Rehabilitation Management Plan
To demonstrate compliance with condition 21.1 of this development approval, prepare a detailed site-specific decommissioning and rehabilitation management plan (by a suitably qualified person). The plan is to include:
a) Details of how the area will be rehabilitated, including the removal of all temporary and permanent infrastructure and facilities</td><td>Section 6.0</td></tr>
<tr><td>b) Details of self-sustaining species (groundcover and vegetation) to be planted within six months of site decommissioning, including proposed numbers and location</td><td>Section 5.3
Section 6.2.7</td></tr>
<tr><td>c) A monitoring programme, including timeframes to ensure the revegetation species will survive (including during the dry period)</td><td>Section 7.0</td></tr>
<tr><td>d) Details of measures to be implemented to prevent weed control and erosion of the site</td><td>Section 6.2.4
Section 6.2.6
Section 6.2.8</td></tr>
<tr><td>e) Identification of the proposed topography of this site after rehabilitation.</td><td>Section 6.2.4</td></tr>
</table>

Condition Number	Condition	Section addressed
	After decommissioning or abandonment for any reason, all significant disturbed land caused by the carrying out of the activity/ies must be rehabilitated to meet the following final acceptance criteria: a) Any contaminated land (e.g. contaminated soils) is remediated and rehabilitated	Section 6.1.3
	b) For land that is not being cultivated by the landholder: i. Groundcover, that is not a declared pest species, is established and self-sustaining ii. Vegetation of similar species richness and species diversity to preselected analogue sites is established and self-sustaining	Section 6.1.3
	c) For land that is to be cultivated by the landholder, cover crop is revegetated, unless the landholder will be preparing the site for cropping within three months of activities being completed	Not applicable

3 DESCRIPTION OF ACTIVITIES

The BOS facility comprises a Launch Control Centre and the Launch Facility. The Launch facility incorporates a concreted area which supports all launch infrastructure including a Vehicle Assembly Building (VAB), launch pad and launch fluids and utilities storage pads. A layout of the BOS facility is provided in Figure 2.

The VAB is the primary location for onsite operations. The VAB is approximately 40m x 18m x 7m with large roller doors at the northern and southern ends and internal facilities including air-conditioned clean rooms, cribbing and ablution, open plan office, tooling and equipment and a material storage room. The northern end of the VAB is aligned with the launch pad centre.

The launch pad and utilities storage pads are located north of the VAB and connected via an internal site road. This area contains all infrastructure to support launch activities including a launch pad, fluid storage, acoustic suppression system, fuel transfer lines and spill collection pits. The operation and management of activities on the launch pad follow detailed launch procedures which are developed and maintained for each launch mission.

Launch activity will involve the transport, re-integration, final verification, fuelling and launch of orbital class launch vehicles.

Space launch activity is planned for a frequency of not more than 12 launches per calendar year and this maximum frequency will be reflected in the Launch Facility License granted by the Australian Space Agency.

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CLIENT: GILMOUR SPACE TECHNOLOGIES

FIGURE 2: BOS FACILITY LAYOUT

0 200 400 600 m

1:4,099

DOCUMENT: 202108-3 Launch Facility Site Layout

DATE: 14/09/2022

AUTHOR: A.Fitzgerald

Coordinate system: GDA2020 / MGA zone 55 EPSG:7855

4 EXISTING ENVIRONMENT

4.1 Site location and description

The BOS Site is located approximately 15 km west of the Bowen township in the Whitsunday Regional Council LGA. The Site is in the north-eastern corner of the Abbot Point State Development Area (APSDA) over three allotments with property descriptions of Lots 8, 9 and 10 on SP295408. Collectively these properties occupy an area of 163.14 ha within an area of the APSDA designated as an industrial use precinct and the facility footprint will be approximately 3 ha.

The facility shares boundaries with:

- Two cattle grazing properties
- An operational hard rock quarry (west of the launch site)
- Intermittent road and rail services along Abbot Point Road corridor and the Newlands System rail which connect the North Queensland Bulk Ports terminal.
- Saltwater creek and dune systems between the site and the coastline

The APSDA provides for a range of existing and future development opportunities including the port facilities precinct which consists of existing port infrastructure, port expansion precinct, restricted development precinct, industry precinct, infrastructure and corridors precinct and environmental management/materials transportation precinct. The launch facility is located within the industry precinct, which is largely undeveloped from an industrial perspective and is still dominated by a grazing land use.

Waters to the west, north and south of the Port of Abbot Point are classified as a General Use Zone under the GBRMP zoning (Map 8 – Cape Upstart). The area of water directly associated with the Port is classified as an exclusion zone within the Great Barrier Reef Marine Park.

4.2 Vegetation communities

Previous field investigations at the site confirmed the presence of RE 11.1.1 - *Sporobolus virginicus* grassland on marine clay plains, RE 11.3.30 - *Eucalyptus crebra*, *Corymbia dallachiana* woodland on alluvial plains and 11.12.1 - *Eucalyptus crebra* woodland on igneous rocks on the site, however RE 11.3.10 and RE 11.3.32 are not present. A description of each RE, it's protection status pursuant to the *Vegetation Management Act* 1999 is presented in Table 3.

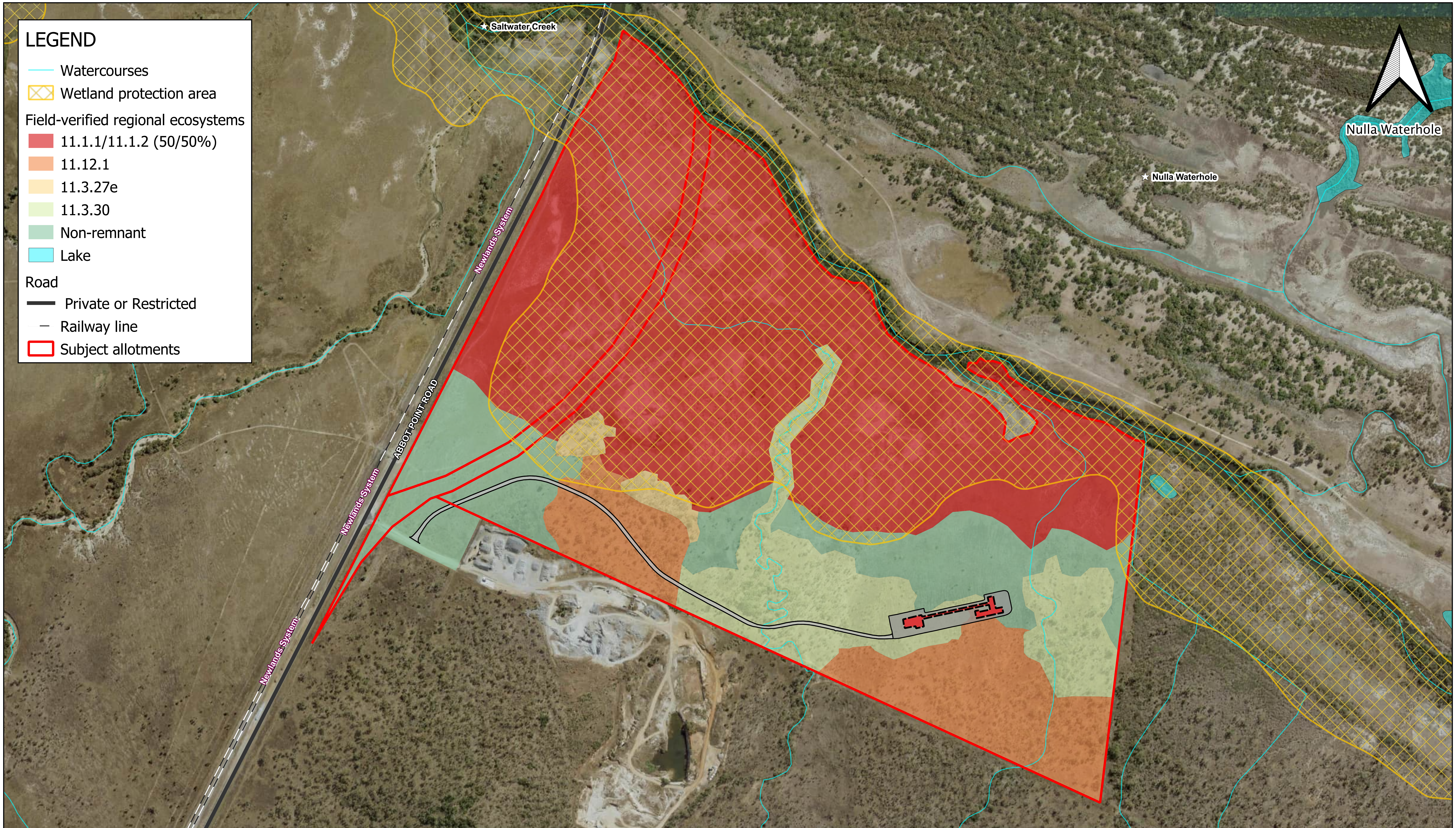
The vegetation communities on the site were observed to be relatively intact with a low abundance of invasive weeds including chinee apple (*Ziziphus mauritiana*), rubber vine (*Cryptostegia grandiflora*) and parkinsonia (*Parkinsonia aculeata*).

The site inspection identified inaccuracies in relation to the RE mapping with some areas mapped as remnant found to contain non-remnant vegetation. Additionally, two additional regional ecosystems were confirmed on the site including RE 11.1.2: Samphire forbland on marine clay plains and RE 11.3.27e: Freshwater/brackish wetlands fringed with *Melaleuca leucadendra* and *M. dealbata*. It is noted that both wetlands are shallow and ephemeral, and water would persist only for a short duration. Neither wetland contained water at the time of the survey.

Table 3 Regional ecosystems descriptions

Regional ecosystem	VM Act Status	Description
7.3.8	Least concern	*Sporobolus virginicus* grassland on marine clay plains
7.3.45	Least concern	*Eucalyptus brownii* woodland on alluvial plains

Regional ecosystem	VM Act Status	Description
11.3.30	Least concern	*Eucalyptus crebra*, *Corymbia dallachiana* woodland on alluvial plains
11.3.32	Least concern	*Allocasuarina luehmannii* low open woodland on alluvial plains
11.12.1	Least concern	*Eucalyptus crebra* woodland on igneous rocks



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CLIENT: GILMOUR SPACE TECHNOLOGIES

FIGURE 3: REVISED REGIONAL ECOSYSTEM MAPPING

DOCUMENT: 202108-3 Field verified vegetation map

DATE: 14/09/2022

AUTHOR: A.Fitzgerald

Coordinate system: GDA2020 / MGA zone 55 EPSG:7855

5 DECOMMISSIONING AND REHABILITATION MANAGEMENT PLAN

5.1 Decommissioning

5.1.1 Planning and management

Decommissioning and demolition plans will be developed by suitably qualified personnel for all surface infrastructure required for the duration of the Project. This may include engaging structural engineers, appropriate technical experts and the application of relevant standards and guidelines (e.g. AS 2601-1991 The Demolition of Structures). A detailed investigation of all structures will be completed to determine the appropriate techniques, equipment required and the sequence for decommissioning and removal.

Demolition activities will be managed by a suitability experienced and qualified demolition supervisor. The demolition supervisor will ensure that demolition activities are carried out in accordance with relevant standards and guidelines.

5.1.2 Preliminary decommissioning

Preliminary decommissioning involves the full isolation of surface equipment and involves one or more of the activities:

- Surface infrastructure and piping electrically and mechanically isolated
- Surface infrastructure depressurised, purged and drained
- Collection and removal of chemicals, wastes and fluids for recycling or disposal

5.1.3 Contamination assessment

A preliminary sampling and analysis program (Phase 1) shall be undertaken in accordance with *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC 2013) of the fuel storage area, chemical storage areas, waste storage/transfer and any other potentially contaminated areas. This will be used to determine whether a detailed assessment (Phase 2 – detailed investigation of contamination involving drilling) should be conducted to assess the nature and extent of contaminated material (if any) that may require remediation. Management of any contaminated areas may include on-site remediation or removal to an appropriately licensed waste disposal facility.

5.1.4 Launch Control Centre, Vehicle Assembly Building and Launch Pad

The conditions of the lease specify that at termination, the tenant will remove all tanks, the launch tower, and any free-standing structures.

LCC, VAB and launch pad areas may be comprised of a combination of pad-mounted, modular structures and onsite fabricated structures. Examples of these buildings may include offices, storage, warehousing, switch rooms, launch pad, bunded pads and power generation.

Modular type structures are generally able to be disassembled and removed intact, where re-use or sale is practicable. Where removal is not practicable then they may be demolished and recycled or disposed of. Fabricated structures typically require demolition activities and comprise partial or complete removal of surface infrastructure, with piping and other structural elements, cut off and/or capped below grade.

The terms of the lease agree that any concrete or other in-land developments revert to landlord’s ownership. Concrete footings and pads will be broken up to at least 1.5 m below the surface and removed. Options for the re-use of this material (i.e. crushed and used for road and track stabilisation) will be investigated as the operation approaches closure. If re-use / recycle opportunities aren’t available, all ‘non-contaminated’ waste material will be disposed of in a suitable approved location.

5.1.5 Electrical and communication lines

Underground electrical and communication lines that are no longer required will be decommissioned in accordance with legislative requirements applicable at that time. Decommissioning and abandonment activities may comprise:

- De-energising and isolating lines
- Removal and recycling or disposal of electrical and communication lines (where practicable) or abandonment *in situ*
- Removal and recycling or disposal of all surface equipment such as transformers, switch rooms and communication towers
- Demolition of concrete pads and foundations such as for, transformers, switch rooms and communication towers (where practicable) or abandonment *in situ*
- Concrete crushed and steel rebar segregated for recycling or disposal
- Demolition and recycling or disposal of transmission poles which may involve cutting off poles below grade

5.1.6 Roads, access tracks and site fencing

Where practicable, roads, access tracks and site fencing may be transferred to a third-party for on-going beneficial use. If a road or access track is to be decommissioned and removed, activities may comprise the removal and recycling or disposal of pavements such as asphalt and gravel (if present) and grading of the surface to form a stable landform.

5.2 Rehabilitation

Areas to be rehabilitated upon decommission of the project includes all launch infrastructure and any areas disturbed during decommission of the infrastructure. The maximum area likely to require rehabilitation is 1.34 ha (1.09 ha for the launch facility and 0.24 ha of temporary disturbance areas) (Figure 4).

5.2.1 Stakeholder engagement

Decommissioning and rehabilitation will be undertaken in consultation with the appropriate landholders impacted by the specific activities.

The consultation process may include:

- Identifying all stakeholders and preparation of a stakeholder engagement strategy
- Discussion regarding the opportunities for the re-use of infrastructure constructed (e.g. access roads, site fencing)
- Identification of additional issues, key risks and information needs regarding decommissioning and rehabilitation of the project area.

5.2.2 Contractor responsibilities

This DRMP prescribes standard decommissioning and rehabilitation methods that may be applied to disturbed land as a minimum. The Contractor(s) will be responsible for developing and implementing site and stage-specific decommissioning and rehabilitation plans as required, taking into consideration detailed staging of works, local environmental and landholder requirements and relevant conditions of development approvals.

CLIENT: GILMOUR SPACE TECHNOLOGIES

FIGURE 4: DECOMMISSIONING REHABILITATION AREA

Terra SOLUTIONS

DOCUMENT: 202108-3 Decommissioning Rehabilitation Area

DATE: 14/09/2022

AUTHOR: A.Fitzgerald

0 70 140 210 280 m

1:1,500

Credits:

Coordinate system: GDA2020 / MGA zone 55 EPSG:7855

5.2.3 Rehabilitation extent and treatment

Gilmour Space has commissioned and shared with the Queensland government a baseline condition report and baseline environmental audit report. These independent reports concluded that the land was suffering some degradation from long term grazing and was free from contamination.

This document is to be used by the landowner to assess if Gilmour Space has caused any contamination or damage to the land under lease and will be bound to make good upon termination of the lease.

The BOS comprise three major facilities; a Launch Control Centre co-located within the North Queensland Bulk Ports (NQBP) facilities, a Vehicle Assembly Building and a Launch Pad with associated fuel and oxidiser storage pads at Lot 10 Abbot Point Road. BOS design incorporates features to contain, mitigate and control nominal and anomalous conditions of small class orbital launch vehicles. The design also incorporates elements to ensure the security of sensitive technology stored within the facility and the safety of the public by isolating the facilities that will store quantities of hazardous goods.

Decommissioning and rehabilitation shall be undertaken to all disturbed and/or contaminated areas associated with construction, operation or decommissioning of the BOS unless otherwise agreed to by the landowners (Figure 2).

5.2.3.1 Launch Control Centre

The Launch Control Centre (LCC) from which launch activities will be managed will be situated approximately 7km away in an exclusive use secured administration facility which is part of the NQBP footprint. This facility will have all amenities required for the establishment of communication and control equipment and will have a direct line of site to the launch location enabling the safe installation of telemetry hardware for mission monitoring and tracking.

5.2.3.2 Vehicle Assembly Building

The VAB is approximately 40m x 18m x 7m with large roller doors at the north and south ends of the building. Internal facilities include air-conditioned clean rooms, cribbing and ablution, open plan office, tooling and equipment and a material storage room. The northern end of the VAB will be aligned with the launch pad centre.

The VAB will be an intrusion resistant facility with inclusion of features including securable internal spaces and security surveillance systems.

5.2.3.3 Launch Pad

The launch pad (PAD) will be a 20x20m self-bunded concrete pad to support transport and erection infrastructure for Gilmour Space Eris launch vehicles and will contain water ejected by the acoustic suppression system. Operation and management of activities on the PAD will be managed by detailed launch operation procedures which are developed and maintained for each launch mission.

5.2.3.4 Launch Fluids and Utilities Storage

Adjacent to the LPAD are the oxidiser, fuel, and utilities pads. These service the LPAD with power, fluids, and local control for launch vehicle filling and launch operations. This will be the principal location at the launch facility for the management of hazardous and dangerous goods. The generation, storage, usage, and disposal management of hazardous and dangerous goods is detailed in the Hazardous and Dangerous Goods Management Plan.

Oxidant Storage Pad – A 20x20m self-bunded concrete pad facilitating the safe and secure temporary storage of oxidisers and deionised water for rocket launch activities. Integrated into the pad will be an oxidiser dump pit with sufficient capacity for safe emergency de-inventory of the launch vehicle. Oxidisers to be stored include Hydrogen Peroxide and Liquid Oxygen. Deionised water sufficient for flushing, dilution and cleaning of oxidiser lines is stored here also. Safety and design of this pad is in line with requirements meeting AS/NZS 4326 and the Queensland Work Health and Safety Regulations, including considerations for separation, containment, labelling and materials.

Utility Pad – A self-bunded concrete pad facilitating the safe and secure storage of launch fluids, control systems and diesel storage for power generation requirements. Emergency de-inventory of propellants from the launch vehicle will be safely stored within the containment area of the pad in a dedicated sump.

Blast Walls –An earth build-up separates the storage pads from the PAD to protect equipment from any exhaust efflux.

The PAD and Utility Pad will feature physical access control including security fencing and remote surveillance systems.

5.2.4 Rehabilitation success factors

Typical rehabilitation success factors are as follows:

- Soil moisture availability:
  - High variability and low reliability rainfall means rehabilitation timing is critical. Where practicable, rehabilitation is to be scheduled immediately prior to the wet season to ensure soil moisture levels are optimal and to provide a greater chance of subsequent rain events. This will reduce the amount of manual watering required (e.g. water trucks or equivalent methods). Seasonal trends can be reviewed at Queensland Government the Long Paddock SOI Phase Rainfall Probabilities for planning purposes.
- Soil nutrients:
  - Vegetation and soil nutrient cycles can be disrupted from construction and decommissioning activities resulting in nutrient deficiencies in underlying subsoil and stockpiled topsoil. Topsoil when correctly stripped, stockpiled and managed can retain sufficient nutrients for native species when respread. Placing vegetation (mulched or otherwise) on top of topsoil stockpiles and following rehabilitation can also assist in nutrient retention. This may mitigate the requirement for application of fertilisers to rehabilitation areas.
- Site preparation:
  - Soil compaction from construction activities inhibits rainfall infiltration and increases the risk of erosion to rehabilitation areas. Ripping along contours will promote successful rehabilitation of native species.

5.2.5 Adaptive management strategies

Adaptive management practices shall be implemented where monitoring indicates rehabilitated areas will not achieve rehabilitation objectives and completion criteria. Adaptive management strategies shall include a combination of the following:

- Manual watering (e.g. water trucks or equivalent methods)
- Application of additional native seed bank
- Soil testing and application of fertilisers or other soil treatments based on chemical and physical soil test results
- Direct seeding, hydromulching or planting of tube stock
- Extending the rehabilitation monitoring and reporting period.

It will be the responsibility of the Contractor(s) to implemented rehabilitation and adaptive management strategies if required.

5.2.6 Rehabilitation timing and process

Areas that have been decommissioned shall be rehabilitated within six months of the cessation of works. In addition to this, consideration will be given to the timing of rehabilitation activities such that it promotes natural regeneration of disturbed areas, maximising potential of existing seedbank and minimising potential for erosion.

5.2.7 Land stabilisation and erosion management

Prior to commencement of rehabilitation, disturbed areas shall be reshaped to a stable form and to blend in with surrounding natural landforms. Access tracks may not require rehabilitation under this DRMP unless it forms part of terms of use. Disturbed surface areas will be roughened to reduce the effects of compaction, allowing for natural regeneration processes to occur.

Natural drainage patterns shall be reinstated as close to pre-disturbance as reasonably possible. Where natural drainage patterns cannot be re-established, drainage control measures shall be implemented. Any drainage control measures must take into consideration the potential for erosion from channelled runoff. Erosion and sediment control measures shall be developed in line with the requirements of erosion and sediment control plan.

Slope lengths and angles shall be compatible with the surrounding landscape, suitable for the proposed land use and resistant to erosion. Reconstructed landforms shall be left with a relatively natural profile to allow for topsoil placement and re-spreading.

The watercourses and drainage line embankments should be reprofiled and rock protection placed where required. Binders suitable for cold spray application may also be applied to stabilise mulched and seeded surfaces on banks in areas of high-risk erosion.

5.2.7.1 Ripping prior to placement of soil

Ripping may be required to reduce compaction and allow infiltration of rainfall into rehabilitated areas. This shall include:

- Removal of any hardstand material (i.e. gravel)
- Deep ripping of compacted areas such as hardstand and laydown areas shall take place after land stabilisation and prior to the placement of topsoil
- Deep ripping shall take place across the natural slope (i.e. parallel to contours) to reduce overland flow velocity and mitigate erosion, at a depth of approximately 0.1 m. Highly compacted areas such as hardstands, laydowns and temporary access tracks may need to be ripped to a greater depth of 0.3 m if possible, with available machinery

5.2.8 Soil assessment and amelioration

A soil assessment within the revegetation areas shall be undertaken by the Contractor to provide site specific recommendations for soil amelioration.

The soil sampling and assessment program shall be conducted by a suitably qualified soil scientist. Soil analysis should be undertaken by an Australasian Soil and Plant Analysis Council (ASPAC) certified laboratories.

Sampling and analysis conducted on topsoil and subsoils should conform with the below.

5.2.8.1 Topsoil

Topsoil sampling shall comply with the following requirements:

- Samples shall be representative of the topsoil type (i.e. no mixing different soil types or subsoils).
- Samples shall be collected as per the frequency outlined in Table 4.

- If sampling stockpiles, sub-samples shall be sampled from various locations and 0.5 m apart.
- Composite samples shall include 10 sub-samples.
- Approximately 3 kg of sample shall be collected.

Table 4 Topsoil sampling frequency

Topsoil	Frequency
In situ topsoil	1 per 2,500 m^2 With a minimum of one test per topsoil type
Site stockpile	1 per 500 m^3 With a minimum of one test per topsoil type
Manufactured site topsoil	1 per 500 m^3 With a minimum of one test per topsoil type
Imported topsoil	1 per 500 m^3 With a minimum of one test per topsoil type

Laboratory analysis shall be undertaken in accordance with relevant Forms outlined in Transport and Main Roads Specification MRTS16 Landscape and Revegetation Works (MRTS16) and shall include:

- Bulk density
- Organic matter
- Wettability
- pH Electrical conductivity
- Extractable Phosphorus content
- Permeability
- Texture
- Water repellence (hydrophobicity)
- Dispersion
- Exchangeable Calcium, Magnesium
- Calcium/Magnesium ratio
- Exchangeable Sodium percentage
- Exchangeable Potassium, Aluminium
- Effective cation exchange capacity
  - If EC > 1.2 dS/m – Soluble Chloride*
  - If EC > 1.2 dS/m – Extractable Sulfur*

Note: * not included when testing manufactured topsoil

5.2.8.2 Subsoil

Subsoil sampling shall comply with the following requirements:

- Samples shall be representative of the subsoil type (i.e. no mixing different soil types or topsoils)
- One test per subsoil type

- Composite samples shall include 10 sub-samples
- Approximately 1 kg of sample shall be collected

Laboratory analysis shall be undertaken in accordance with relevant Forms outlined in MRTS16 and include:

- Wettability
- pH
- Electrical conductivity
- Texture
- Water repellence (hydrophobicity)
- Exchangeable Calcium
- Exchangeable Magnesium
- Calcium/Magnesium ratio
- Exchangeable Sodium percentage
- Exchangeable Potassium
- Exchangeable Aluminium
- Effective cation exchange capacity.

5.2.9 Revegetation

Revegetation is planned for all disturbed areas except areas designated for permanent infrastructure (e.g. access tracks). Revegetation shall be performed using a combination of hydromulching and tube stock planning techniques as outlined below.

- Revegetation to be undertaken by a suitably qualified and experienced contractor.
- Mark out the areas to be rehabilitated.
- Weed eradication prior to undertaking revegetation works.
- Calculate material requirements for rehabilitation works well in advance of work commencement (noting there may be a requirement to propagate certain plant species)
- Contact nursery/seed providers to ascertain the availability of seed and plant tube stock for use in rehabilitation work
- Nursery/seed providers must provide proof of 'local provenance' for all material. A record of provenance should be maintained by the contractor undertaking the work. Where possible plants should have a provenance within 100 km of the site.
- At least 100 days should be allowed between seed collection and rehabilitation planting to ensure adequate tube-stock maturation
- Apply hydromulching material to revegetation areas (100% cover on areas to be revegetated) at the minimum application rate as per the nominated product requirements. Hydromulch shall not be applied under the following weather conditions:
  - Temperature is higher than 35°C
  - Winds exceed 15 km/hr
  - Where, in the opinion of the Superintendent the surface is too wet
  - During rain periods or when rain appears imminent

- Tube-stock should be planted a few months before the first wet season rains and irrigated, to maximise vegetation establishment before high velocity flows occur in watercourses and drainage features. Additional mulch is to be provided for 300mm around planted tube stock to a depth of 100mm.
- Tube stock shall have the following characteristics:
  - Tube stock to be minimum 50mm diameter and 80mm deep
  - Tube stock height to be 200mm when planted
- Plant stock to be supplier in good health as demonstrated by the following:
  - Leaf colour and size
  - Absences of dieback
  - Absence of other plant stress indicators
  - Free from significant injury
  - Free from pest and diseases
- Tube stock planting requirements include:
  - **Identify the trunk flare**. The trunk flare is where the trunk expands at the base of the tree. This point should be partially visible after the tree has been planted.
  - **Dig a shallow, broad planting hole**. Holes should be 2-3 times wider than the root ball, but only as deep as the root ball.
  - **Remove the containers or cut away the wire basket**. Inspect container tree root balls for circling roots. Straighten, cut, or remove them.
  - **Place the tree at the proper height**. Take care to dig the hole to the proper depth – and no more. If the tree is planted too deep, new roots will have difficulty developing because of a lack of oxygen.
  - **Straighten the tree in the hole**. Before backfilling, have someone view the tree from several directions to confirm it is straight.
  - **Fill the hole gently, but firmly**. Pack soil around the base of the root ball to stabilize it. Fill the remainder of the hole, firmly packing the soil to eliminate air pockets that may dry out roots. Further reduce air pockets by watering periodically while backfilling. Avoid fertilization at the time of planting.
  - **Stake the tree, if necessary**. Studies have shown that trees establish more quickly and develop stronger trunk and root systems if they are not staked at the time of planting.
  - **Mulch the base of the tree**. Mulch is organic matter spread around the base of a tree to hold moisture, moderate soil temperature extremes, and reduce grass and weed competition.
  - **Provide follow-up care**. Keep the soil moist, but not water-logged. Water trees at least once a week, barring rain, and more frequently during hot, windy weather.
- The following outlines the steps for hand planting tube-stock into a hydromulched site:
  - Clear hydromulch
  - Prepare the hole using a mechanical or hand auger remove tube-stock from the pot, supporting the stem
  - Plant, ensuring the seedling is planted below the surface of the ground
  - Backfill hole ensuring no potting mix from the tube stock is exposed (to avoid capillary drying of the root area immediately after planting)
  - Firm in and re-establish mulch around the plant (keep stems clear of mulch) water in to establish good root-to-soil contact
  - Stake and secure canopy and sub-canopy trees planted on banks

  - Water in at planting to establish good root to soil contact
  - Tree guards shall be required if predation from wildlife/livestock is a risk
- Fencing shall be required as directed by the Superintendent to protect rehabilitation areas from pest, livestock and native animals, as well as to control pedestrian and vehicle access
- A minimum plant establishment period of 12 weeks is applicable to all plants, including any replacement tube stock required during the maintenance period following initial planting as a result of plant failure.

Specific hydromulch and tube stock requirements are detailed in

Table 5 Hydromulch and tube stock requirements

<table>
<tr><th rowspan="2">Hydromulch</th><th colspan="3">Tube stock requirements</th></tr>
<tr><th>Tube stock planting rate at the following rates per stratum</th><th>Tube stock species diversity requirements</th><th>Plant spacing requirements</th></tr>
<tr><td>• Endemic grass species should be used with the goal of surface stabilisation through over-seeding the rehabilitation area with endemic grass species.
• Seeding rate should be sufficient for germination and sustainable cover of approximately 1000 plants per hectare, per riparian zone.
• A minimum of four different native grass species should be used. Several options are provided in Table 6.
• Bonded fibre matrix to be provided at watercourse banks as a minimum. 6-month functional longevity, minimum application rate of 5000 kg/ha (500 g/m2) and minimum wet thickness of 5 mm.
• Apply hydromulching material to rehabilitation areas (100% cover on entire rehabilitation footprint) at the minimum application rate as per the nominated product requirements</td><td>• 30 canopy trees per hectare
• 35 sub-canopy trees per hectare
• 40 shrubs per hectare
• 900 grasses per hectare.</td><td>• A minimum of two different canopy species.
• A minimum of two different sub-canopy species.
• A minimum of two different shrub species.
• A minimum of four different grass species.</td><td>• Plant sub-canopy, shrub, and ground strata species with a minimum spacing of 10 - 20m
• Plant canopy species with a minimum spacing of 10 - 20m.</td></tr>
</table>

Table 6 Suitable plant species for rehabilitation of disturbed remnant areas

	Lifeform	Species	Common name	RE 11.12.1	RE 11.3.30
Canopy	Tree	*Corymbia dallachiana*	Dallachy's ghost gum	✓	✓
	Tree	*Corymbia erythropholia*	Red bloodwood	✓	-
	Tree	*Eucalyptus crebra*	Narrow-leafed ironbox	✓	✓
	Tree	*Eucalyptus exserta*	Queensland peppermint	✓	-
	Tree	*Eucalyptus paedoglauca*	Mount Stuart ironbark	-	✓
Subcanopy	Tree	*Grevillea striata*	Beefwood	✓	✓
	Shrub	*Acacia salicina*	Sally's wattle	✓	✓
	Tree	*Alphitonia excelsa*	Soap tree	✓	-
Shrub	Shrub	*Alphitonia excelsa*	Soap tree	✓	-
	Shrub	*Acacia salicina*	Sally's wattle	✓	✓
	Shrub	*Gardenia vilhelmii*		✓	-
	Shrub	*Grevillea striata*	Beefwood	✓	✓
	Shrub	*Bursaria tenuifolia*	Mock orange	✓	--
	Shrub	*Planchonia careya*	Cocky Apple	✓	-
	Forb	*Glycine tabacina*	Glycine	✓	✓
	Forb	*Galactia tenuiflora*	Galactia	-	✓
	Forb	*Tephrosia juncea*	Pink tephrosia	-	✓
	Forb	*Grewia retusifolia*	Dog's balls	✓	-
	Grass	*Heteropogon contortus*	Black Speargrass	✓	✓
	Grass	*Heteropogon triticeus*	Giant spear grass	✓	✓
	Grass	Bothriochloa bladhii	Forest bluegrass	-	✓
	Grass	*Themeda triandra*	Kangaroo Grass	✓	✓
	Grass	*Cynodon dactylon*	Green couch	✓	✓
	Grass	*Bothriochloa pertusa*	Indian couch	✓	✓

5.2.10 Site maintenance

Maintenance of rehabilitation areas will be required to achieve project objectives. The following maintenance and obligations that will be required are as follows:

- Establishment phase maintenance of rehabilitation areas
- Ongoing maintenance of rehabilitation areas

5.2.10.1 Establishment phase maintenance

After rehabilitation is established the following minimum maintenance tasks shall be undertaken for the first 12 weeks after completion of rehabilitation:

- Any combination of water truck, hand watering and/or temporary irrigation system shall be utilised to fully establish the plants and grass within the project. Watering of tube stock shall occur twice a week for the 12 weeks following planting.
- Check the planted tube-stock for mortality. If greater than 5 % mortality (per stratum), replace any plant losses.
- Inspection for declared weed species should be undertaken every four months by personnel experienced in weed identification and control should be undertaken as necessary using appropriate control techniques.
- Inspection of watercourses to ensure weather has not caused any degradation of the rehabilitation works in these areas and undertake restoration works where required.

5.2.10.2 Ongoing maintenance

Once established, the following site maintenance activities will be undertaken:

-
- Watering of tube stock shall occur once every two weeks until the end of the defect liability period.
- Site inspection for declared weed species should be undertaken every four months by personnel experienced in weed identification and control should be undertaken as necessary using appropriate control techniques.
- Inspection of watercourses to ensure weather has not caused any degradation of the rehabilitation works in these areas and undertake restoration works where required.

6 MONITORING

Monitoring will be undertaken by a separate representative appointed by Gilmour and undertaken every four months until the end of the Defects Liability Period. Monitoring requirements are detailed in Table 7.

Table 7 Monitoring requirements

Element	Description
Photographic points	Two points for each watercourse or drainage featured restored will be established and marked with star pickets
Soil stability	Assessed visually by observing each monitoring site for signs of erosion
Groundcover	Groundcover establishment will be assessed by randomly placing five 1x1 m plots at 10 sites within the rehabilitation areas where hydromulching is proposed recording the following: • Species present and individual percent cover litter percent cover • Rock percent cover cryptogam percent cover bare earth percent cover
Tubestock survival	Tube stock survival rate will be assessed using a 2 x 20m2 (2 x 10m) quadrats at each of the differing regional ecosystem types.

7 PERFORMANCE AND COMPLETION CRITERIA AND CORRECTIVE ACTIONS

Monitoring results will be used to determine if the following performance criteria are met, as interim outcomes and targets, prior to completion criteria being achieved. These criteria provide an indication of the success of the management measures being implemented and serve as trigger values where failure to achieve will result in the implementation of corrective actions. Performance and completion criteria and corrective actions are detailed in Table 8.

Table 8 Performance and completion criteria and corrective actions

Element	Criteria	Compliance	Potential corrective actions
Landform	Final landform is stable and land surface contours within riparian areas are consistent with the adjacent areas	At completion of rehabilitation maintenance period	Installation or repair of erosion and sediment control measures where erosion or stabilisation issues are identified.
Declared weeds	No declared weeds	At completion of rehabilitation maintenance period	Removal of declared weeds
Endemic groundcover	Land is vegetated with groundcover (>70% groundcover comprising of preferred endemic species) which is not a declared weeds species and is established and self-sustaining	At completion of rehabilitation maintenance period	Removal of weeds where undesirable species are present
Suitability	Land is fit for purpose (grazing pasture, bank stabilisation) Safe for humans and wildlife	At completion of rehabilitation maintenance period	All of the above
Tube stock survival	>80% of plantings survived	At completion of the rehabilitation maintenance period	• Replanting of tube stock • Modification of watering regime where plant health indicates insufficient or excess water has been received • Application of fertilizer where plant health indicates nutrient deficiency Removal of weeds where undesirable species are present
Contamination	Land is within acceptable guideline limits for its intended purpose and flows from the site do not harm the receiving environment.	At completion of rehabilitation maintenance period	Conduct further assessments to determine the nature and extent of contaminated material. Manage contaminated areas to include on-site

Element	Criteria	Compliance	Potential corrective actions
			remediation or removal to an appropriately licensed waste disposal facility.

8 QUALITY REQUIREMENT

8.1 Post rehabilitation inspections

Following the completion of rehabilitation works and prior to demobilisation from site, rehabilitated areas shall be inspected by a suitable qualified and experienced representative familiar with Project requirements (e.g. environmental manager or equivalent). The purpose of the inspection will be to record and sign off that works have been completed generally in accordance with this DRMP. If rehabilitation works are considered not to meet the requirements outlined in this DRMP, corrective actions shall be agreed and recorded. Corrective actions shall then be implemented by the responsible Contractor with a follow up inspection completed to certify the rectification works were completed to the required standard.

8.2 Hold points

Table 9 identifies the required hold points and required inspections.

Table 9 Monitoring requirements

Activity	Requirement	Notice for inspection	Level of inspection	Released by
Quality control	Submission of all quality control documentation including management plans and inspection and testing plans	10 working days	Hold Point	Superintendent
Revegetation	Submission of revegetation contractor qualifications	10 working days	Hold Point	Superintendent
Survey	Submission of proposed land to be revegetated	10 working days	Hold Point	Superintendent
Weed eradication	Submission of proposed method for weed eradication	10 working days	Hold Point	Superintendent
Trees and shrubs	Submission of details of vegetation and planting plan	10 working days	Hold Point	Superintendent
MSDS to be provided	10 working days	10 working days	Hold Point	Superintendent
Seed Mix	Submission of seed mix for approval	10 working days	Hold Point	Superintendent
On site mark out	On site mark out of areas to be revegetated	10 working days	Hold Point	Superintendent

9 COMPLETION REPORT

9.1 Rehabilitation works completion

Contractor is to notify the Superintendent immediately on completion of the works for inspection by a suitably qualified appropriate representative. A rehabilitation completion report with suitable records is also to be provided to the superintendent within five days following the completion of the rehabilitation works.

9.2 Rehabilitation maintenance period completion report

Following completion of the revegetation maintenance period (which shall correspond to the Contract Defects Liability Period), a rehabilitation completion report demonstrating compliance of the revegetation works against the completion criteria in Section 8 shall be developed by a suitably qualified ecologist engaged by the Contractor and submitted to the Superintendent.

The completion report will be submitted by Gilmour to relevant OCG under conditions of approval.

Appendix I Bushfire Management Plan

Appendix J Flora and Fauna Management Plan

FLORA AND FAUNA MANAGEMENT PLAN

Gilmour Space Technologies

Reference No. 202108-3

Prepared for Gilmour Space Technologies Pty Ltd

5 February 2024

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1 Introduction

This Flora and Fauna Management Plan (FFMP) was produced by Terra Solutions Pty Ltd (Terra) for Gilmour Space Technologies (Gilmour) for the Bowen Orbital Spaceport (BOS) Launch Operations located on Lots 8, 9 and 10 on SP295408 (the Site) in the Abbot Point State Development Area (Figure 1).

Gilmour has conditioned approval for a material change of use (MCU) for a high impact industry (launch facility) at the site. The MCU provides this approval from the date of obtaining Commonwealth approval pursuant to the Space (Launches and Returns) Act 2018, for a launch facility licence to operate a launch facility on the site.

Relevant conditions of the OCG approval require that a FFMP be implemented to demonstrate compliance with the Development Approval and following conditions are identified in Section 2.

The FFMP stipulates the flora and fauna monitoring and reporting requirements to be followed to ensure impacts to listed species under the Nature Conservation Act 1992 and Environment Protection and Biodiversity Conservation Act 1999 and associated regulations are minimised.

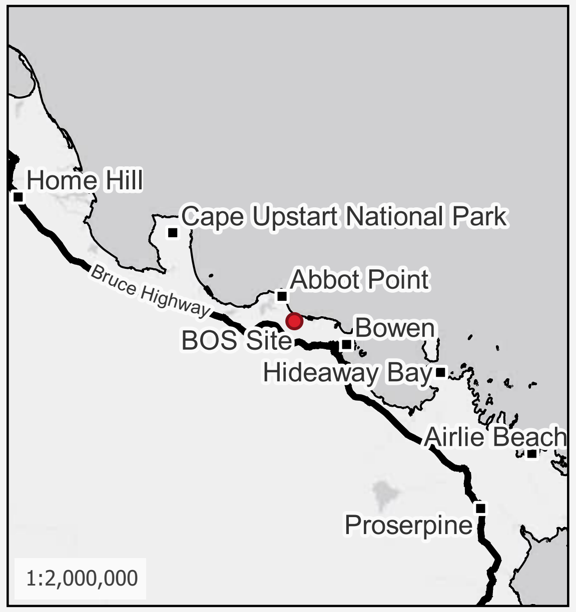
1.1 Objectives

The objective of the FFMP is to provide a framework that will ensure that impacts to listed flora and fauna species are minimised as consequence of activities associated with the BOS Launch Operations and BOS Test Facility Operations.

FIGURE 1: SITE LOCATION

LEGEND:

- Subject Allotments
- Launch Pad
- HRE Test Pad
- Highway
- Roads
- Lakes
- Watercourse



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2 Relevant Legislation and Approvals

2.1 Legislation

The key legislative requirements for consideration in this FFMP are provided in Table 1 below.

Table 1 Relevant legislation

Legislation	Authorising Body
Environmental Protection Act 1994	The object of the EP Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).
Nature Conservation Act 1992	The *Nature Conservation Act 1992* (NC Act) aims to conserve nature in Queensland, while allowing for the involvement of Indigenous people in the management of protected areas in which they have an interest under Aboriginal tradition or Island custom. The NC Act provides for the protection of wildlife, including threatened species, and areas of conservation significance.
Environment Protection and Biodiversity Conservation Act 1999	The Environmental Protection and Biodiversity Act 1999 (EPBC Act) is the key piece of Commonwealth environmental legislation. It provides a legal framework to protect and manage nine matters of national environmental significance (MNES): - listed threatened species and communities - listed migratory species - Ramsar wetlands of international importance - Commonwealth marine environment - world heritage properties - national heritage places - the great barrier reef marine park - nuclear actions - a water resource, in relation to coal seam gas development and large coal mining development. Under the EPBC Act, an action that has, will have, or is likely to have a significant impact on any MNES or other protected matters must not be undertaken without approval from the Commonwealth Minister for the Environment. Before a proponent can lawfully undertake an action that may have a significant impact on a MNES, the action must be referred to the minister for consideration. If it is determined that an action may have a significant impact on MNES it is categorised as a 'controlled action' requiring assessment and approval under the EPBC Act. This impact assessment may be undertaken in accordance with a relevant bilateral agreement between the commonwealth and a state or territory.

2.2 Relevant Approval Conditions

The permits applicable to the activity include the following:

- Decision notice for AP2021/007 – SDA approval for a material change of use for a high impact industry (launch facility) in the Abbot Point State Development Area (SDA)

Requirements of the approval relevant for the development of the FFMP and sections of the FFMP that address the conditions are detailed in Table 2.

Table 2 Relevant conditions from DA permits

Condition Number	Condition	Section in Report
AP2021/007 – SDA approval for a material change of use for a high impact industry (launch facility) in the Abbot Point State Development Area (SDA)		

Condition Number	Condition	Section in Report
12.1	Prepare and submit to the Coordinator-General and Whitsunday Regional Council, a detailed project specific Environmental Management Plan (EMP) addressing both the construction and operational phases of the project. The EMP must be certified by an independent suitably qualified third-party confirming the adequacy of the EMP in accordance with current best practice. The EMP must include the following matters: (b) flora and fauna management plan	Entire document
Enclosure 3 To demonstrate compliance with condition 12.1 of this development approval, prepare a site-based flora and fauna management plan (by a suitably qualified person) that addresses, at a minimum, the following matters:		
a)	the location, extent, condition and significance of native terrestrial and marine fauna populations, including individual endangered, threatened (or near threatened) and vulnerable species and communities in the surrounding area, including on land, wetlands (Caley Valley Wetland), waterways and the marine environment	Section 3
b)	inclusion of a monitoring and recording program for populations of endangered, threatened (or near threatened) and vulnerable species of state significance, inclusive of a count of the relevant species, prior to the commencement of the use (a launch event) and monitored on regular annual intervals, during both dry and wet seasons, for the duration of the approval period	Section 5
c)	detail the ability of populations or individuals to recover	Section 4.6
d)	the mitigation and management measures required to protect threatened species, including among other things: actions and procedures to be followed during the pre-construction, construction, operational and (if appropriate) rehabilitation phases of the project a program of monitoring, reporting and review to facilitate adaptive management of the actions and measures, should it be required the developments compliance with all relevant provisions of the Nature Conservation Act 1992 (Qld).	Section 7
e)	provision for the relocation of fauna prior to each launch event	Section 7
f)	measures to prevent bird strike	Section 7.1
g)	measures to prevent fauna being harmed from noise and heat exposure must be implemented during operational activities and immediately before a launch event	Section 7.2
h)	monitoring and management of flora and fauna pest species, including prevention of pest animals accessing putrescible waste at facilities	Refer to Site-based Land Management Plan

3 Operations Description

3.1 BOS Launch Operations

Launch operations from the BOS are approximately 60–90-day campaigns where a launch vehicle undergoes final assembly and commissioning prior to fuelling and launch.

The BOS facility comprises a Launch Control Centre, Vehicle Assembly Building (VAB), launch pad and launch fluids and utilities storage pads.

The VAB is the primary location for onsite operations. The VAB possesses large roller doors at the eastern and western ends and internal facilities including cribbing and ablution, open plan office, tooling and equipment and a material storage room. The northern end of the VAB is aligned with the launch pad centre.

The launch and utilities storage pads are east of the VAB and connected via an internal site road. The facility consists of several concrete pads for fluid storage along with infrastructure to transport and erect Gilmour Rockets. The launch pad includes a water deluge system that is designed to suppress noise and vibrations and prevent damage to the launch pad and launch vehicle in the moments prior to and immediately after lift-off. The suppression system also works to limit environmental noise emissions during this phase of the launch. Operation and management of activities on the launch pad follow detailed launch procedures which are developed and maintained for each launch mission.

The Gilmour Space ERIS (Small Class Orbital Expendable Launch vehicle) is approximately 25 m in length with a mass at lift-off of approximately 35 tonnes. The rocket comprises 3 stages. The stage 1 booster is a hybrid rocket which provides up to 600kN vacuum thrust. The hybrid rocket utilises a hydrogen peroxide liquid oxidiser along with a solid fuel. The exhaust products of the rocket are predominantly water and carbon dioxide with some trace amounts of carbon monoxide and nitrous oxides as by-products of exhaust interaction with the atmosphere.

The flight time from take-off to 10 km (altitude of commercial jets in cruise) is approximately 60 seconds and an additional 20 seconds is required to attain an altitude of 20 km (above the troposphere).

Flight paths between the 19° - 65° trajectories are considered possible from the BOS. The angle is specified anti-clockwise relative to due east. The noise modelling has been based on a 57° trajectory since this alignment is likely to be the most common, noting that each launch will require its own independent flight safety analysis and launch permit approval from the Australian Space Agency.

During a launch activity, no sonic boom would be expected to occur proximal to the ground during the vertical ascent phase of the flight because the acoustic energy of the sonic boom is directed upward, unless particular atmospheric conditions cause some energy to refract back to the ground. As the launch vehicle pitches over to access the specified target orbit, the sonic boom energy (rays) may intersect the water. Given the proposed range of trajectories the sonic boom is not expected to be experienced on land.

A failure on or close to the launch pad would have the greatest blast energy since the rocket during this early phase of the launch has not consumed any fuel. Detonation of the launch vehicle is unlikely due to the fuel and oxidiser selected by Gilmour Space Technologies but is noted as the only unexpected event with potential noise and vibration consequences.

Current projections indicate there are likely to be 2 launches per year until 2025 and then increase in frequency towards a target of monthly launches.

3.1.1 Noise Sources

Rocket noise is generated from both the combustion process and the turbulent mixing of the exhaust flow with the surrounding air.

A water deluge system, intended to protect the Launch Pad, its infrastructure, and the launch vehicle from sound energy during lift, will effectively lower the noise generated for approximately the first five or so seconds of engine burn, until the vehicle accelerates clear of the Launch Pad. Noise generated on launch is directly related to the amount of thrust generated: the mitigation of rocket noise beyond the initial few seconds of launch is not practicable.

Temporary mechanical noise will be produced in the lead-up to each launch. Noise associated with onsite work will be negligible.

3.1.2 Vibration Sources

Two potential sources of ground vibration can be generated during a launch activity, which are the ignition pulse and conversion of air-borne acoustical energy into ground vibration (SEG 2021). Other sources of vibration associated with onsite work will be negligible.

The ignition pulse is generated from the high velocity jet and rocket motor exhaust which directly impacts the ground during the ignition phase of the launch. The proposed hybrid rocket motors do not produce a significant peak (or pulse) on ignition, the thrust develops gradually and maintains a relatively constant pressure on the concrete launch pad. Consequently, it is not anticipated the ignition component of the launch will generate any noticeable vibration pulse into the ground (SEG 2021).

The transmission of acoustic energy over the surface of the launch pad and launch structure is chaotic and variable over time and will reduce rapidly after ignition as the launch vehicle gains altitude (SEG 2021). By way of guidance, most acoustic energy is reflected from a solid impervious surface, however even a small fraction of transmissibility could cause vibration in the structures close to the rocket motors (SEG 2021).

To address the operational issues associated with vibrations caused by high acoustic levels during launch, the launch facility adopts a water deluge system to attenuate high acoustic levels during the initial phase of the launch, which is expected to reduce the sound power by approximately 38 dB (Panda et al 2014 cited in SEG 2021).

Sound power which may be transmissible to vibration at the pad location is expected to be attenuated by approximately 78 dB by the combined effects of a water deluge, and the transmissibility effects. The source sound power level from the rocket exhaust is expected to be approximately 180 dB, which may result in a modelled incident vibration of up to 102 dB (SEG 2021).

When considering the high acoustic noise levels at a macroscale, there will not be large areas of in-phase or resonance vibrations and consequently environmental effects from this effect would be limited. It is conservatively estimated PPV ground vibrations at 100 m from the launch pad would be below 10 mm/s (SEG 2021).

3.1.3 Modelling Noise at Sensitive Recepors

Sound power level measurements from Hybrid Rocket Testing undertaken by SEG (2021) predicted a source sound power level for the Gilmour Space Technologies hybrid motor of 179 dB (A).

These measurements were subsequently incorporated into the PEN3D General Prediction Model (GPM) to calculate the predicted noise levels at selected sensitive receptors during launch events (SEG 2021). The modelling also indicated that ground-level sound levels will naturally dissipate as the launch vehicle achieves higher altitudes with levels falling below 90dB(A) once the vehicle passes 5 km in height (approximately 42 seconds after launch).

The estimated impact of noise events from modelling indicates that Saltwater Creek and beach areas to the north of the launch site will be exposed to high impact noise levels of 120 dB(A) of 105 dB(A) respectively (Table 3).

It is noted that launch activities will be infrequent, short duration events which will limit exposure and thus the level of impacts. Whilst noises of this magnitude are characterised as very loud, they will be infrequent and of very short duration (approximately 30 seconds of intense sound per launch).

Table 3 Calculated noise levels at selected receptors (from SEG 2021)

Receptor	Calculated L_{Amax} [dB(A)]	Calculated SEL [dB(A)]	Timeframe above 100 dB(A) (seconds)	Impact category
R9 – Northern boundary and Saltwater Creek	120	124	36	High
R10 – Eastern Beach north of launch pad	104	112	28	High

3.2 BOS Test Facility Operations

The BOS test facility comprises testing of rocket engines within two purpose-built engine test pads (Test Pad 1 and Test Pad 2). The test pads comprise a central concrete slab surrounded by a gravel surface. The test pads will consist of block walls constructed adjacent to the primary engine test stand. Engine testing is only to take place during the day period. Test engines are fired horizontally.

Gilmore Space provided the likely maximum use of the site and proposed seven alternative engine test options with up to 6 engine test firings in a single day. All these engines and engine combinations have been modelled, assessed and compared with the site environmental site license. It was found the site readily complies with the site license conditions with regards to residential and commercial sensitive receptors.

The engine type and test pad are shown in Table 4.

Table 4 Engine test locations

Engine Type	Test Pad
Catpack	1
Small HRE	1
Big HRE	1
Small RCS	1
Big RCS	1
Small LRE	2
Big LRE	2

3.2.1 Test Pad 1

Test Pad 1 is located at Latitude: 19°57'24.57" S and Longitude: 148° 6'54.96" E, refer to Figure 2. The container wall comprises 2 rows of 40ft containers. The sandbag wall is 3m high and 20m long.

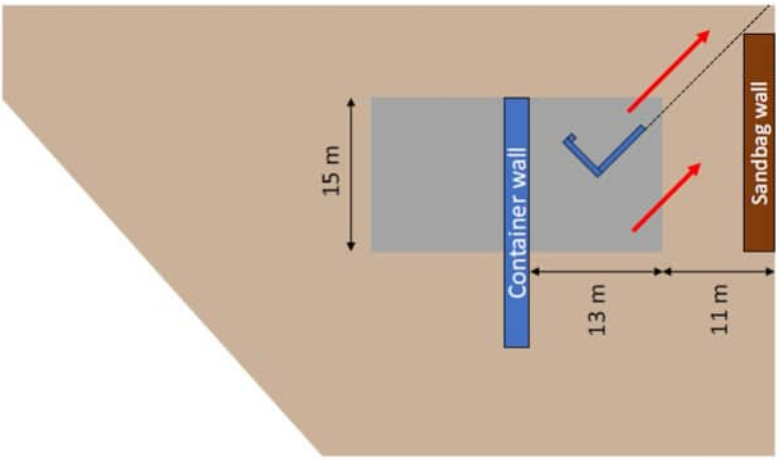

Figure 2 Test Pad 1 Showing Engine Stands, Container Wall, and 20 m Long Sandbag Wall

Test stand 1A is for firing engine types Catpack and Big HRE while Test stand 1B is for firing engine types Small HRE, Small RCS and Big RCS. The firing direction is 25°, i.e. to the NE. The link block walls around Test stand 1A are shown in Figure 10.

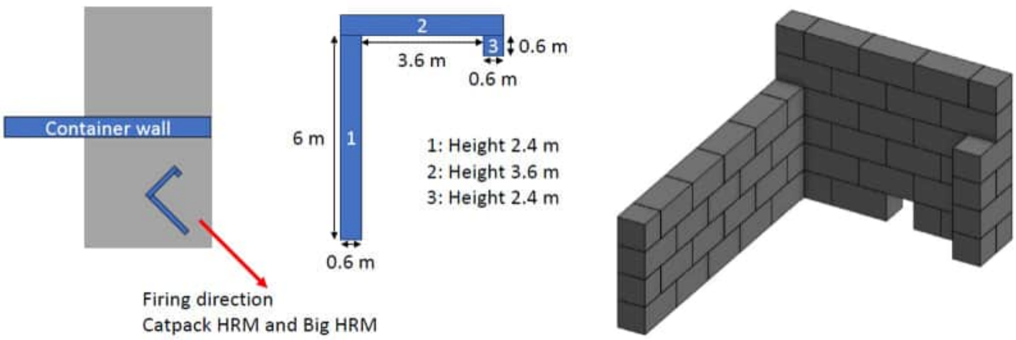

Figure 3 Link Block Walls Test Stand 1A

3.2.2 Test Pad 2

Test Pad 2 situated at Latitude: 19°57'25.23" S Longitude: 148° 6'45.70" E and is shown in Figure 4. The Link block walls are shown in Figure 5. Test Pad 2 will be for testing engine types Small LRE and Big LRE. The firing direction is 17°, i.e. to the NE.

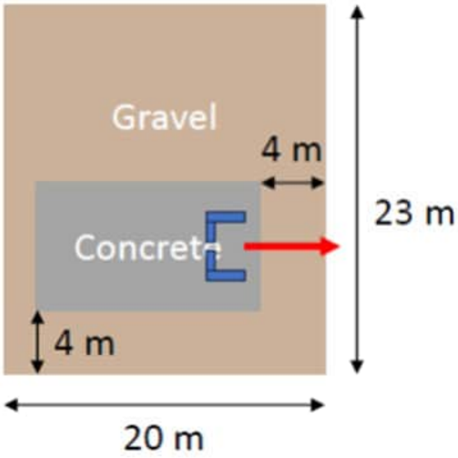

Figure 4 Test Pad 2 Showing Test Stand and Link Block Walls

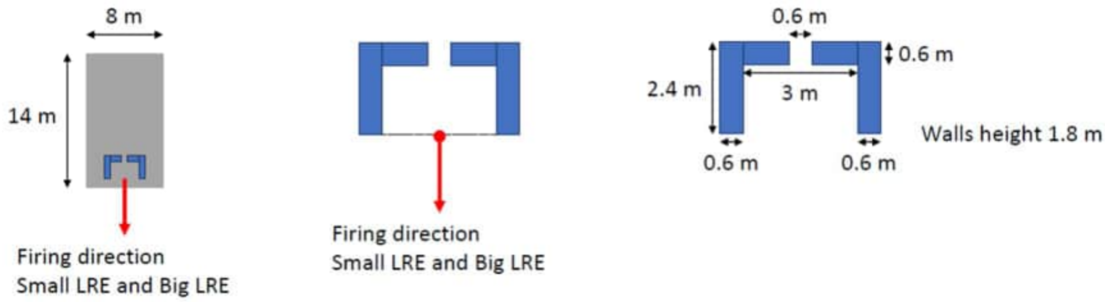

Figure 5 Test Pad 2 Link Block Walls Description

Typical maximum testing regimes are contained Table 5. These engine test plans define the maximum likely use of the site. All engine tests are carried out during the day, 7am to 6pm.

Table 5 Engine test plans

Test Day Options	Engine Tests
Option 1	1 Big HRE test for 120 sec
Option 2a	3 Catpack tests for 30 sec each + 1 Small LRE test for 240 sec
Option 2b	3 Catpack tests for 30 sec each + 2 Big RCS tests for 60 sec each
Option 3a	2 Small HRE tests for 120 sec each + 1 Small LRE test for 240 sec
Option 3b	2 Small HRE tests for 120 sec each + 2 Big RCS tests for 60 sec each
Option 4a	4 Big RCS tests for 60 sec each + 1 Small LRE test for 240 sec
Option 4b	4 Big RCS tests for 60 sec each + 2 Big LRE tests for 5 sec each

3.2.3 Noise Source

Rockets test engines generate significant noise from the combustion process and turbulent mixing of the exhaust flow with the surrounding air. There is a supersonic potential core of exhaust flow, surrounded by mixing region. Noise is generated in this flow. It is directional, with the highest noise levels at an angle of 40 to 50 degrees from the direction of the exhaust flow.

The emitted noise is modified in several ways as it propagates outward from the test engine. These effects include source directivity, geometric spreading, atmospheric absorption, and ground interference to a receiver location.

3.2.4 Modelling Noise at Sensitive Receptors

The proposed engine test facility is to be designed to comply with the site license conditions. These are described in Table 6.

Table 6 Noise level limits

Noise Index	Noise Level Imit in dB(A) at Places	
	Sensitive Receptors	Commercial Receptors
L_{Amax}	96	115
SEL	110	115
Day Night Average Sound Level (DNL)	70	80

Noise modelling (SEG 2023) indicates that the noise level limits (L_{Amax} and DNL) at all residential and commercial sensitive receptors will readily comply with the licensed noise limits.

3.2.4.1 Residential Receptors

The highest noise level is likely to be an L_{Amax} of 62 dB(A) at R1 during neutral meteorology for the Big HRE. This engine is usually tested over 120 seconds. Assuming a constant sound output over 120 seconds, the SEL would be 21 dB(A) higher, i.e. a SEL of 83 dB(A), readily complying with the residential SEL limit of 110 dB(A).

3.2.4.2 Commercial Receptors

The highest noise level at a commercial receptor is likely to be an L_{Amax} of 91 dB(A) at R11 during neutral with wind meteorology for the Big HRE. This engine is usually tested over 120 seconds. Assuming a constant sound output over 120 seconds, the SEL would be 21 dB(A) higher, i.e. a SEL of 103 dB(A), readily complying with the commercial premises SEL limit of 115 dB(A).

4 Existing Environment

4.1 Site Location and Description

The BOS site is located approximately 15 km west of the Bowen township in the Whitsunday Regional Council LGA (Figure 1). The Site is in the north-eastern corner of the Abbot Point State Development Area (APSDA) over three allotments with property descriptions of Lots 8, 9 and 10 on SP295408. Collectively these properties occupy an area of 163.14 ha within an area of the APSDA designated as an industrial use precinct and the facility footprint will be approximately 3 ha.

Areas to the east and north of the site consist of coastal dune and estuarine environments. Small rural allotments are located between the site and the township of Bowen. A quarry is located to the southwest of the launch facility. Abbot Point Road and the Newlands railway line are located to the west of the site with the latter providing coal bulk haulage to the Abbot Point Coal terminal located to the north-west of the launch site. West of the Newlands bulk coal rail line is the Caley Valley wetlands which in addition to Saltwater Creek and the coastal environment to the north are the main ecological areas proximate to the site. The closest bound of the wetland area is at Saltwater creek which drains west toward the main wetland areas closer to the Abbot Point Coal Terminal and runs along the northern boundary of the property.

The APSDA provides for a range of existing and future development opportunities, including the port facilities precinct which consists of existing port infrastructure, port expansion precinct, restricted development precinct, industry precinct, infrastructure and corridors precinct and environmental management/materials transportation precinct. The launch facility is located within the industry precinct, which is largely undeveloped from an industrial perspective and is still dominated by a grazing land use.

Waters to the west, north and south of the Port of Abbot Point are classified as a General Use Zone under the GBRMP zoning (Map 8 – Cape Upstart). The area of water directly associated with the Port is classified as an exclusion zone within the Great Barrier Reef Marine Park.

A baseline condition assessment of the site undertaken by Terra Solutions confirmed the following habitat and land condition values present on the site:

- Large trees are uncommon across the site and are generally absent in cleared areas and all marine clay plains and rare or absent in areas of regrowth.
- Canopy height in the remnant woodland ecosystems is relatively low (approximately two-thirds of benchmark BioCondition heights. This was particularly notable on the granite hills to the south of the site. Tree heights are highest along the main watercourse.
- The shrub layer in woodland sites was found to be poorly developed and of low diversity, probably due to suppression by cattle grazing. This lack of diversity has flow-on impacts to the range of fauna habitats available and in turn the diversity of fauna that utilise the site.
- The native plant species richness in the grass/herb layer is very low-low across the site The lack of diversity is again related to the impacts of cattle grazing including the browsing and trampling of plants and the spread and proliferation of weeds. The depauperate grass/herb layer diversity is also likely to have affected the invertebrate diversity, the diversity of invertebrate predators and the abundance of granivorous species.
- Non-native plant cover was high in terrestrial habitats except for marine clay plains that are generally inhabited by specialised marine plants including marine couch and samphire species.
- The steeper high elevation sections of the site contained cobbles and boulders and were in comparatively better condition than all other parts of the site, presumably due to more limited access by cattle.
- Coarse woody debris at woodland sites was very low which affects the habitat availability of ground dwelling fauna including invertebrates that feed on decomposing organic matter.
- The grass/forb layer was generally in poor condition at woodland sites with less than expected native perennial grass cover (expecting >40% at most sites) and diversity (approximately one third of the expected diversity).

The site contains extensive areas of saline soils that are devoid of vegetation. Soil compaction from grazing practices are common, particularly on the marine clay plains and around watercourses and pools of water used for hydration by cattle.

A total of five listed weed species under the Biosecurity Act 2014 are known to occur on or immediately adjacent to the site. Notable weed infestations are located along the main watercourse consisting of mimosa bush, rubber vine, parkinsonia, chinee apple and leucaena. Control of weeds in this area is recommend in the short term to prevent further spread. A significant weed infestation of bellyache bush, mimosa bush and potentially prickly acacia (Category 3 and WoNS) is located on adjacent land and lines almost the entire eastern boundary of the site. Refer to the Site-based land and pest management for control objectives and monitoring of onsite weed populations.

The Development Approval stipulates a wetland buffer in the area immediately north of the access track (refer Figure 6). Vehicles are restricted from entering this area to protect the wetland values present on the site.

Terra SOLUTIONS

FIGURE 6: EXISTING ENVIRONMENTAL FEATURES

0 250 500 750 m
1:25,000

LEGEND:

- Launch Pad
- HRE Test Pad
- LRE Test Pad
- Sensitive Receptors
- River Labels
- Road
- Subject allotments
- HES Wetlands
- Watercourses

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COORDINATE SYSTEM: GDA2020 / MGA zone 55

CREDITS:
The State of Queensland (Department of Resources), State of Queensland (Department of Resources) 2023

4.2 Sensitive Environmental Receptors

Key sensitive receptors were previously identified in the BOS Public Environment Report (Gilmour 2022) and the Environmental Assessment Report (SMEC 2021). The key areas identified within these documents are used here to determine suitable locations for monitoring sites. The distance and bearing from the launch pad to the identified receptors are presented in Table 7 and Figure 6. The receptors comprise significant natural features including saltwater creek, foreshore communities and intertidal areas and the Caley Valley wetlands. The closest sensitive receptor is Saltwater Creek.

Table 7 Relevant sensitive receptors and proximity to launch operations (SEG 2021)

Receptor ID	Description	Approximate distance and bearing from launch pad
R9	Environmental receptor (Saltwater Creek) and northern property boundary	450 m at 15°
R10	Environmental receptor (Eastern Beach) north of Launch Pad	1,800 m at 5°
R12	Environmental receptor (Caley Valley Wetlands)	2950 m at 315°

The distance and bearing from the test facility to the identified receptors are presented in Table 8 and Figure 6. The closest sensitive receptor is Saltwater Creek.

Table 8 Relevant sensitive receptors and proximity to test facility operations

Receptor ID	Description	Approximate distance and bearing from test pads
R9	Environmental receptor (Saltwater Creek) and northern property boundary	Test Pad 1 (HRE): 255 m at 354° Test Pad 2 (LRE): 372 m 139°
R10	Environmental receptor (Eastern Beach) north of Launch Pad	Test Pad 1 (HRE): 1,570 m at 161° Test Pad 2 (LRE): 1,708 m at 153°
R12	Environmental receptor (Caley Valley Wetlands)	Test Pad 1 (HRE): 2,947 m at 230° Test Pad 2 (LRE): 2,751 m at 226°

4.3 Important Flora and Fauna Habitat Areas

The Abbot Point region supports several important habitat types that are known to, or potentially support listed threatened or migratory species including Caley Valley Wetlands, Saltwater Creek, and intertidal and foreshore habitats.

Caley Valley Wetlands covers an area of about 5,154 ha and is listed in the Directory of Important Wetlands in Australia. The wetlands comprise intertidal mudflats, sandflats, estuary channels, mangroves, and saltmarshes under tidal influence in its western extent and a large fresh and brackish water wetland basin within an artificial bund in its eastern extent (Blackman et al.1999). Saltwater Creek links the freshwater wetland basin to Euri Creek on the eastern side of the wetland (Lloyd et al 2020).

During the wet season when water levels in Euri Creek are high, water flows north-westwards along Saltwater Creek and into the wetland (Lloyd et al 2020). Freshwater also drains into the wetland from the Salisbury Plain and the slopes of Mount Roundback and Mount Little to the south (Environment Australia 2001).

The wetland basin has a complex hydrology due to seasonal changes in freshwater input and the presence of two artificial bunds: 1) an outer, western bund; and 2) an inner bund or causeway (Lloyd et al 2020). Without the construction of these bunds the hydrology of the area would be vastly different with greater marine dominance due to the influx of tidal water from Curlewis Bay (SMEC 2021). The reduced influx of tidal waters due to bunding have resulted in a system that is now classified as fresh to brackish.

The Caley Valley Wetlands support several important environmental values of relevance to the project including:

- Habitat for many waterbirds, including threatened and migratory species

- Important habitat for Australian painted snipe (Rostratula australis) within the coastal grass-sedge wetlands
- Breeding and general habitat for waterbirds colonial and non-colonial species including spoonbills and darters

Intertidal and foreshore habitats north of the launch site support the following known environmental values:

- Foraging and roosting habitat for shorebirds and beach-nesting birds including beach stone-curlew, curlew sandpiper, greater sand plover, lesser sand plover, bar-tailed godwit, and eastern curlew.

Onsite terrestrial and wetland habitats:

- Potential habitat for squatter pigeon and intermittently wetland birds

4.4 Significant Flora Species

No threatened terrestrial flora species are likely to occur on the site or were identified during previous ecological investigations. Offsite threatened plants are unlikely to be affected by launch operations of the site or are likely to be impacted within the project area however the potential for weed spread into adjacent habitats is possible. Refer to the Site-based land and pest management for monitoring and control of onsite weed populations.

4.5 Threatened Fauna

No threatened fauna species were identified within the project area during ecological investigations, although several threatened fauna species have previously been recorded or have the potential occur within the launch impact area (Table 9). Over the course of the monitoring program there may be a requirement to monitor additional species for various reasons, including new threatened species listings (i.e. from least concern to vulnerable or endangered) or the detection of threatened species not previously detected within the impact area.

Table 9 Threatened species with potential to occur in impact area

Common Name	Scientific Name	EPBC Act	NC Act	WildNet records within 5 km	Likelihood of occurrence
Curlew sandpiper	*Calidris ferruginea*	CE	E	Yes (1)	Likely
Greater sand plover	*Charadrius leschenaultia*	V	V	No	Possible
Lesser sand plover	*Charadrius mongolus*	E	E	No	Possible
Beach stone-curlew	*Esacus magnirostris*		V	No	Possible
Squatter pigeon	*Geophaps scripta scripta*	V	V	No	Likely
White-throated needletail	*Hirundapus caudacutus*	V	V	No	Likely
Bar-tailed godwit (western Alaskan)	*Limosa lapponica baueri*	V	V	No	Possible
Eastern curlew	*Numenius madagascariensis*	V	V	No	Possible
Australian painted snipe	*Rostratula australis*	E	E	Yes (1)	Likely
Koala	*Phascolarctos cinereus*	E	E	Yes (1)	Unlikely

4.6 Potential Impacts to Fauna and Recovery Ability

4.6.1 Physical Effects of Loud Noise on Birds

Potential effects of man-made noise on birds include hearing damage, permanent and temporary threshold shifts (PTS[1] and TTS[2]), masking of vocal communication and other biologically important sounds, and other physiological and behavioral responses. The duration of a noise source can be continuous (constant), transient (short duration), or impulsive (typically < 2 seconds).

Dooling and Popper (2007) conducted a literature review of studies on noise-induced hearing damage in birds. That review concluded that continuous noise levels between 93 and 110 dB(A) may cause TTS, with higher levels possibly resulting in PTS. For impulsive noise, levels above 140 dB(A) for single pulses or 125 dB(A) for multiple pulses were estimated to cause hearing damage.

4.6.2 Behavioural Response by Birds to Loud Noise

The available literature indicates that the behavioural responses by birds to loud noise are typically of short duration (< 2 mins) and are generally restricted to noises exceeding 85 dB(A). Behavioural responses by birds may include increased movement after a launch, avoiding or leaving areas where a launch occurs, brief changes in foraging patterns, and arousal of species-specific defensive behaviours (e.g., flight, aggression). A summary of key ecological research on the behavioral responses of birds to noise which have relevance to the suite of birds and noise generation levels relevant to the current assessment is presented in Table 10.

Table 10 Behavioural response of birds to noise impacts

Assessment Summary	Biological Focus & Noise Characteristics
Black *et al.* (1984) assessed the effect of low-level military F-16 training flights over wader breeding colonies comprising egrets, herons, ibis, and darter over two seasons in Florida. Noise levels recorded during overflights (≤152m AGL) ranged from 55 to 100 dB(A). The study found a minor response (birds looking skyward) as noise levels reached 60-65 dB(A), began changing position (typically to an alert posture) at 70-75 dB(A), and when noise levels were from 75-100 dB(A) birds variously either exhibited no response, looked up, or presumed an alert posture. That work also noted the following: birds typically resumed normal position about 1-2 minutes after an overflight; and observed no differences in adult nest attendance, chick feeding rates, or increase in aggressive encounters, resulting from overflights. The study also noted that noise levels within a breeding colony can reach 64 dB(A) during nest building, feeding sessions, etc. (Wiese 1978 in Black *et al.* 1984) and thus, may equal or surpass noise levels during some overflights.	Wader breeding colonies Impulsive and transient noise – low-level military jet flyovers
Gourdie & Jones (2004) found noise levels exceeding 80dBA generated by military jet flyovers elicited a positive dose response in the alert behaviour of harlequin ducks *Histrionicus histrionicus* at their study sites in Labrador, North America. They conducted a before-after-control-impact (BACI) study design to quantify the effects of low-level military jet over-flights on the behaviour of individual harlequin ducks in a 130,000 km^2 Military Training Area. Noise generated from low-level passes (30–100 m above ground level) by military jets was sudden in onset and high in amplitude (>100 dBA), substantially above background sound levels at the two control sites (40–50 dBA and 60–70 dBA). Harlequin ducks reacted to noise from military jets with alert behaviour, showing a	Waterfowl – feeding and breeding Impulsive and transient noise – low-level military jet flyovers

1 Permanent threshold shift (PTS) – A permanent loss of hearing caused by an acoustic or drug trauma. PTS results in irreversible damage to the sensory hair cells of the ear, and thus a permanent loss of hearing.

2 Temporary threshold shift (TTS) – Temporary loss of hearing as a result of exposure to sound over time. Exposure to high levels of sound over relatively short time periods will cause the same amount of TTS as exposure to lower levels of sound over longer time periods.

Assessment Summary	Biological Focus & Noise Characteristics
positive dose-response that especially intensified when noise exceeded 80 dBA. Residual effects, i.e., deviations from normal behaviour patterns after initial responses, were decreased courtship behaviour for up to 1.5 hours after and increased agonistic behaviour for up to 2 hours after military jet over-flights. Direct behavioural responses to military jet over-flights were of short duration (generally <1 min) and were unlikely to affect critical behaviours such as feeding and resting in the overall time-activity budgets of breeding pairs. However, the presence of residual effects on behaviour implied whole-body stress responses that were potentially more serious; these require further study because they are potentially more detrimental than immediate responses and may not be detected in studies that focus on readily observed overt responses.	
Wright *et al.* (2010) investigated waterbird responses to impulsive noise in relation to ambient noise at a site within the Humber estuary (a large field, close to several industrial power plants, and used by shorebirds as a high tide roost). The study findings included the following: that intentional noise disturbance at very low dB(A) levels was highly unlikely to elicit a behavioural response, while at above 65.5 dB(A) a behavioural response of some kind becomes more likely to occur than no response; and that at levels above 72.2 dB(A), flight with abandonment of the site became the most likely outcome of the disturbance. Wright *et al.* (2010) considered that if a non-response and non-flight response were taken to be relatively harmless, and flight responses potentially costly (in terms of energy expenditure), then for those species studied at the site, a costly outcome becomes more likely at ≥69.9 dB(A). The study concluded that it is unclear whether it is the perceived change in impulsive noise in relation to ambient noise, or simply the level of the impulsive sound itself causes the behavioural responses.	Waders and waterfowl Impulsive noise - industrial power plant
Brown (1990) examined the influence of pre-recorded aircraft noise (65 to 95 dB(A)) on roosting and breeding terns in the Great Barrier Reef and indicated that maximum responses were restricted to noises >85 dB(A). No conclusions were made on the effect of this on breeding success, however the study identified that acoustic and visual disturbance combined, increased the level of flight response.	Tern roosting and breeding colonies Impulsive noise – jet aircraft.
Komenda-Zehnder *et al*. (2003) performed 326 experimental overflights over wetlands situated in three different areas of the Swiss lowlands to assess the behaviour of waterbirds before, during and after overflights. They analysed the influence of type of aircraft and crossing altitude on the proportion of waterbirds showing a stressed behaviour (alarm posture, swimming, flying). That study found that birds returned to a relaxed behaviour (resting, preening, feeding) within five minutes after the overflights, and no short-term habituation or sensitisation was observed. They noted that the disturbance effect of helicopters was higher than for aeroplanes and the disturbance effect was greater at lower altitude; and that the behaviour of the birds was not significantly influenced if the aeroplanes flew at 300m above ground level (AGL) and if the helicopter flew at 450 AGL or higher. That study concluded that disturbance by aircraft can be reduced significantly if minimum flight altitudes of 450 m AGL are implemented.	Waterbirds Impulsive and transient noise – low-level jet and helicopter flyovers
Comony *et al.* (1998) quantified behavioural responses of wintering American black ducks (*Anas rubripes*), American wigeon (*A. americana*), gadwall (*A. strepera*), and American green-winged teal (*A. crecca carolinensis*) exposed to low-level flying military aircrafts. Waterfowl spent approximately 1.4% of their time responding to aircraft, which included flying, swimming, and alert behaviours. Mean duration of responses by species ranged from 10 to 40 sec. Costs to each species were deemed low because disruptions represented a low percentage of their time-activity budgets, only a small proportion of birds reacted to disturbance (2%), and the likelihood of resuming the activity disrupted by an aircraft disturbance event was high (64%). Recorded levels of aircraft disturbance (i.e., x = 85.1 dBA) were not adversely affecting the time-activity budgets of selected waterfowl species wintering at Piney and Cedar islands.	Waterfowl Impulsive and transient noise – low-level jet and helicopter flyovers

4.6.3 Ecological Monitoring of Bird Populations

There is no existing public information on potential impacts to populations or ecological monitoring results for similar projects in Australia[3], and no detailed information for the facility in New Zealand[4]. In New Zealand, the critically endangered shorebird tūturuatu (*Thinornis novaeseelandiae*) occurs along the Māhia Peninsula (Dowding 2022). Monitoring shows that this rare shorebird continues to nest on the shoreline about two kilometres from the rocket launch site (NZ DoC 2018).

Since 1983, long-term monitoring of endangered species has been undertaken across land at Cape Canaveral (NASA 2014). Monitoring associated with the Space Shuttle program (135 launches over 30 years or 4.5 launches per year) found that there was an initial flight response from birds in the vicinity, but no long-term impacts were observed to birds or populations of endangered avifauna (NASA 2014).

Whilst the data is limited, the available information suggest fauna populations are either not impacted by launch activities or recover from impacts over time.

4.6.4 Expected Noise Impacts of BOS Launch Operations

Launches will generate noise levels up to 120 LAmax dB(A) in the immediate vicinity of the launch pad (SEG 2021) and over 85 dB(A) over much of Caley Valley Wetland (Figure 10). From perception on the ground these levels will rapidly diminish over approximately 20 seconds following launches. Noise impact contours for launch activities are presented in Figure 7 – Figure 9.

In accordance with the findings of Dooling and Popper (2007), the impact area of noise-induced hearing damage in birds is 140 dB(A) for single pulses, 125 dB(A) for multiple pulses and 110 dB(A) for continuous noise. PTS associated with a single impulsive noise (>140 dB(A)) will be confined to the area immediately surrounding the launch site (Figure 9) for a period of approximately 2 seconds and can be readily managed. Multiple impulsive noises above (125 dB(A)) are unlikely, as the noise at this level will last for approximately 2 seconds and is not repeated (Figure 8). Noise-induced hearing damage associated with launch activities is therefore limited to TTS, thereby avoiding PTS in threatened species habitat. TTS linked to continuous noise (110 dB(A)) may extend up to 1 km from the launch (Figure 7).

The brief duration of launch-associated noise makes it highly improbable to have significant ongoing effects, such as masking vocal communication and other biologically important sounds, however short-term behavioural responses are expected.

[3] e.g., Southern Launch Space site at Whalers Cove, South Australia.

[4] Rocket Lab Launch Complex on the Māhia Peninsula, New Zealand.

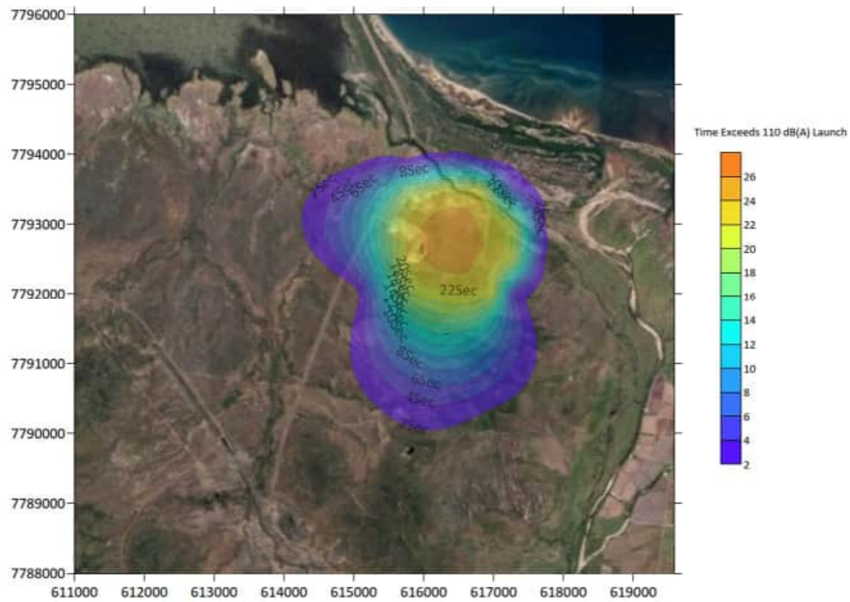

Figure 7 Time exceeding 110 db(A) during launch

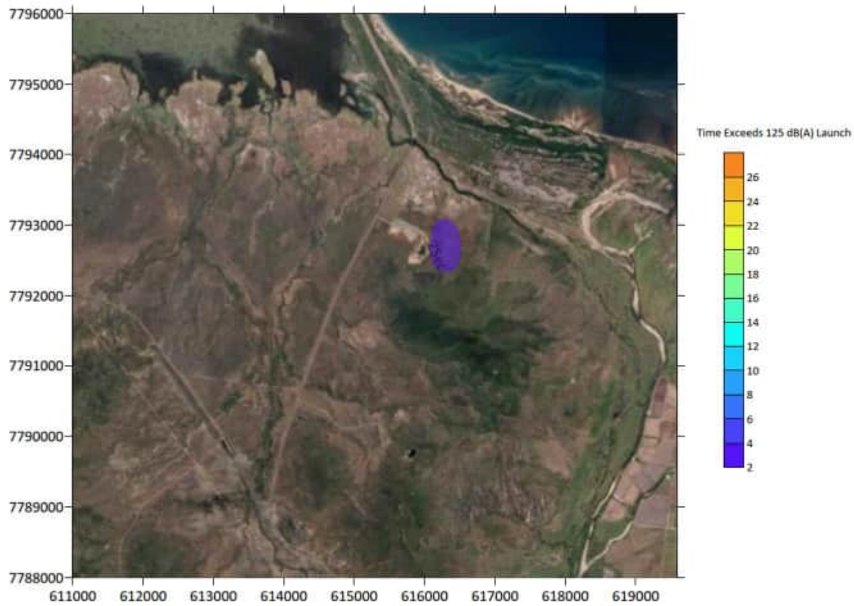

Figure 8 Time exceeding 125 db(A) during launch

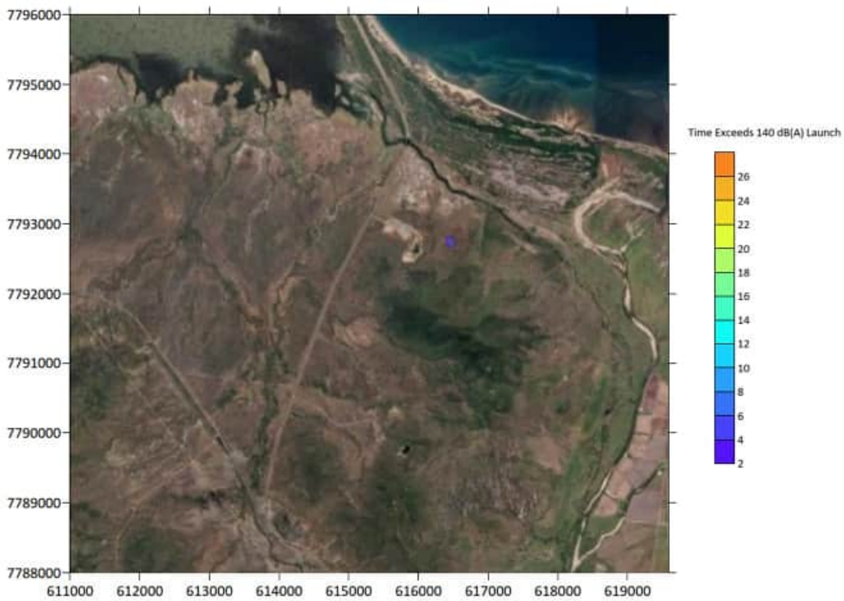

Figure 9 Time exceeding 140 db(A) during launch

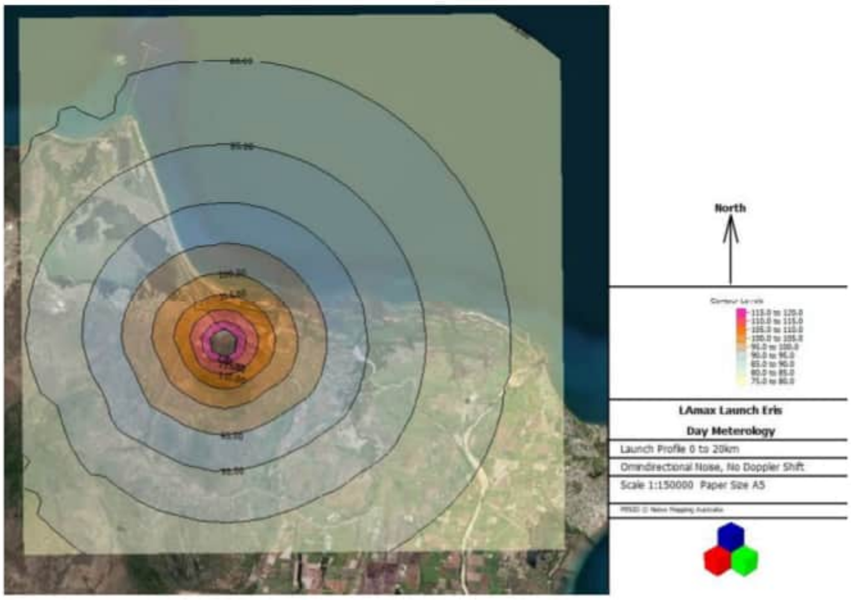

Figure 10 Peak sound exposure L_{Amax}

4.6.5 Noise Impacts of BOS Test Operations

As testing is proposed to occur over a period of 120 seconds, all noise related to the tests are defined as continuous. There are several modelled instances that have the potential to cause PTS or TTS hearing loss in birds (i.e. 110 dB(A) or greater). Noise-related impacts to environmental sensitive receptors will exceed that of a launch event due to the longer timeframe birds would be subject to these levels (i.e. up to 120 seconds). Sensitive sites of relevance are R9 and R10, but primarily R9. Additionally, these levels are modelled to occur during testing of the Catpack, Big HRE, Small LRE and Big LRE under a range of meteorological conditions.

4.6.6 Potential Impacts on Threatened and Migratory Birds

Based on current knowledge of the impacts of rocket noise on birds from other countries it is reasonable to conclude that bird populations are either not impacted by launch activities or recover quickly from noise impacts. This is likely to be the case for species potentially impacted by BOS launch activities.

The noise levels during testing of the Catpack, Big HRE, Small LRE, and Big LRE under various meteorological conditions are modelled to exceed 110 dB(A) and have the potential to cause permanent hearing loss in birds. The proposed measures are presented in Section 7.

The relevant species include, but are not necessarily limited to:

- Migratory waders including, curlew sandpiper, greater sand plover, lesser sand plover, bar-tailed godwit, and eastern curlew breed in the northern hemisphere and therefore the reproduction or dispersal potential is not directly affected by launch activities.
- Squatter pigeon (Sth.) remains common north of the Carnarvon Ranges in Central Queensland and is distributed as a single, continuous (i.e., inter-breeding) sub-population (Squatter Pigeon Workshop 2011). A substantial population of squatter pigeon exists in the surrounding area and therefore recolonisation is likely should individuals be affected by launch activities.
- Australian painted snipe. The majority of wet season habitat and all dry season habitat is beyond the areas of significant noise disturbance (i.e. 100 dB(A) contour in Figure 10). Impacts within affected areas will be of short duration and unlikely to have any long-term notable effects.
- White-throated needletail may utilize the airspace above the launch facility, however given the mobility and broad distribution of the species, impacts would be limited to the highly unlikely event of a bird strike. These issues are dealt with in Section 7.
- Beach stone-curlew. This species is a sedentary shorebird that appears to tolerate coastal development, since they are still regularly observed on beaches with high levels of disturbance (Freeman 2003). Habitat along the eastern beach will experience noise levels of 100 dB(A) for up to 26 seconds which is not high enough to result in TTS or PTS but may result in some temporary behavioural change. These impacts are unlikely to affect species populations or recovery objectives for the species.
- Colonial nesting species including egrets, herons, and ibis. These species are known to breed, nest and rear young along Saltwater Creek requiring active management in in this area, particularly with regards to engine testing activities.

5 Flora and Fauna Monitoring Program

5.1 Background and Context

This monitoring program is designed to detect potential impacts of operational activities at the BOS on neighbouring populations of threatened species including potential changes in habitat usage / occurrence. Since the impacts associated with the launch facility and test facility are unlikely to affect MSES or MNES listed plants, frogs, reptiles, or mammals, only birds will be targeted for monitoring.

Flora management including the monitoring and management of weed and the exclusion of vehicle access to wetland protection areas are dealt with separately in the Site-based land and pest management plan. The implementation of this plan will prevent the spread of weeds into offsite environmentally sensitive areas that may support threatened plants.

Whilst there is potential for estuarine crocodile to occur within Saltwater Creek the likelihood that this species will be affected by noise or other impacts from launch activities is very low and no monitoring is proposed.

Ideally, monitoring will involve establishing a baseline of species presence and abundance prior to activity in order to compare with the species presence after the activity. This will require determining populations during the wet and dry seasons prior to activities so that existing significant seasonal/environmental/anthropogenic effects can be separated from operational activities associated with BOS operations. Many bird species, for example, will demonstrate significant seasonal changes in abundance irrespective of spaceport activity. Typically, a baseline assessment of this kind would require at least one dry season and wet season survey prior to any launches however more data is beneficial.

The monitoring program is adaptive to account for changes in habitat condition, the identification of important habitats not previously confirmed in this plan or to changes in the listing status of species under the NC Act and therefore shall be reviewed every three years to add or remove monitoring sites based on advice received by suitably qualified ecologists.

Monitoring will focus on sensitive sites that will be impacted by launch and test facility activities. Sensitive sites in the context of this monitoring program include areas known to, or with a potential to, support individuals or populations of threatened and / or migratory species and are affected by noise associated with launches. The primary sensitive sites include the south-eastern extent of Caley Valley Wetlands located northwest of Abbot Point Road and Eastern Beach located north of the site.

A list of threatened species to be considered by this monitoring program is provided in Table 11[5].

Table 11 Key threatened target species

Family	Scientific Name	Common Name	NCA status	EPBCA status	QG	CVW
Burhinidae	*Esacus magnirostris*	beach stone-curlew	V		x	x
Charadriidae	*Charadrius leschenaultii*	greater sand plover	V	V, M	x	x
Charadriidae	*Charadrius mongolus*	lesser sand plover	E	E, M	x	
Rostratulidae	*Rostratula australis*	Australian painted-snipe	E	E	x	x
Scolopacidae	*Calidris canutus*	red knot	E	E	x	
Scolopacidae	*Calidris ferruginea*	curlew sandpiper	CR	CE	x	x
Scolopacidae	*Calidris tenuirostris*	great knot	CR	CE	x	

5 There are no NC Act Near-threatened species relevant to the site or surrounds.

Family	Scientific Name	Common Name	NCA status	EPBCA status	QG	CVW
Scolopacidae	*Limosa lapponica baueri*	bar-tailed godwit	V	V	x	x
Scolopacidae	*Numenius madagascariensis*	eastern curlew	E	CE	x	x

Table notes:
- EPBCA status: Status under the Commonwealth -Environment Protection and Biodiversity Conservation Act 1999- (EPBCA). Codes are: CE – critically endangered; E – endangered; V – vulnerable; and M – migratory.
- NCA status: Status under Queensland -Nature Conservation Act 1992- (NCA) and its Nature Conservation (Wildlife) Regulation 2006. Codes are: CR – critically endangered; E – endangered wildlife; and V – vulnerable.
- QG: Queensland Government (2022) database records for an area within 30km of the launch pad site. CVW: Occurrence records derived from surveys of the Caley Valley Wetlands (Agnew 2017).

5.2 Monitoring Method and Target Species

Whilst the monitoring program has been designed to maximise the potential detection of threatened species, the collection of meaningful survey data to support sound analysis and review, may not be possible for a variety of reasons – e.g., species are rare and / or sparsely distributed. To account for this potential, the monitoring program provides a strong focus on the collection of data for ecologically similar species which are more abundant / common in addition to the target threatened species to investigate, and make inferences regarding the potential impacts, and ultimately, drive adaptive impact mitigation strategies.

A full inventory of wetland-dependent birds known or likely to occur within the Caley Valley Wetlands and within adjacent coastal habitats is provided in Appendix A[6]. This inventory provides the list of potential surrogate species (i.e., ecologically similar species) to be included within the wetland and coastal surveys.

The monitoring program comprises surveys in two areas identified as significant areas for threatened species although migratory shorebird species are also likely to be represented. The surveys proposed include:

- Shallow wetland surveys
- Coastline surveys

These surveys will be implemented within an area approximately three kilometres from the launch and test site. This area generally coincides with the area between the 100 dB(A) L_{Amax} SPL contour line and the launch and test site.

Diurnal bird surveys are to be undertaken to obtain a direct census of bird species occurrence and abundance. All surveys shall be undertaken by suitably qualified biologists with experience in implementing waterbird and shorebird bird surveys and with all target species.

5.2.1 Wetland Surveys

Wetland surveys shall be undertaken throughout closed marsh / shallow water / wetted mud habitats within the south-eastern extent of the Caley Valley Wetland.

Of the threatened species listed in Table 11, key target bird species for this survey include Australian painted snipe, greater sand plover and curlew sandpiper.

Key surrogate species (ecologically similar species) to be included in this survey are those species within the following Families:

- *Charadriidae* (plovers, dotterels, and lapwings)
- *Rallidae* (crakes, rails, and gallinules)
- *Recurvirostridae* (stilts and avocets)
- *Scolopacidae* (sandpipers, stints, snipe, godwits, and curlews)

[6] The list is derived from survey records from the Caley Valley Wetlands (Agnew 2017), and Queensland Government (2022) database records for an area within 30 km of the launch pad site.

- *Threskiornithidae* (ibis and spoonbills)

Bird counts will be undertaken at point locations north-west of the launch and test site (Figure 11). Point locations are used due to safety hazards with wetland transects at the site. The eastern edge of the survey points will coincide with the water's edge to account for the seasonal and yearly differences in the wetland extent due to the expansion and contraction of the wetland.

A hand-held rangefinder will be used to determine point count limits. Counts will be undertaken using a combination of high-powered spotting scopes and binoculars.

5.2.2 Coastline Surveys

Bird counts will be undertaken across inter-tidal flat / beach / foredune habitats along the coast to the near north-east of the launch site (Figure 11).

Of those threatened species listed in Table 11, key target bird species for this survey include beach stone-curlew, greater sand plover, lesser sand plover, red knot, great knot, curlew sandpiper, bar-tailed godwit, and eastern curlew.

Key surrogate species (ecologically similar species) to be included in this survey are those species within the following Families:

- *Charadriidae* (plovers, dotterels, and lapwings)
- *Haematopodidae* (oystercatchers)
- *Rallidae* (crakes, rails, and gallinules)
- *Recurvirostridae* (stilts and avocets)
- *Scolopacidae* (sandpipers, stints, snipe, godwits, and curlews)
- *Threskiornithidae* (ibis and spoonbills)

Two transect surveys along the coastline will be implemented to account for the influences of low and high tide conditions. These surveys shall be timed to coincide with the period within two hours either side of both high and low daytime tidal limits.

A key aspect of the low-tide beach traverse is to include shorebirds attracted to feed on the exposed tidal flats. Surveys of beach and foredune habitats will target, but not be limited to, beach-stone curlew and survey surrogates. The high tide traverse is aimed at encountering congregations of birds at their roost sites.

Counts shall be undertaken using a combination of high-powered spotting scopes and binoculars.

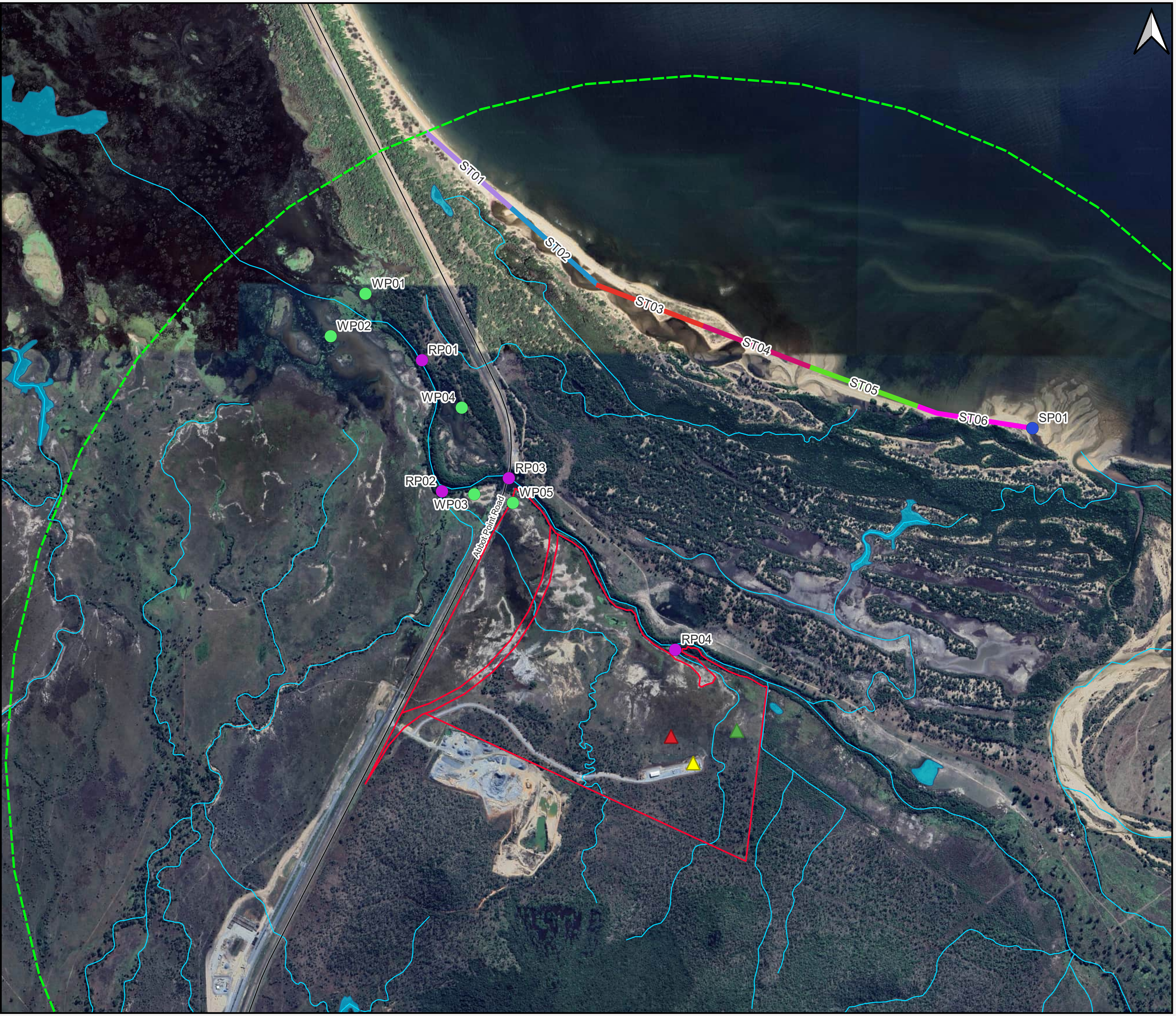

FIGURE 11: SURVEY LOCATIONS

0 250 500 750 m
1:15,000

LEGEND:

- Subject Allotments
- Launch Pad
- HRE Test Pad
- LRE Test Pad
- Roads
- Lakes
- Watercourses
- 3km Buffer
- Riverine survey points
- Shorebird survey points
- Wetland survey points

Survey Transects

- ST01
- ST02
- ST03
- ST04
- ST05
- ST06

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5.3 Data Recording

Survey data will be recorded in a standardised manner using count proformas. Originating data collection will be via a hand-held Dictaphone and / or proforma. Any data collected via Dictaphone is to be transcribed onto the survey proformas soon after survey completion. Data to be determined should include site identification, environmental conditions, observer details, species name, observed disturbance and habitat change.

Photographs will be taken as required to provide a visual record of the survey conditions, habitat types and major disturbances deemed likely to affect bird counts. Locations of any threatened species will be recorded by GPS.

5.4 Monitoring Frequency and Timing

Bird surveys are to be undertaken prior to and following each launch event and prior to and following testing events.

Pre-launch surveys are to occur as close as possible to the launch date to gain an accurate representation of bird abundance and diversity prior. Post-launch surveys are to be undertaken within two weeks following the launch / test to assess potential changes and / or stabilisation of bird numbers.

Bird activity can fluctuate widely during the day and therefore per pre / post monitoring events are to be undertaken at a similar time to enable more accurate statistical comparison that attempts to eliminate covariates in the data.

Preferably bird surveys should not be undertaken during inclement weather, especially during rain or windy conditions. These conditions reduce the ability of the observer to detect the species and can underestimate bird counts.

Surveys are expected to take two to three days per pre / post monitoring events.

6 Reporting and Analysis

6.1 Fauna Monitoring Event Summaries

Fauna monitoring data will be evaluated at the conclusion of each set of paired monitoring events to assess pre and post launch bird counts, as well as before, during and following engine testing.

The analytical data will be compiled in tables and graphs and will incorporate statistical analysis.

Environmental information recorded during the monitoring events will be used to qualitatively and/or quantitatively interpret the monitoring results. Care should be taken when comparing the results of monitoring events undertaken during different periods due to confounding seasonal factors (i.e., the presence of migratory birds).

Each monitoring event will be summarised in a technical memorandum for future reference. The following information will be summarised as a minimum:

- Date(s), timing, personnel, and prevailing weather conditions for the monitoring event
- Meteorological conditions leading up to the monitoring event (e.g., rainfall in the previous month and comparison against averages)
- A summary of any site conditions or other relevant issues that may influence the data throughout the monitoring period (e.g., areas accessed, and extrapolations required)
- A brief description of the survey methodology
- A tabulation of recorded species and abundance
- A brief description of habitat conditions (e.g., extent of water, evidence of disturbance, evidence of feral animals & / or peat plants)
- A summary of any deviations from the FFMP
- Identification of any issues affecting plan implementation.

6.2 3-Yearly Fauna Monitoring Report

Following three years of monitoring, a report will be prepared to provide a major review of data with the aim of determining whether the methodology has established a suitable baseline and data for statistical analysis. Based on that outcome, the report will consolidate and finalise all aspects of the methodology for on-going monitoring. Importantly, the report will summarise monitoring findings, and provide a discussion on the validity of the methodological approach and recommendations to improve both monitoring and contribute to adaptive management of the overall operations. The report is to include as a minimum, but not be limited to the following:

- A table of species and species counts. Provided sufficient data is accumulated, then the inclusion of population size estimates including any data extrapolations, assumptions, or limitations
- Identification and description of the statistical analysis employed.
- A discussion of the results including a comparison of bird numbers between pre-launch monitoring events and post-launch monitoring events, as well as before, during and following test events.
- A discussion of factors which may be considered to be constraints to survey findings, known or presumed.
- Discussion of any deviation from the FFMP or changes to monitoring since the previous annual report
- Discussion on the validity of the methodological approach and recommendations to improve monitoring protocols.
- Recommendations to contribute to adaptive management of the overall project operations.

6.3 Data Analysis

Data from the program design will initially be examined with a General Linear Model (to examine the influence of season and anthropogenic activity on the abundance of each vulnerable species while accounting for repeated measures over time) as well as a data reduction analysis involving Principal Components Analysis (to examine the influence of seasonal and anthropogenic effects on the community of vulnerable bird species).

Similar statistical approaches would be used if baseline surveys are insufficient to describe the diversity and abundance of threatened bird species prior to operational activities but the ability to allocate any changes in bird communities to existing seasonal/environmental/anthropogenic activities would be limited.

7 Management Measures

7.1 Measures to Prevent Bird Strike

The potential for bird strike is very small. The rocket will inhabit the range of air space in which birds fly for only a few seconds following launch and at that stage, rocket speed is relatively slow. The subsequent range when the rocket is at elevated speed, though still under the birds' flight ceiling, may only last a few seconds[7].

As a precautionary measure, a siren increasing to 110dB will be used to 'scare' fauna within the immediate area prior to launch. This mitigation measure is designed to encourage fauna to move away from the noise and heat zone close to the launch pad and to prevent bird strike during take-off. The noise deterrent shall be undertaken using a similar methodology as recommended for in Queensland Government's Industry Information Sheet Environmental Nuisance - Noise - Scare/Scatter guns (DES 2021) detailed below:

- The orientation of the device shall be:
  - Directed away from a sensitive receptor by using the shielding effects of natural features, buildings etc. to reduce the level of the blasts at sensitive receptors.
  - Directed away from any noise sensitive place.
  - Distance between deterrents must be a minimum of 300 m apart.
- All deterrents must be set on a timer to blast at the same time.
- Each deterrent must not emit more than 70 blasts in total in any one day. At all times, the interval between blasts from any deterrent must be 10 minutes or longer.
- Operation of deterrents shall only occur between the period half an hour before sunrise and half an hour after sunset. The time of sunrise and sunset for the noise affected location will be determined from Bureau of Meteorology records.

Noise deterrents will be operated remotely within 1 hour of the launch as the subject site is within an exclusion area during this period.

Further, the launch facility and adjacent land within the site[8] will be subject to passive management practices consistent with the strategies set out in the AAA (2015) best practice guidelines to manage bird and strike risk.

To minimise the risk of fauna harbourage within / around facilities associated with the launch site, the EMP provides a range of other management actions (Gilmore 2021).

7.2 Measures to Mitigate Harm due to Heat Exposure

The heat exposure zone during launch will be confined to a 50 m blast radius around the launch facility. To reduce impact on wildlife, a search within a 100 m radius of the launch/test site will be conducted for immobile fauna or nests. Fauna incapable of fleeing the launch area will be relocated at least 200 m away from the facility before launch.

7.3 Measures to Mitigate Noise Impacts on Wildlife

The management objective with regards to noise associated with launch and test activities is to limit the impacts on bird populations to behavioural responses and prevent more significant impacts such as TTS and PTS. The highest risk

[7] Most birds in daily activities fly below 100m above ground level (a.g.l.), except for birds which regularly use orographic or thermal uplift to soar to heights of up to 300m a.g.l. (e.g., raptors) (SKYbrary 2022). Birds undertaking long distance (often international) migrations typically fly at altitudes of 1,500m a.g.l., though do regularly fly between 3,000 to 6,000m a.g.l. (Lindstrom et al. 2021).

[8] i.e., the launch fluids and utilities storage facility, warehouse, and office.

area occurs along Saltwater Creek where colonial species (e.g., egrets, herons, and ibis) are known to breed, nest and rear young. To mitigate impacts in this and other sensitive areas the following measures will be implemented:

A water deluge system will be employed to reducing noise and heat generated by the launch vehicle.

In the hour leading up to launches and testing birds will be encouraged to relocate by using passive management measures such as scare guns, sirens, stock whips, or loudly banging two objects near Saltwater Creek.

Immediately prior to launch or testing a siren that progressively increases to the modelled LAmax of the engine being tested will be sounded. This avoids producing a sudden noise capable of causing PTS and allows birds to respond naturally by relocating when noise levels become uncomfortable.

Monitoring of bird response to the siren along Saltwater Creek will be used to confirm whether the siren has the desire result. This type of monitoring should only occur prior to engine testing.

7.3.1.1 Special Case - Colonial Bird Breeding Events

Engine Testing

The modelled noise levels for engine testing indicates that excessive noise levels are expected in the area around Saltwater Creek. The levels are high enough to cause permanent physiological damage or death to birds including unfledged chicks. We therefore recommend that testing should not occur during colonial breeding events unless alternative engineered safeguards are implemented to reduce noise levels in this area to below 100 dB(A).

Launches

Whilst launch activities are expected to have a lower risk of noise impacts on colonial breeding birds there is potential for behavioural responses in adult and young birds including chicks falling from nests and drowning. Monitoring of Saltwater Creek by site personnel should occur weekly in the two months preceding the launch event. Where nesting bird colonies are identified a noise desensitization program should be implemented immediately. The objective of the program is to habituate birds to noise associated with launch events (up to 105 dB(A)). Noise producing activities shall primarily occur along Saltwater Creek. Methods utilised will include but not necessarily be limited to the following:

- Operation of noise deterrents (e.g. launch siren)
- Using a stockwhip or loudly banging two pieces of wood together near the creek line.

Ongoing monitoring of bird populations along Saltwater Creek will be used to confirm whether birds within this sensitive area have become accustomed to noise-producing activities.

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Appendix A Wetland-Dependent Birds – Abbot Point

Table 12 Wetland-dependent birds – Abbot Point

Family	Scientific Name	Common Name	NCA	EPBCA	QG	CVW
Anatidae	*Anas castanea*	chestnut teal	C		1	1
Anatidae	*Anas gracilis*	grey teal	C		1	1
Anatidae	*Anas rhynchotis*	Australian Shoveller	C			1
Anatidae	*Anas superciliosa*	Pacific black duck	C		1	1
Anatidae	*Aythya australis*	hardhead	C		1	1
Anatidae	*Chenonetta jubata*	Australian wood duck	C		1	1
Anatidae	*Cygnus atratus*	black swan	C		1	1
Anatidae	*Dendrocygna arcuata*	wandering whistling-duck	C		1	1
Anatidae	*Dendrocygna eytoni*	plumed whistling-duck	C		1	1
Anatidae	*Malacorhynchus membranaceus*	Pink-eared Duck	C			1
Anatidae	*Nettapus coromandelianus*	Cotton Pygmy-Goose	C			1
Anatidae	*Nettapus pulchellus*	Green Pygmy-Goose	C			1
Anatidae	*Radjah radjah*	radjah shelduck	C		1	1
Anatidae	*Strictonetta naevosa*	Freckled Duck	C			1
Anhingidae	*Anhinga novaehollandiae*	Australasian darter	C		1	1
Anseranatidae	*Anseranas semipalmata*	magpie goose	C		1	1
Ardeidae	*Ardea alba modesta*	eastern great egret	C		1	1
Ardeidae	*Ardea intermedia*	intermediate egret	C		1	1
Ardeidae	*Ardea sumatrana*	great-billed heron	C		1	1
Ardeidae	*Bubulcus ibis*	cattle egret	C		1	1
Ardeidae	*Butorides striata*	striated heron	C		1	1
Ardeidae	*Egretta garzetta*	little egret	C		1	1
Ardeidae	*Egretta novaehollandiae*	white-faced heron	C		1	1
Ardeidae	*Egretta picata*	pied heron	C		1	
Ardeidae	*Egretta sacra*	eastern reef egret	C		1	
Ardeidae	*Ixobrychus flavicollis*	black bittern	C		1	1
Ardeidae	*Nycticorax caledonicus*	nankeen night-heron	C		1	1
Burhinidae	*Esacus magnirostris*	beach stone-curlew	V		1	1
Charadriidae	*Charadrius leschenaultii*	greater sand plover	V	V, M	1	1
Charadriidae	*Charadrius mongolus*	lesser sand plover	E	E, M	1	
Charadriidae	*Charadrius ruficapillus*	red-capped plover	C		1	1

Family	Scientific Name	Common Name	NCA	EPBCA	QG	CVW
Charadriidae	*Elseyornis melanops*	black-fronted dotterel	C		1	1
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel	C		1	1
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel	C			1
Charadriidae	*Pluvialis fulva*	Pacific golden plover	SL	M	1	1
Charadriidae	*Pluvialis squatarola*	grey plover	SL	M	1	
Charadriidae	*Vanellus miles*	masked lapwing	C		1	1
Charadriidae	*Vanellus tricolor*	banded lapwing	C		1	
Ciconiidae	*Ephippiorhynchus asiaticus*	Black-necked Stork	C		1	1
Gruidae	*Antigone rubicunda*	brolga	C		1	1
Haematopodidae	*Haematopus fuliginosus*	sooty oystercatcher	C		1	
Haematopodidae	*Haematopus longirostris*	Australian pied oystercatcher	C		1	
Jacanidae	*Irediparra gallinacea*	Comb-crested Jacana	C		1	1
Laridae	*Chlidonias hybrida*	whiskered tern	C		1	1
Laridae	*Chlidonias leucopterus*	white-winged black tern	SL		1	1
Laridae	*Chroicocephalus novaehollandiae*	silver gull	C		1	1
Laridae	*Gelochelidon nilotica*	gull-billed tern	SL	M	1	1
Laridae	*Hydroprogne caspia*	Caspian tern	SL	M	1	1
Laridae	*Sterna hirundo*	common tern	SL	M	1	1
Laridae	*Sterna sumatrana*	black-naped tern	SL	M	1	
Laridae	*Sternula albifrons*	little tern	SL	M	1	1
Laridae	*Thalasseus bengalensis*	lesser crested tern	C		1	
Laridae	*Thalasseus bergii*	crested tern	SL		1	
Pelecanidae	*Pelecanus conspicillatus*	Australian Pelican	C		1	1
Phalacrocoracidae	*Microcarbo melanoleucos*	Little Pied Cormorant	C		1	1
Phalacrocoracidae	*Phalacrocorax carbo*	Great Cormorant	C		1	1
Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant	C		1	1
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant	C		1	1
Podicipedidae	*Podiceps cristatus*	Greater Crested Grebe	C			1
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe	C			1
Rallidae	*Fulica atra*	Eurasian coot	C		1	1
Rallidae	*Gallinula tenebrosa*	dusky moorhen	C		1	1
Rallidae	*Gallirallus philippensis*	buff-banded rail	C		1	1
Rallidae	*Lewinia pectoralis*	Lewin's rail	C		1	1
Rallidae	*Porphyrio melanotus*	purple swamphen	C		1	1

Family	Scientific Name	Common Name	NCA	EPBCA	QG	CVW
Rallidae	*Porzana pusilla*	Bailon's Crake	C		1	1
Rallidae	*Porzana tabuensis*	Spotless Crake	C		1	1
Rallidae	*Tribonyx ventralis*	Black-tailed Native-hen	C		1	1
Recurvirostridae	*Himantopus himantopus*	black-winged stilt	C		1	1
Recurvirostridae	*Recurvirostra novaehollandiae*	red-necked avocet	C		1	1
Rostratulidae	*Rostratula australis*	Australian painted-snipe	E	E	1	1
Scolopacidae	*Actitis hypoleucos*	common sandpiper	SL	M	1	1
Scolopacidae	*Arenaria interpres*	ruddy turnstone	SL	M	1	
Scolopacidae	*Calidris acuminata*	sharp-tailed sandpiper	SL	M	1	1
Scolopacidae	*Calidris alba*	sanderling	SL	M	1	
Scolopacidae	*Calidris canutus*	red knot	E	E	1	
Scolopacidae	*Calidris falcinellus*	broad-billed sandpiper	SL	M	1	
Scolopacidae	*Calidris ferruginea*	curlew sandpiper	CR	CE	1	1
Scolopacidae	*Calidris ruficollis*	red-necked stint	SL	M	1	1
Scolopacidae	*Calidris tenuirostris*	great knot	CR	CE	1	
Scolopacidae	*Gallinago hardwickii*	Latham's snipe	SL	M	1	1
Scolopacidae	*Limosa lapponica baueri*	Western Alaskan bar-tailed godwit	V	V	1	1
Scolopacidae	*Limosa limosa*	black-tailed godwit	SL	M	1	1
Scolopacidae	*Numenius madagascariensis*	eastern curlew	E	CE	1	1
Scolopacidae	*Numenius minutus*	little curlew	SL	M	1	1
Scolopacidae	*Numenius phaeopus*	whimbrel	SL	M	1	1
Scolopacidae	*Tringa brevipes*	grey-tailed tattler	SL	M	1	
Scolopacidae	*Tringa glareola*	Wood Sandpiper	M	M		1
Scolopacidae	*Tringa incana*	wandering tattler	SL	M	1	
Scolopacidae	*Tringa nebularia*	common greenshank	SL	M	1	1
Scolopacidae	*Tringa stagnatilis*	marsh sandpiper	SL	M	1	1
Scolopacidae	*Xenus cinereus*	terek sandpiper	SL	M	1	
Threskiornithidae	*Platalea flavipes*	Yellow-billed Spoonbill	C			1
Threskiornithidae	*Platalea regia*	royal spoonbill	C		1	1
Threskiornithidae	*Plegadis falcinellus*	glossy ibis	SL		1	1
Threskiornithidae	*Threskiornis molucca*	Australian white ibis	C		1	1
Threskiornithidae	*Threskiornis spinicollis*	straw-necked ibis	C		1	1

Table note:
- EPBCA status: Status under the Commonwealth -Environment Protection and Biodiversity Conservation Act 1999- (EPBCA). Codes are: CE – critically endangered; E – endangered; V – vulnerable; and M – migratory.

- NCA status: Status under Queensland -Nature Conservation Act 1992- (NCA) and its Nature Conservation (Wildlife) Regulation 2006. Codes are: CR – critically endangered; E – endangered wildlife; and V – vulnerable.
- QG: Queensland Government (2022) database records for an area within 30km of the launch pad site.
- CVW: Occurrence records derived from surveys of the Caley Valley Wetlands (Agnew 2017).

Appendix K Cultural Heritage Management Agreement

Cultural Heritage Agreement

Between

Kyburra Munda Yalga Aboriginal Corporation

RNTBC ICN7581

-and-

Gilmour Space Technologies Pty Ltd ABN 17 166 858 260

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Defined Terms and Interpretation

Aboriginal Cultural Heritage has the meaning given to that term in the ACHA.

Aboriginal Cultural Survey means a survey to identify and record Aboriginal Cultural Heritage.

Aboriginal Party means the Kyburra Munda Yalga Aboriginal Corporation RNTBC.

Aboriginal Tradition means the body of traditions, observances, customs, laws and beliefs of Aboriginal people generally or of a particular group of Aboriginal People, and includes any such traditions, laws, observances, customs and beliefs relating to particular persons, places, areas of land or water, things or relationships.

ACHA means the *Aboriginal Cultural Heritage Act 2003 (Qld).*

Agreed Recommendations means the measures set out in Annexure 1 to the CHA for the management of Aboriginal Cultural Heritage in the Survey Area which, as at the Commencement Date, have been agreed between the Parties and are based upon the findings and recommendations of the Initial Survey.

Applicable Authorisations means all authorisations, authorities, rights, tenures, leases, licences, permits, approvals, certificates, consents, directions, titles, renewals or notices from any government or governmental or other competent authority or other decision maker making a decision authorised by an Applicable Law which are necessary or desirable for the doing of the Proponent Works.

Applicable Laws means a law or regulation of the State or the Commonwealth from time to time in operation in the State.

Avoidance Area means an area where no Ground Disturbance Activities may be carried out by the Proponent.

Breach means any act or omission in contravention of the CHA.

Business Day means all days of the week excluding Saturday and Sunday and any Public Holiday in Queensland.

Business Hours means the hours between 8.00am and 5.00pm on a Business Day.

CHU means the Cultural Heritage Unit of the Queensland Department of Seniors, Disability Services and Aboriginal and Torres Strait Islander Partnerships.

CHA means Cultural Heritage Agreement.

CHA Area means the area covered by this CHA which is Lot 10 on SP295408

Claims means any claim, proceeding, action, cause of action, demand, damages, costs, losses or expenses.

Commencement Date means the date on which this CHA was executed by the last of the Parties.

Compensation means any compensation, right or entitlement (whether monetary or otherwise) under any law (including common law, commercial law, equity or statute) owed to the Aboriginal Party in relation to any damage or destruction of Juru Cultural Heritage.

Confidential Information means all information of a confidential nature in relation to Cultural Heritage and Cultural Heritage Issues.

Contact Officer has the meaning given to that term in item 3.1(b) of this agreement.

Cultural Heritage Duty of Care means the requirement that a person who carries out an activity must take all reasonable and practicable measures to ensure the activity does not Harm Aboriginal Cultural Heritage, and as provided for in section 23(1) of the ACHA.

Cultural Heritage Induction Convenor means the member of the Juru People nominated from time to time by the Aboriginal Party, who will present the Cultural Heritage Induction in accordance with item 7 of the CHA.

Cultural Heritage Protection Provisions means the provisions contained in sections 23, 24, 25, and 26 of the ACHA.

Discovery means a Discovery of Aboriginal Cultural Heritage during the conduct of Proponent Works under item 8 of this CHA.

Dispute means a dispute or disagreement between the Parties to this agreement arising under this agreement.

Dispute Notice has the same meaning given to that term in item 11.3 of this CHA.

Early Works includes all preliminary investigative activities within or of the CHA Area

Early Works Clearance means the assessment of areas within the CHA Area by the Proponent and Field Officer/s with a view to identifying and managing any Aboriginal Cultural Heritage which may be affected by the Early Works, carried out in accordance with item 6 of the CHA.

Early Works Clearance Form means the form prepared by the Field Officer/s involved in the Early Works Clearance that documents the results of the conduct of an Early Works Clearance in the form attached at Annexure 7 to the CHA.

Elder means a member of the Juru People who is acknowledged as having detailed knowledge of traditional laws and customs of the Juru People and has extensive knowledge of the area that is situated in and around the specific CHA Area.

Expert means a person who is an experienced and qualified Archaeologist with extensive knowledge of Aboriginal Cultural Heritage objects, sites, and areas.

Field Officer means members of the Juru People who are nominated by the Aboriginal Party to investigate, protect and /or manage Aboriginal Cultural Heritage in the CHA Area.

Future Survey means a survey of an area conducted in accordance with items 5.1 to 5.7 of the CHA.

Future Survey Report means a report drafted following a Future Survey which includes:

(a) an assessment of Aboriginal Cultural Heritage in the CHA Area;

(b) an assessment of the impacts of the proposed works upon Aboriginal Cultural Heritage in the CHA Area;

(c) any recommendations for avoidance or minimisation of Harm to such Aboriginal Cultural Heritage.

Geotechnical Investigations means the activities required to assess the suitability of relevant areas of the CHA Area, including the conduct of seismic surveys, surveys for sand, gravel and mineral sources, the undertaking of drilling and test pitting as required, the provision of access tracks and any ancillary investigations.

Ground Disturbance Activities means:

(a) disturbance by machinery or hand tool of the topsoil or surface rock layer of the ground, such as grubbing, ploughing, drilling or dredging; and

(b) the removal of vegetation by disturbing root systems and / or exposing underlying soil in the CHA Area by a Proponent or its agents, contractors or sub-contractors;

(c) the flattening or compaction of vegetation by vehicles even if the vegetation remains living; or

(d) the slashing or mowing of vegetation by vehicles to facilitate access to tracks or areas in the CHA Area.

GST has the meaning given to that term in the GST taxation law.

Harm has the meaning given in the ACHA.

Human Remains Guidelines means the guidelines gazetted under the ACHA.

Independent Expert means a suitably qualified and experienced Expert agreed by the Aboriginal Party and the Proponent.

Initial Survey means the surveys conducted prior to the commencement of Proponent Works being carried out in an area of the CHA Area

Initial Survey Reports means the Cultural Heritage Reports that are formulated by the Field Officer/s and /or the Independent Expert in relation to any Initial Survey.

Initial Survey Area means that part of the CHA Area which was the subject of the Initial Survey.

Aboriginal Party Juru People means the native title holders identified in the Juru People Native Title Determination *Lampton on behalf of the Juru People v State of Queensland.*

[2014] FCA 736.

Methodology means the Methodology for undertaking Future Surveys developed and agreed by the Aboriginal Party and the Proponent under item 5.4 of the CHA.

Mitigation Measures means measures to avoid Harm to Aboriginal Cultural Heritage as agreed by the Aboriginal Party and the Proponent.

Monitoring means supervision by Field Officer/s of ground disturbance activities being carried out by the Proponent in the CHA Area.

Party / Parties means subject to item 1.1 of the CHA, either the Aboriginal Party and the Proponent.

Proponent means Gilmour Space Technologies Pty Ltd ABN 17 166 858 260.Party.

Proponent Works means all works, operations or infrastructure which are to be undertaken in relation to or incidental to the investigation, implementation, development, construction, installation, operation, maintenance, repair, replacement, further development or decommissioning of the Proponent Works within the CHA Area including:

(a) works, operations or infrastructure which are to be undertaken in relation to or incidental to the investigation, implementation, development, construction, installation, operation, maintenance, repair, replacement, further development or decommissioning of an orbital space launch facility and associated components in the CHA Area;

(b) infrastructure, services and facilities to support the construction and operation of these facilities; and

(c) preparatory, consultant and associated works required to construct, install, service and operate these facilities,

including (without limitation):

(i) the construction, operation and maintenance of any access roads, haul roads or bridges, groyne walls, power lines, telecommunication lines, water pipelines and associated infrastructure, sewerage pipelines and associated infrastructure, other utility infrastructure, navigational equipment or aids, office or accommodation buildings, camps and any other buildings or structures;

(ii) the clearing of land and or vegetation;

(iii) Environmental rehabilitation and flora and fauna management;

(iv) the conduct of geotechnical investigations and surveys;

(v) the establishment and operation of quarries, storage or laydown areas and stockpile areas;

(vi) the removal or relocation of any works, operations or infrastructure;

(vii) the disposal of dredge material, contaminated waste, or unclean gravel or dirt;

Salvage means any or all of collecting, bagging, tagging, cataloguing, Salvage or moving of a Significant Aboriginal Object.

Significant Aboriginal Area means an area or particular significance to Aboriginal People as defined in section 9 of the ACHA.

Significant Aboriginal Object means an object of particular significance to Aboriginal People as defined in section 10 of the ACHA.

Technical Adviser means the archaeologist providing professional advice in relation to Aboriginal Cultural Heritage to the Parties of the CHA.

Timesheet means the form contained in Annexure 3 to the CHA.

Work Area means a nominated area within the CHA area for which Proponent Works are proposed to be or are being carried out

1. Application of CHA

1.1 General

(a) The Parties acknowledge that the Aboriginal Party are the Aboriginal Party under the ACHA for the Area.

(b) The purpose of CHA is to operate as "another agreement pursuant to section s23(3)(a)(iii) of the ACHA.

(c) The CHA covers the protection and management of all Aboriginal Cultural Heritage in the Area for the purposes of all activities undertaken for, or in relation to, the Proponent by:

  (i) the Aboriginal Party Representatives and its employees, agents or contractors, and

  (ii) the Proponent and its employees, agents or contractors.

1.2 Application between Parties

(a) The Parties agree that:

  (i) each Party will share in confidence the reports, data and other results of any survey conducted for the benefit of the Proponent;

  (ii) the Agreed Recommendations are binding on all Parties to the CHA;

  (iii) Any Mitigation Measures developed by the Parties in relation to any activities undertaken, or to be undertaken by the Proponent are binding on all Parties.

1.3 Laws Still Apply

In addition to this CHA, all laws relating to the protection and management of Aboriginal Cultural Heritage continue to apply to all Proponent works. However, the Parties agree to take all reasonable steps to exhaust the procedures set out in this CHA before having resort to other avenues for the protection and management of Aboriginal Cultural Heritage, including under Part 3 Division 1 and 4 of the ACHA, the *Land Court Act 2000(Qld)* or the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)*.

1.4 No Secret or Sacred Information

The Parties acknowledge that, except as expressly stated in this CHA, this CHA does not contain any information protected in accordance with section 29 of the ACHA and that the Aboriginal Party shall be the sole judge of whether knowledge or information, whether currently known or identified or acquired in the future, is of a secret or a sacred nature.

2. Governing Principles

2.1 Principles of Cultural Heritage Management

The Parties acknowledge the following principles of cultural heritage management:

(a) the recognition, protection and conservation of Aboriginal Cultural Heritage should be based on respect for Aboriginal knowledge, culture, beliefs, customs and traditional practices;
(b) Aboriginal people should be recognised as the primary knowledge holders and custodians of Aboriginal Cultural Heritage;
(c) It is important to respect, preserve and maintain knowledge, innovations and practices of Aboriginal communities and to promote understanding of Aboriginal Cultural Heritage;
(d) Activities involved in recognition, protection and conservation of Aboriginal Cultural Heritage are important because they allow Aboriginal people to reaffirm their obligations to "law and country";
(e) There is a need to establish timely and efficient processes for the management of the activities that may Harm Aboriginal Cultural Heritage;
(f) There is a need to preserve the aesthetic, historic, scientific, social, cultural (or other) value in the CHA Area for past, present and future generations.

2.2 Principles Governing the CHA Area

The Parties also acknowledge that in consideration of the principles set out in item 2.1 above and the objectives of the Proponent Works, this CHA seeks to:

(a) Ensure the Aboriginal Party Representatives have direct involvement in the formulation and implementation of this CHA;
(b) Outline the roles and responsibilities of the Parties in the management of Aboriginal Cultural Heritage during Proponent Works;
(c) Allow the Proponent to carry out works in a manner that meets the required regulatory standards while assisting in the management of the Aboriginal Cultural Heritage which is affected by the Proponent Works.
(d) Ensure respect for, and recognition of, Aboriginal Cultural Heritage by anyone associated with the Proponent or Proponent Works.

3. Roles and Responsibilities

3.1 General

(a) This item 3 is to be read in conjunction with the roles and responsibilities outlined elsewhere in this CHA;
(b) Each Party will appoint an officer (Contact Officer) to fulfil any obligations of that Party under this CHA, including to provide notices or information or respond to notices or requests for information. The Parties are entitled to rely upon advice provided by a Contact Officer as the informed and final decision of the Party the Contact Officer represents, and any advice provided by a Contact Officer will bind the Party the Contact Officer represents to act in accordance with the terms of the advice provided;
(c) All Parties agree to act in good faith throughout the term of this CHA.

3.2 Roles and Responsibilities of Proponent

The Proponent agrees to:

(a) Perform their obligations under this CHA;

(b) Provide all information that is reasonably required to allow the Field Officer/s and the Aboriginal Party to implement any element of this CHA;

(c) Assist the Field Officer/s and Aboriginal Party or Juru Nominated Party to carry out all elements of this CHA and comply with policies or rules established by the Proponent;

(d) When required any necessary resources to enable one Technical Advisor (archaeologist) to assist the Aboriginal Party during Proponent Works;

(e) Ensure that key personnel and / or contractors are aware of their responsibilities under this CHA, including by ensuring that such key personnel and / or contractors involved in the conduct of Ground Disturbance Activities or sampling attend an Aboriginal Cultural Heritage induction in accordance with item 7

(f) Only conduct Ground Disturbance Activities or sampling in:

(i) those parts of the CHA Area that are, at the Commencement Date, the subject of Proponent Works.

(ii) in any other part of the CHA Area where the Aboriginal Party has given a Proponent a Notice under item 5.1(a)

And otherwise in accordance with:

(iii) If in an Initial Survey Area, the applicable Agreed Recommendations;

(iv) If in a Future Survey Area, the applicable Mitigation Measures;

(v) If during early works, the applicable Early Works Clearance;

(g) Ensure that the Agreed Recommendations and Mitigation Measures applicable to the Proponent are fully implemented;

(h) Make the payments provided for in this CHA to the Aboriginal Party within the timeframes set out in this CHA

3.3 Roles and Responsibilities of the Aboriginal Party

(a) The Aboriginal Party will make every reasonable effort to:

i. Nominate suitable Field Officers to undertake Surveys;

ii. Meet Proponent timetables;

iii. Provide such information as is reasonably required by Proponent to implement any element of the CHA;

iv. Comply with provisions of any Applicable Laws governing Aboriginal Cultural Heritage;

v. Assist the operations of Proponent where it is acting in accordance with this CHA and is not otherwise in breach of any obligations under the ACHA;

vi. Assist with the development and delivery of a cultural heritage induction program for the Project Area;

vii. Comply with all obligations as specified within this CHA or Subsidiary Agreements; and

viii. Agree to do all things that are necessary to effectively implement this CHA.

4. Field Officers

4.1 Nomination

The Aboriginal Party must nominate a reasonable number of Field Officers as agreed between the Parties, to undertake the role and responsibilities set out in item 4.2 to ensure that a sufficient pool of Field Officers is available to replace any Field Officer who is unable to undertake his or her duties under this CHA due to illness, fulfilment of cultural obligations or otherwise.

4.2 Obligations and Responsibilities

The Aboriginal Party will procure that the Field Officers:

(a) Comply with the requirements of this item 4;
(b) Participate in Future Surveys in accordance with item 5;
(c) Participate in any required Early Works Clearances in accordance with item 6;
(d) Implement the Agreed Recommendations and /or Mitigation Measures in accordance with this CHA;
(e) Deal with Discoveries of human remains and new Discoveries in accordance with item 8;
(f) Participate in the process in relation to an alleged breach in accordance with item 9;
(g) Generally adhere to any policies or rules established by the Proponent which are not inconsistent with this CHA

4.3 Pre-requisite training

(a) Prior to a Field Officer entering the Proponent Works Area, permit or lease area, to undertake any work required for the purposes of this CHA, a Field Officer:
  (i) Must undertake any induction required by the Proponent;
  (ii) Must successfully complete any:
    (a) On the job training;
    (b) Health and safety training;
    (c) medical testing;
  reasonably required by a Proponent prior to commencing work;
  (iii) May be required to undertake specific site inductions, the conduct of which shall be at the cost of the Proponent.
(b) If any Field Officer fails to comply with any of the requirements in item 4.3(a), then:
  (i) The Proponent acting reasonably and in accordance with item 4.5, may direct the Aboriginal Party to:
    (a) remove the relevant Field Officer from the Work Area
    (b) appoint another Field Officer to attend and who must be able to comply with item 4.3(a)
  (ii) The Aboriginal Party must on receiving a direction from the Proponent under item 4.3(b)(i):
    (a) Direct the Field Officer to leave the Work Area;

(b) Appoint a substitute Field Officer in accordance with item 4.5.

4.4 Health and Safety

(a) The Aboriginal Party acknowledges that the Proponent has legal obligations in relation to health and safety.

(b) At all times that the Field Officer/s are in the Work Area they must:

(i) Take all reasonable precautions to ensure that they and all other persons participating in the processes set out in this CHA remain free from injury;

(ii) Comply with all laws and regulations in relation to health and safety, follow all reasonable directions of the Proponent's personnel regarding health and safety issues and comply with the Proponent's health and safety protocols, policies and plans;

(iii) Dress appropriately, and comply with the Proponent's personal protection equipment requirements, including by wearing long sleeved shirts, long legged pants and steel capped boots (to be provided by the Field Officer):

(iv) Remain completely free of the effects of illegal drugs and alcohol and submit to any drug and / or alcohol tests carried out by a Proponent in accordance with its established drug and alcohol policies:

(v) Be of a level of fitness required to enable them to participate in the processes set out in this CHA;

(vi) Behave in a manner that is not offensive, intimidating, threatening or otherwise prejudicial to any other person including any other Party representative.

(c) If:

(i) A Field Officer does not comply with a requirement in item 4.4(b) and;

(ii) The Field Officer's non-compliance poses a risk to any of the Proponent's compliance obligations, or otherwise exposes a Proponent to risk of prosecution or civil liabilities

Then:

(iii) The Proponent acting reasonably and in accordance with item 4.5, may direct the Aboriginal Party to:

(a) Remove the relevant Field Officer from the Work Area; and

(b) Appoint another Field Officer to attend the Work Area.

(iv) The Aboriginal Party must on receiving a direction from the Proponent under item 4.4(c)(iii):

(a) Direct the Field Officer to leave the Work Area; and

(b) Appoint a substitute Field Officer in accordance with item 4.5

(d) The Aboriginal Party acknowledges and agrees that for the purposes of the Proponent complying with its health and safety obligations, a representative of the Proponent may accompany Field Officer/s and any other participant in a process under this CHA on behalf of the Aboriginal Party at all times when such representatives are attending upon the CHA Area.

4.5 Ground Disturbance Activities to proceed on failure by Field Officer/s

(a) The Proponent must promptly notify the Aboriginal Party by telephone in the event that a Field Officer:

(i) Does not attend the CHA Area within one hour of the scheduled commencement of Ground Disturbance Activities under a roster established pursuant to item 5 or 6;

(ii) Is to be removed from the Work Area in accordance with item 4.3(b) or item 4.4(c).

(b) The Aboriginal Party must appoint a substitute Field Officer to attend the relevant part of the Work Area within one hour (or such other reasonable period agreed by the Parties) of receiving telephone notice from the Proponent under item 4.5(a).

(c) If no Field Officer is appointed and attends the Work Area within the timeframe set out in item 4.5(b) or as otherwise agreed between the Aboriginal Party and the Proponent, the Proponent may direct that Ground Disturbance Activities proceed.

4.6 Insurance

(a) The Aboriginal Party will ensure that the necessary public liability, motor vehicle and workers compensation insurance as part of the Field Officer/s standard terms and conditions of employment, and procure that the Technical Adviser has professional indemnity insurance if the Aboriginal Party contracts or provides the Technical Adviser directly, and, if requested to do so by the Proponent, the Aboriginal Party will provide copies of all policy certificates to evidence Aboriginal Party compliance with this obligation.

(b) If the Aboriginal Party is unable to, or otherwise does not meet the requirements of item 4.6(a), the Proponent may take out the relevant insurance policies on behalf of the Aboriginal Party and the Proponent will be entitled to set-off the costs of taking out such insurance policies against any payments which become due to the Aboriginal Party under this CHA

4.7 Daily Time Sheet and Work Reports

At the end of each day that the Field Officers attend the Work Area to perform the responsibilities outlines in this CHA, the Field Officer must:

(a) Accurately complete timesheets and Field Officer report forms to:

(i) outline any work undertaken;

(ii) identify any Aboriginal Cultural Heritage inspected and its condition;

(b) File the completed timesheet and Field Officer report form at the Project Office or at Juru Enterprises Limited Office.

4.8 Rosters

(a) The Parties agree that the overriding principle for the agreement of all rosters of Field Officers under this CHA will be the cost-efficient use of resources.

(b) Unless otherwise agreed between the Parties, rosters will be drafted on the basis of a five day cycle.

4.9 Remuneration

(a) The Aboriginal Party will maintain a record of the hours worked by each Field Officer, the Cultural Heritage Induction Convenor that represent the Aboriginal Party in carrying out the processes set out in this CHA, in accordance with the timesheets and Field Officer report forms.

(b) The Proponent will pay each valid tax invoice that is:

(i) itemised in accordance with the format set out in annexure 6

(ii) calculated in accordance with the service rates set out in annexure 2 (subject to item 4.9(c))

(iii) supported with copies of the timesheets and Field Officer report forms;

and properly rendered by the Aboriginal Party within 30 days of its receipt by the Proponent and the Aboriginal Party will in turn make all payments required to made to the relevant personnel. Provided that all amounts required to be paid by the Proponent under this CHA are paid to the Aboriginal Party by the Proponent, the Aboriginal Party will indemnify and hold the Proponent harmless against any claim made by any Field Officer, Cultural Heritage Induction Convenor or other Juru personnel in relation to such payments.

(c) The Parties agree that the services rate set out in Annexure 2 apply from the Commencement Date and the rates are to be adjusted per annum at the end of the financial year, with reference to CPI and calculated in accordance with the CPI percentage rate for the said financial year.

(d) In the event that activities rostered to occur under this CHA are cancelled by a Proponent due to unforeseen reasons (e.g. inclement weather) and the Proponent directs the Field Officer/s to depart the Works Area until such time as those activities may recommence:

(i) if the Aboriginal Party is notified of the cancellation of the following day's rostered activities by 4pm on the day prior to the cancelled day, the rostered Field Officer/s will not be entitled to any payment for the cancelled day

(ii) if the Aboriginal Party is notified of the cancellation of day's rostered activities on the cancelled day, the rostered Field Officer/s will be entitled to be paid one half of the daily rate for that day

And in any such circumstances the Aboriginal Party will take all reasonable steps to ensure that the Field Officer/s are available to return to the Work Area as soon as activities under this CHA are able to recommence.

(e) The Field Officer/s, the Cultural Heritage Induction Convenor and other participants in a process under this CHA on behalf of the Aboriginal Party are the employees of the Aboriginal Party's nominated service provider. The Aboriginal Party and this CHA does not create any relationship of employment, trust, agency, fiduciary or partnership between each Proponent, the Field Officer/s, the Cultural Heritage Convenor or any other participant in a process under this CHA.

5. Future Surveys

5.1 Where no Future Survey required

(a) The Aboriginal Party may give the Proponent Notice of any location that it is aware of within the Work Area where Ground Disturbance Activities are unlikely to cause disturbance to any Aboriginal Cultural Heritage and for which the Proponent:

(i) will not be obliged to conduct a Future Survey in that identified area;

(ii) may proceed with Ground Disturbance Activities without further notice.

(b) A Future Survey is not required to be conducted in respect of areas in relation to which the Aboriginal Party has given notice to the Proponent in accordance with item 5.1(a) and the Proponent may carry out Ground Disturbance Activities in such areas without further notice to the Aboriginal Party, subject only to item 8.1 and 8.2.

5.2 Future Surveys

(a) Unless item 5.1(b) applies, no Ground Disturbance Activities in CHA Areas may be conducted until:

(i) a Methodology has been developed in accordance with item 5.4;

(ii) a Future Survey has been undertaken in the relevant CHA Area in accordance with item 5.6;

(iii) Mitigation Measures have been formulated and agreed to govern the basis on which the Ground Disturbance Activities will be carried out in the CHA Area.

(b) Future Surveys will be conducted over the CHA Area, either (at the discretion of the Proponent):

(i) as soon as possible after the Commencement Date; or

(ii) on an ongoing basis in relation to individual Work Areas throughout the overall CHA Area.

(c) The primary objectives for the conduct of the Future Surveys and the development of Mitigation Measures are to:

(i) identify the location, nature, extent and significance of Aboriginal Cultural Heritage in the Works Area;

(ii) identify the impacts of the Works in the Works Area on the identified Aboriginal Cultural Heritage;

(iii) ensure that the Aboriginal Party is consulted about the works in the Works Area and any identified impacts on Aboriginal Cultural Heritage to the extent it is within the Works Area;

(iv) develop processes and management strategies to avoid the effects of Works on Aboriginal Cultural Heritage within the Works Area.

5.3 Conduct of Future Surveys

(a) The Proponent will provide the Aboriginal Party with notice from time to time regarding the Ground Disturbance Activities proposed to be conducted in the CHA Area (other than any area the subject of a notice under item 5.1(a)), which will include:

(i) a topographical map (of appropriate scale) depicting the Works Area;
(ii) a description of the activities proposed and a description of the type of equipment, and approximate number of people that will be present on the CHA Area.

(b) Within 10 Business Days after the receipt of each work program (or such other timeframe agreed between the Parties), the Aboriginal Party will advise the Proponent in writing whether the Aboriginal Party considers that a Future Survey should be undertaken prior to the conduct of activities in the CHA Area in accordance with the works program.

(c) Where the Aboriginal Party advises that a Future Survey is required:
(i) the Parties will develop the Methodology for a Future Survey in accordance with item 5.4;
(ii) the Aboriginal Party:
(a) will conduct a Future Survey in accordance with item 5.6 in the Works Area on the basis of the activities to be conducted under the Work program;
(b) may nominate a Technical Advisor to assist in conducting the Future Survey and the Proponent will not unreasonably withhold approval of their nomination.

(d) Where the Aboriginal Party does not respond to a Works Program within 10 Business Days (or such other timeframe agreed between the Parties) in accordance with item 5.3(b), no Future Survey will be required, and the Proponent's only obligations under this CHA with respect to the Works Area will be those under items 8.1 and 8.2

5.4 Development of Methodology

(a) The Parties will develop the Methodology for a Future Survey with a view to determining the most appropriate and mutually acceptable means of conducting the Future Survey in the CHA Area, having regard to:
(i) the Aboriginal Party responsibilities under Aboriginal Tradition for Aboriginal Cultural Heritage in the CHA Area;
(ii) the Ground Disturbance Activities proposed by the Proponent;
(iii) the contents of a Future Survey as required by item 4.5.

(b) The Methodology for a Future Survey may consider the following:
(i) the specific areas to be the subject of the Future Survey;
(ii) the survey approach (for example, the distances between gridded transects to be surveyed);
(iii) any key areas and features to be targeted;
(iv) how artefacts and sites will be recorded;
(v) any other reporting and recording requirements;
(vi) the number of participants on behalf of the Aboriginal Party that will participate;
(vii) an estimate of the days required to complete the field component of the Future Survey;
(viii) the days on / days off that will be worked;
(ix) responsibilities for the provision of equipment;
(x) any other matter as agreed between the Parties.

5.5 Content of a Future Survey

The following will form part of each Future Survey:

(a) An assessment of the logistics, nature, extent and significance of Aboriginal Cultural Heritage in the CHA Area.

(b) An assessment of the impacts of the proposed Ground Disturbance Activities upon Aboriginal Cultural Heritage in the CHA Area and recommendations as to measure for mitigating impacts identified.

(c) The completion of the results of and recommendations from these investigations into a Future Survey report.

5.6 Completion of a Future Survey

(a) Unless otherwise agreed by the Parties, the Aboriginal Party will use its reasonable endeavours to ensure that each Future Survey is completed in accordance with the timeframe and process set out below:

(i) the Future Survey will be conducted in accordance with the Methodology, subject to any minor amendments to the Methodology for logistical matters;

(ii) any necessary fieldwork required for the Future Survey will commence within 20 Business Days of the Proponent giving the work program to the Aboriginal Party, or such other period as agreed between the Parties in writing;

(iii) a draft Future Survey Report will be issued by the Aboriginal Party to the Proponent within 15 Business Days from the completion of the fieldwork;

(iv) the Proponent has 10 Business Days from its receipt to review (review period) and if necessary, provide their comments on the draft Future Survey Report to the Aboriginal Party;

(v) the Aboriginal Party, having taken into account any comments made by the Proponent on the draft Future Survey Report, must settle and provide the Proponent with a copy of its final Future Survey Report within 10 Business Days of the close of the Review Period.

subject to any requirement for a meeting in accordance with item 5.6(b)

(b) If:

(i) the participants in the Future Survey discover Aboriginal Cultural Heritage during the conduct of a Future Survey; and

(ii) the Aboriginal Party considers that the Aboriginal Cultural Heritage is of such a nature as to require immediate steps to either or both:

(a) ensure the Works does not Harm such Aboriginal Cultural Heritage; or

(b) avoid delays to the conduct of the Works

Then the Aboriginal Party will notify the Proponent, and:

(iii) the contact officers of the Parties will meet to discuss the nature of the Aboriginal Cultural Heritage so discovered and the likely implications for the Mitigation Measures;

Provided that more than one Future Survey Report may be discussed in any such meetings.

5.7 Mitigation Measures

(a) The Parties must meet promptly after the issue of the final Future Survey Report, under item 5.6(a) to discuss and agree the Mitigation Measures to apply to the conduct of the relevant work program.

(b) The Mitigation Measures must:

(i) subject to the Aboriginal Party's Aboriginal Tradition, comprehensively list all of the identified Significant Aboriginal Areas and Significant Aboriginal Objects for the relevant Works Area; and

(ii) outline actions that should be taken for the mitigation, management and protection of Aboriginal Cultural Heritage in each Works Area.

(c) The Parties will seek to agree the Mitigation Measures within 20 Business Days from the date of the issue of the final Future Survey Report under item 5.6(a)(v).

(d) The Mitigation Measures will be subject to variation (by agreement in writing) by the Parties or their Contact Officers in the event of a new Discovery and in accordance with the process set out at item 8 of this CHA.

(e) Mitigation Measures entailing Monitoring will be restricted to those areas that are not at the Commencement Date, the subject of infrastructure, and the Aboriginal Party will be entitled to appoint a maximum of one Field Officer per item of machinery or team of persons, that will conduct Ground Disturbance Activities (or as otherwise agreed between the Parties in writing) to conduct such monitoring.

6. Early Works Clearances

6.1 Number of Field Trips and Negotiation of scope of work

(a) The Proponent will notify the Aboriginal Party when Early Works are required, and will provide relevant information (including maps, the nature of the Early Works to be undertaken and the earth disturbance the Proponent reasonably expects to result from the Early Works).

(b) The Aboriginal Party will have five Business Days to respond to the notice given under item 6.1(a), and commence discussions with the Proponent about the scope and timing for an Early Works Clearance of the area where the Early Works will be conducted.

(c) The Parties will agree on the scope and timing of the Early Works Clearance, and a roster for Field Officer participation in the Early Works Clearance within 10 Business Days from the Aboriginal Party receipt of the notice given in item 6.1(a).

(d) During the conduct of the Early Works Clearance the Aboriginal Party will direct the Proponent to areas where Early Works may proceed without further steps being necessary to avoid or minimise Harm to Aboriginal Cultural Heritage.

6.2 Provision of Field Officer/s

The Aboriginal Party agrees to provide the Proponent, where required, with one Field Officer (unless otherwise agreed) to undertake the Early Works Clearance of the area where Early Works are to be conducted.

6.3 Provision of Written Reports

The Field Officer will provide the Proponent with Early Works Clearance Forms documenting the results of the conduct of the Early Works Clearance, at the conclusion of each day on which the Early Works Clearance is conducted.

6.4 Identification and Assessment of Aboriginal Cultural Heritage

(a) In locations where no Aboriginal Cultural Heritage is identified during the Early Works Clearance, the Proponent may proceed with Early Works. This clearance may be given to the Proponent immediately following the Early Works Survey in accordance with section 6.3.

(b) In locations where Aboriginal Cultural Heritage is identified during the Early Works Clearance, a Field Officer must immediately notify the Proponent, and the Field Officer/s and the Proponent Representative will seek to agree on whether the Aboriginal Cultural Heritage:

   (i) must be avoided for the purposes of the Early Works, in which case the Proponent will not conduct works in that location; or

   (ii) may be Salvaged in which case the Field Officer/s will use all reasonable endeavours to relocate the Aboriginal Cultural Heritage so that Early Works may proceed at that location.

(c) The Aboriginal Party will subsequently provide confirmation in an Early Works Clearance Form in the event that the Aboriginal Cultural Heritage:

   (i) is reasonably likely to need further assessment prior to the Proponent works; or

   (ii) is likely to require inclusion in the Mitigation Measures after the Early Works are completed

In which case the Aboriginal Party will consider the relevant Early Works Clearance Form, any further assessment required and any appropriate Mitigation Measures arising.

7. Aboriginal Cultural Heritage Awareness Training

(a) The Proponent is committed to ensuring general awareness of Aboriginal Cultural Heritage amongst personnel.

(b) The Proponent will ensure that key personnel involved in the conduct of Ground Disturbance Activities in areas not, at the Commencement Date, attend an Aboriginal Cultural Heritage induction, which will be conducted by the Cultural Heritage Induction Convenor at such times and frequency as is requested by the Proponent.

(c) The Aboriginal Party will provide:

   (i) the induction material, in consultation with a Proponent; and

   (ii) the Cultural Heritage Induction Convenor;

as required under this item 7.

8. Discoveries During Works

8.1 Discovery of Human Remains

If Human remains are identified during Proponent Works the process set out in the Human Remains Guidelines must be followed.

8.2 Discovery of Aboriginal Cultural Heritage

(a) If after the completion of a Future Survey, and during the works of the Proponent there is an unexpected Discovery of potential cultural heritage material the Proponent must immediately direct that any Ground Disturbance Activities cease and the Proponent will erect such temporary barriers and signage and / or take such other reasonable measures as are necessary to ensure that the new Discovery will be avoided while the activities in this item 8.2 are undertaken.

(b) The Proponent will notify the Aboriginal Party, such notice to set out details of the Discovery and invite the Aboriginal Party to arrange for a Field Officer/s to inspect the Discovery within two hours or such period agreed between the Parties

(c) If the Field Officer/s attends within three hours of receipt by Aboriginal Party of the notice referred to in item 8.2(b) and is of the opinion that the Discovery is Aboriginal Cultural Heritage, the Discovery will be recorded using the Field Officers Report Form and be Salvaged (wherever reasonably possible). If salvaging of the Discovery is not reasonably possible, the Field Officer/s and the Proponent will endeavour to agree alternative management actions, failing which, the process in item 8.2(d) must be followed, during which time Ground Disturbance Activities may recommence at a distance from the site of the Discovery (to be determined by the Field Officer/s and the Proponent) so as not to reasonably pose any threat of Harm to the Discovery.

(d) If the Field Officer/s does not inspect the Discovery within three hours of receipt by the Aboriginal Party of the notice referred to in item 8.2(b), the Proponent may notify the Aboriginal Party that Ground Disturbance Activities are recommencing at a reasonable distance from the Discovery area and notify the Aboriginal Party as to what distance the Activities are in relation to the Discovery.

9. Procedure in the event of alleged Breach

9.1 Notice and conduct during Breach process

(a) The Field Officer/s will advise the Proponent as soon as possible if, in the Field Officer's view, a Breach has occurred, and provide a copy of the completed form in Annexure 5.

(b) The Proponent will advise the Field Officer/s as soon as possible if, in the Proponent's view, a Breach has occurred, and provide a copy of the completed form in Annexure 5.

(c) Each Party will continue to meet their obligations under this CHA which are not directly impacted upon by the alleged Breach during the conduct of the process under this item 9.

9.2 Investigation

The Field Officer/s and Proponent will jointly institute measures to investigate the alleged Breach. They will also advise the Aboriginal Party of the incident and any measures that have been implemented to investigate it.

9.3 Review of Agreed Recommendations or Mitigation Measures

As a first step, the Field Officer/s and the Proponent will review this CHA to determine what Mitigation Measures or Agreed Recommendations, if any, were meant to have been implemented at the site where the Breach is alleged to have occurred. Together they will assess whether the Mitigation Measures or Agreed Recommendations were complied with, and whether the incident comprises a Breach. Either or both of the Field Officer/s and the Proponent may seek the assistance of the Technical Advisor in conducting this review and assessment.

9.4 Where no Breach

Where the Field Officer/s and the Proponent determine that there has not been a Breach, the Field Officer and the Proponent will document the details of the investigation and confirm that no Breach has occurred, and no further action will be required under this item 9. However, the Field Officer/s and Proponent may, by agreement, determine whether additional measures (which may include seeking the input and assistance of the Technical Adviser) in which case the Field Officer and the Proponent will:

(a) advise the Aboriginal Party of the results of their investigation, and any action taken;

(b) attach a copy of the completed Annexure 5 to this CHA detailing the additional measures and noting when the additional measures were implemented;

(c) sign the completed Annexure 5;

(d) formally advise all relevant Proponent Personnel of the amended management measures for that site.

9.5 Where Breach

(a) If the Field Officer/s and Proponent determine that there has been a Breach, the Aboriginal Party and the Proponent will initiate an investigation of the incident. All relevant documentation including timesheets and Field Officer/s Report forms filed by the Field Officers will be reviewed to determine whether the relevant Aboriginal Cultural Heritage had been subject to previous inspection, and when such inspection took place, thereby enabling determination of when the incident may have occurred, and what work crew/s or other personnel may have been present when the incident took place.

(b) Where the Aboriginal Cultural Heritage has not been the subject of previous documented inspection, the Proponent is to take all reasonable steps to determine which work crew/s or other personnel were in the vicinity of the Aboriginal Cultural Heritage at the time the Breach is alleged to have occurred.

9.6 Interviews with Personnel

(a) As and when the nature and timing of the incident has been determined, and relevant work crew/s or Proponent personnel identified, the Proponent will undertake interviews to determine if any person has any knowledge of the incident, including how it occurred, when it occurred and who was responsible. The Proponent will also establish whether those personnel responsible had been inducted in Aboriginal Cultural Heritage, and appropriately briefed as to the Mitigation Measures. The Proponent will maintain a formal record of the results of all interviews which must be signed by the relative personnel and the Party interviewed at the conclusion of the interview.

(b) The Proponent will, within five Business Days of completing all interviews, advise the Field Officer/s of the reasonable details of the results of all interviews and give to the Field Officer a copy of the conclusions reached about the incidents.

9.7 Disciplinary Action

Where it is determined that there has been a Breach, the Proponent will initiate disciplinary measures. The Parties agree that a Breach of this CHA is a serious matter which may involve the dismissal of any employee involved in such a Breach, or may involve the imposition of breach notices under any contract if a contractor of the Proponent or a contractor's employee is involved in a Breach. Such disciplinary action will be conducted according to law and any relevant industrial instrument.

9.8 Further Induction

(a) Where it is determined that the Breach was not the result of wilful or knowing action, the Proponent will ensure that the personnel involved are Inducted (or inducted again and appropriately briefed) and will in collaboration with the Field Officer/s, review existing Mitigation Measures and Agreed Recommendations and adopt any additional management measures as agreed.

(b) The Proponent and Field Officer/s will further advise the Aboriginal Party of the results of their investigation, any recommendations arising and action taken, They will also attach a copy of the completed Annexure 5 to the Mitigation Measures or Agreed Recommendations (as applicable) detailing the additional measures and noting when they were implemented. This document is to be signed by the Proponent and Field Officer/s. They will advise all relevant personnel of the amended Management Measures for that Aboriginal Cultural Heritage.

9.9 Rehabilitation and repair

(a) When relevant, the Aboriginal Party together with the Aboriginal Party will propose remedial or rehabilitating measures that should be adopted to repair any damage to Aboriginal Cultural Heritage. The Proponent will not unreasonably withhold acceptance of any reasonable remedial or rehabilitating measures proposed by the Aboriginal Party or the Aboriginal Party.

(b) The Proponent and the Aboriginal Party and the Aboriginal Party will negotiate about the timing and other arrangements for their implementation of such works. No remedial or rehabilitation work will be undertaken without the written authorisation of the Aboriginal Party and the Aboriginal Party, nor without their direct involvement.

9.10 Compensation for damage

(a) When relevant, the Aboriginal Party together with the Aboriginal Party will propose that an agreed amount of compensation be paid by the Proponent, to the Aboriginal Party if the Damaged Aboriginal Cultural Heritage cannot be repaired or rehabilitated.

(b) If the Proponent and the Aboriginal Party and Aboriginal Party cannot agree to the compensation arrangements then the Parties shall follow the steps in item 11.

10. Ownership of Cultural Heritage and Intellectual Property

(a) The Proponent agrees that it has no intellectual property rights in Aboriginal Cultural Heritage in the Works Area, and to the extent permitted by law the Aboriginal Party is the owner and trustee for the Juru Peoples ownership of Aboriginal Cultural Heritage in the Works Area.

(b) The Parties agree that Ownership of intellectual property in any initial Survey Report, Future Survey Report or other Report prepared pursuant to this CHA remains with the Aboriginal Party, and the Proponent has a fully-paid up royalty-free licence and is otherwise authorised to use such information and any intellectual property therein for all purposes necessary or incidental to this CHA, the completion of Proponent works and compliance with the Cultural Heritage Protection Provisions.

11. Dispute Resolution under this CHA

11.1 Guiding Principle

The Parties agree that every effort should be made to ensure that Disputes do not arise and that if a Dispute does occur the Parties should make every reasonable effort to resolve the Dispute in good faith without recourse to this clause.

11.2 Independent Expert

Where an Independent Expert is engaged to perform any of the matters under item 12, the Dispute resolution procedure in this item 11 will not apply.

11.3 Dispute Notice

If a Party considers that a Dispute has arisen, the Party may send the other Party or Parties a Notice setting out a full description of the matters in Dispute or in respect of which there is a difference (Dispute Notice).

11.4 Meet and Talk

(a) The representatives of each Party must meet (whether in person, by videoconference or by teleconference) within five Business Days of receipt of a Dispute Notice and attempt to resolve the Dispute.

(b) Elders of the Native Title Claim Group, as nominated by the Aboriginal Party may participate in any meeting under item 11.4(a).

11.5 Mediation

(a) If the Parties cannot resolve the Dispute within two Business Days of discussions, or ten Business Days after a Party receives a Dispute Notice, either Party may refer the Dispute to resolution by an independent mediator.

(b) If the Parties to a Dispute cannot agree on a mediator within three Business Days after a Party receives a Dispute Notice, any Party may request that the President of the Queensland Law Society appoint a mediator.

(c) The role of a mediator is to assist in negotiating a resolution of the Dispute. A mediator may not make a binding decision on a Party to the Dispute except if the Party agrees in writing.

11.6 General

The Parties agree:

(a) to participate in good faith and use their best endeavours to resolve the Dispute;

(b) each Party meet their own costs of participation in the mediation;

(c) unless otherwise agreed by the Parties, the place of resolution of any Dispute is Bowen, Queensland;

(d) any information or documents disclosed by a Party under this item 11:

 (i) must be kept confidential;

 (ii) may only be used to attempt to resolve the Dispute;

(e) that nothing in this item 11 will preclude a Party from commencing proceedings in a court of competent jurisdiction for the purposes of seeking urgent injunctive or interlocutory relief;

(f) despite the existence of the Dispute, unless otherwise specified the Parties must continue to perform their obligations under this CHA.

12. Acknowledgement by Aboriginal Party and

12.1 Acknowledgement

The Aboriginal Party and Aboriginal Party acknowledges that the Proponent may engage an Independent Expert to undertake any one or more of the following:

(a) develop the Methodology for a Future Survey if the Parties are unable to agree to the Methodology within 15 Business Days of the date of the Proponent giving notice of a new work program to the Aboriginal Party and/or Aboriginal Party, or the Aboriginal Party and/or Aboriginal Party does not otherwise comply with item 5.4;

(b) assist the Proponent in the conduct of a Future Survey and prepare a Future Survey Report if the Aboriginal Party and/or Aboriginal Party does not complete either or both of a Future Survey and Future Survey Report in accordance with a Methodology for the Future Survey or otherwise comply with the requirements of item 5.6(a);

(c) develop the Mitigation Measures if the Parties cannot agree the Mitigation Measures within the period provided for under item 5.7(c) or 20 Business

Days from the preparation of a Future Survey Report under item 6.3 (as applicable);

(d) assist the Proponent with the conduct of the Early Works Clearance if the Parties do not agree on the scope and timing of the Early Works Clearance within the period provided for under item 6.1(c), or determine whether to avoid or Salvage any Aboriginal Cultural Heritage identified during an Early Works Clearance where such measures are not otherwise be agreed between the Field Officer/s in accordance with item 6.4(b);

(e) develop measures for avoiding or minimising Harm to a Discovery under item 8.2(c) where such measures are not otherwise agreed between the Proponent and the Field Officer/s in accordance with that item;

(f) assist the Proponent with the implementation of Agreed Recommendations or Mitigation Measures, if the Parties do not agree a roster for the attendance of Field Officer/s within the period provided for in item 4.2(b);

(g) determine whether there has been a Breach if the Parties are unable to agree within 15 Business Days of provision of a completed form in Annexure 5 by the relevant Party under item 9.1.

12.2 Still in Accordance with CHA

(a) The Parties expressly acknowledge that the Proponent will still be acting in accordance with this CHA when carrying out any activity provided for under items 4.5(c), 5.3(d), or 12.1, including if Mitigation Measures are not being complied with solely as a result of the absence of a Field Officer in accordance with item 4.5(c) or if the Proponent undertakes Ground Disturbance Activities in a Work Area in accordance with Mitigation Measures developed under item 12.1(c).

(b) For the purposes of a Party's compliance with the Cultural Heritage Duty of Care, provided the procedure in item 9 of the CHA is followed, a Breach will not cause that Party or Party's employees, agents or contractors to be acting other than in accordance with this CHA.

Executed as an Agreement

-between-

Kyburra Munda Yalga Aboriginal Corporation RNTBC ICN 7581

....	....
Director	Director
Name: Peta Ross	Name: Trevor Prior
Date 30/10/21	Date: 30/10/21.

Gilmour Space Technologies Pty Ltd ABN 17 166 858 260

....
Director
Name: James Gilmour
Date 30/10/21

Annexure 1 – Agreed Recommendations

1. Agreed Recommendations

Commitments	
1	
2	
3	
4	
5	
6	
7	
8	

Annexure 2 – Conditions and rates for service

Item	Rates and conditions
Rates of Pay	Technical Advisor: at cost Field Officer: $750.00 per day Cultural Heritage Induction Convenor : $50.00 per hour
Hourly Rates Conditions and Inclusions	The rates of pay are payment for services rendered (and for the avoidance of doubt, do not constitute cash flow in the course of a "hobby") and include all: (a) Administrative costs (b) taxation (c) superannuation (d) Worker Compensation Insurance (e) any and all other allowances
Meals and Accommodation	For all Juru Field Officers/Convenors that normally reside outside of Bowen: Meals – At ATO Rate Accommodation – At Cost
Travel Expenses	From Brisbane return: At cost – to be arranged by the Cultural Heritage Convener, with prior approval from Proponent From Cairns return: At cost – to be arranged by the Cultural Heritage Convener, with prior approval from Proponent From Townsville return: At cost – to be arranged by the Cultural Heritage Convener, with prior approval from Proponent From Ayr return: At cost – to be arranged by the Cultural Heritage Convener, with prior approval from Proponent
Working Hours	
Work Cycle	
Inductions	
Medical	

Annexure 3 – Timesheet

Name: ______________________

Signature: ____________________   Period Ending: ____/____/______

	Date				Start Time				Lunch Start				Lunch Finish				Finish Time				Total			
	D	D	M	M	H	H	M	M	H	H	M	M	H	H	M	M	H	H	M	M	H	H	M	M
Sat																								
Sun																								
Mon																								
Tue																								
Wed																								
Thur																								
Fri																								

Total Time For Period:_________________

Proponent Approval

Name:______________________

Signature:____________________

Annexure 4 – Field Officer Report Form

Name of Person Completing Form	Signature:	
Position:	Contact No:	Date:

Northing of Origin	Easting of Origin	Nature of Find	Find Made By (Name)	Reported To (Name)	Time and Date Reported	Action Taken	Northing of Relocation	Easting of Relocation

Position:	Print Name:	Signature:	Date:
Field Officer			
Field Officer			
Technical Adviser			
Proponent			

Annexure 5. – Alleged Breach Form

Cultural Heritage Protocol
Alleged Breach

Name of Person Completing Form:		Signature:
Position:	Contact No:	Date:

Nature of Alleged Breach: (describe what has happened and to what site)

Datum:	Northing:	Easting:	Description:

Breach Observed By: (Print Name)	Breach Reported to: (Print Name, Position and Company	Time and Date of Breach

Was Action taken to remedy the Breach: Yes No

What Action if any was taken:

Was Resolution of Breach achieved: Yes No

Any Further Action Required: Yes No

What Further Action is Required:

Who Authorised Action: (names and positions) (include all persons that took part in discussions or negotiations)

Name: (Print Name)	Position:	Date:

Refer Form to Field Officer and advise to Proponent
(4 copies to be made after signing)

Position	Name	Signature	Date
Field Officer			
Field Officer			
Technical Advisor			
Proponent			

Annexure 6 – Invoice Format

[insert Business Name]
[Business address and contact details]

Tax Invoice

Bill to:
[Proponent Name]
[address]

Invoice No:
Date:
Order No:

<table>
<tr><th>Date</th><th colspan="2">Description</th><th>Amount</th><th>Code</th></tr>
<tr><td></td><td colspan="2">Bank Details;
Name;
BSB;
Account No;</td><td></td><td></td></tr>
<tr><td colspan="2" rowspan="4">Terms: Net 7</td><td>GST</td><td colspan="2"></td></tr>
<tr><td>Total Including GST</td><td colspan="2"></td></tr>
<tr><td>Amount Applied</td><td colspan="2"></td></tr>
<tr><td>Balance Due</td><td colspan="2"></td></tr>
</table>

Appendix L Environmental Inspection Checklist

<table>
<tr><td></td><td colspan="5">Bowen Orbital Spaceport
Environmental Inspection Checklist</td></tr>
<tr><td rowspan="4">RATING</td><td colspan="5">Hazard Assessment</td></tr>
<tr><td colspan="2">H</td><td>M</td><td colspan="2">L</td></tr>
<tr><td colspan="2">Must be rectified within 24 hours
High Risk – detailed research and management planning required</td><td>Must be rectified within 14 days
Moderate Risk – management attention required</td><td colspan="2">Must be rectified within 28 days
Low Risk – managed by routine procedures</td></tr>
<tr></tr>
<tr><td>1 No Credit</td><td>2 Poor</td><td>3 Fair</td><td>4 Good</td><td colspan="2">5 Excellent</td></tr>
</table>

<table>
<tr><td colspan="5" rowspan="2">Inspection Team:</td><td colspan="2">Date:</td></tr>
<tr><td colspan="2">Time:</td></tr>
<tr><td rowspan="2">Item</td><td rowspan="2">Y/N</td><td rowspan="2">Rating</td><td rowspan="2">Priority</td><td rowspan="2">Observations</td><td colspan="2">Assigned Action</td></tr>
<tr><td>Person</td><td>Date</td></tr>
<tr><td>LCC</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is the area clean and free of litter?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Are spill kits available and being restocked regularly?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>VAB</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Are the roadways being maintained?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Are stormwater drains clean of residue?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is stormwater drainage in good condition?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is dust being managed?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is the water cart operating?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is noise being managed?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is equipment being maintained?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Is the area clean and free of litter?</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Is waste being segregated in correct bins?						
Are spill kits available and being restocked regularly?						
Are spills being cleaned?						
Are buildings being maintained?						
PAD						
Are the roadways being maintained?						
Are stormwater drains clean of residue?						
Is stormwater drainage in good condition?						
Is dust being managed?						
Is the water cart operating?						
Is noise being managed?						
Is equipment being maintained?						
Is the area clean and free of litter?						
Is waste being segregated in correct bins?						
Are spill kits available and being restocked regularly?						
Are spills being cleaned?						
Are buildings being maintained?						
Other Comments or Observations						

Appendix 7

Simpson Engineering Group

Document title:

Bowen Orbital Spaceport – Engine Test Facilities

Document Type:

Noise Assessment

Prepared for:

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Authorised and signed

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220410D03	4 Dec 2023	Final	Remove watermark and minor typographical changes

Contents

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1 Introduction

SEG Consulting Engineers has been retained by Gilmore Space to prepare a noise assessment associated with the engine test facilities at the Bowen Orbital Spaceport (BOS). The assessment:

- describes the intended use,
- presents the approved noise level limits,
- presents the results of noise modelling during typical and adverse meteorology,
- assessment of the noise exposure.

1.1 Project Description

The BOS is a facility to support small class orbital launch vehicles with access to multiple Low Earth Orbit trajectories. It is located within the Abbot Point State Development Area (SDA), which falls within the Whitsunday Regional Council (WRC) area, approximately 15km west of the Bowen township, refer to Figure 1.

The engine test facility is co-located with the launch site on Lot 10 Abbot Point Road which is accessed from the Bruce Highway via Abbot Point Road. The facility footprint will be approximately 3 ha within the 94 Hectare lot in a previously cleared new growth area.

The facility shares boundaries with two unoccupied cattle properties, an operational hard rock quarry and Abbot Point Road/rail corridor to the North Queensland Bulk Ports terminal.

The noise modelling receptors noted in this report are listed in Table 1. Modelling receptors R1 to R7 are sensitive receptors, R11 is a commercial receptor, while R9 and R10 are points of interest. Receptor R1 is the closest permanent residence to the site. The site is situated near the coast between Bowen and Abbot Point coal terminal. There is a large hill to the south reaching an elevation of 280m compared to nominally 10m for the subject site and surrounding areas. There is a wetlands area and several creeks between the site and the coastline to the north. The closest dwelling on Dry Creek Road is approximately 3km ESE of the test pad. There are a series of dwellings along Euri Creek between 3.7km and 4.8km adjacent to Euri Creek.

Table 1: Noise Modelling Receptors

Receptor	Description	Receptor	Description
R1	Dwelling	R6	Dwelling
R2	Dwelling	R7	Dwelling - Bowen
R3	Dwelling	R9	Site Boundary North
R4	Dwelling	R10	Beach North
R5	Dwelling - Bowen	R11	Quarry Office

Figure 1: Regional Map Showing Test Site, Bowen and Noise Modelling Receptors

2 Operations

The BOS test facility comprises infrastructure for testing of rocket engine. There are proposed to be two purpose-built engine test pads. The test pads comprise a central concrete slab surrounded by a gravel surface. The test pads will have block walls constructed adjacent to the primary engine test stand. The engine type and test pad are shown in Table 2.

Table 2: Engine Test Location

Engine Type	Test Pad
Catpac HRM	1
Small HRM	1
Big HRM	1
Small RCS	1
Big RCS	1
Small LRE	2
Big LRM	2

Typical maximum testing regimes are contained Table 3. These engine test plans define the maximum likely use of the site. All engine tests are carried out during the day, 7am to 6pm.

Table 3: Engine Test Plans

Test Day Options	Engine Tests
Option 1	1 Big HRM test for 120 sec
Option 2a	3 Catpack HRM tests for 30 sec each + 1 Small LRE test for 240 sec
Option 2b	3 Catpack HRM tests for 30 sec each + 2 Big RCS tests for 60 sec each
Option 3a	2 Small HRM tests for 120 sec each + 1 Small LRE test for 240 sec
Option 3b	2 Small HRM tests for 120 sec each + 2 Big RCS tests for 60 sec each
Option 4a	4 Big RCS tests for 60 sec each + 1 Small LRE test for 240 sec
Option 4b	4 Big RCS tests for 60 sec each + 2 Big LRE tests for 5 sec each

3 Noise Limits

The proposed engine test facility is to be designed to comply with the site license conditions. These are described in Table 4.

Table 4: Noise Level Limits

Noise Index	Noise Level Limit in dB(A) at Places	
	Sensitive Place	Commercial Place
L_{Amax}	96	115
SEL	110	115
Day Night Average Sound Level (DNL)	70	80

The L_{Amax} is appropriate for community noise assessment of a distinct events, such as a rocket tests. This metric represents the highest A-weighted integrated sound level for the event in which the sound level changes value with time. The $_{LAmax}$ metric indicates the maximum sound level occurring for a fraction of a second. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities. Loud individual events can pose a hearing damage hazard to people, and can also cause adverse reactions by animals. Adverse animal reactions can include flight, nest abandonment, and interference with reproductive activities.

The SEL is a composite metric that represents both the intensity of a sound and its duration. Individual time varying noise events (e.g., aircraft overflights) have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. SEL provides a measure of the net impact of the entire acoustic event, but it does not directly represent the sound level heard at any given time. For example, during an aircraft flyover, SEL would include both the maximum noise level and the lower noise levels produced during onset and recess periods of the overflight. SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of a constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For a rocket test, the SEL is expected to be greater than L_{Amax}.

The DNL is the day-night average sound level (DNL) noise metric is used to reflect a person's cumulative exposure to sound over a 24-hour period, expressed as the noise level for the average day of the year. The DNL is the time-average sound level, in decibels, over a 24 hour period (from midnight to midnight), obtained after the addition of 10 decibels to sound levels in the night (from midnight to 7.00am and from 10.00pm to midnight).

4 Predicted Environmental Noise Levels

Rocket test engines generate significant noise from the combustion process and turbulent mixing of the exhaust flow with the surrounding air. There is a supersonic potential core of exhaust flow, surrounded by mixing region. Noise is generated in this flow. It is directional, with the highest noise levels at an angle of 40 to 50 degrees from the direction of the exhaust flow.

The emitted noise is modified in several ways as it propagates outward from the test engine. These effects include source directivity, geometric spreading, atmospheric absorption and ground interference to a receiver location.

$$Lp = Lw - (20 \log_{10}[r] + 10 \log_{10}[4\pi]) + AE$$

Where:

Lp is the sound pressure level at an observer

Lw is the sound power level of the source

$20 \log_{10}(r) + 10 \log_{10}(4\pi)$ is the distance attenuation (spherical)

AE is the excess attenuation factors.

The excess attenuation factors AE comprise:

$$AE = Aa + Ag + Am + Ab + Af$$

Where:

Aa = Excess attenuation due to air absorption

Ag = Excess attenuation due to ground reflection

Am = Excess attenuation due to meteorological effects

Ab = Excess attenuation due to barriers

Af = Excess attenuation due to forests

and rocket specific factors comprising

Adir = Excess attenuation due to source directivity azimuthal symmetry assumed

A digital terrain noise model of the site and surroundings has been developed using PEN3D V2.7.1.275 software. The PEN3D General Prediction Model (GPM) is based on the method contained in a book by Bies and Hansen (1988, pages 117, 127).

4.1 Engine Test Pads

There are two test pads, described as Test Pad 1 and Test Pad 2. Test engines are fired horizontally.

Test Pad 1 is located at Latitude: 19°57'24.57" S and Longitude: 148° 6'54.96" E, refer to Figure 2. The container wall comprises 2 rows of 40ft containers. The sandbag wall is 3m high and 20m long.

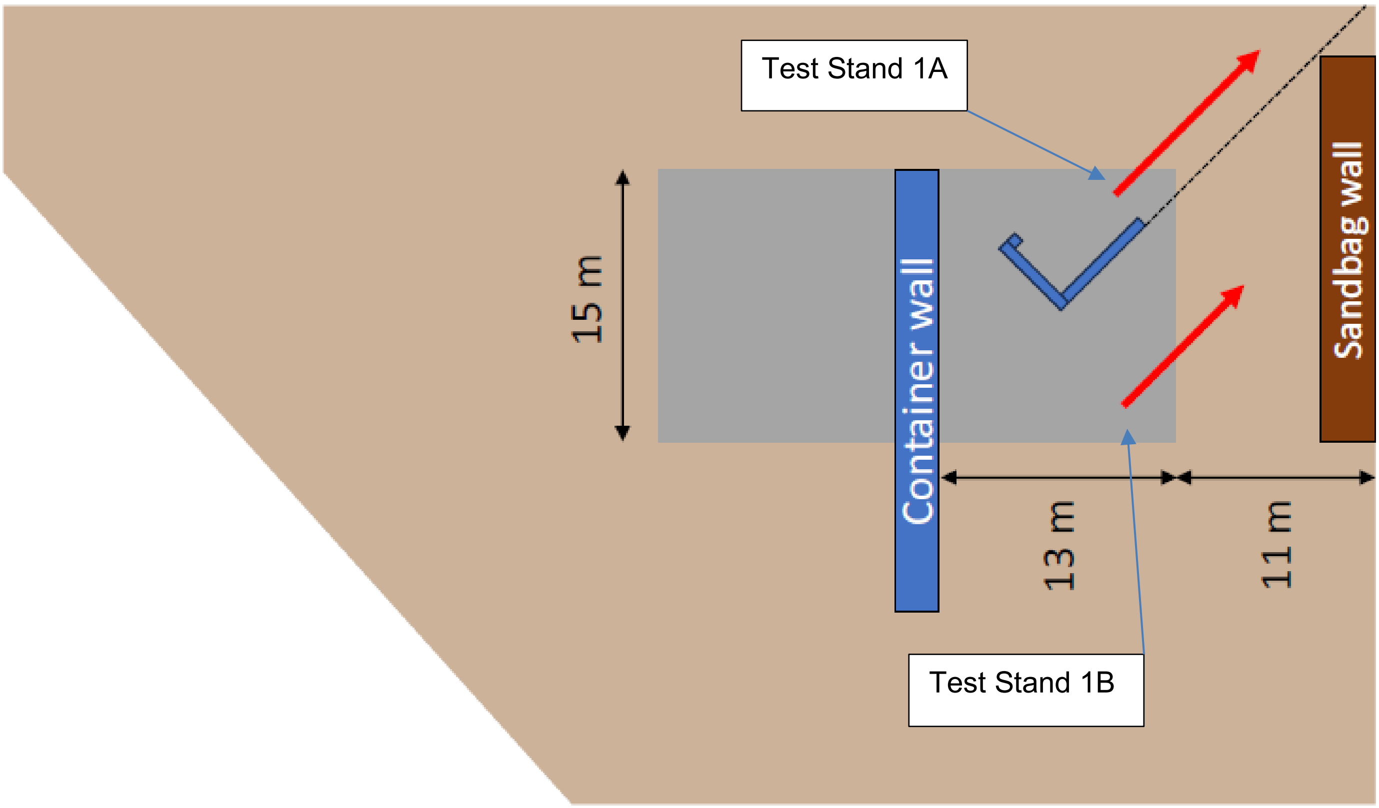


Figure 2: Test Pad 1 Showing Engine Stands, Container wall and 20m long Sandbag wall.

Test stand 1A is for firing engine types Catpack HRM and Big HRM while Test stand 1B is for firing engine types Small HRM, Small RCS and Big RCS. The firing direction is 25°, i.e. to the NNE.

The link block walls around Test stand 1A are shown in Figure 3.

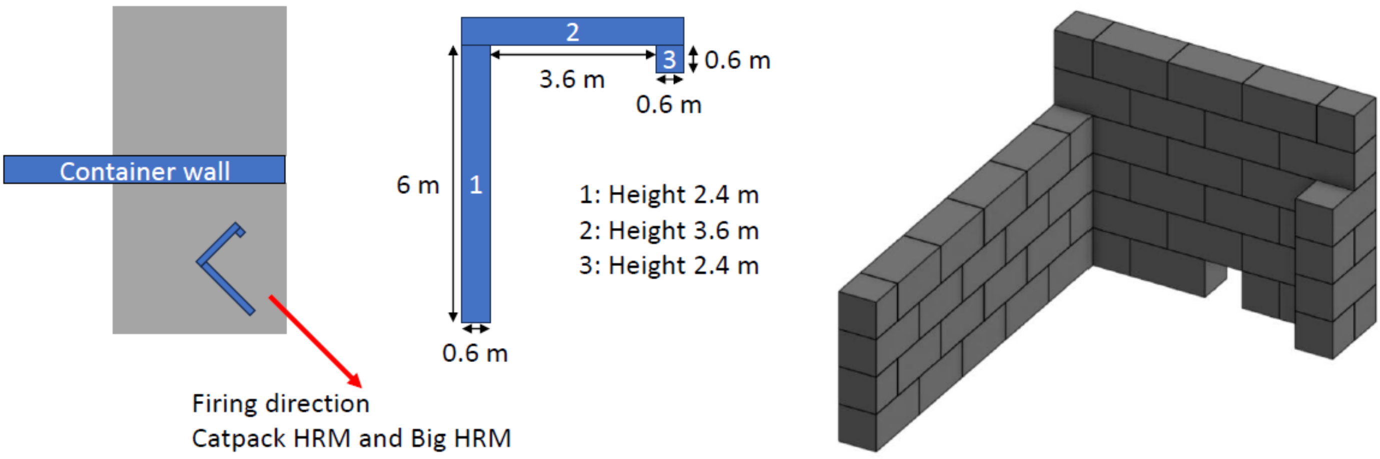


Figure 3: Link Block Walls Test Stand 1A

Test Pad 2 situated at Latitude: 19°57'25.23" S Longitude: 148° 6'45.70" E and is shown in Figure 4. The Link block walls are shown in Figure 5. Test Pad 2 will be for testing engine types Small LRE and Big LRE. The firing direction is 17°, i.e to the NNE.

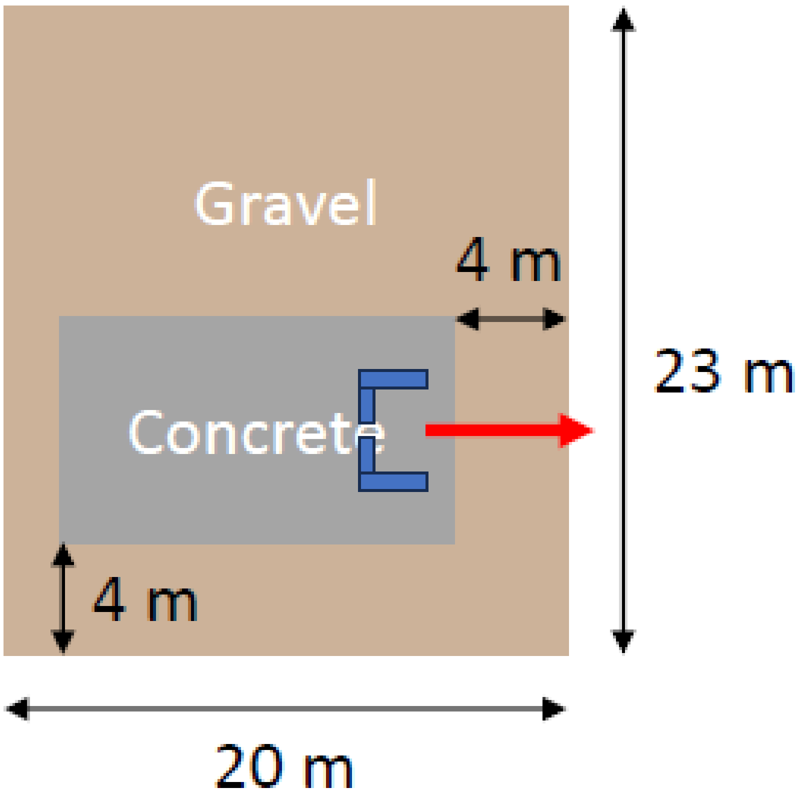


Figure 4: Test Pad 2 Showing Test Stand and Link Block Walls

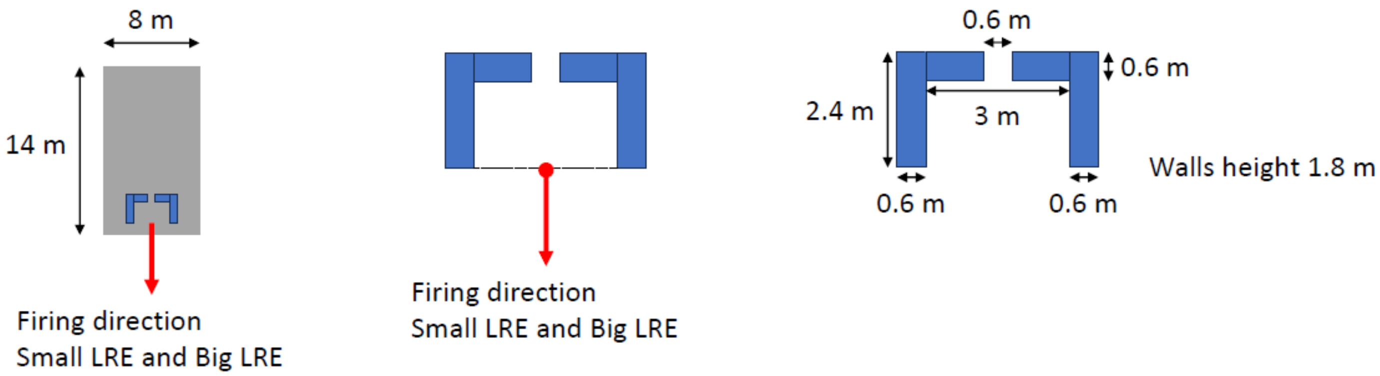


Figure 5: Test Pad 2 Link Block Walls Description

4.2 Meteorology

The noise modelling has considered 4 meteorological cases, refer to Table 5. Engine testing is only to take place during the day period. Thus, the most common cases during this would be a sunny day with or without wind. While the most adverse case (i.e., leading to the highest environmental noise levels) would be neutral conditions, with or without winds.

Table 5: Meteorological Modelling Cases

Modelling case	Lapse Rate	Temperature	Wind	Comment
Day with wind	-3°/100m	30°C	3m/s from SE	Typical sunny day with light wind
Day no wind	-3°/100m	30°C	No wind	Typical sunny day without wind
Neutral	0°/100m	20°C	No wind	Cloudy or early morning prior to significant solar heating
Neutral with wind	0°/100m	20°C	1m/s from SE	Cloudy or early morning prior to significant solar heating with wind

4.3 Calculated Noise Levels

The calculated noise levels (L_{Amax} and DNL) for each engine type, daily use options and meteorological condition are contained in Table 6 to Table 13. Appendix A contains the calculated noise contours for selected engines and selected day use options. Specifically, the noisiest engines and day use options are presented for each meteorological condition.

Table 6: Calculated L_{Amax} for Day with Wind Meteorology

Receptors	L_{Amax} in dB(A)						
	Catpack HRM	Big HRM	Small HRM	Small RCS	Big RCS	Small LRE	Big LRE
R1	27	40	23	11	23	24	35
R2	26	39	21	9	22	21	31
R3	22	35	18	6	19	18	28
R4	18	31	14	2	15	15	25
R5	38	51	43	30	44	44	56
R6	13	26	7	-6	8	8	19
R7	30	43	4	-10	5	29	40
R9	108	121	94	85	94	109	117
R10	93	106	96	87	96	96	104
R11	75	88	65	55	65	83	91

Table 7: Calculated DNL for Day with Wind Meteorology

Receptors	SEL in dB(A)						
	Option 1	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	Option 4 (a)	Option 4 (b)
R1	11	1	<thh	1	<thh	1	0
R2	10	<thh	<thh	<thh	<thh	<thh	<thh
R3	7	<thh	<thh	<thh	<thh	<thh	<thh
R4	3	<thh	<thh	<thh	<thh	<thh	<thh
R5	22	19	17	21	20	22	21
R6	<thh	<thh	<thh	<thh	<thh	<thh	<thh
R7	14	5	0	3	<thh	3	1
R9	92	85	78	84	70	84	78
R10	78	71	69	73	72	73	71
R11	59	58	46	57	41	57	52

Table 8: Calculated L_{Amax} for Day Meteorology

Receptors	L_{Amax} in dB(A)						
	Catpack HRM	Big HRM	Small HRM	Small RCS	Big RCS	Small LRE	Big LRE
R1	38	51	35	23	35	33	44
R2	32	45	29	17	29	28	39
R3	29	42	25	13	26	24	35
R4	23	36	20	8	21	20	30
R5	40	53	46	33	47	47	58
R6	20	33	14	1	15	15	25
R7	34	47	10	-3	12	33	44
R9	99	112	85	75	85	105	113
R10	74	87	74	64	74	74	83
R11	64	77	58	48	58	71	80

Table 9: Calculated DNL for Day Meteorology

Receptors	SEL in dB(A)						
	Option 1	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	Option 4 (a)	Option 4 (b)
R1	23	11	11	11	11	12	11
R2	17	6	5	6	5	6	5
R3	13	2	1	2	2	3	2
R4	8	<thh	<thh	<thh	<thh	<thh	<thh
R5	25	22	19	24	22	25	23
R6	4	<thh	<thh	<thh	<thh	<thh	<thh
R7	18	9	4	7	<thh	7	5
R9	83	80	69	80	61	80	74
R10	58	50	48	51	50	51	50
R11	49	46	36	46	34	46	41

Table 10: Calculated L_{Amax} for Neutral Meteorology

Receptors	L_{Amax} in dB(A)						
	Catpack HRM	Big HRM	Small HRM	Small RCS	Big RCS	Small LRE	Big LRE
R1	49	62	46	35	47	41	51
R2	39	52	36	24	36	35	45
R3	35	48	32	21	33	30	41
R4	28	41	25	14	26	23	33
R5	45	58	45	33	47	47	58
R6	32	45	26	14	27	25	36
R7	39	52	35	22	37	37	48
R9	100	113	86	77	86	107	114
R10	82	95	84	75	83	84	92
R11	70	83	61	51	61	74	83

Table 11: Calculated DNL for Neutral Meteorology

Receptors	SEL in dB(A)						
	Option 1	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	Option 4 (a)	Option 4 (b)
R1	33	20	21	22	22	22	21
R2	23	12	11	13	12	13	12
R3	20	8	8	9	9	9	8
R4	13	1	1	2	2	2	1
R5	29	22	20	24	22	24	23
R6	16	4	4	3	3	4	3
R7	23	13	11	14	12	14	13
R9	85	81	71	81	63	81	75
R10	66	59	57	61	60	61	59
R11	55	49	41	49	37	49	44

Table 12: Calculated L_{Amax} for Neutral With Wind Meteorology

Receptors	L_{Amax} in dB(A)						
	Catpack HRM	Big HRM	Small HRM	Small RCS	Big RCS	Small LRE	Big LRE
R1	36	49	32	21	33	32	43
R2	32	45	28	16	29	27	37
R3	28	41	24	12	25	23	34
R4	22	35	18	7	19	17	28
R5	39	52	44	31	46	46	57
R6	24	37	18	6	19	18	29
R7	30	43	6	<thh	8	30	41
R9	104	117	91	81	90	108	115
R10	91	104	95	86	94	94	102
R11	78	91	64	54	64	84	93

Table 13: Calculated DNL for Neutral with Wind Meteorology

Receptors	SEL in dB(A)						
	Option 1	Option 2(a)	Option 2(b)	Option 3(a)	Option 3(b)	Option 4 (a)	Option 4 (b)
R1	20	9	8	10	8	10	9
R2	16	5	4	5	4	5	4
R3	12	1	0	1	0	1	0
R4	7	<thh	<thh	<thh	<thh	<thh	<thh
R5	23	21	18	23	21	23	22
R6	8	<thh	<thh	<thh	<thh	<thh	<thh
R7	14	5	0	4	-17	4	2
R9	88	83	74	82	67	82	76
R10	76	69	67	72	71	72	70
R11	62	59	48	59	40	59	53

4.4 Noise Assessment

The noise modelling indicates that the noise level limits (L_{Amax} and DNL) at all sensitive receptors are likely to be readily met. Similarly, the noise levels at commercial receptors readily comply with the noise limits. Examples of typical noise sources and sound pressure levels are contained in Figure 6.

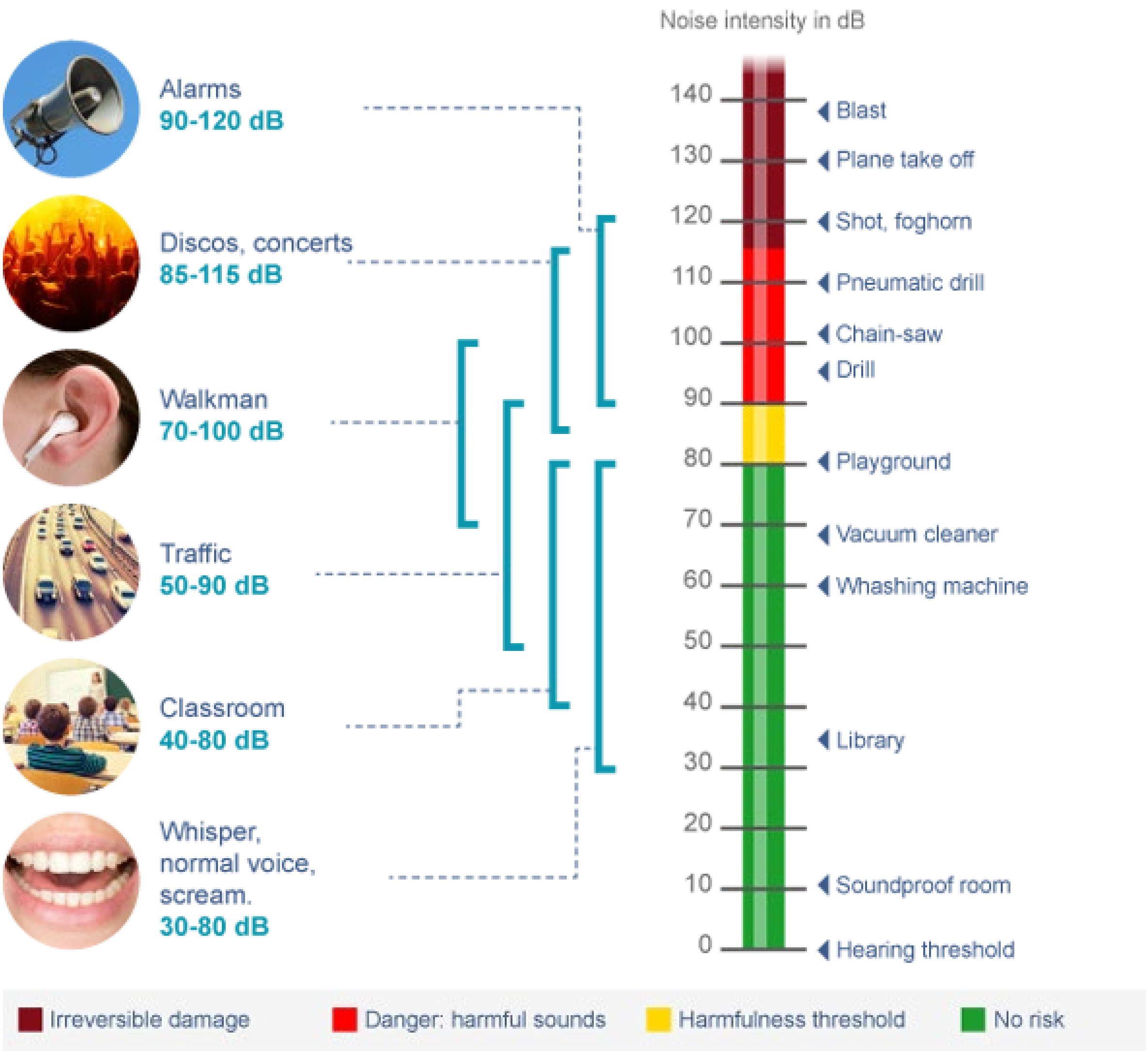


Figure 6: Examples of Noise Sources and Sound Pressure Levels(Source Cochlea.org)

Sensitive Receptors

The highest noise level is likely to be an L_{Amax} of 62 dB(A) at R1 during neutral meteorology for the Big HRM. This engine is usually tested over 120 seconds. Assuming a constant sound output over 120 seconds, the SEL would be 21 dB(A) higher, i.e. an SEL of 83 dB(A), readily complying with the residential SEL limit of 110 dB(A). The highest L_{Amax} noise levels of 62 dB(A) would be similar in intensity to a quiet traffic or a washing machine.

Commercial Receptors

The highest noise level is likely to be an L_{Amax} of 91 dB(A) at R11 during neutral with wind meteorology for the Big HRM. This engine is usually tested over 120 seconds. Assuming a constant sound output over 120 seconds, the SEL would be 21 dB(A) higher, i.e. an SEL of 103 dB(A), readily complying with the commercial premises SEL limit of 115 dB(A).

The highest L_{Amax} noise levels of 91 dB(A) would be similar in intensity to noisy traffic or a hand drill.

The occupational noise level goal to prevent hearing loss is an $L_{Aeq(\text{ 8 hour})}$ of 85 dB(A) and an L_{CPeak} of 140 dB(A). The noise levels from rocket testing is likely to readily comply with occupational noise level goals at commercial premises.

5 Conclusion

The proposed engine test facility at the BOS comprises two engine test pads and has been designed to test various types of engines.

Gilmore Space provided the likely maximum use of the site and proposed seven alternative engine test options with up to 6 engine test firings in a single day. All of these engines and engine combinations have been modelled, assessed and compared with the site environmental site license. It was found the site readily complies with the site license conditions.

Appendix A – Noise Contours from Test Engines

Gilmour Space

Noise Modelling Test Pods

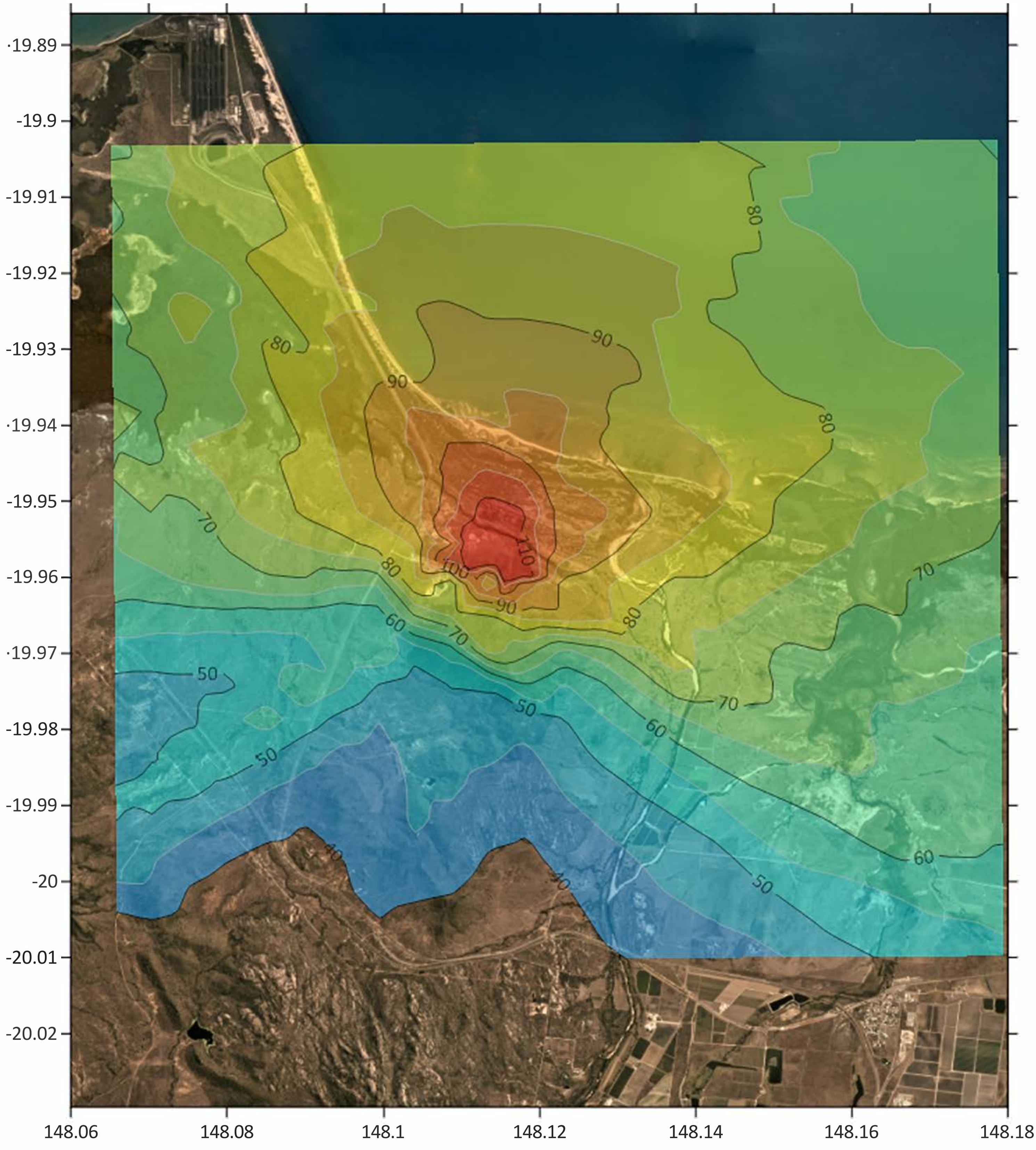
Big HRM - LAmax (dB(A))

Test Pad I

Firing Angle 25degrees

Neutral Meteorology

Barrier {3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

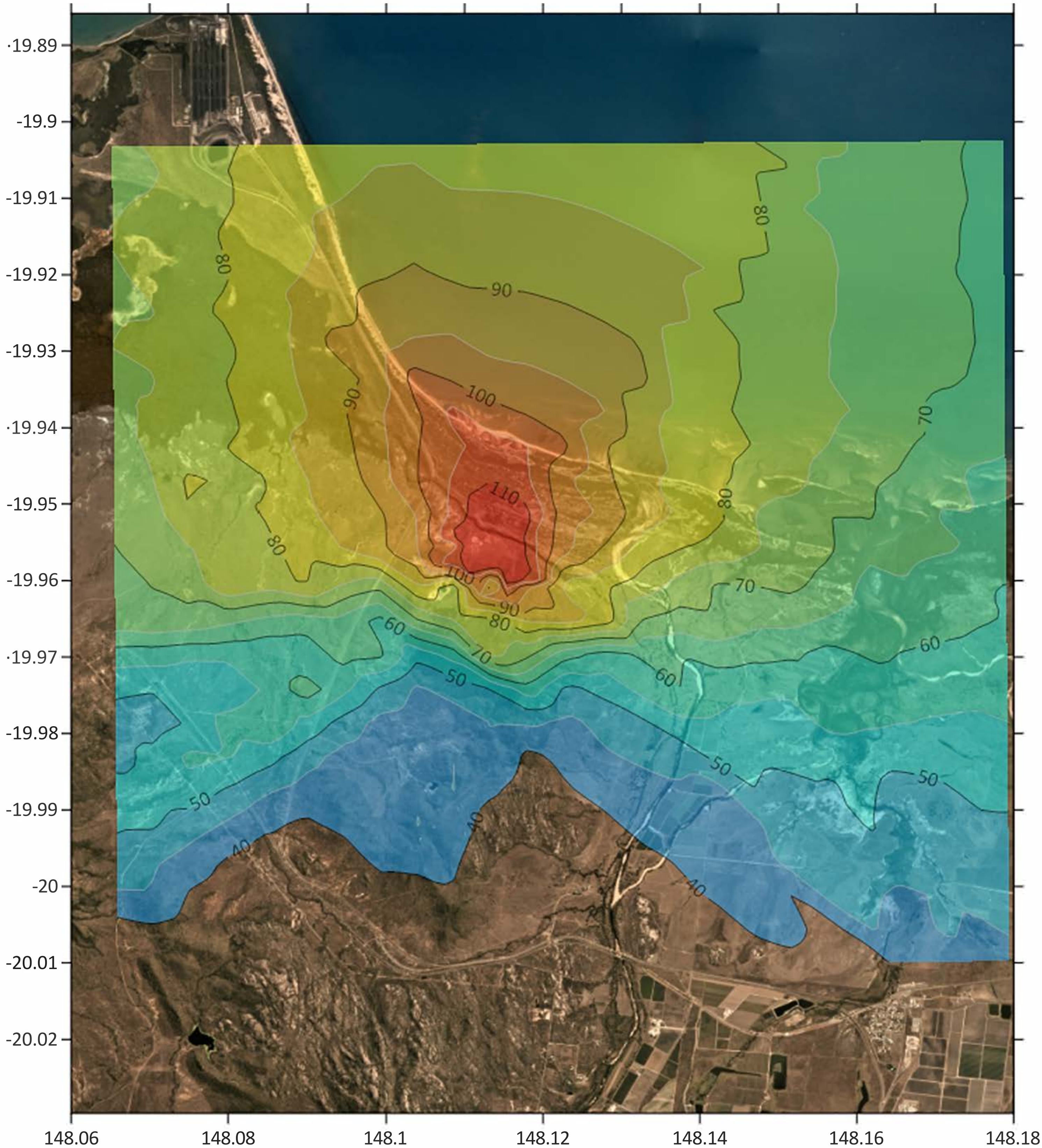
Big HRM - LAmax (dB(A))

Test Pad l

Firing Angle 25degrees

Neutral With Wind Meteorology

Barrier (3m high 20m long)



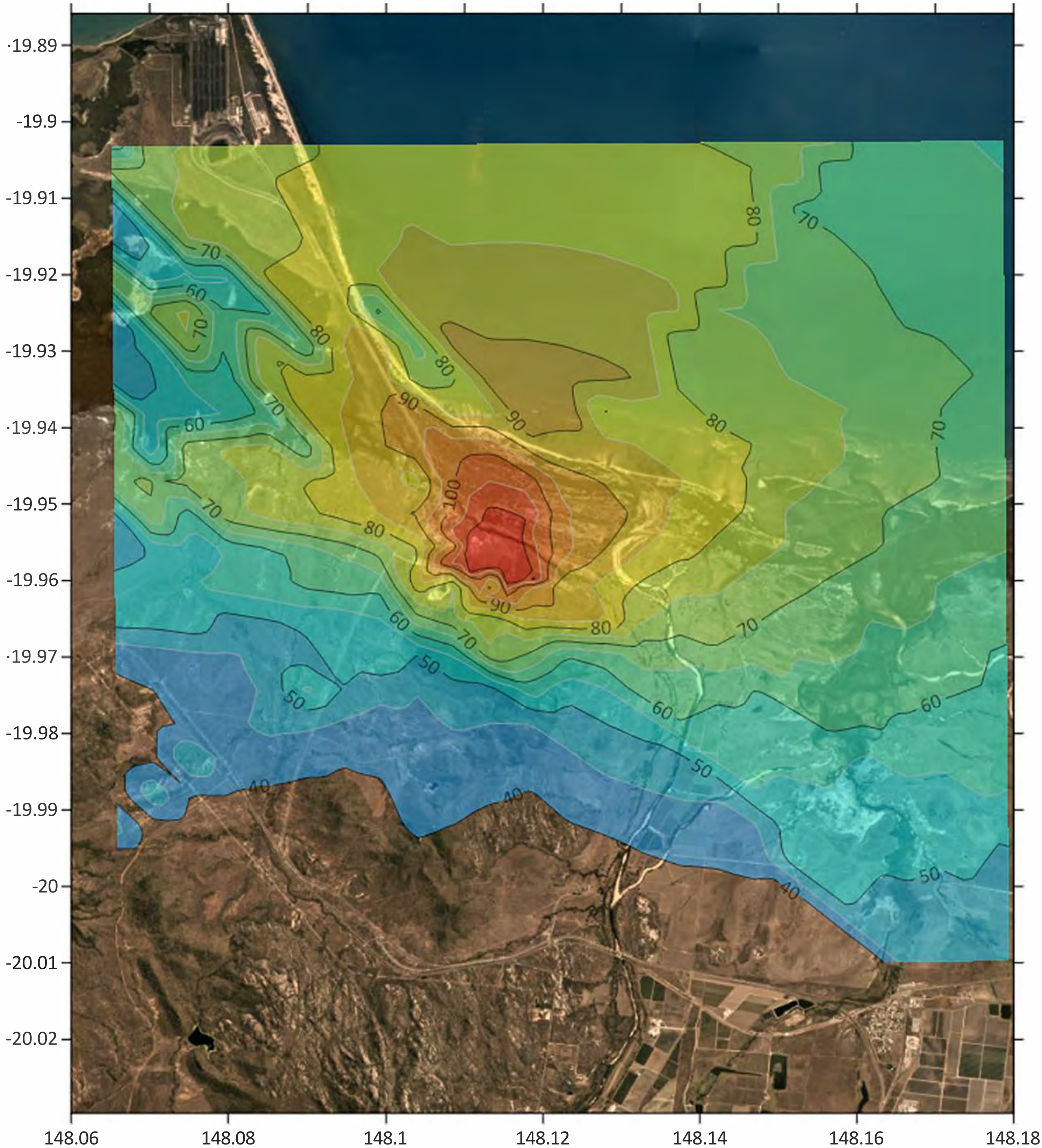
Gilmour Space

Noise Modelling Test Pods

Big HRM - LAmax (dB(A))

Test Pad I
Firing Angle 25degrees

Day Meteorology
Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

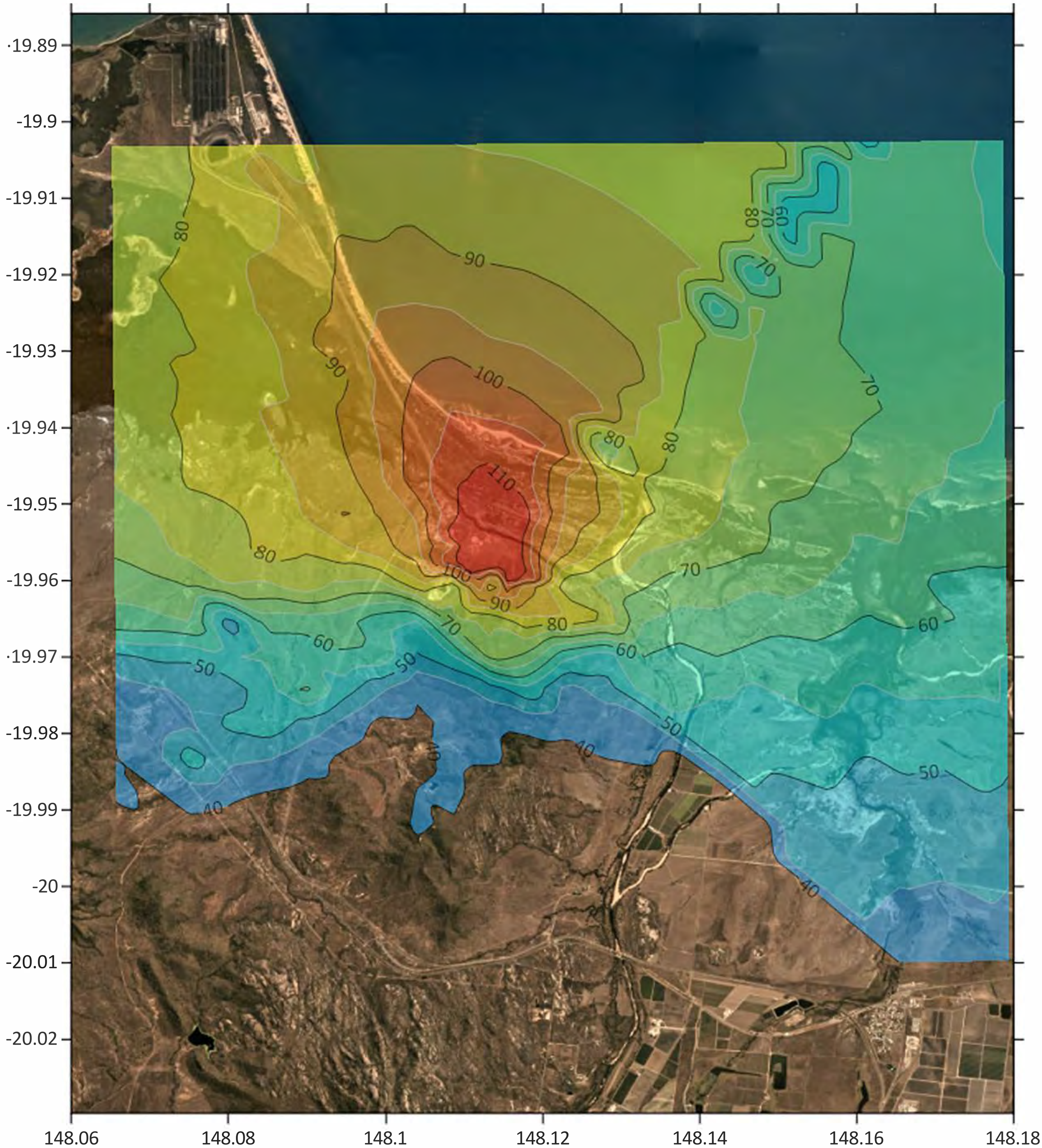
Big HRM - LAmax (dB(A))

Test Pad l

Firing Angle 25degrees

Day with Wind Meteorology

Barrier (3m high 20m long)



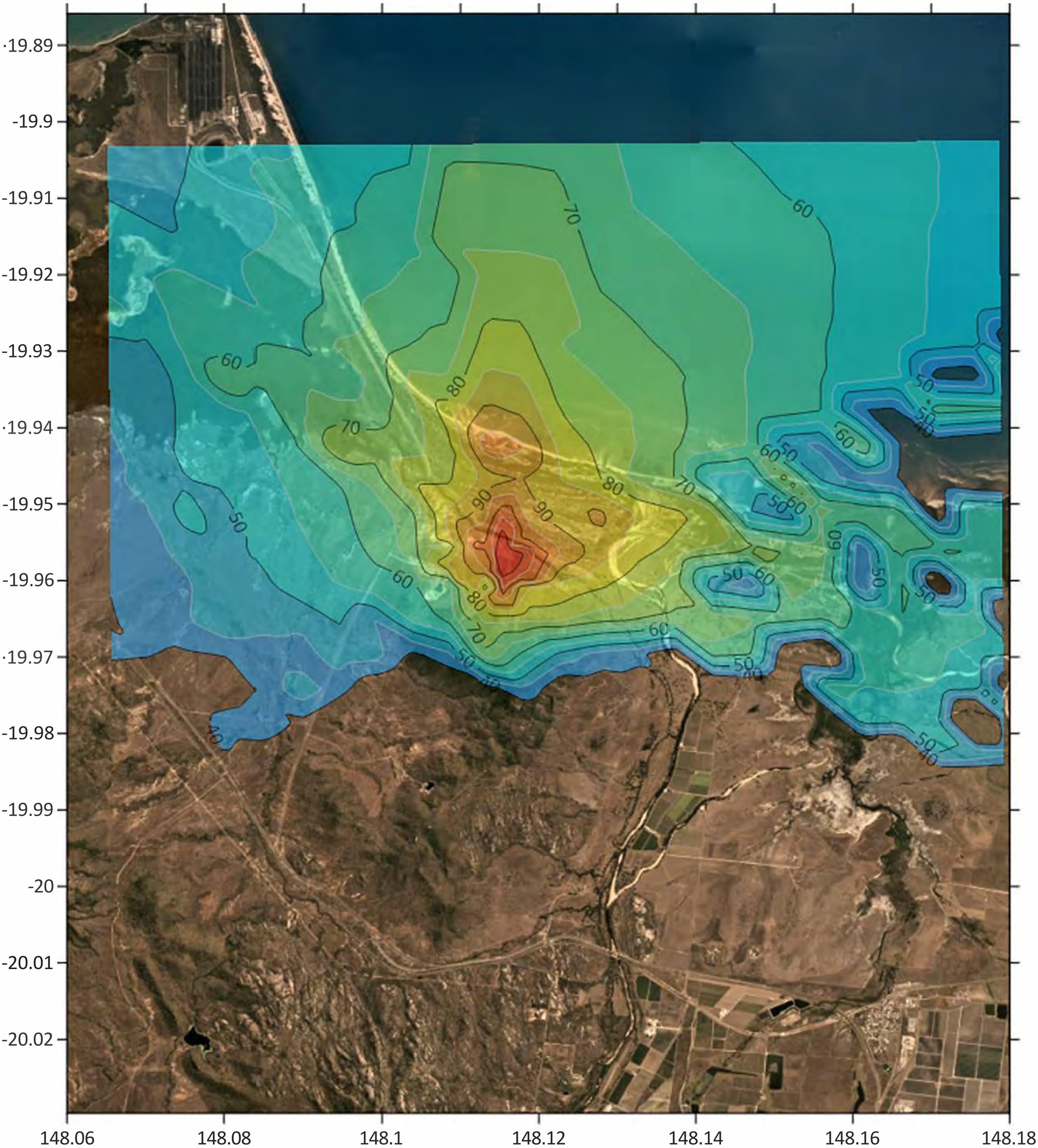
Gilmour Space

Noise Modelling Test Pods

Small HRM - LAmax (dB(A))

Test Pad 1a
Firing Angle 25degrees

Neutral With Wind Meteorology
Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

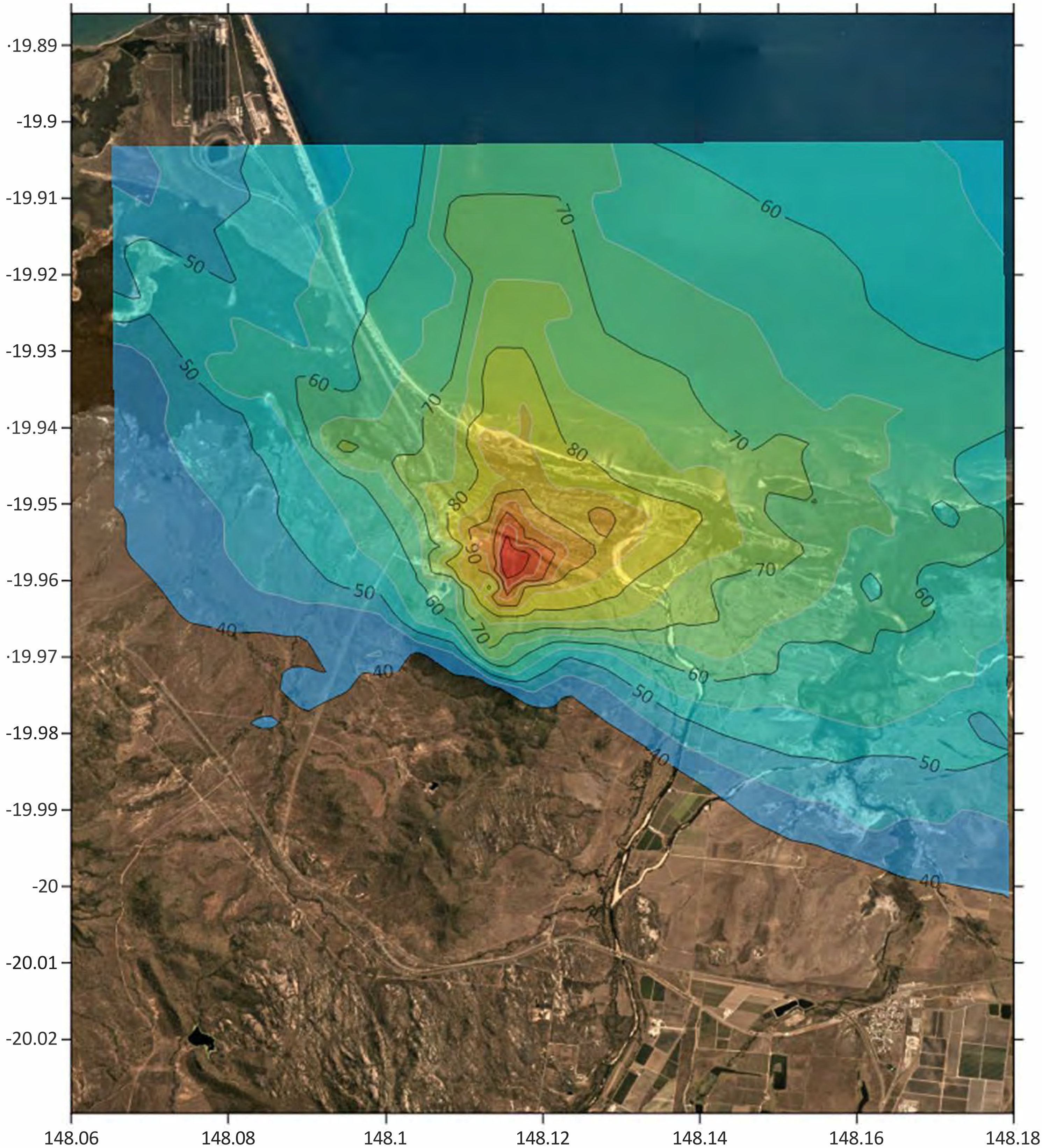
Small HRM - LAmax (dB(A))

Test Pad 1a

Firing Angle 25degrees

Neutral Meteorology

Barrier {3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

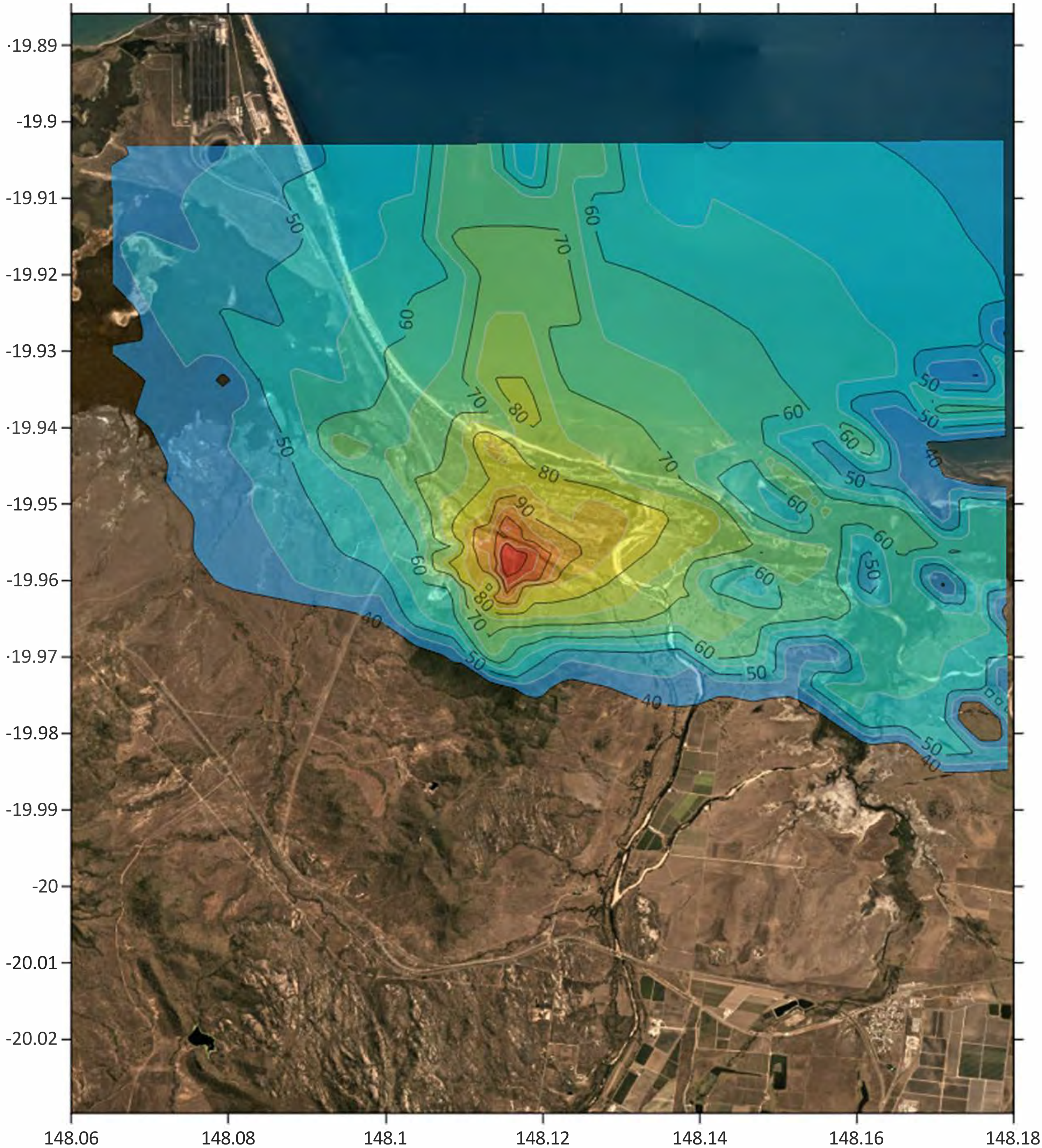
Small HRM - LAmax (dB(A))

Test Pad 1a

Firing Angle 25degrees

Day Meteorology

Barrier (3m high 20m long)



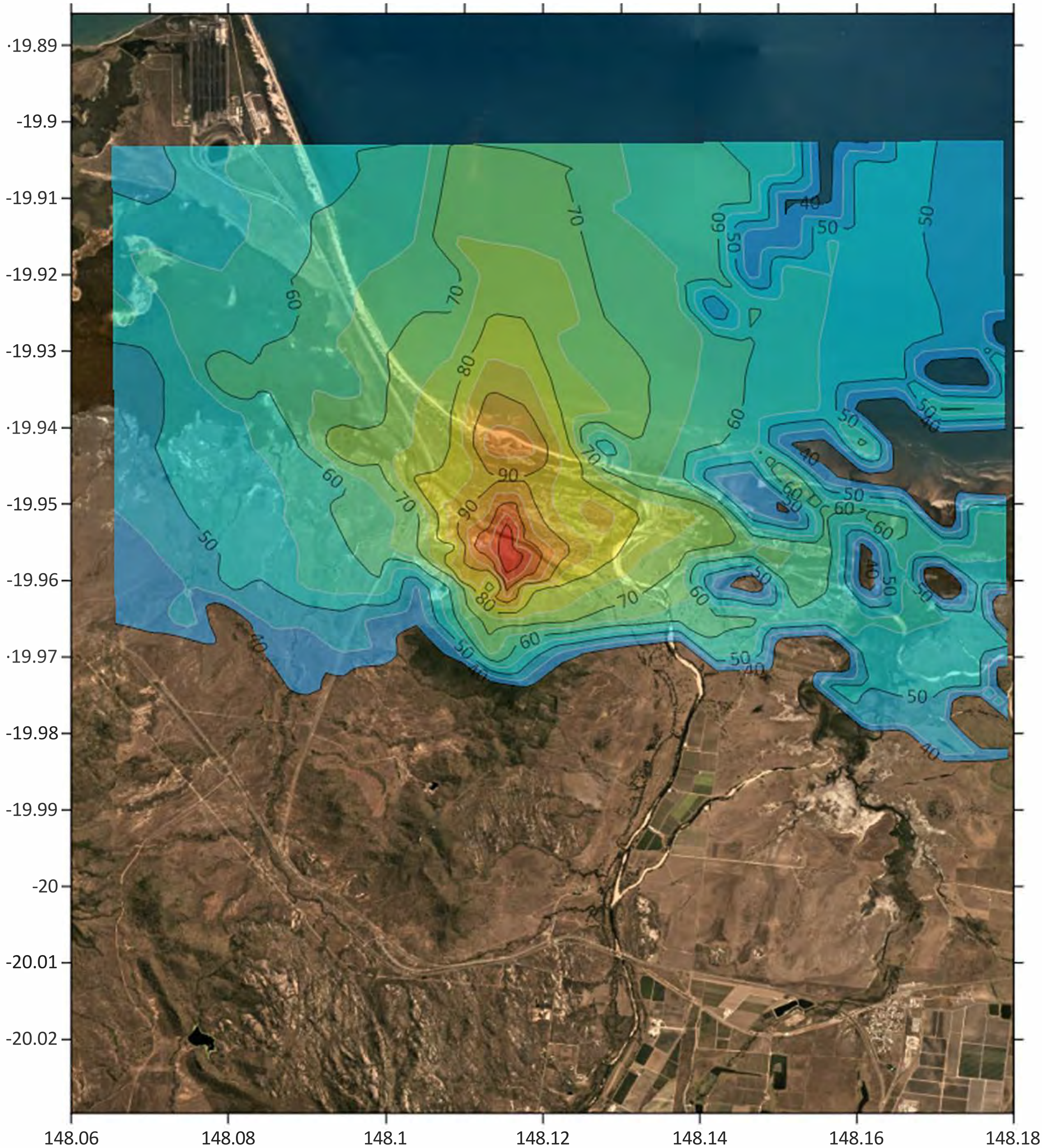
Gilmour Space

Noise Modelling Test Pods

Small HRM - LAmax (dB(A))

Test Pad 1a
Firing Angle 25degrees

Day with Wind Meteorology
Barrier (3m high 20m long)



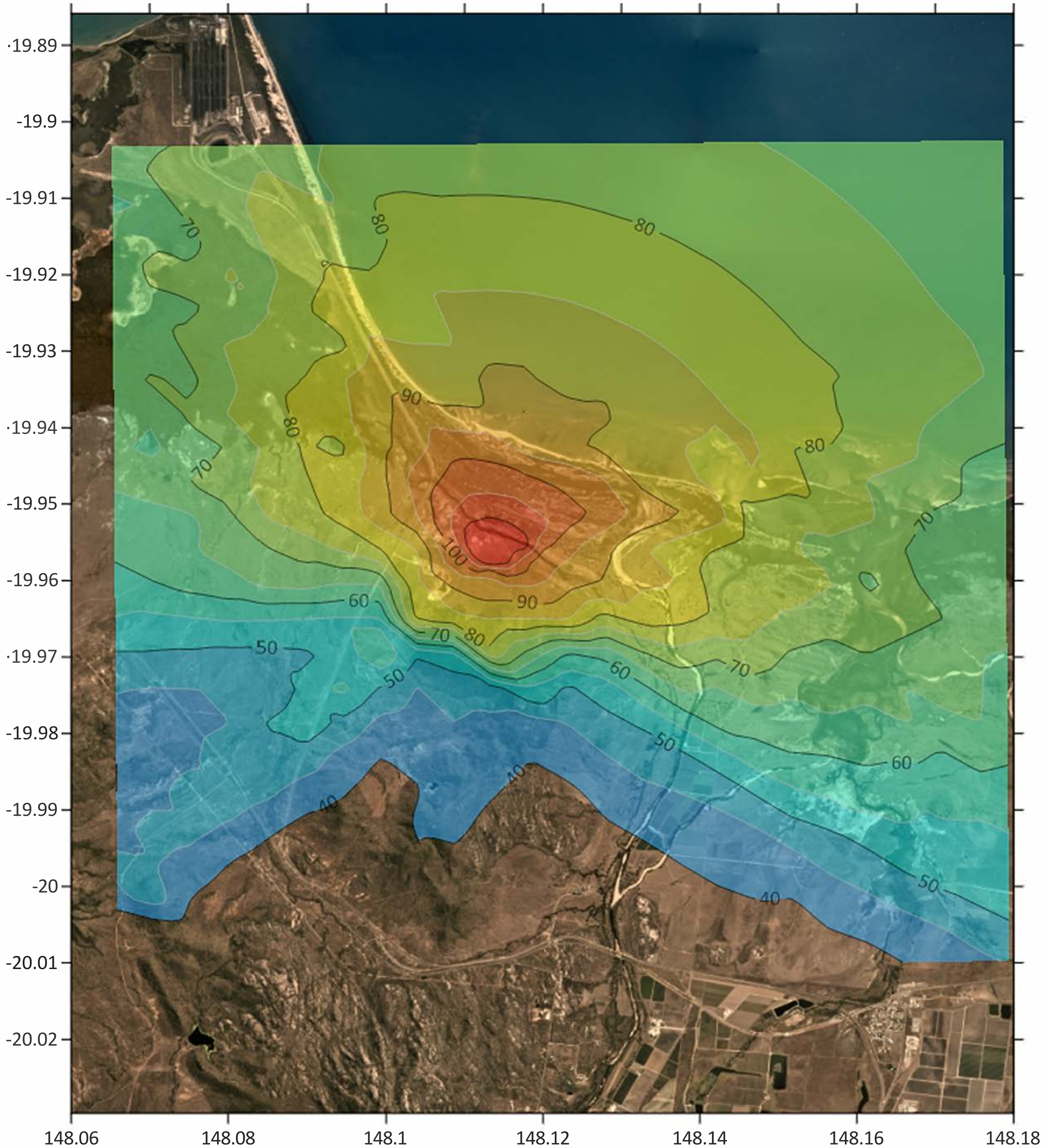
Gilmour Space

Noise Modelling Test Pods

Big LRE - LAmax (dB(A))

Test Pad 2
Firing Angle 17degrees

Neutral Meteorology
Barrier {3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

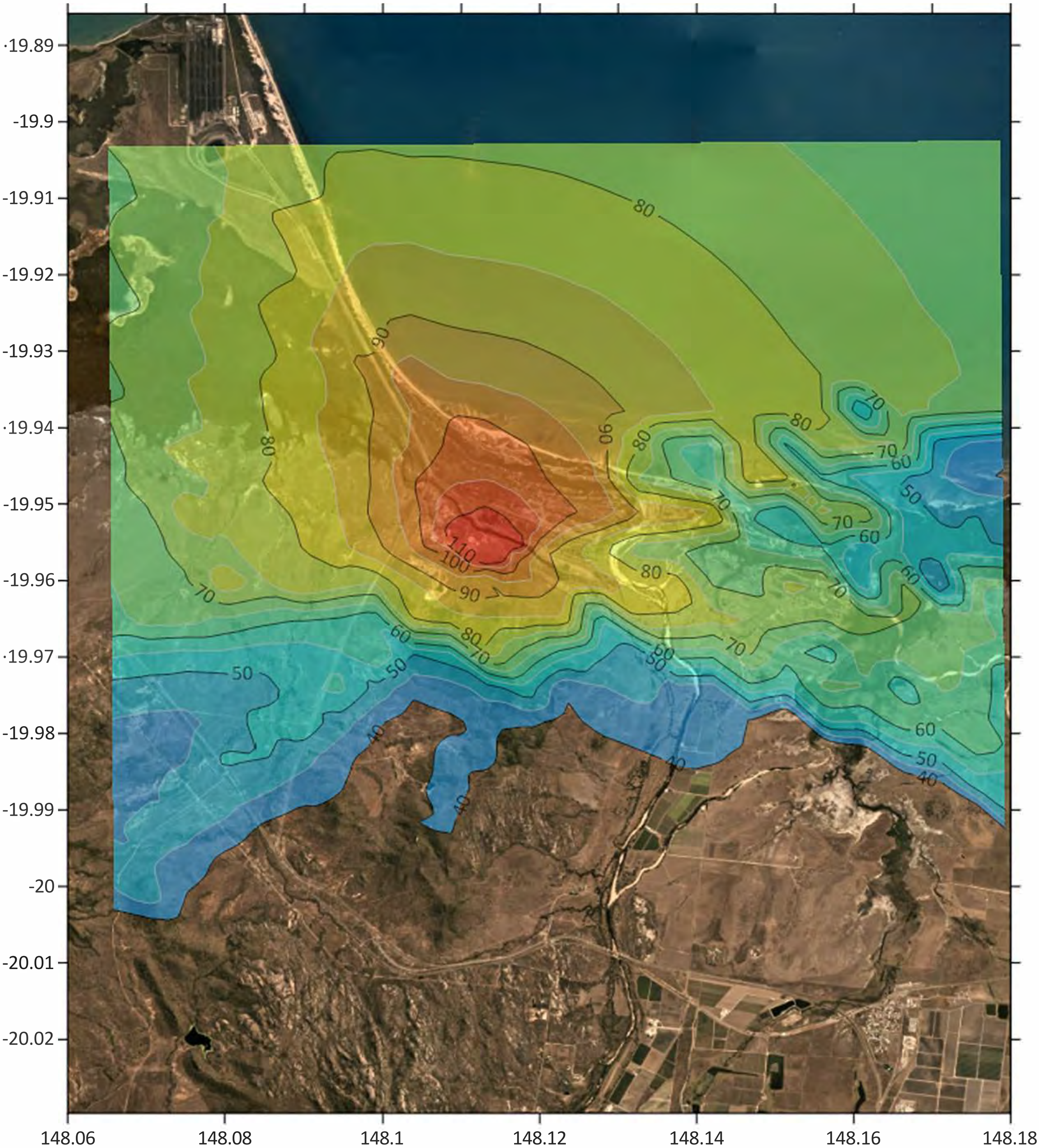
Big LRE - LAmax (dB(A))

Test Pad 2

Firing Angle 17degrees

Neutral With Wind Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

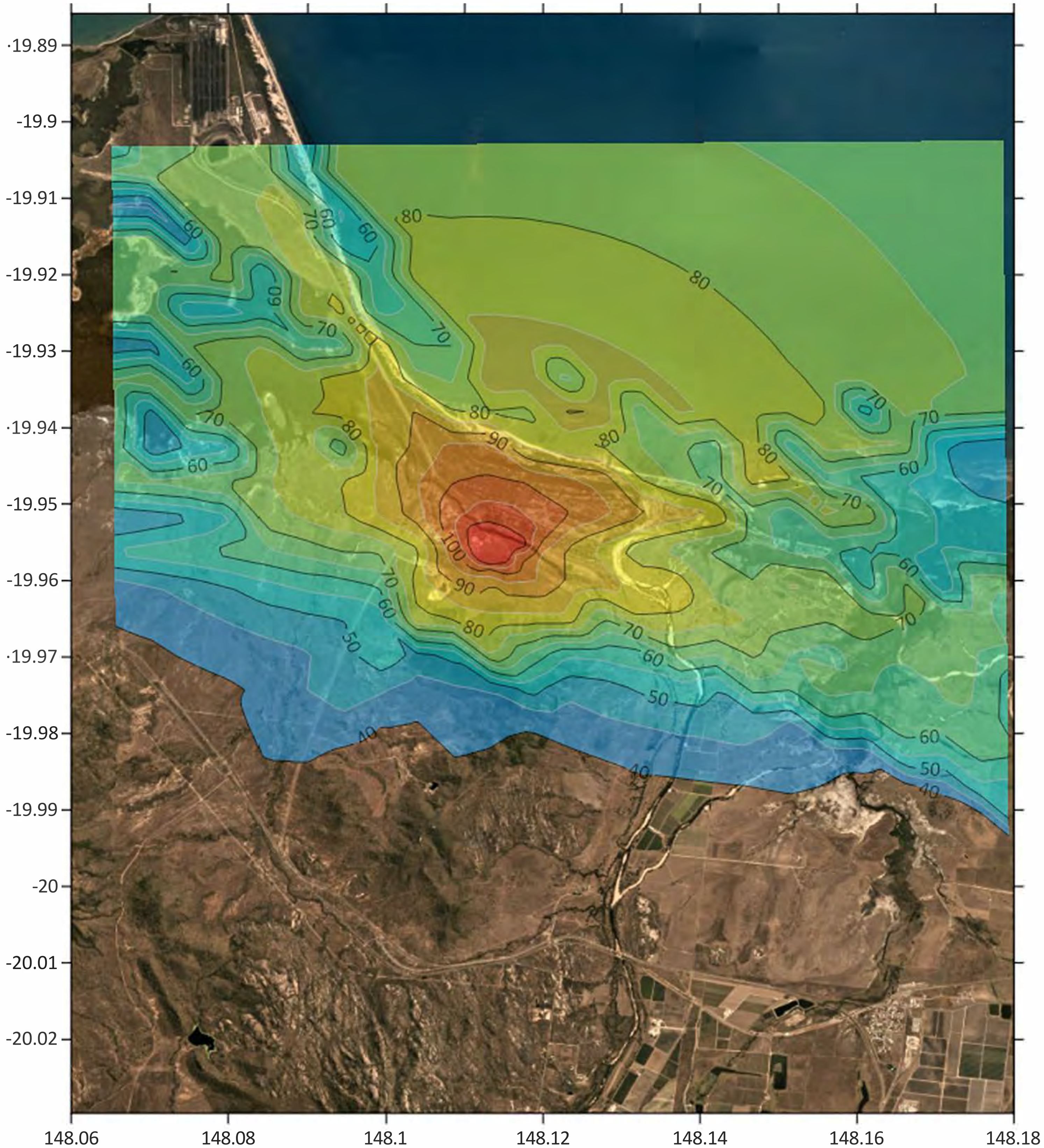
Big LRE - LAmax (dB(A))

Test Pad 2

Firing Angle 17degrees

Day Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

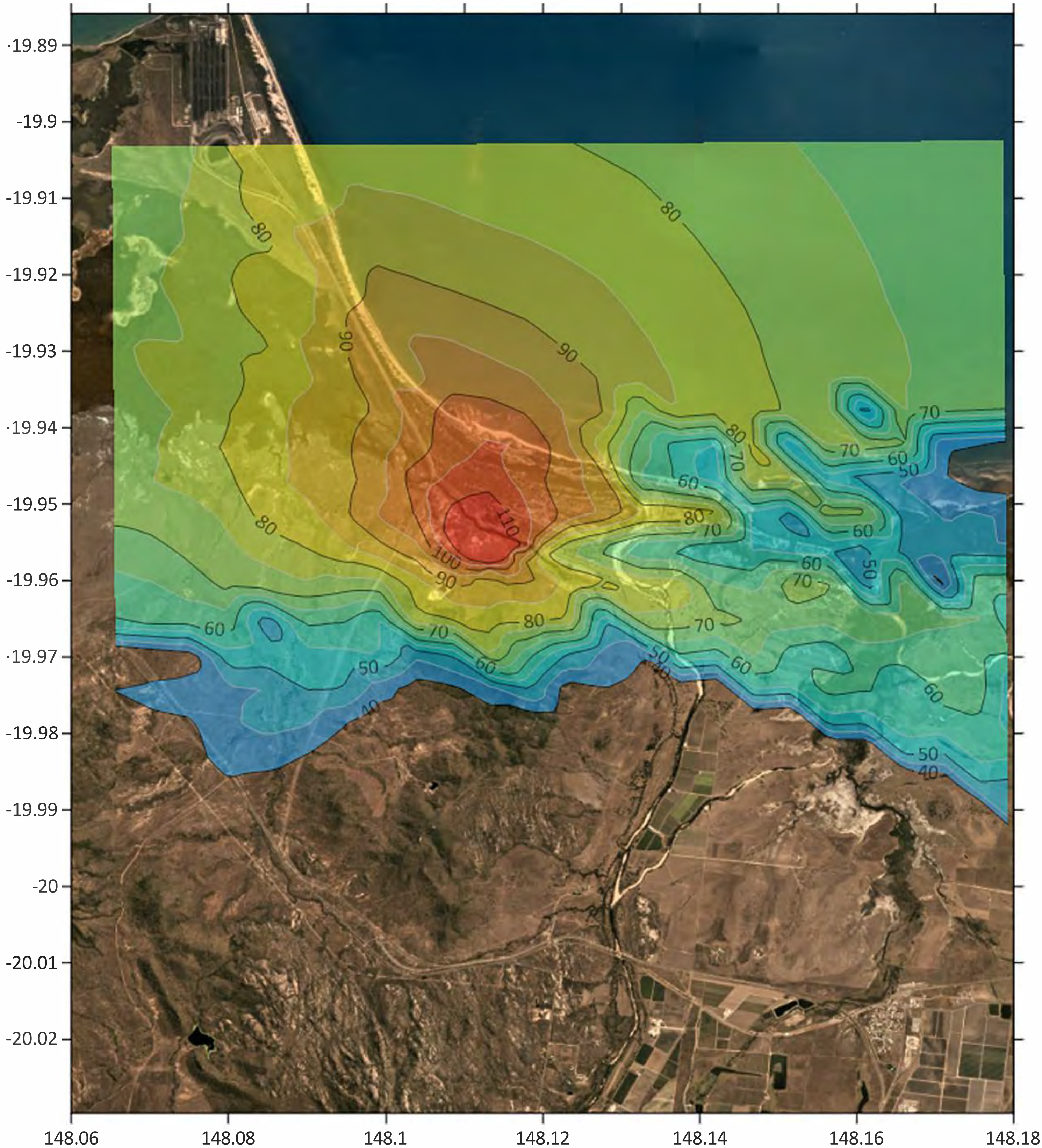
Big LRE - LAmax (dB(A))

Test Pad 2

Firing Angle 17degrees

Day with Wind Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

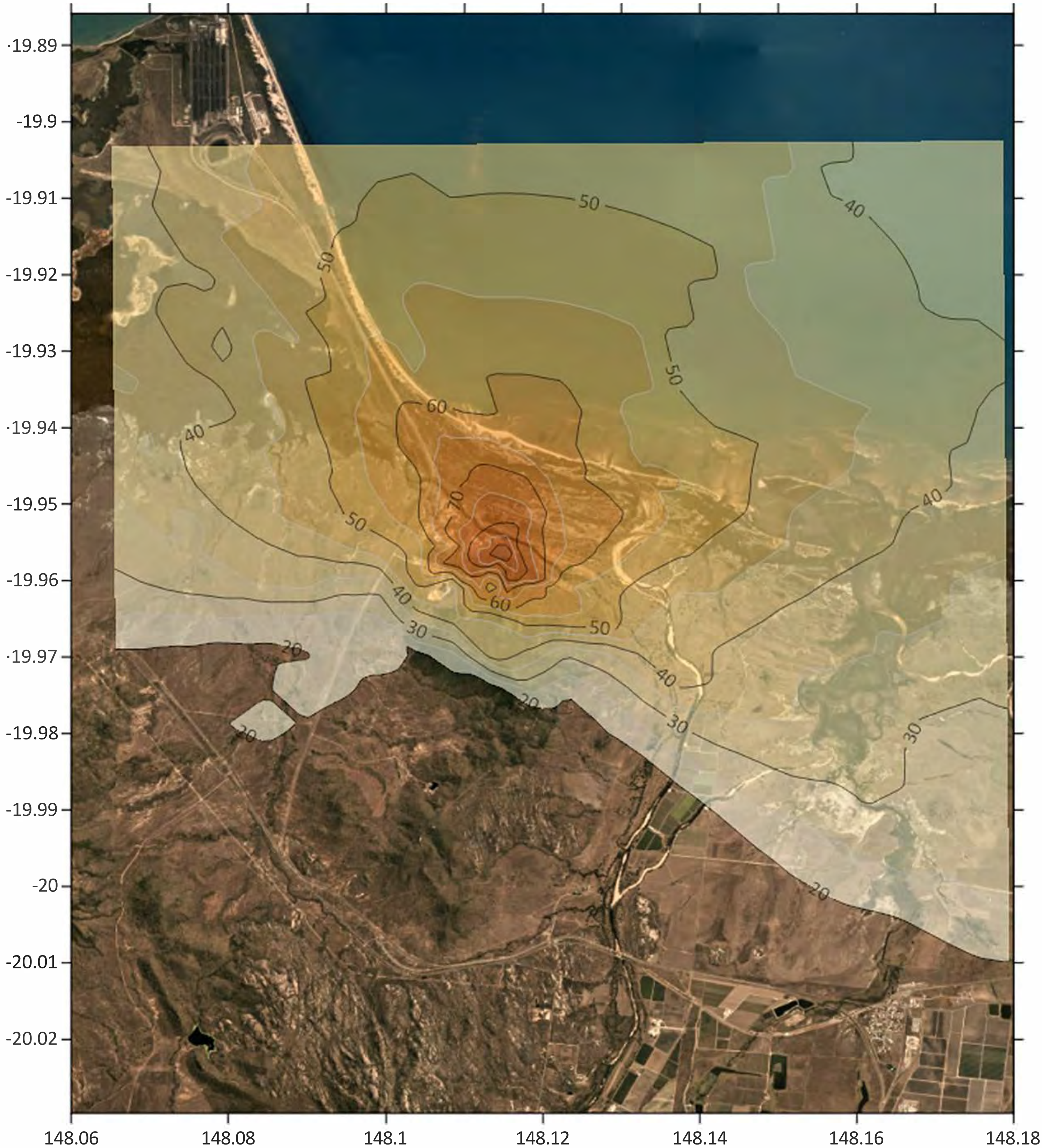
DNL (in dB(A))

Option 1

Big HRM 120 Seconds

Neutral Meteorology

Barrier {3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

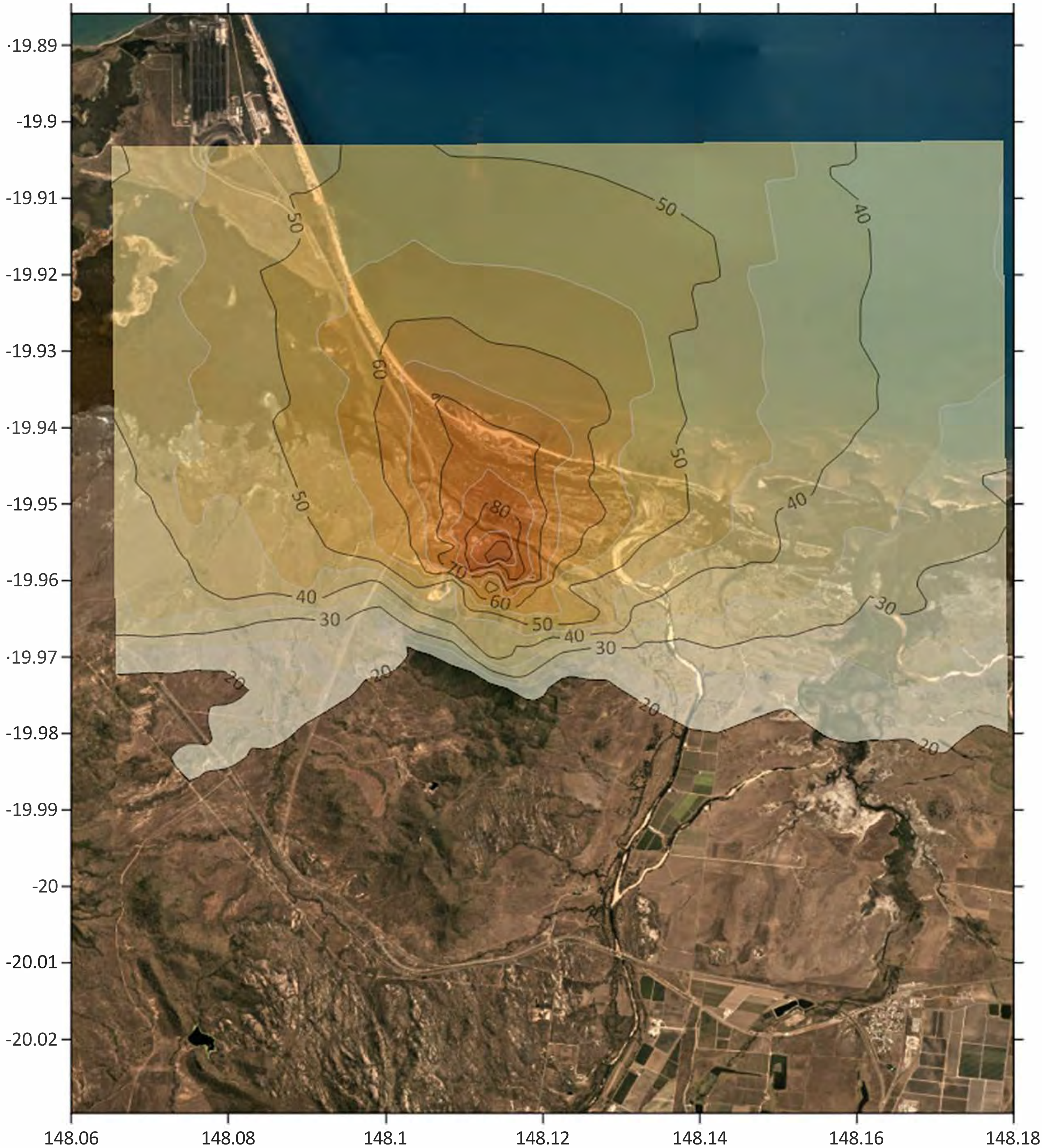
DNL (in dB(A))

Option 1

Big HRM 120 Seconds

Neutral With Wind Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

DNL (in dB(A))

Option 1

Big HRM 120 Seconds

Day Meteorology

Barrier (3m high 20m long)

Gilmour Space

Noise Modelling Test Pods

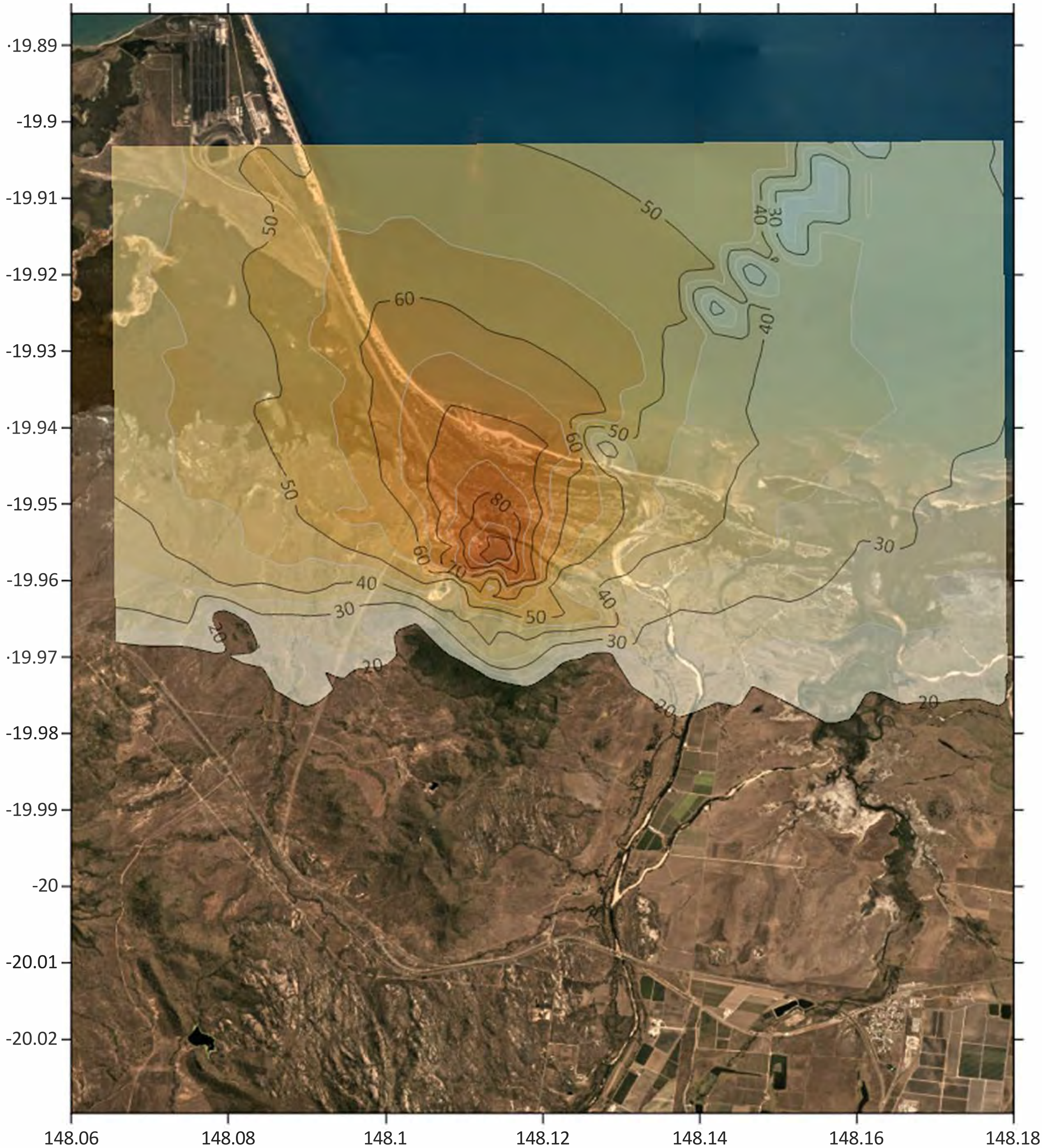
DNL (in dB(A))

Option 1

Big HRM 120 Seconds

Day with Wind Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

DNL (in dB(A))

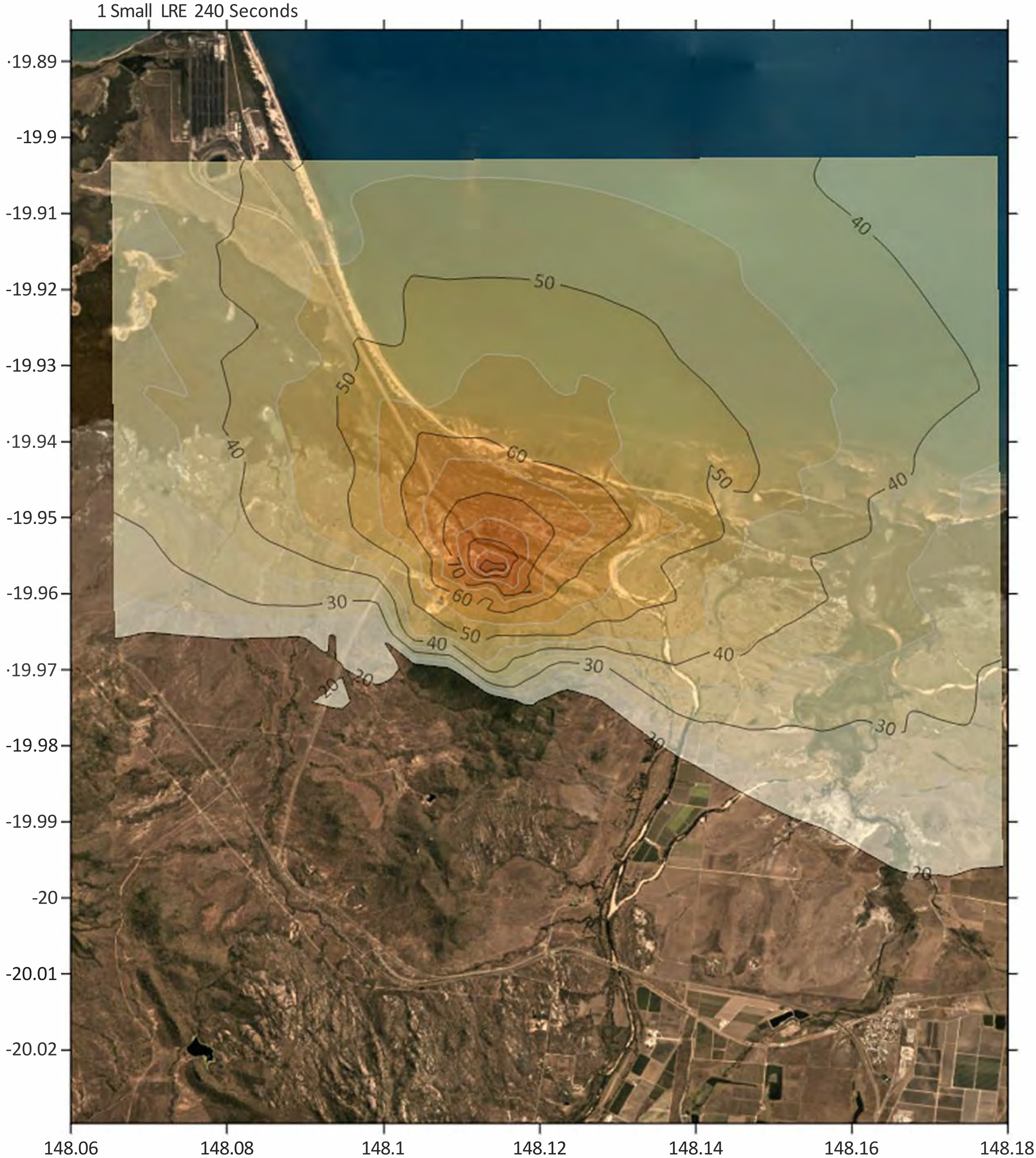
Option 2

3 Catpack 30 Seconds each

1 Small LRE 240 Seconds

Neutral Meteorology

Barrier {3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

DNL (in dB(A))

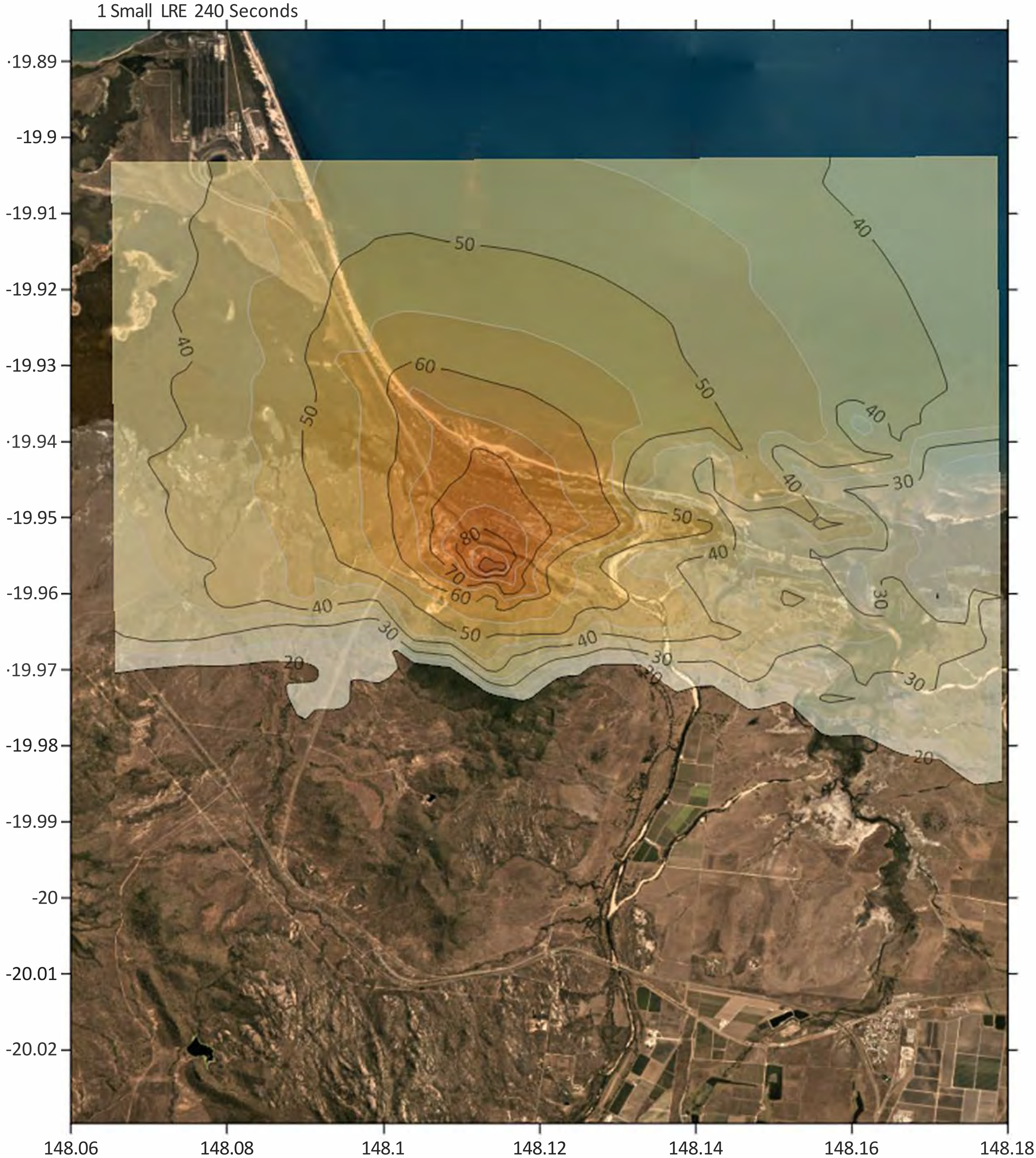
Option 2

3 Catpack 30 Seconds each

1 Small LRE 240 Seconds

Neutral With Wind Meteorology

Barrier (3m high 20m long)



Gilmour Space

Noise Modelling Test Pods

DNL (in dB(A))

Option 2
3 Catpack 30 Seconds each
1 Small LRE 240 Seconds

Day Meteorology
Barrier (3m high 20m long)

Gilmour Space

Noise Modelling Test Pods

DNL (in dB(A))

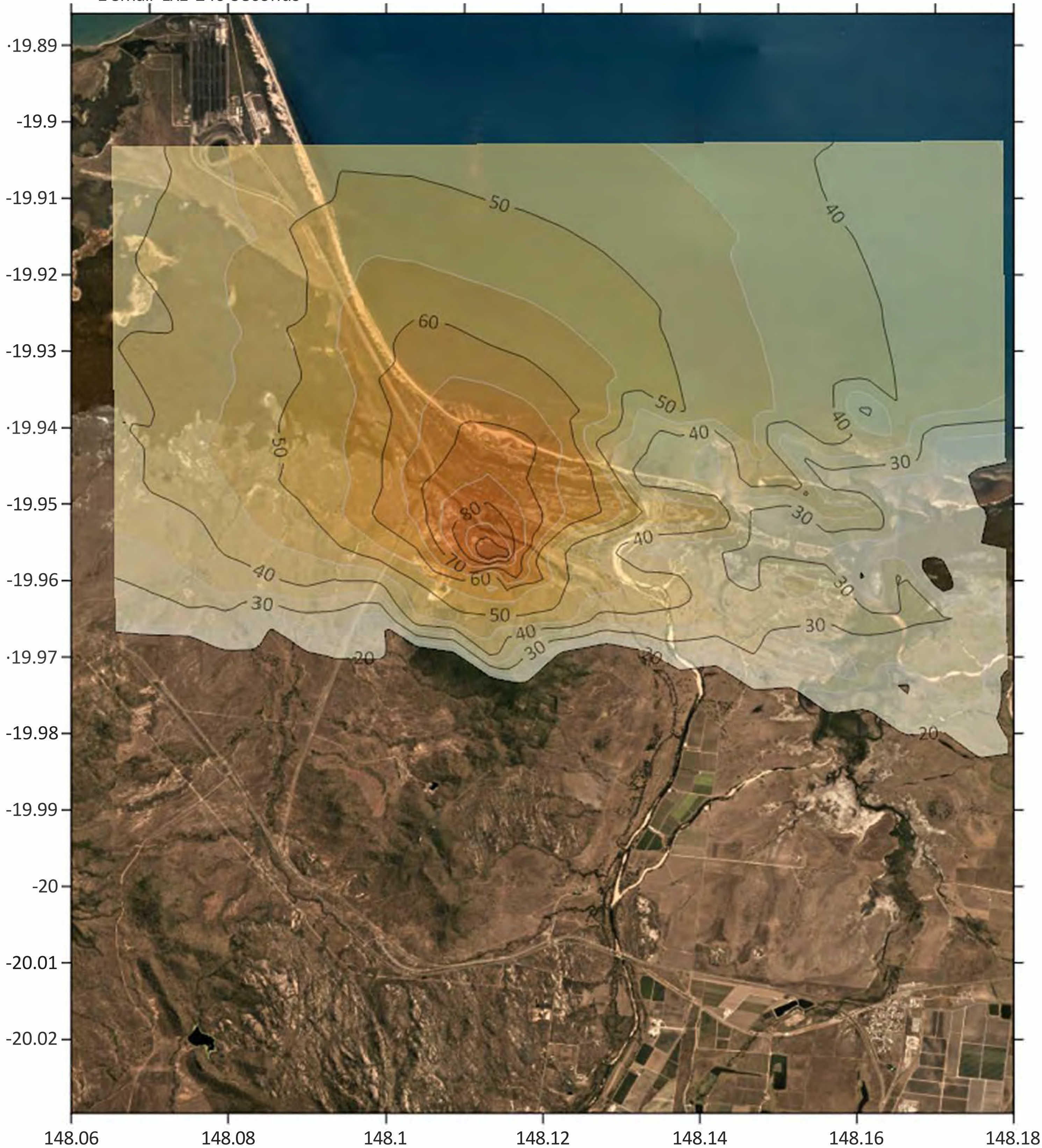
Option 2

3 Catpack 30 Seconds each

1 Small LRE 240 Seconds

Day with Wind Meteorology

Barrier (3m high 20m long)



Appendix 8

Bowen Orbital Spaceport Facility Management Plan

Document ID: LAUNCH-358547011-1686

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ALL ORBITS, ALL PLANETS

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Executive Summary

This Facility Management Plan explains Gilmour Space's approach to managing and operating the Bowen Orbital Spaceport launch facility in a safe, responsible, and legislatively compliant manner. The conduct of space launch activity is subject to bodies of legislation regarding not only the launch, but also transport, work safety, environmental protection, and state and regional planning regulation. Gilmour Space will work with all relevant authorities and is conducting early and wide engagement to this end.

The Plan describes the general location, layout, and design features of the Spaceport as well as its intended operations. The design methodology has included careful selection of the site to ensure control of hazardous areas proximate to the launch pad and design features to mitigate and control any anomalous conditions including bunding, berms, and deluge systems. The operational aspects of the plan note the intended vehicle for first use would be a Gilmour Space Eris launch vehicle and depicts a nominal flight path that has undergone internal modelling and review. It also notes and puts forth a set of bounding launch trajectories for the Facility.

The Plan explains the operational approach to execution of launch campaigns in partnership with the launch customers and cognisant of regulatory requirements, it captures key milestones and activities by phase in the launch campaign, calling out specific gates and reporting requirements.

The five phases of campaign design are:

1. Exploration
2. Mobilisation
3. Integration and Confirmation
4. Execution
5. Reporting and Remediation

Gilmour Space treats the infrastructure, operational and maintenance procedures of the launch facility as "Stage Zero". Effectively labelling it a product line subject to the Company's Quality Management System.

Finally, the Plan addresses the records and documentation management system Gilmour Space has adopted for the operation, management and maintenance of the facility.

1 Introduction

Gilmour Space is committed to providing Australia with sovereign launch capability. Though the domestic space industry represents a small sector of the Australian economy, it has significant growth potential.

Establishing an operational orbital launch facility with a wide range of accessible launch azimuths will enable greater market participation for Australian space companies in both domestic and international markets.

1.1 Purpose

This Facility Management Plan has been prepared to characterise and record Gilmour Space's approach to ensuring Space Act compliant operation of an orbital spaceport facility at the identified site within the Abbot Point State Development Area (SDA).

1.2 Scope

This Plan describes the systems and methods that Gilmour Space will use in operating Bowen Orbital Spaceport (BOS), including:

- Facility design
- Launch campaign planning and verification activities
- Facility maintenance reporting and record keeping

This Plan does not cover routine administration, procurement, or accounting practices.

2 Review of Regulatory Authorities and Standards

Per the Space (Launches and Returns) Act 2018 (the Space Act), the regulatory authority for space activities in Australia is the Australian Space Agency (ASA). The ASA is responsible for issuing Launch Facility Licences and Launch Permits for the launch and return of space objects.

2.1 The Space (Launches and Returns) Act 2018

The Space Act holds all space activities to a high standard of integrity and ensures public safety, economic and environmental standards are satisfied. The Space Act establishes a system for the regulation of space activities from Australia, or by Australians and implements Australia's obligations under UN Space Treaties.

The Space Act gives authority to several regulations for space activities:

- Space (Launches and Returns) (General) Rules 2019
- Space (Launches and Returns) (General) Rules 2019 Explanatory Statement
- Space (Launches and Returns) (High Power Rocket) Rules 2019
- Flight Safety Code
- Space (Launches and Returns) (Insurance) Rules 2019
- Maximum Probable Loss Methodology

2.2 Work Health and Safety Act 2011

The Queensland Work Health and Safety Act provides a balanced and nationally consistent framework to secure the health and safety of workers and workplaces through the principle that workers and other persons should be given the highest level of protection against harm to their health, safety, and welfare from hazards and risks arising from work or from particular types of substances or plant as is reasonably practicable.

Gilmour Space maintains and operates its own compliant workplace health and safety system and the BOS maintains a Site Safety Management Plan.

2.3 The Environmental Protection and Biodiversity Conservation (EBPC) Act 1999

The application for a Launch Facility Licence under the Space (Launches and Returns) Act requires commonwealth environmental consideration of the BOS activity and potential downstream effects to determine whether any significant impacts would arise.

Gilmour Space commissioned the Snowy Mountains Engineering Company (SMEC) to conduct an Environmental Assessment Review on activities of BOS against these significant impact criteria.

Subsequent to this referral the Department of Agriculture Water and the Environment has decided that launch activity from the Bowen Orbital Spaceport constitutes a Controlled Action under the Act and will be assessed via the Public Environment Report process which is anticipated to reach a conclusion by December of 2022.

2.4 The Environmental Protection (EP) Act 1994

The Environment Protection Act 1994 seeks to protect the Queensland environment while allowing development that improves the total quality of life, both now and in the future, in a way that maintains ecological processes. The EP Act sets forth the process for consideration of whether an activity meets the threshold of an Environmentally Relevant Activity (ERA).

The established construction and operational activities of BOS do not meet any ERA thresholds.

The EP Act also allows that under the State Development Act, a development planning application or Material Change of Use shall be considered as a properly made submission for environmental approval.

Several conditions of the BOS MCU Approval under the EP Act are captures within the BOS Environmental Management Plan.

2.5 Abbot Point State Development Area (SDA) Scheme

The Abbot Point SDA was established in 2008 under the State Development and Public Works Organisation Act 1971 to facilitate large-scale industrial, manufacturing and port-related development of regional, state, and national significance. Developments within the Abbot Point SDA are approved by the Coordinator-General.

Current high impact industrial activities within the APSDA include:

- Industrial and port activities
- Coal bulk haulage
- Extractive quarrying industry
- Proposed future uses including possible renewable green hydrogen and energy production

OCG development approval for the Bowen Orbital Spaceport (granted on 21 June 2022) levied certain conditions upon the operation of the facility. These conditions will be audited by an independent auditor on a regular basis. The approval conditions (and where appropriate the means through which they are implemented) are captured in Appendix E.

The Coordinator-General, or any person authorised by the Coordinator-General, is permitted to inspect any aspect of the BOS.

2.6 Hazardous and Dangerous Goods Management

The legislation, best practice, standards, and codes for the treatment and transport of Dangerous Goods is the subject of International Agreements, National and State Legislation and various codes of practice. These codes, standards and legislation are referenced in the BOS Hazardous and Dangerous Goods Management Plan.

3 Description of the Bowen Orbital Spaceport and Orbital Launch

3.1 BOS Location and Layout

The Bowen Orbital Spaceport is Australia's first commercial orbital launch facility, unlocking access to low earth orbit for small payloads from Australian soil. Small launch vehicles are classified as those capable of lifting less than 2000kg payloads into orbit. [1]Bowen is ideally suited for this classification of launch vehicles due to its geography and its proximity to a regional industrial base"[2]. The low latitude takes advantage of the earth's rotation for launch efficiency and the proximity to the coast for eastward launches, remote location with limited population centres and relatively sparse air and maritime traffic downrange, allow for inherent levels of safety for launch.

The site is located within the bounds of the Abbot Point State Development Area (SDA). Lot 10 on SP295408 is identified as being within the Industry Precinct, Environmental Management/Materials Transportation Precinct of the Abbot Point SDA Development Scheme. Supplementary mapping is shown in Appendix A.

Figure 1 - Bowen Orbital Spaceport Location

[1] 14 CFR Part 420 Appendix A
[2] abbot-point-launch-site-investigation-factsheet.pdf (statedevelopment.qld.gov.au)

3.2 BOS Design

The BOS comprises 3 major facilities; a Launch Control Centre (LCC) co-located within the North Queensland Bulk Ports (NQBP) facilities, a Vehicle Assembly Building (VAB) and a Launch Pad (PAD) with associated utility pad and test pads at Lot 10 Abbot Point Road. BOS design incorporates features to contain, mitigate and control nominal and anomolous operations of small class orbital launch vehicles and sub-systems. The design also incorporates elements to ensure the security of sensitive technology stored within the facility and the safety of the public. The BOS construction concluded in December of 2022. The launch pad centre coordinates are at 19°57'29.20"S 148° 6'48.97"E. Figure 2 shows the position of the launch pad within Abbot Point SDA whilst Figure 3 depicts the layout of the main facility.

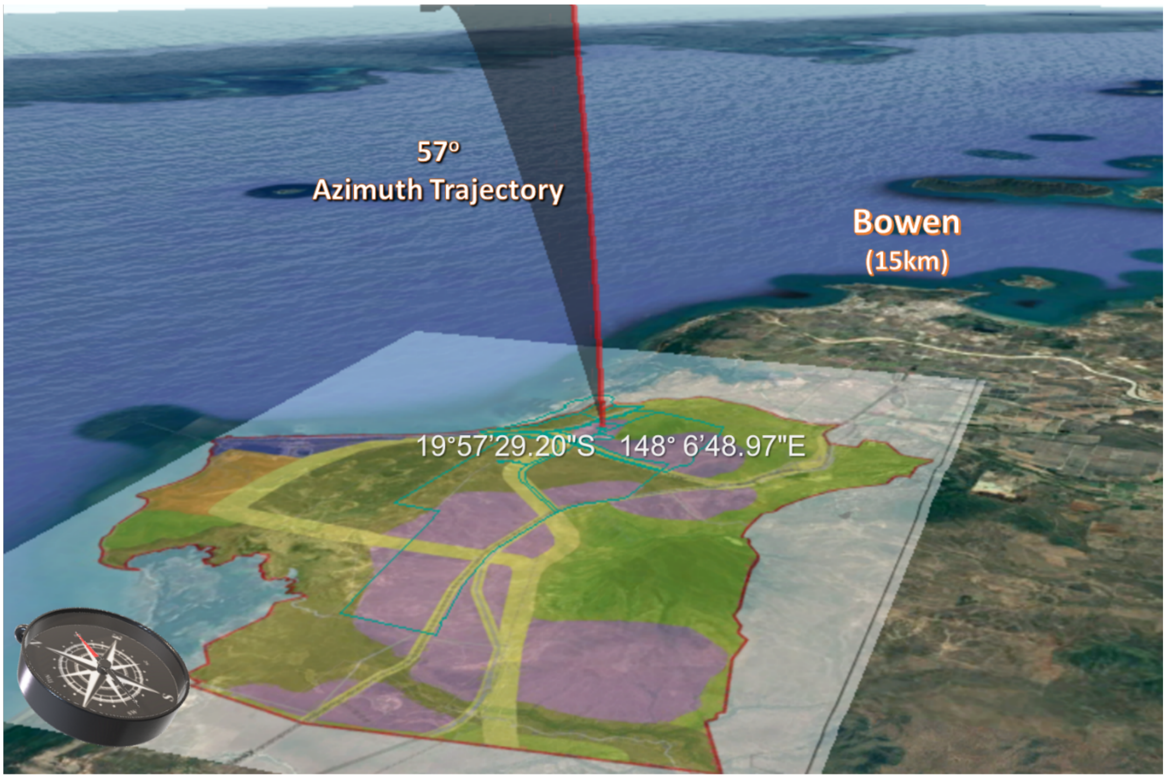


Figure 2 - BOS Launch Facility Launch Pad Centre

3.2.1 Launch Control Centre

The LCC from which launch activities will be managed, is situated approximately 7km away from Lot 10 in a temporary, secured administration facility which is part of the NQBP footprint. This facility has all amenities required for the establishment of communication and control equipment and has provided for a direct line of site to the launch location, enabling the safe installation of telemetry hardware for mission monitoring and tracking.

3.2.2 Vehicle Assembly Building

The VAB is the primary location of operations for the site. The purpose of the VAB is to facilitate the final manufacture steps of a launch vehicle which includes the delivery, receipt, upgrade or repair, assembly, integration and testing of launch vehicle parts, stages, and payloads in a clean and secure environment in preparation for a launch activity.

The VAB is approximately 40m x 18m x 7m with large roller doors at the east and west ends of the building. Internal facilities include air-conditioned workbays, cribbing and ablution, open plan offices, tooling and equipment and material storage racks. The eastern end door of the VAB is aligned with the launch pad centre.

The VAB is an intrusion resistant facility with inclusion of features including electronic access control, securable internal spaces and security surveillance systems.

3.2.3 Launch Pad

The launch pad is a self-bunded concrete pad to support transport and erection infrastructure for Gilmour Space Eris launch vehicles. Operation and management of activities on the launch pad is managed by detailed launch operation procedures which are developed and maintained for each launch mission.

3.2.4 Launch Fluids and Utilities Storage

Adjacent to the launch pad are the oxidiser, cryogenic, and fuel and gas pads. These service the launch pad with power, fluids, and local control for launch vehicle filling and launch operations. This will be the principal location at the launch facility for the management of hazardous and dangerous goods. The generation, storage, use, and disposal management of hazardous and dangerous goods is detailed in the Hazardous and Dangerous Goods management Plan.

The Launch Pad and launch fluid storage areas feature physical access control including vehicle protection bollards and remote surveillance systems.

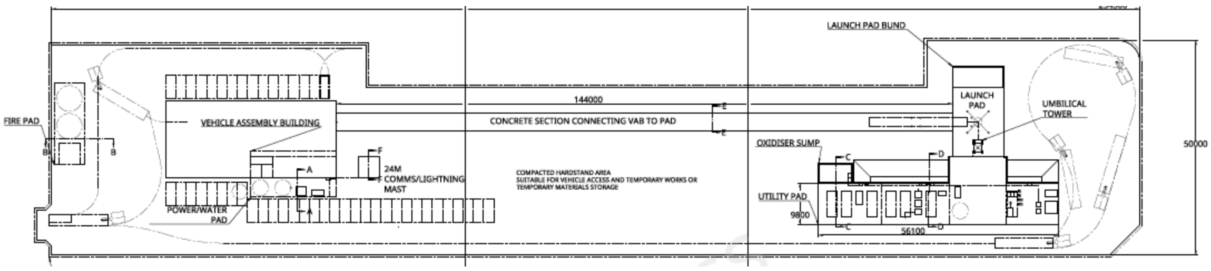


Figure 3 - BOS Facility layout

3.2.5 Test Pads

The two test pads are located adjacent to the BOS fire trail on the northern side of the compound. The test pads exist for the isolated conduct of engine and propulsive component test and verification activity. Each pad is contained within a designated fenced area and incorporates a minimal hardstand, vehicle access ramp and thrust structure. Each is configurable to support a variety of tests. Test Pad 1 is primarily intended for hybrid rocket motor tests, with a run tank for test usage of hydrogen peroxide, while Test Pad 2 is primarily a liquid rocket engine test pad with temporary storage facilities for kerosene and liquid oxygen. The locations of Test Pad 1 and 2 are displayed in Figure 4.

.

Figure 4 Test Pad Locations

3.3 BOS Security Plan

The BOS will contain both sensitive and hazardous materials during launch and test campaigns. BOS design and operations include measures to both secure sensitive materials from potential interference or disclosure and exclude public access to areas containing hazardous substances or activities. BOS access is not available to the general public and requires passage through a NQBP controlled security access point on Abbot Point Road and will require separate access authorisation and escort for entry to Lot 10 or the LCC area (Please refer to the BOS Security Plan for Visitor access policy).

The Gilmour Space Security Plan (which has DISP Entry Level accreditation for Physical and Cyber Security and Level 2 accreditation for Personnel and Governance) mandates a requirement for a BOS Site Specific Security Plan and complies with general security requirements for protection of personnel, physical and cyber assets. The BOS Security Plan is at Appendix F.

3.4 BOS Intended Activity

Launch operations are campaign activities that will begin with the delivery of launch vehicle components and for initial launches, culminate some 60-90 days later with the launch of a vehicle followed by up to 10 days of post launch activity to remediate and return the site to readiness for a new launch campaign. The first tranche of these campaigns will involve the Gilmour Space Eris Block 1 launch vehicle.

BOS test operations will be variable in length and will be designed to test or verify components of the vehicle propulsion system at system and subsystem level. Sub system tests will include verification of components like oxidiser pumps or liquid igniters where system level tests would include flight-like rocket engines or verniers.

During periods between launch and test campaigns a minimum level of activity will be maintained to ensure the security, safety and maintenance of the facility as well as ongoing data gathering activity in support of environmental baselining, including meteorological observations through a fixed weather station and regular meteorological balloon launch activity approved by the Civil Aviation Safety Authority (as detailed in Bowen Orbital Spaceport Meteorological Data Program.docx).

3.5 Eris Launch Vehicles

While Gilmour Space intends its first launch at the BOS to be achieved with an Eris launch vehicle matching the data used in this plan, performance and trajectory is necessarily representative of many similar small class orbital launch vehicles. The Eris vehicle is yet to achieve an Australian Launch Permit and will undergo design optimisations in performance, mass, and fluid quantities, all of which will be the subject of Launch Permit applications.

The Eris Block 1 is a 3-stage small class orbital launch vehicle. The first and second stage propulsion systems are innovative hybrid rocket systems. These rocket systems use a stabilised high concentration Hydrogen Peroxide (H_2O_2) which is a non-cryogenic fluid, in combination with a solid polymer fuel grain. Hybrid rockets are inert, non-explosive and safe to handle during pre-launch activities with adequate PPE controls. The third stage of the Eris vehicle is a traditional liquid oxygen and kerosene propulsion system.

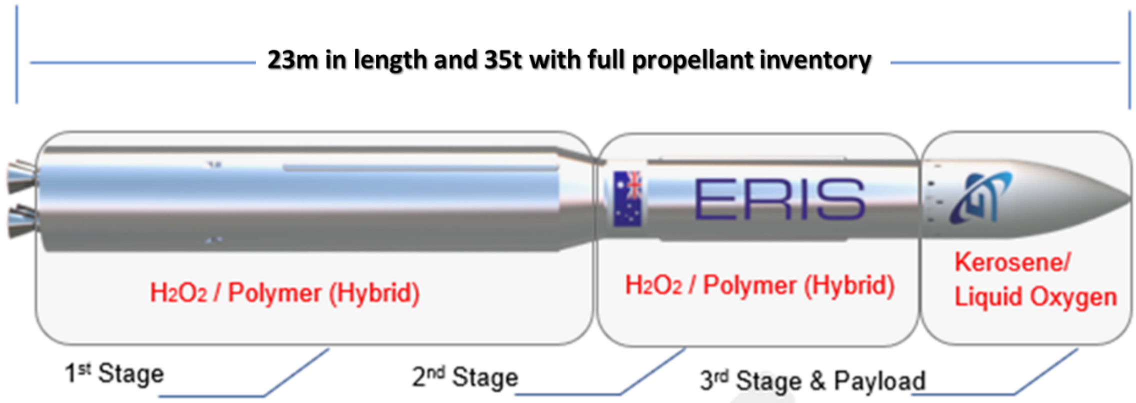


Figure 5 Eris Launch Vehicle

Eris launch vehicles are approximately 23m tall, and the main body section of the rocket is approximately 2m in diameter. The majority of the mass of the vehicle at launch is oxidiser and fuel while the major structural elements are aerospace grade aluminium, stainless steel, and carbon fibre.

3.6 Launch Frequency

In 2023, Gilmour Space plans to launch 2 rockets, after which we aim to increase launch frequency towards a maximum of a monthly cadence by 2025, however, launches will rarely occur from the BOS month on month as alternate launch locations become available, elsewhere in Australia. Gilmour predicts that up to 50 launches could be conducted from the BOS by 2032 if targets for development and launch vehicle contracts are achieved.

Gilmour Space works in collaboration with stakeholders including NQBP and Aurizon (as the designated railway manager under the QLD Transport Infrastructure Act) to schedule launch activity. Gilmour Space will share a forward 12 month schedule of launch dates with the stakeholders within the Abbot Point Port stakeholder group.

3.7 Launch Azimuths and Orbit

The BOS is well placed to safely service a significant array of orbital azimuths between 25° and 71°. Strict public and property safety requirements for the planning of space activities are detailed in the

Space (Launches and returns) Act and its subordinate regulations, rules and codes. These public safety requirements are enforced by mandating that each specific launch trajectory be modelled by an independent, suitably qualified expert prior to submitting the application for an Australian Launch Permit. Gilmour Space is cognisant of these requirements and has a process that assesses and confirms the compliance of each proposed launch. Only Permitted launches will occur from BOS.

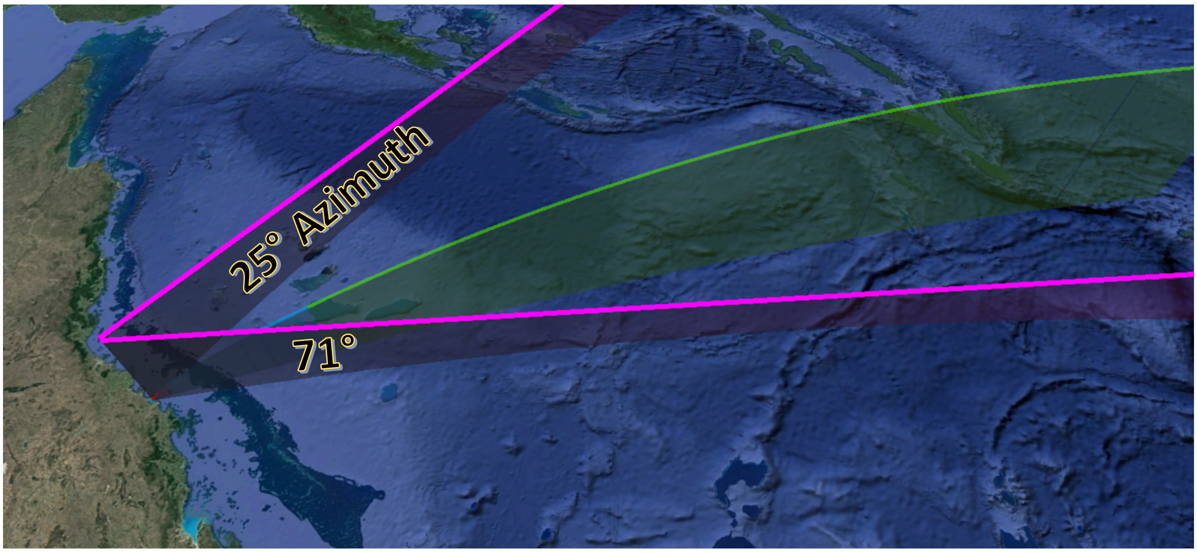


Figure 6 - BOS Nominal Launch Trajectory for 57º azimuth launch and bounding azimuths

3.8 Launch Activity at BOS

During an active launch campaign, several phases of activity will occur, with a variable workforce at the BOS. Table 1 illustrates the typical launch campaign activity.

Table 1 - Typical Launch Campaign Activity

Approximate Timing	Typical Activities
T-90 days Launch Readiness Activities	Launch vehicle components begin arriving at the VAB from the Gilmour Space technologies at Helensvale on the Gold Coast integration and test activity Launch Payloads import planning and compliance assessed Planned launch trajectory and exclusion zones assessed
T-60 days	Mission Readiness Review Conducted Operational Readiness Review Conducted
T-45 days Client Payload and Launch Approvals	Client Payload is received at the VAB. Assembly and Integration of the Payload begins. Permits for launch activity must be approved by the Australian Space Agency on this date.
T-10 days Launch Pad Configuration	Launch pad preparation and testing Launch support and recovery services establish at LCC Compliance with Launch Permit Conditions Assessed
T-5 days Launch Fluids Connection and Testing	Flight Readiness Review conducted Launch fluids are delivered Target Launch Date and time is confirmed and communicated to relevant agencies

Approximate Timing	Typical Activities
T-24 hours Weather monitoring and Final Checks	Launch Readiness Review Anemometry and weather monitoring begins to confirm forecast weather conditions for launch. The launch vehicle is fully integrated into the launch erector and fluid systems are connected.
T-4 hours Exclusion zone implementation	Public safety barriers and controls, Airspace notifications, and Marine exclusion zones are notified and prepared for activation Links are established for surveillance of ground, air and sea exclusion zones
T-2 hours Launch Sequence Commence	Core and Test Exclusion Zone activated Launch vehicle communications are confirmed, rocket is pressurised, final manual checkouts are performed, Gilmour space begins monitoring exclusion zones. Rocket filling and launch procedures to begin.
T- 30 Minutes Launch Countdown	T- 30 minutes Downrange exclusion zone and all GO/NO GO criteria confirmed clear for launch Launch Exclusion Zones Activated Flight countdown and final flight readiness checks commenced
T = 0	Rocket hold downs released - Launch
Post Launch	Mandatory reporting compiled and dispatched Facility Inspection and remediation carried out

3.9 Test Activity

Test activity at BOS includes the qualification and characterisation of production and developmental components of propulsion systems at the system and sub system level. Test activity involves several phases: test set up (wherein test stands and test articles are prepared), test activity (wherein the test article operates, ie pump run or engine ignition), and test tear down (wherein data is retrieved, the test article is removed and the test stand is decommissioned or placed into storage mode). Test frequency and test length will vary according to need. Short duration, qualification activity will generally be associated with launch campaigns and will last days utilising the same engineering and technical staff as the launch campaign. Longer duration, characterisation and developmental activity will be deconflicted with launch campaigns and will last weeks with small, dedicated teams of engineering and technical staff (3-5 personnel) deployed to BOS for the duration of these activites.

3.10 Public Safety & the Environment

Gilmour Space identifies residual risks to public safety arising from launches and test activities. Whilst these will be assessed for each launch as a part of the launch permit application process, and in the case of testing, through the Gilmour Space Risk Management Policy, the BOS approach to management of these risks is focussed on exclusion.

Primarily, BOS seeks to eliminate risks through engineering and design and subsequently, mitigate any residual risks by excluding personnel and the public from danger areas. The BOS Range Safety team, working in partnership with Queensland Police Service, North Queensland Bulk Ports, Volunteer Marine Rescue, Maritime Safety Queensland, the Australian Maritime Safety Authority, Airservices Australia and the Civil Aviation Safety Authority), Gilmour Space will declare safety zones in the land, sea and air domains to protect public safety. Zones outside Australian jurisdiction will be declared in partnership with relevant authorities with the assistance of the Australian Space Agency. Where safety zones are completely confined within Lot 10 the Range Safety team will declare and manage those zones on the property.

To show the likely safety zone design for launch, Gilmour Space has modelled the trajectory of the Eris launch vehicle and used modelling data on aerodynamic and explosive breakup failure modes. The resultant understanding of the statistical spread of potential debris allows construction of terrestrial, air and maritime safety zones to control residual risks to public safety.

The safety zones depicted below in Figure 7 and Figure 8 are intended to demonstrate a typical design that would meet the regulatory requirements shown in Table 2.

Table 2 - Acceptable Risk Criteria[3]

	Collective Risk per launch	Individual Risk per launch	Annualised 3rd Party Risk
Personnel Casualty	$1x10^{-4}$	$1x10^{-6}$	$1x10^{-5}$
Asset Damage	$1x10^{-4}$	NA	$1x10^{-5}$

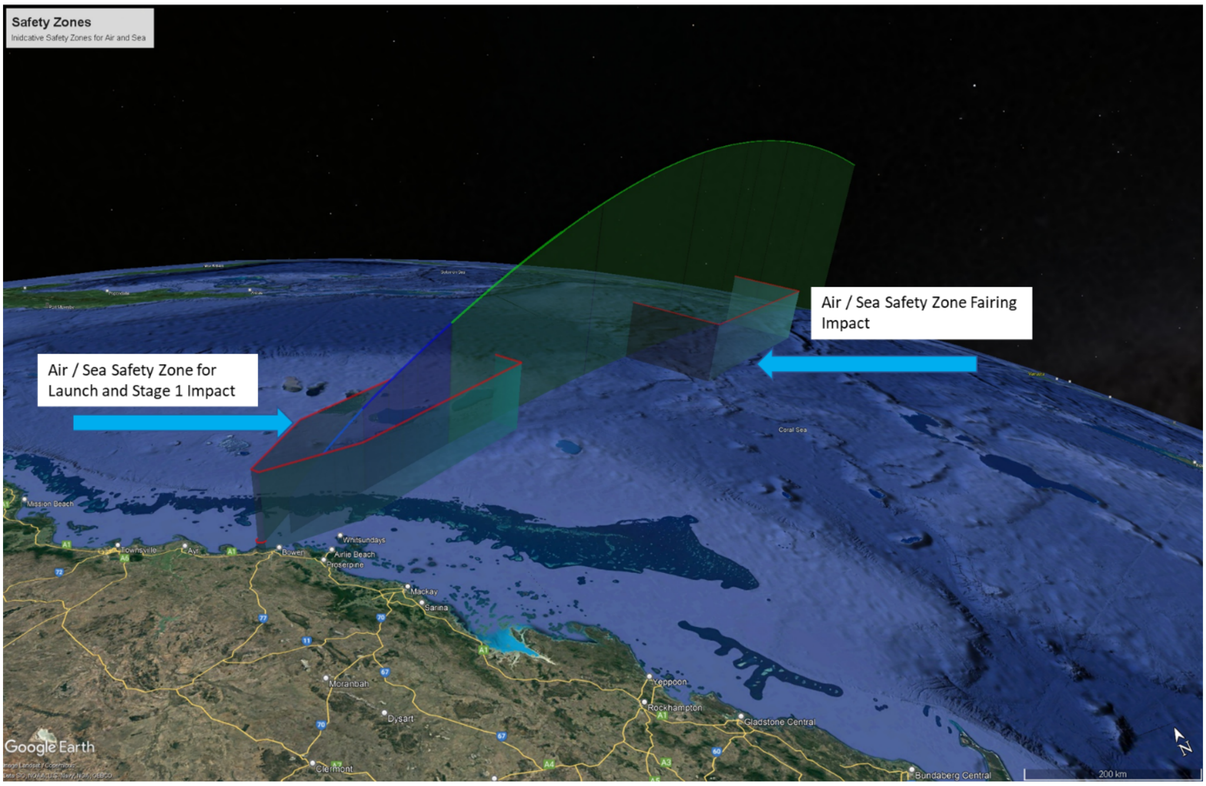


Figure 7 - Air / Sea Safety Zones

[3] Taken from the Australian Space Agency Flight Safety Code p10

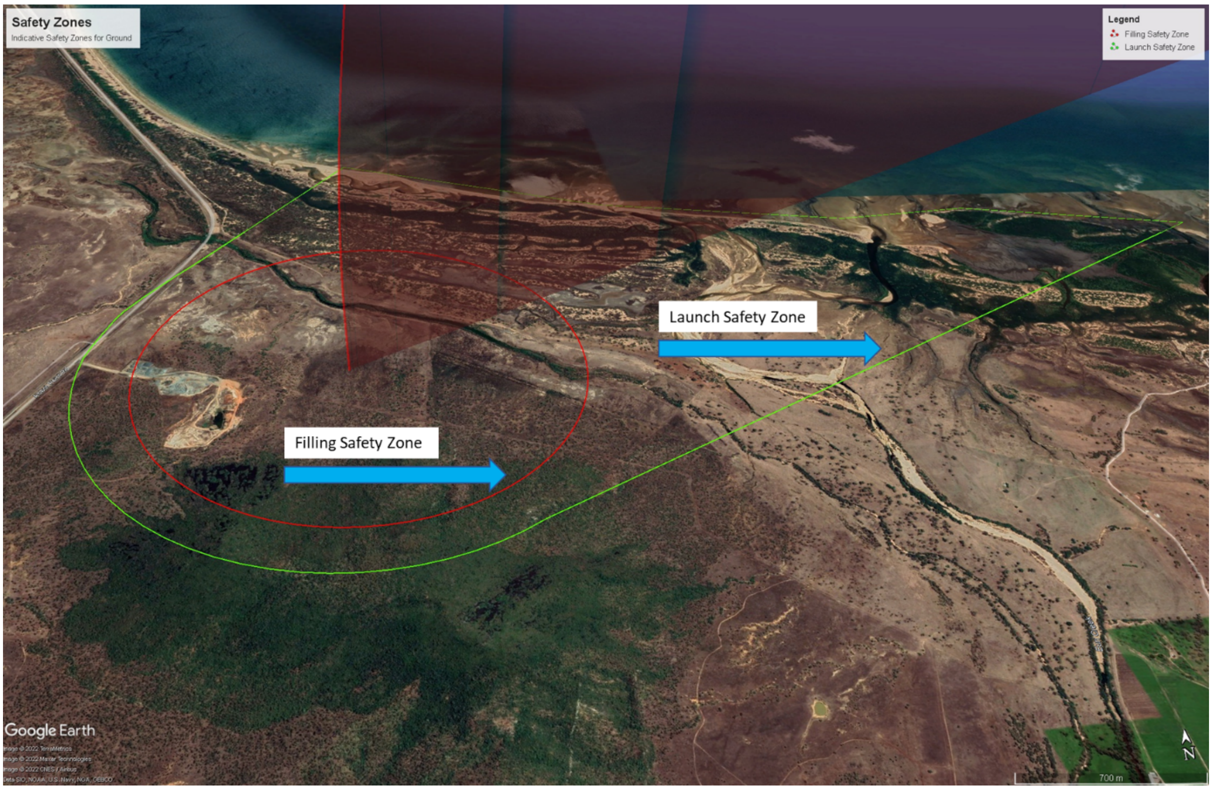


Figure 8 - Ground Safety Zones

For launch activity, the safety zones will be widely and publicly advertised in advance. During execution they will be sanitised through remote observation accompanied by published restrictions (NOTAMs and NTMs) and regular broadcast of warnings in the downrange environment to reduce the risk to personnel of impacts from inflight failure (or scheduled debris). Within these safety zones, the probability of injury or damage increases with increasing proximity to the planned ground track of the launch vehicle and its scheduled debris.

For test activity, the potential impacts are much smaller and the means to control the potential effects much greater (as the test stands are static) and as a consequence the safety zones are much smaller and confined to the boundaries of Lot 10. Gilmour Space controls access to Lot 10 and will exclude all personnel from active safety zones associated with test activity. Safety zone design is based upon calculations of stored energy, sound, thermal and potential blast effects arising from any failure modes of the system or test articles in accordance with the Gilmour Space Risk Management Policy.

With public safety as a priority, Gilmour Space's public engagement strategy has included not only direct consultations with the agencies above but broad and early interaction with community bodies including membership or regular interaction with of the Local Disaster Management Group, Port Advisory Group, Volunteer Marine Rescue, Tourism Whitsundays, Bowen Chamber of Commerce and Bowen Collinsville Enterprise.

The risk to the environment arising from launch activity has been addressed through a comprehensive Public Environment Report.

4 BOS and the Community

BOS as a project was first conceived as early as 2018 and the development has consistently sought early and broad engagement with the Bowen and wider regional community. This engagement is essential to the maintenance of the social license to operate in the region and has resulted in significant public support that has been of critical import in gaining approvals for the construction and operation of the facility. Continuing community support is key to successfully operating a spaceport in Abbot Point and Gilmour Space is committed to continuing honest and open engagement with the community.

4.1 Means of Communication

Gilmour Space and the BOS maintain several channels of communication with the community. Beyond the existence of the public facing telephone and email contacts Gilmour Space, will broadcast information through social media presence (Twitter, Facebook and Instagram) and traditional media (newspaper, television and radio) for both normal operations, test activity and upcoming launch activity.

In the lead up to a launch campaign, Gilmour Space will engage directly with affected landowners regarding launch safety zones activation and will conduct letter drop activities for all landowners and commercial operators who may be affected by launch noise.

4.2 Community Feedback

The BOS maintains a mechanism for addressing and recording any community feedback received regarding operation of the facility. In particular, any complaints or incidents will be recorded in the BOS Incident / Complaint Register and will be replied to within 2 business days of receipt[4]. A summary of the Incident / Complaint register is included in the BOS Annual Report.

[4] As required in OCG Development Approval Conditions (Condition 19)

5 Launch Campaigning

The contractual model for delivery of capabilities into orbit involves three entities, the payload operator, the launch vehicle operator and the launch facility operator. The Gilmour Space company produces launch vehicles, space vehicles, operates an orbital launch facility and so can represent all three entities within the company. This management plan acknowledges that the payload operator could be any of a range of domestic or foreign space companies.

To protect public safety, regulatory compliance and executability, Gilmour Space will engage in phased activities during the launch campaign in collaboration with payload and vehicle operators as well as regulatory authorities.

5.1 Exploration

In order to enact a launch contract Gilmour Space is required to engage with the payload and vehicle operator (hereafter the launch customers) to confirm their suitability for a launch from BOS. This will entail examining:

- the payload's point of origin and intended method of transport and (if applicable) import;
- the launch vehicle's point of origin and intended method of transport and (if applicable) import;
- the launch vehicles physical characteristics to ensure compatibility with BOS licencing and infrastructure;
- the payload's intend orbit, and the launch vehicle proposed trajectory to confirm a flight path that can be achieved from BOS;
- where applicable the existence of suitable international agreements regarding technology security and the International Trafficking in Arms Regulations (ITAR); and
- existing launch campaigns at BOS to confirm a suitable window exists for execution of a launch campaign.

5.2 Mobilisation

Upon agreement to a contract for launch from BOS Gilmour will work with the launch customers to formulate and execute a plan to:

- stand up workforce to receive the launch customers, manage local suppliers and day to day activities during the launch campaign;
- conduct an Operational Readiness Review of the Campaign Plan;
- ensure arrangements for transport, receipt and storage of any dangerous or hazardous goods;
- identify local suppliers where possible for goods and services required by the launch customers;
- activate BOS contractual support arrangements in support of future phases;
- commence community and stakeholder engagement plan for launch activity including expected launch window;
- arrange dilapidation surveys of required road and rail corridors;
- synchronise the transport receipt and storage of all materiel required for launch; and
- prepare the VAB, LCC and PAD for occupation by the launch customers.

5.3 Integration & Confirmation

From the first arrival of launch customers or their material the BOS becomes responsible for their safe and compliant operation within the facility. The BOS is the responsible authority onsite to ensure:

- the treatment of hazardous and dangerous goods are compliant with the Australian codes;

- work practices by launch customers are compliant with relevant Australian legislation;
- access and requested information is facilitated for the appointed Launch Safety Officer with the consent of the launch permit holder; and
- the BOS facility is maintained and operated in a safe and secure manner.

Furthermore, as integration proceeds, Gilmour Space BOS must ensure that:

- the intended launch activity complies with the Space Act in that it is authorised via an Australian Space Agency Launch Permit;
- the intended launch activity is compliant with any conditions of its Launch Permit including verification of payload integration;
- all operational plans remain valid and accurate through participation in the launch vehicle Flight and Launch Readiness Reviews;
- the emergency response plan is tested in conjunction with launch customers (at least once per year);
- the community engagement plan is ongoing and ensures all local agencies and stakeholders are aware of the planned activity;
- the intended launch trajectory and all attendant ground, air and sea safety zones are appropriately planned and notified to the relevant agencies; and
- any notifiable changes to launch plans are notified to the Minister via the Australian Space Agency.

5.4 Execution

After integration is complete and confirmation is achieved that launch can proceed in compliance with the Space Act, BOS will operate to enact launch services, the operation of the launch range, the necessary and prudent interaction with authorities for notifications to the public and, if necessary, activation of the emergency response plan. Specific functions during launch execution will be captured in launch operations procedures (tailored for each launch) but will include:

- Ensuring all BOS Management Plans, launch permits, and owners consent documentation are reviewed to ensure the documentation package is current;
- Providing a copy of landowner's consent to the implementation and enforcement of an safety zone to the Coordinator-General ten business days prior to launch;
- Providing a copy of each launch permit to the Coordinator-General, ten business days before launch;
- Confirming that Flight and Launch Readiness Reviews have been conducted including review of launch permit and conditions;
- Activation and operation of the LCC including appropriate data capture / storage devices;
- Test and activation of PAD fluids & gasses control architecture;
- Broadcast information to all community stakeholders with launch window information;
- Activation and surveillance of the scheduled air land and sea safety zones;
- Monitoring of required environmental parameters in place prior to launch;
- Provision of access and requested information for appointed Launch Safety Officer;
- Provision of Range Safety operations
- Oversight of filling operations;
- Oversight of launch procedures (Countdown) and confirmation of compliance with any permit conditions and declared Go/ No Go criteria;
- Confirmation of Scheduled debris impact and range / safety zone deactivation when clear;
- Activation of emergency response plans and coordination with response agencies in the event of anomaly;

- Data capture / storage secured and quick reports completed; and
- LCC Stand down and inspection of VAB / PAD to confirm safety of site.

5.5 Reporting and Remediation

All records and documents are to be retained and stored in accordance with the Gilmour Space Document Management Plan.

Reporting will be required during all phases of the launch campaign. Post launch reporting activities include quick reporting and considered reporting. Quick reporting is drafted and dispatched within one hour of launch to satisfy regulatory requirements and ensure space actors are made aware of the new space object's orbital parameters while considered reporting is performed over a period of days to enable analysis, quality assurance and improvement activities. These reports will be shared with launch customers, and appropriate regulatory authorities including the Australian Space Agency, Australian Space Operations Centre, Australian Maritime Safety Authority, Civil Aviation Safety Authority and local partner agencies.

A list of regular required reporting is included below:

- Launch Reports – Quickrep and Considered Report
- Variation Report – any variation to advised launch facility documentation
- Emergency Response Plan Test Report – annually
- Failure, malfunction or defect reports[5] – relating to BOS launch infrastructure during the campaign

Should a mishap occur, BOS will contribute to the investigation report generated by the appointed Launch Safety Officer or Investigating Officer.

Post launch remediation activity at the facility will include dispatch of remaining launch customer materiel, inspection of all facilities, remediation of any damage or wear, and next launch preparation or perhaps inhibition of launch facility infrastructure for an idle period.

Should the comparison of the pre- and post-launch surveys identify that rectification works attributable to launch activities are required to portions of Abbot Point Road or rail transport infrastructure proximate to launch, Gilmour Space has undertaken to complete necessary rectification works, to ensure the infrastructure is returned to its pre-launch condition or better, to the satisfaction of NQBP and the railway manager.

In line with the quality assurance plan for the BOS, all maintenance and remediation activity will be conducted in accordance with documented maintenance procedures and recorded in line with the Gilmour Space Document Management Plan.

[5] As required by OCG Development Approval Conditions (Condition 19)

6 Quality Management System

6.1 Overview

The objective of Quality Assurance is to provide confidence that the end product or service satisfies requirements. The BOS is constructed and operated in accordance with the Gilmour Space Quality Management Plan which has drawn on the experience of the European Cooperation for Space Standardization (ECSS).

The plan details the company process for ensuring the safety and reliability of all Gilmour Space products and services. Its provisions give instruction that dependability and safety requirements are implemented in the design, critical items are identified, and adequate controls measures are implemented. It establishes integrity of design by reviewing analytical and development data, gives evidence of test programs, procedures, and reports. It gives evidence of the adequacy of the selection and application of components, mechanical parts, and material.

6.2 BOS as a Product

Gilmour intends to operate the BOS launch facility in much the same way as we operate launch vehicles, with detailed attention given to the maintenance and operation of the systems that support launch including design reviews, scheduled maintenance activities and operations in accordance with validated procedures.

This approach will necessarily entail application of the Product Assurance Plan to the BOS facility and its components which should be viewed as though it were “stage zero” of the launch vehicle. This approach ensures that not only safety concerns but also facility operational effectiveness are addressed in a systematic and accountable manner.

A relevant extract from the Gilmour Space Quality Assurance Plan is provided in Appendix B.

Gilmour Space constructed the facility iaw with National Building Code and all conditions accompanying the development approvals granted by the Office of the Coordinator General under the Abbot Point State Development Area development scheme and the Whitsunday Regional Council local planning scheme. All civil engineering plans are certified by RPEQ engineers, and all structures are subject to private certification and registered with the local council.

The manufacture, installation and commissioning of the launch infrastructure includes the development of operation, maintenance and inspection procedures for all infrastructure. Gilmour Space maintains these procedures in a procedure management system (like Epsilon 3 or Fiix software as a service packages) which record not only the procedures and their changelogs but also records of each procedure run and any operator inputs.

This procedure management is informed by the incorporation of this system into operations at our former test facility. The test facility developed and deployed this procedure management system in 2021 and safely and successfully conducted several iterations of engine test fire procedures since introduction.

Maintenance activity, scheduled or unscheduled, will be conducted, recorded and reported in accordance with the Bowen Orbital Spaceport Maintenance Management Plan which is included with this submission as Appendix D.

7 Record Keeping

Gilmour Space is ISO 9001:2015 certified at our Gold Coast headquarters will operate the BOS launch facility in accordance with the structures that achieved this, including the Gilmour Space Document Management Plan (included in this application as Appendix C. BOS maintains a suite of controlled documents for operation of the facility and its sub-systems as version-controlled documents as defined under the plan, with an associated approval process, mandated review periods and version control systems.

As “version-controlled documents” the Management Plan requires indefinite retention and maintenance of a digital history of up to 500 previous major versions.

Further, BOS will maintain a suite of documentation for each launch campaign within the SharePoint system, detailing all launch customer activity on BOS, capturing all campaign specific plans, regular reporting, permits, conditions, authorisations, failures, malfunctions, or defects reports, and readiness reviews generated during the campaign.

Gilmour acknowledges the Space Act requirements for document and record keeping relating to operation of the facility and intends using the Gilmour Space SharePoint document management system in accordance with the Document Management Plan, as its repository to meet all requirements.

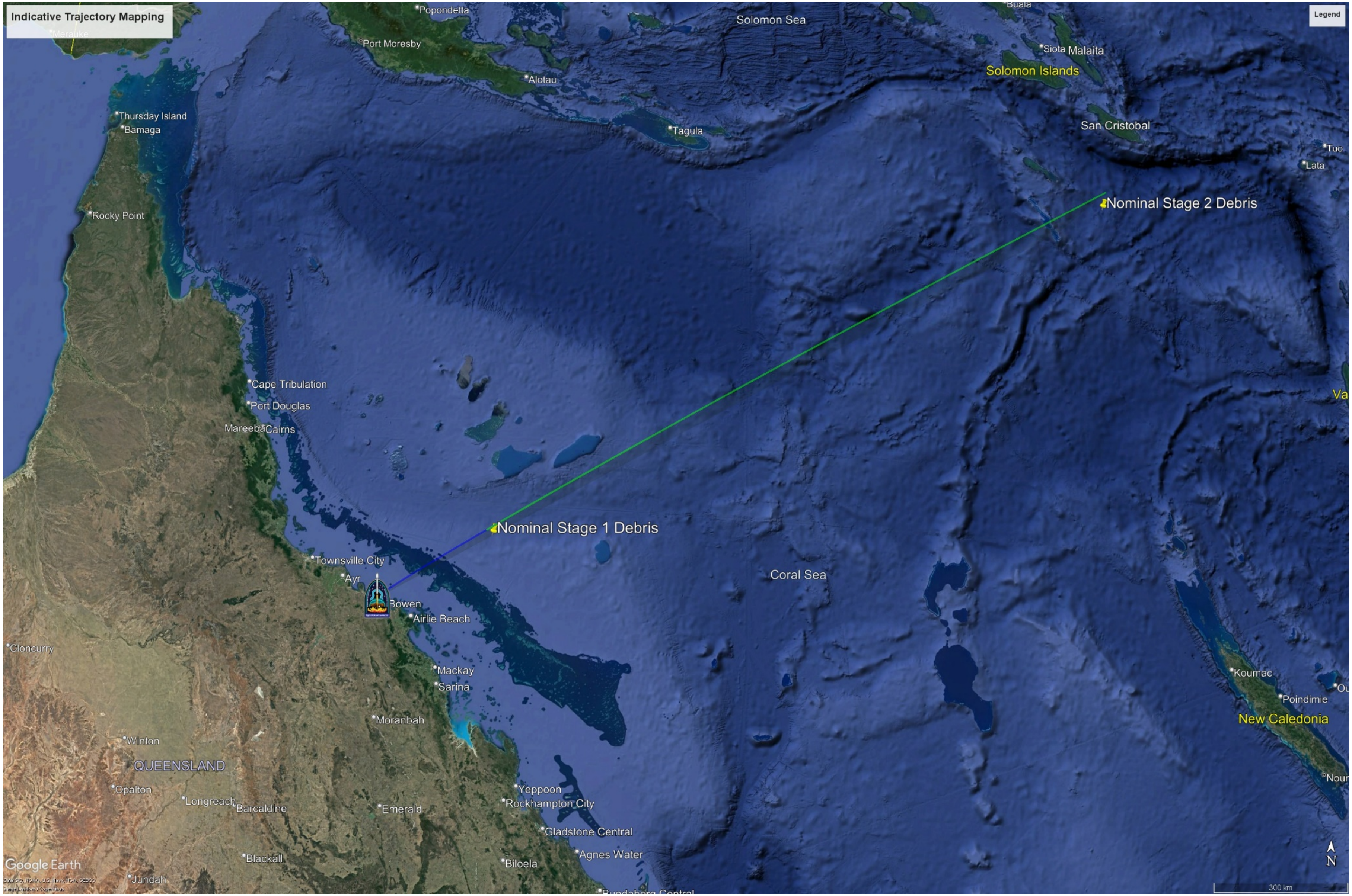
Abbreviation	Definition
1080	Sodium Fluoroacetate
ACH	Aboriginal Cultural Heritage
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
APSDA	Abbot Point State Development Area
ASA	Australian Space Agency
BOS	Bowen Orbital Spaceport
CSMP	Coral Sea Marine Park
DFO	Distant Focussing Overpressure
DGR	Dangerous Goods Regulations
ECSS	European Cooperation for Space Standardization
EDQ	Economic Development Queensland
EMP	Environmental Management Plan
EP Act	Environmental Protection Act
ERA	Environmentally Relevant Activity
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Management Plan
FMECA	Failure Modes, Effects, and Criticality Analysis
FMP	Facilities Management Plan
FSS	Flight Safety System
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GST	Gilmour Space Technologies
H_2O	Water
H_2O_2	Hydrogen Peroxide
HDGMP	Hazardous and Dangerous Goods Management Plan
IAASS	International Association for the Advancement of Space Safety
IATA	International Air Transport Association
IMDGC	International Maritime Dangerous Goods Code
LCC	Launch Control Centre
LEO	Low Earth Orbit
LMP	Land Management Plan
LOx	Liquid Oxygen
PAD	Launch Pad
MEDQ	Minister for Economic Development of Queensland
NASA	National Aeronautics and Space Administration
NEW	Net Explosive Weight
NQBP	North Queensland Bulk Ports
O_2	Oxygen
PCBU	Person Conducting a Business or Undertaking
PPE	Personal Protective Equipment
RHD	Rabbit Haemorrhagic Disease

SDA	State Development Area
SDS	Safety Data Sheet
SPP	State Planning Policy
SSP	Site Security Plan
TAP	Transport and Access Plan
TBC	To be Confirmed
TNT	Trinitrotoluene
UN	United Nations
VAB	Vehicle Assembly Building
WHS	Workplace Health and Safety
WMP	Waste Management Plan
WRC	Whitsunday Regional Council

Appendix A Supplementary Mapping


BOS Lot 10 and LCC locations
Legend
Abbot Point Road
Bruce Highway
Lot 10 Boundary
Abbot Point
LCC
LOT 10
Google Earth
2 km


BOS Locations showing APSDA and Surrounds
Legend
Abbot Point Road
Abbot Point State Development Area
Bruce Highway
Lot 10 Boundary
Abbot Point
LCC
Abbott Bay Resources Reserve
LOT 10
Mount Cheeseman
Sunset Point
QUEENS BEACH
Horseshoe Bay Beach
BOWEN
Bowen
DELTA
Stone Island
The Big Mango
BOOTOOLOO
Google Earth
N
4 km


Indicative Trajectory Mapping
Legend
Solomon Sea
Port Moresby
Alotau
Tagula
Solomon Islands
Malaita
San Cristobal
Thursday Island
Bamaga
Rocky Point
Nominal Stage 2 Debris
Cape Tribulation
Port Douglas
Mareeba
Cairns
Nominal Stage 1 Debris
Townsville City
Ayr
Bowen
Airlie Beach
Coral Sea
Cloncurry
Mackay
Sarina
Moranbah
Winton
QUEENSLAND
Opalton
Longreach
Barcaldine
Emerald
Yeppoon
Rockhampton City
Gladstone Central
Agnes Water
Biloela
Blackall
Jundah
Koumac
Poindimie
New Caledonia
Google Earth

Appendix B Extract from the Gilmour Space Quality Assurance Plan

7.1 QA for Ground Support Equipment

GSE (mechanical, fluid, electrical and software support equipment) as defined in the product tree and used for testing, simulation, transportation, and handling of Space Segment elements will be analysed for operational risks for the flight hardware and human-safety aspects. Identification of hazards, classification, and resolution will be included in the Safety Analysis, to support the vehicle safety analysis as described in Section **Error! Reference source not found.**.

Safety certification will be provided as necessary for deliverable ground system products to demonstrate that the GSE is safe and in compliance with the applicable safety standards for planned activities during testing and general handling at Gilmour Space and third-party premises.

A GSE manual will provide all information, clear and complete instructions for installation, preparation, handling, connecting, operation, run-down and disconnecting of the GSE.

Operations with risks for the flight hardware and human-safety aspects will be described in detail. Ground Support Equipment interfaces will be evaluated for potential failure not propagating to flight hardware.

QA activities comprise of the following:

- Definition of a quality assurance programme for GSE Items based on ECSS-Q-ST-20C (RD22)
- Implementation of safety provisions according to requirements of national/international standards or regulations
- Identification and labelling
- Configuration control
- Witness of acceptance testing
- Non-conformances control during verification and acceptance testing
- Verification control
- Control of materials and parts where contact is made to flight HW

Deliverable GSE will be accepted on basis of an EIDP. The GSE-EIDP will contain as a minimum:

- Overview and interface description
- Configuration baseline
- Certificate of Conformance for as-built
- Certificate of Conformance to national and international law (e.g. labelling)
- Deviations from contractual requirements (if any)
- Acceptance data
- Certification for handling devices, proof test results, etc
- Product manual
- Safety data or safety certification

7.1.1 Safety for GSE

The safety program and techniques apply also for the Ground Segment and its operations. Before use of the ground segment the identified hazards must be closed, controlled and verified. Any control relevant for personnel operation will be subject for ground training or instruction.

Special consideration will be given to the safety hazards for tanking and pressurisation. These processes will be compliant with the Launch Site safety requirements and the procedures subject to customer and Launch Site authority approval.

Special consideration will be given to:

- Transportation of dangerous goods (e.g. propellant)
- The ultimate and proof pressure factors for structural and pressure
- Pressure gauges calibration minimum 1 year before use
- EGSE interfacing with flight hardware will comply with reliability and safety requirements (These connectors will be of flight standard also in terms of material)

7.1.2 Material Selection for GSE

All material used for GSE will be in accordance with flight standards if in contact with flight hardware. Cleaning agents will comply with flight hardware performances.

Appendix C Gilmour Space Document Management Plan

Gilmour Space Document Management Plan.docx

Appendix D Bowen Orbital Spaceport Maintenance Management Plan

20220518_Bowen Orbital Spaceport Maintenance Management Plan.docx

Appendix E OCG Development Approval Conditions

INM1775 - OCG - Development Approval .pdf

Appendix F BOS Site Security Plan

20240216_Bowen Orbital Spaceport Security Plan.docx

Appendix G BOS Launch Campaign Plan Template

20220627_Bowen Orbital Spaceport Launch Campaign Plan Template.docx

Appendix 9

Engine Test Hazard and Risk

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Executive Summary

This review reflects the work of Gilmour Space to identify, characterise and quantify the attendant and residual risks that arise from the operation of the Bowen Orbital Spaceport test facilities to inform interested parties regarding the treatment of risks and regulatory compliance.

The Bowen Orbital Spaceport is Australia's first purpose-built launch facility for small class orbital launch vehicles. It is sited within the Abbott Point State Development Area.

The activity of a spaceport in Australia is governed by several regulatory requirements Key amongst which for the purposes on engine test are the Work Health and Safety Act (QLD), the Environmental Protection and Biodiversity Conservation Act and the Environmental Protection Act (QLD). Gilmour Space has conducted a risk assessment under its risk framework to examine the residual risks of engine test activity to safety and to the environment within the regulatory requirements.

While diligent engineering and innovative design eliminate risk much as they do in the commercial aviation industry, the real possibility of off-nominal events persists particularly within the context of research and development activity associated with rocket engines.

Risks to safety and treatments are identified to limit the exposure of personnel and property to noise, blast effects, chemical contamination, and debris. Treatment of safety risks rest on the containment of potential contamination and the exclusion of personnel and aircraft from nominated safety zones to reduce the exposure to hazards.

The exclusion of persons from exposure to harm requires analysis of potential debris fields from nominal and off nominal launch and test operations. The design of safety zones, informed by proper analysis results in demonstratable compliance with the requirements of the applicable legislation.

Independent experts have been engaged to conduct modelling and environmental analyses, quantifying the potential effects of engine test operations and their analysis has informed these mitigations which we assess will comply with the requirement to avoid significant impact to matters of national or state environmental significance.

1 Introduction

Gilmour Space is committed to achieving sovereign orbital launch capabilities for Australia. The Australian space sector represents a small but significant sector of the Australian economy with significant growth potential. The establishment of an engine test facility will enable greater market participation for Australian space companies in both domestic and international space markets.

1.1 Purpose

This review is intended to inform Development Approval (DA) change application process. The hazard and risk review characterises and quantifies the residual risks associated with the operation of an engine test facility at the identified site within the Abbot Point State Development Area (APSDA).

1.2 Scope

The scope of this review involves assessment of the systemic context, risk management processes, identified hazards, controls and treatment of residual risks including:

- nominal engine test
- engine test failure modes and effects

This report does not assess routine personal occupational or workplace safety risks which instead are addressed within the relevant site safety plan.

1.3 Structure of this report

This hazard and risk review is structured as follows:

Section 1 – Introduction

Section 2 – Description of the BOS

Section 3 – Description of Engine Test

Section 4 – Review of Regulatory Authorities and Standards

Section 5 – The Risk Methodology

Section 6 – Risk and Control Analysis

Section 7 - Summary of Residual Risks against Regulatory Requirements

2 Description of the Bowen Orbital Spaceport

2.1 BOS Location

The Bowen Orbital Spaceport (BOS) is Australia's first orbital launch facility, enabling access to low Earth orbit for small payloads from Australian soil. The remote location and extensive undeveloped areas on the lot provide opportunities to develop modest facilities meeting the ongoing need for engine test activity.

Figure 1 - Bowen Orbital Spaceport Location

2.2 BOS Layout

The BOS complex occupies two disparate sites, the Launch Control Centre (on NQBP land adjacent to the Eastern Laydown Area) and the Launch site (on Lot 10 Abbot Point Road).

Figure 2 BOS Facilities

Within Lot 10 lies the launch facility and the proposed location for two engine test pads. The Launch facility comprises a secure hardstand, Vehicle Assembly Building (VAB) and Launch Pad (PAD) including all associated infrastructure including towers, tanks and storage areas. Each of the engine test pads (accessed via the firetrail) will comprise a fenced hardstand hosting reconfigurable infrastructure to support various engine test activity (Test Pad 1 for hybrid rocket engines and Test Pad 2 for liquid rocket engines).

Figure 3 Lot 10 Layout

2.3 BOS Intended Activity

Launch operations are campaign activities that will begin with the delivery of launch vehicle components and culminate some 60-90 days later with the launch of a vehicle followed by up to 10 days of post launch activity to remediate and return the site to readiness for a new launch campaign. The first tranche of these campaigns will involve the Eris launch vehicle.

Engine test activities are shorter, more focussed activities varying in length from a few days to several weeks. Engine tests may be performed as a part of a verification / qualification activity in support of a launch campaign or as a separate experimental or developmental activity.

3 Engine Test Activity

Testing of rocket engines is necessary for verification of production or flight articles including liquid bi-propellant rocket engines (ERIS 3rd stage), hybrid rocket engines (ERIS 1st and 2nd stages) and mono-propellant engines (ERIS vernier engines) as well as product development and characterisation.

Testing is conducted on customised test rigs that include thrust structures; power supplies; fluids supply networks; control, instrumentation and data acquisition equipment; kinetic capture and armouring structures; and emergency stop apparatus.

Test activity may be conducted for very short durations of 1-3 seconds or full burn durations of up to 2-3 minutes. These activities are necessarily nested within test campaigns that may last from days to weeks, as small (3-5 person) teams prepare the test articles and supporting test infrastructure, conduct the test, gather the test data and demobilise the test articles and supporting infrastructure from the pad.

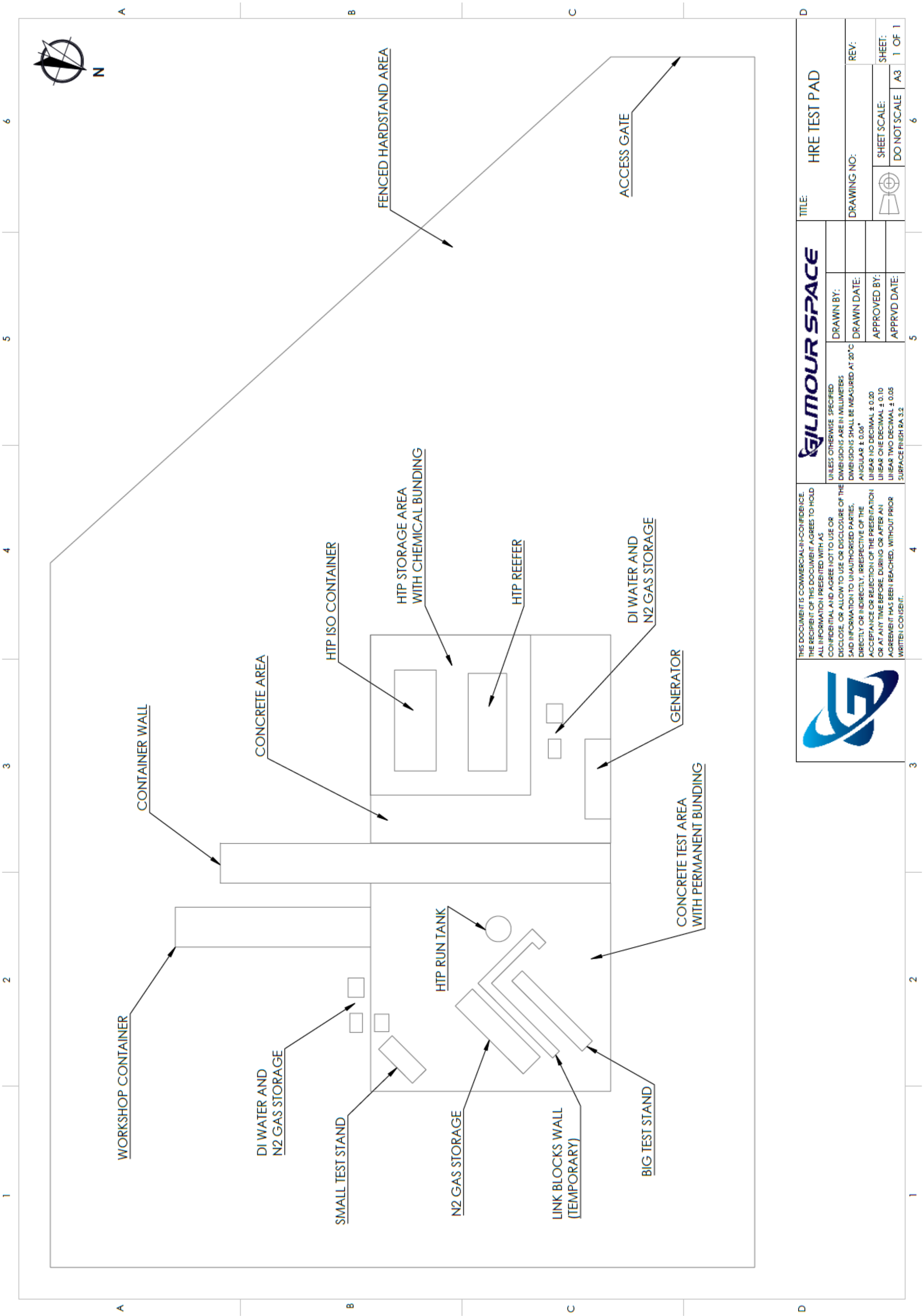

Figure 4 HRE Test Pad Typical Layout

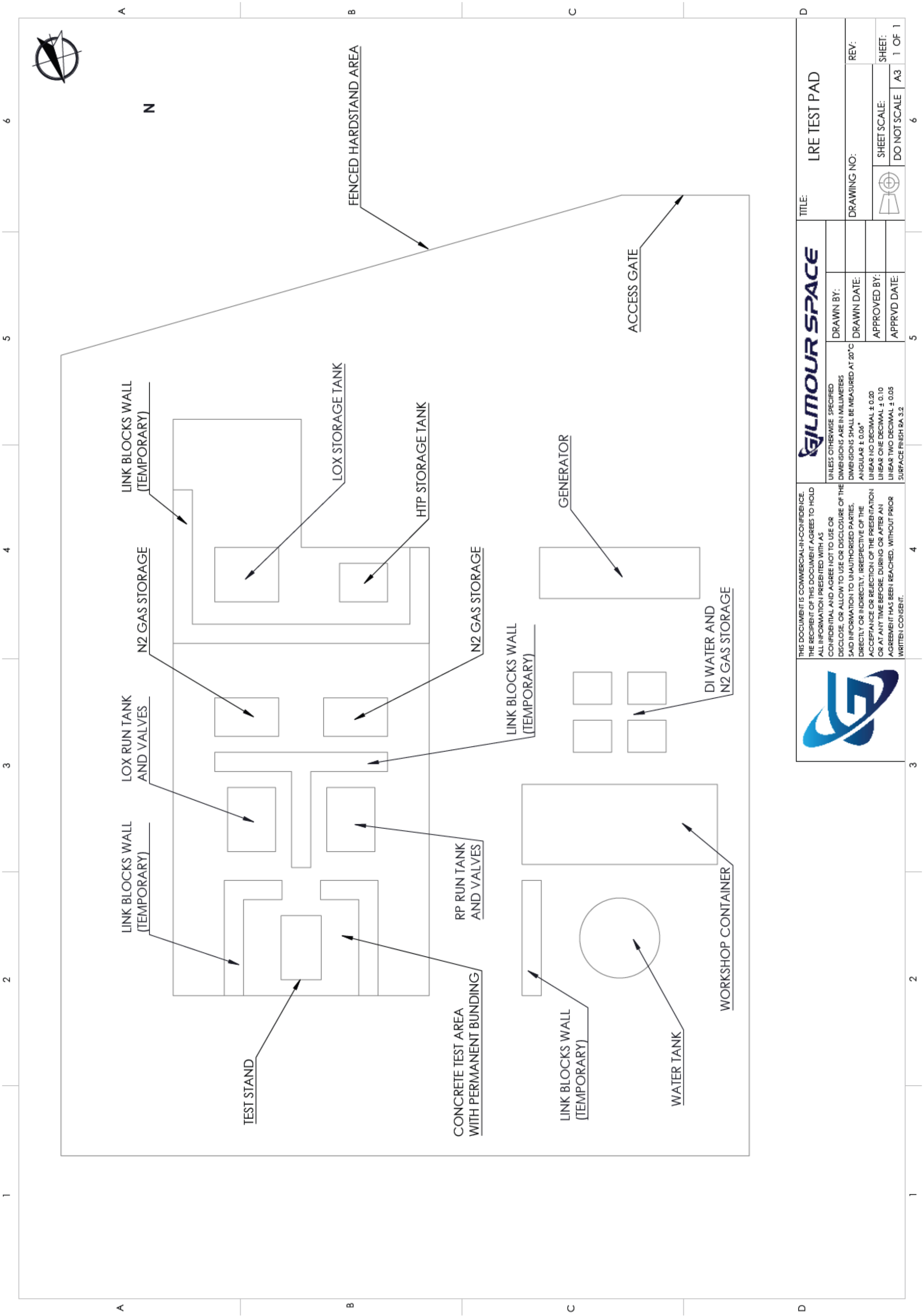

Figure 5 LRE Test Pad Typical Layout

4 Review of Regulatory Authorities and Standards

The regulatory authority for space activities in Australia is the Australian Space Agency (ASA). This agency is responsible for issuing of Launch Facility Licences and Launch Permits for the safe launch and return of space objects. However, engine test activity is an industrial, research and development activity that is regulated under extant regulatory mechanisms.

4.1 The Environmental Protection and Biodiversity Conservation (EBPC) Act

The EPBC Act provides a legal framework to protect and manage unique plants, animals, habitats and places. This includes heritage sites, marine areas, some wetlands and other protected matters.

The conduct of engine test will generate emissions (noise, heat, light and exhaust plumes) and may generate debris fields or explosive effects. Gilmour Space secured the services of an external provider to assess the potential and expected environmental impacts of activities at the engine test facility. This hazard and risk review is informed by that environmental assessment on engine test activities which considers the establishment of the Bowen Orbital Spaceport engine test facility against the significant impact criteria of this federal Act.

4.2 The Environmental Protection (EP) Act QLD

The Environmental Protection Act 1994 seeks to protect the Queensland environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains ecological processes. The EP Act sets forth the process for consideration of whether an activity meets the threshold of an Environmentally Relevant Activity (ERA). The established construction and operational activities of the Bowen Orbital Space do not meet any ERA Thresholds.

The EP Act also allows that under the State Development Act, a development planning application or Material Change of Use shall be considered as a properly made submission for environmental approval.

4.3 State Planning Policy (SPP) Act QLD

The Planning Act aims to establish an efficient and accountable system of land-use planning and development assessment to lead to ecological sustainability which balances the protection of ecological processes and natural systems at local, regional, state and national levels. The requirements of the Act are captured within the Abbot Point Scheme.

4.4 Abbot Point State Development Area (APSDA) Scheme

Declared in 2008, the APSDA was established under the State Development and Public Works Organisation Act 1971 to facilitate large-scale industrial, manufacturing and port-related development of regional, state, and national significance. Developments within the APSDA Scheme are approved by the Coordinator-General.

Current high impact industrial activities within the APSDA include:

- Industrial and port activities
- Coal bulk haulage
- Extractive quarrying industry
- Proposed future uses including possible renewable green hydrogen and energy production

4.5 Work Health and Safety Act

The Work Health and Safety Act 2011 (Qld) sets out requirements and standards for healthy and safe workplaces. It outlines what you must do to protect the health, safety and welfare of workers and other people in a place of work. It also puts legal obligations, or duties, on companies and their employees. The implementation of safety procedures around the conduct of test activity will be of critical import.

4.6 Hazardous and Dangerous Goods Management

The legislation, best practice, standards, and codes for the treatment of Dangerous Goods is the subject of International Agreements, National and State Legislation and various codes of practice. These codes, standards and legislation are reflected in the BOS Hazardous and Dangerous Goods Management Plan.

5 Risk Methodology

The Gilmour Space risk management methodology is derived from the principles, framework, and processes outlined in ISO 31000:2018 as well as other relevant risk management guidelines, legislative policies, and regulations. It details the strategy, roles, and responsibilities for risk management as well as explains the implementation of the Gilmour Space risk management framework.

In preparing this hazard and risk analysis, Gilmour Space conducted an assessment of the attendant risks of the launch and test operations of the spaceport facility in the context of the APSDA and recorded these results in a risk register. This assessment considered:

- The local environment of the BOS facility.
- Engineering designs for the BOS facility.
- Environmental Assessment Report.
- International literature as published by organisations such as NASA, ECSS, IAASS.
- Test campaigns to be conducted at BOS.

The category of risks considered were safety, technical, schedule, finance, environment (including cultural heritage), legal and reputation. This hazard and risk review will describe key risks to safety and the environment, including their treatment through controls and mitigations as well as the subsequent residual levels of risk when judged against the regulatory standards.

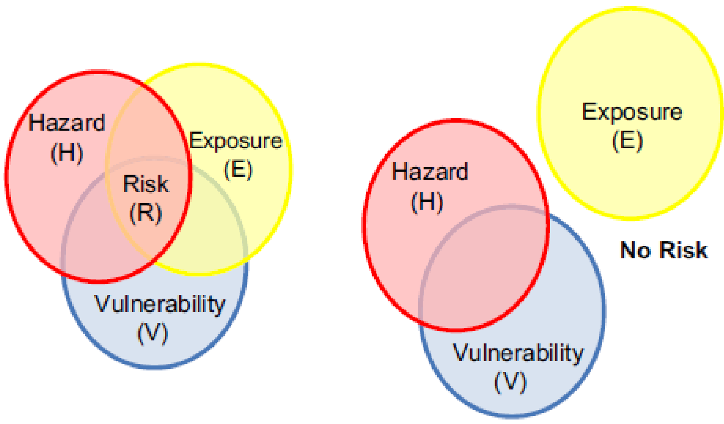

Figure 6 Representation of how Exposure Removal through Implementation of Exclusion Zone Lowers Risks

6 Risk and Control Analysis

6.1 Overview

The risk assessment for engine test at BOS can be found in Appendix A to this review. It identifies residual risks from the operation of the BOS engine test facilities which will be further discussed below. It is important to acknowledge that while all engineering effort is made in the design of test articles and supporting systems, the residual risk of failure during a test remains credible. Therefore, the locations for tests have been chosen to minimise these risks to the public and the environment.

The review of the systems associated with the operation of the BOS engine test facilities highlighted the key risk contexts below which are considered in the analysis.

- Risks to personal safety on site.
- Risks to property and operations within the APSDA.
- Risk to the coastal environment within the BOS site.

Table 3 below highlights the hazards identified as related to activities associated with the BOS within the contexts to which they are applicable for this analysis.

Table 1 – Identified Hazards for Risk Analysis

Phase & Identified Hazards	Applicable Risk Contexts		
	Personal Safety	APSDA	Coastal Env.
Test Activities			
Rocket Noise and Vibration	✔	✔	✔
Exhaust Velocity and Thermal Effects	✔		
Hazardous and Dangerous Goods	✔	-	-
Catastrophic Failure	✔	-	-

6.2 Untreated Hazards and Risks

Hazards generated by the conduct of engine test are generally associated with the generation of noise, the generation of an exhaust plume that is both hot and high velocity, the use of potentially hazardous substances and in the case of test failures, the generation of overpressure effects, thermal effects, debris fields, and loss of containment of hazardous substances.

These hazards are characterised below.

6.2.1 Rocket Noise

Rocket engine test generates significant noise from the combustion process and turbulent mixing of the exhaust flow with the surrounding air. There is a supersonic potential core of exhaust flow, surrounded by a mixing region. Noise is generated in this flow. It is directional, with the highest noise levels at an angle of 40 to 50 degrees from the direction of the exhaust flow.

The emitted noise is modified in several ways as it propagates outward from the test engine. These effects include source directivity, geometric spreading, atmospheric absorption and ground interference to a receiver location.

Unmitigated noise levels in proximity to the test articles would represent a hazard that exceeds the QLD Work Health and Safety noise exposure standard of L_{Cpeak} 140dB(C) and L_{eq8hr} 85dB(A) carrying the risk or hearing impairment for unprotected personnel or fauna in proximity to the test article.

Simpsons Engineering Group conducted modelling engine types and planned testing frequencies and when comparing noise effects already studied within the previous development approval submission and the federally approved Public Environment Report, determined that the noise emissions from engine test activities "readily complies with existing site license conditions" (Bowen Orbital Spaceport – Engine Test Facilities, Simpson Engineering Group 4 Dec 2023).

6.2.2 Exhaust Velocity and Thermal Effects

Rocket engine tests seek to demonstrate the capability of an engine to generate thrust through combustion and the generation of a reaction from high-speed exhaust.

Exhaust plumes will exit the test articles with temperatures exceeding 1500°C and velocities exceeding 3km/sec. Whilst both will dissipate within relatively short distances, these temperatures and velocities represent physical hazards that carry the risk of direct physical damage to personnel or fauna and the risk of starting fires in any exposed vegetation or other combustible materials.

6.2.3 Hazardous and Dangerous Goods

Engine test activity on the test pads includes the storage and use of non-flammable compressed gasses, cryogenic fluids, combustible liquids, oxidising agents and industrial solvents. Hazardous goods carry the risk of personnel or fauna exposure and environmental contamination in both nominal use cases and in the event of a catastrophic failure described below.

6.2.4 Catastrophic Failure

Catastrophic failure of a test rig or test article will result in the nearly instantaneous release of energy being generated or stored by the test. This energy release can manifest in many ways but the worst case involves generation of the following hazards:

- an overpressure blast wave (explosion);
- an expanding flame front (fireball);
- a debris field (fragmentation); and
- uncontained hazardous goods (contamination).

These hazards all represent risks to personnel, fauna and the environment in proximity to the activity.

6.3 Controlling the Risks

Whilst all reasonable precaution will be taken in careful design and engineering of the articles to be tested, a reasonable probability of failure will accompany engine test activities and even nominal engine tests will generate risks. Therefore controls will necessarily rely upon the exclusion of personnel and fauna from proximity of the test activity, reasonable preparation of the surrounding area to prevent propagation of hazards in the event of a failure and plans in place for response to any anomalous spills, fires or debris field generation.

6.3.1 Safety Zone Calculation Methodology

In order to calculate the safety exclusion zones, the Defense Explosives Safety Regulation (DESR) 6055.09 Edition 1 developed by the US Department of Defense was applied. This standard primarily covers explosive ordnance use within military applications, but also contains provisions for the application of the standard to liquid fuelled launch vehicles and engine test stands. The outcome of the calculation process provides two separation distances based upon the personnel involved:

- Essential Personnel distance which accounts for blast wave and thermal (expanding flame front) hazards and assumes the test operators are within a control area protected from fragmentation, and
- Non-Essential Personnel distance, which accounts for blast wave, thermal and fragmentation and is the safe distance at which all other site personnel may operate normal activities during an engine firing.

The separation distances are unique to each engine design being tested, due to the varying fluid propellants, pressures and sizes, and the test stand design. These are then enacted for each test through the Range Safety Plan. The basic methodology applied from DESR 6055.09 follows:

1. Determine the equivalent net explosive weight based upon the type of propellants, engine and size from VOLUME 5 – ENCLOSURE 4: ENERGETIC LIQUIDS,
2. Determine the thermal & blast wave separation distances for Essential and Non-Essential Personnel from VOLUME 5 – ENCLOSURE 3: AREAS USED FOR INTENTIONAL BURNS AND DETONATIONS,
3. Determine the fragmentation distance from VOLUME 3 – ENCLOSURE 3: QD CRITERIA FOR ACCIDENTAL DETONATIONS. Non-Essential Personnel distance is then the larger of 2 and 3.

All blast wave and thermal separation distances are confined within the Lot 10 boundaries. Appropriate blast wall shielding with concrete link block walls and concrete barricades will be installed to confine all fragmentation distances to within the Lot 10 boundaries.

Uncontained hazardous chemical spills or contamination are mitigated through bunding around the test stand pad area compliant to the relevant Australian Standards (AS4326, AS1894, AS1940).

6.3.2 Test Operations and Range Safety

Range Safety at BOS incorporates functions to control and monitor heightened risk activity to maintain safety of employees and the public. The Range Safety Plan details the Range Safety Organisation and responsibilities, Range Design limitations and requirements, Range Operations processes, and the capabilities of the Local Response Team.

In preparation for engine test activity, the range safety team will sweep the hazard areas for each test to ensure they are clear of wildlife, inspect any bunding or containment measures in place to limit propagation of hazardous substances, conduct ground preparation (cutting long grass or wetting vegetation) and assume standby positions for response to any anomaly.

All test operations will be assessed through a Test Readiness Review that considers technical, operational procedures, logistic support, safety planning and emergency response aspects of the proposed test including review of a comprehensive risk assessment completed in line with the Gilmour Space Risk Management Policy and reviewed by the Workplace Health and Safety Officer.

The review assigns specific roles to the test director and test conductor and ensures consultation with range safety and BOS operations staff has been completed.

Range safety carries two key responsibilities during the conduct of test activity:

Maintenance of the safety zones. Through communication, physical barriers and surveillance of the required safety area, range safety will declare the range open – authorising the test activity to commence and, in the event of any safety zone likely or actual incursion, range safety will declare an abort. Range Safety will also deactivate the safety zones once the test hazards are confirmed to be retired.

Response to Anomaly. In the event of any anomaly, Range Safety will manage the BOS response including and Emergency Response Plan actions, containment, clean up and deactivation of the safety zones when satisfied the situation has been returned to nominal conditions.

7 Summary of Residual Risks and Regulatory Requirements

This hazard analysis and risk assessment indicates residual risks exist at the BOS during the conduct of engine test activity. The regulatory requirements of the WHS, EBPC, and EP Acts require that Gilmour Space control or mitigate these risks to meet certain standards. The residual risks and treatments are described in the sections below.

7.1 EBPC, EP Act

The federal and state level environmental protection and planning legislation require that activities be controlled such that they represent no significant impact to the environment where it concerns matters of national or state environmental significance. Gilmour Space have sought advice on the significance of ecological impact of engine test on the environment surrounding the test pads.

Terra Solutions have prepared a revised Environmental Management Plan for the site incorporating operation of the proposed test infrastructure which notes that the test activity is not likely to meet any definitions of a significant impact to Matters of National Environmental Significance under the EBPC Act. The Flora and Fauna Management plan prepared by Terra Solutions provides a framework within which that the proposed development does not approach the threshold of nor that of an Environmentally Relevant Activity under the EP Act.

7.2 Workplace Health and Safety Act

Gilmour Space Risk Management Policy incorporates the requirement to conduct risk management for any heightened risk activities in order to reduce the residual risks of test activity as far as reasonably practicable. Gilmour Space policy reviews all risk assessments through the WHS officer and Test Readiness Reviews to ensure these requirements are met.

Abbreviations

Abbreviation	Definition
1080	Sodium Fluoroacetate
ACH	Aboriginal Cultural Heritage
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
AMSA	Australian Maritime Safety Authority
APSDA	Abbot Point State Development Area
ASA	Australian Space Agency
AusSpOC	Australian Space Operations Centre
BOM	Bureau of Meteorology
BOS	Bowen Orbital Spaceport
CSMP	Coral Sea Marine Park
DA	Development Application
DFO	Distant Focusing Overpressure
DGR	Dangerous Goods Regulations
EAA	Emergency Assembly Area
EC	Emergency Controller
ECG	Emergency Control Group
ECSS	European Cooperation for Space Standardization
EDQ	Economic Development Queensland
EMP	Environmental Management Plan
EP Act	Environmental Protection Act
ERA	Environmentally Relevant Activity
ERP	Emergency Response Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Management Plan
EW	Emergency Warden
EWLCC	LCC Emergency Warden
EWLPAD	LPAD Emergency Warden
EWVAB	VAB Emergency Warden
FMECA	Failure Modes, Effects, and Criticality Analysis
FMP	Facilities Management Plan
FSS	Flight Safety System
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GP	General Public
GST	Gilmour Space Technologies
H_2O	Water
H_2O_2	Hydrogen Peroxide
HDGMP	Hazardous and Dangerous Goods Management Plan
IAASS	International Association for the Advancement of Space Safety
IATA	International Air Transport Association
IIP	Instantaneous Impact Point

IMDGC	International Maritime Dangerous Goods Code
Kero	Kerosene
LCC	Launch Control Centre
LDMG	Local Disaster Management Group
LEO	Low Earth Orbit
LMP	Land Management Plan
LOx	Liquid Oxygen
LPAD	Launch Pad
MCU	Material Change of Use
MEDQ	Minister for Economic Development of Queensland
MSDS	Material Safety and Data Sheets
NASA	National Aeronautics and Space Administration
NEW	Net Explosive Weight
NQBP	North Queensland Bulk Ports
O_2	Oxygen
PCBU	Person Conducting a Business or Undertaking
PPE	Personal Protective Equipment
QFES	Queensland Fire and Emergency Services
QPOL	Queensland Police Open Learning
QPS	Queensland Police Service
RHD	Rabbit Haemorrhagic Disease
SDA	State Development Area
SDS	Safety Data Sheet
SO	Safety Officer
SPP	State Planning Policy
SSP	Site Security Plan
TAP	Transport and Access Plan
TBC	To be Confirmed
TNT	Trinitrotoluene
UN	United Nations
VAB	Vehicle Assembly Building
VMR	Volunteer Marine Rescue
WHS	Workplace Health and Safety
WMP	Waste Management Plan
WRC	Whitsunday Regional Council

Appendix 10

GILMOUR SPACE

Bowen Orbital Spaceport

Hazardous and Dangerous Goods Management Plan

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1 Introduction

Gilmour Space is committed to safe and effective operation of the Bowen Orbital Spaceport (BOS). The conduct of space launch activity and the operation of the Spaceport will involve the management of various classes of hazardous and dangerous goods on site.

1.1 Purpose

This Hazardous and Dangerous Goods Management Plan (HDGMP) seeks to establish a framework for the transport, receipt, storage, use and handling, as well as disposal of hazardous and dangerous goods at BOS.

The HDGMP aims to minimise the potential impacts on human health, property, and the natural environment, while also complying with the objectives of applicable legislation, standards, and codes of practice.

1.2 Scope

This document will address operations and launch activity at BOS.

1.3 Legislation, Standards and Guidelines

International Codes and Standards:

- **International Maritime Organization**
  - The International Maritime Dangerous Goods Code (IMDGC)
- **International Air Transport Association**
  - International Air Transport Association (IATA) Dangerous Goods Regulations (DGR)

Commonwealth Legislation:

- **National Transport Commission**
  - Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code)

State Legislation:

- **Worksafe Queensland**
  - Work Health and Safety Act 2011
  - Work Health and Safety Regulation 2011
  - Managing risks of hazardous chemicals in the workplace code of practice 2021
  - Labelling of workplace hazardous chemicals code of practice 2021
  - Preparation of safety data sheets for hazardous chemicals code of practice 2021

Australian Standards:

- **Standards Australia**
  - AS ISO 31000:2018 Risk Management Principals and Guidelines
  - AS/NZS 1940:2017 The storage and handling of flammable and combustible liquids
  - AS 1894:1997 The storage and handling of non-flammable cryogenic and refrigerated liquids
  - AS 2444:2001 Portable Fire Extinguishers and Fire Blankets – Selection and Location
  - AS/NZS 3833:2007 Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Bulk Containers
  - AS/NZS 4326:2008 Storage and Handling of Oxidisers
  - AS 2030.1:2009 the verification, filling, inspection, testing and maintenance of cylinders for the storage and transport of compressed gases

- AS 3780:2008 The storage and handling of corrosive substances
- AS 1170.4 and 1170.4: 2021 Wind Actions

2 Roles and Responsibilities

All employees and contract staff are responsible for the safe handling of hazardous and dangerous goods at BOS. This includes complying with relevant approval and permit requirements and ensuring that all reasonable and practical measures to prevent or minimise harm are taken for all activities.

Contractors and Employees

- Assess the workplace and work activities for hazardous substances before commencing any work.
- Ensure that for any hazardous substances identified, that the relevant SDS for the substance has been reviewed by the work party.
- Ensure that the risks of using hazardous substances are assessed and that appropriate controls are in place for risks prior to initiating work (Risk Assessments, SWMS, JSA or Take5).

Launch Site Operations Supervisor

- Ensure employees and contractors have sufficient knowledge and training in the handling of hazardous substances that will be encountered.
- Ensure that the SDS register is updated and that SDS are available to all workers and work parties.
- Ensure that all hazardous substances brought to site are receipted properly and are registered in the hazardous substance register.
- Maintain an Emergency Response Plan for BOS incorporating response measures to incidents involving hazardous or dangerous goods.

Workplace Health and Safety Officer

- Provide guidance and facilitation for assessment of the risks relating to hazardous substances, and oversee controls for those risks are their implementation.
- Supervise audits and verifications on the storage and use of hazardous substances.
- Own and maintain hazardous substances and SDS storage registers.

3 Hazardous Substances Management

3.1 Risk Assessments

A documented risk assessment shall be conducted prior to working with hazardous substances (SWMS, JSA or Take5). Documented risk assessments are to be kept in sharepoint (Safety) and should be updated whenever the scope of the work activity involving a hazardous substance or the environmental conditions for which the risk assessment was conducted changes.

Risk assessments are to be conducted in line with the Gilmour Space risk management procedure, which follows a 5-step process of:

- **Identifying the Risk** – Identify hazards presented by project, task, or activity.
- **Assessing the Risk** – Qualify or quantify the consequence and likelihood.
- **Making Risk Decisions** – Determine controls or actions from hierarchy of controls.
- **Implementing Controls** – Assign ownership and timing to controls or actions.
- **Supervision** – Risk acceptance and review.

The hierarchy of controls shown in figure 1 below should be used when determining controls or actions.

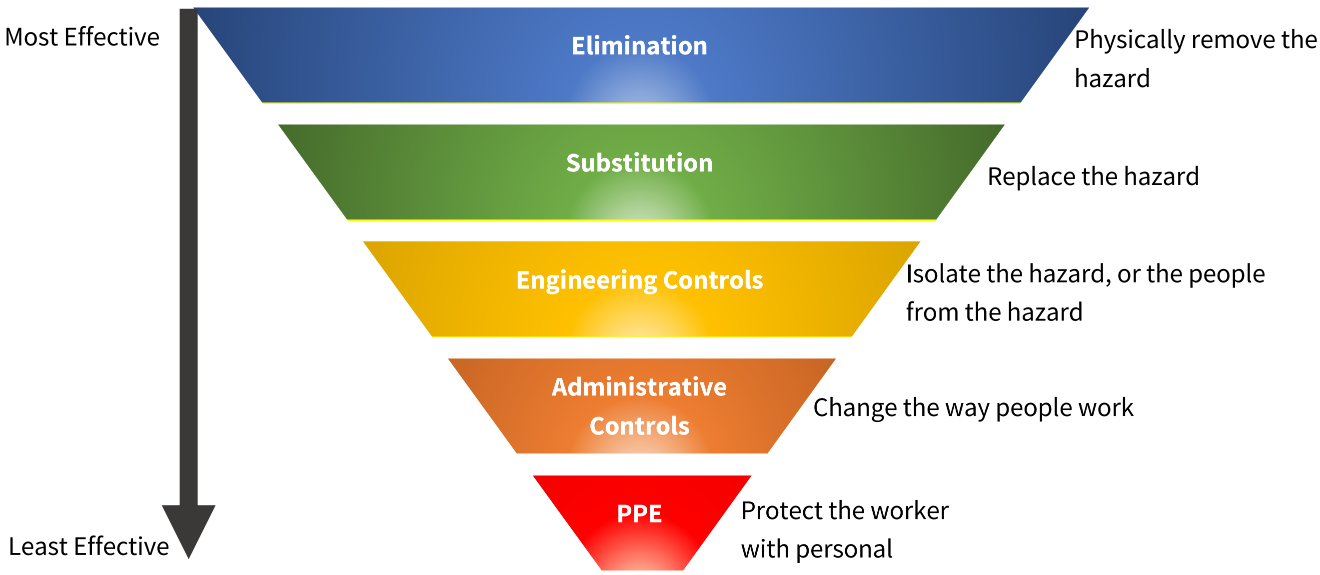

Figure 1 - Hierarchy of Controls

3.2 Receipt of Hazardous Substances

Hazardous and Dangerous Goods may arrive onsite to either the warehouse (for packages delivered by courier or procured by staff) or direct to their storage container (for vendor deliveries, eg Liquid Nitrogen or generator Diesel fuel). Generally, the BOS Warehouse Technician is primarily responsible for the receipt of good at BOS but, any receipt of hazardous substances at the BOS requires persons receiving to ensure that:

- All deliveries are labelled in accordance with labelling requirements in this HDGMP.
- Any damages or concerns are immediately identified via receiving an inspection and reported to Site Operations Supervisor.

- Risks associated with the transport and handling of the hazardous substances or dangerous goods are known.
- Receiving personnel are trained and knowledgeable about the handling and storage of the hazardous substance or dangerous goods to be received.
- Receiving personnel are trained and knowledgeable in how to respond to incidents involving the hazardous substance or dangerous goods to be received.
- All equipment for loading and unloading, required power and utilities, necessary storage and ullage area, and PPE is available for receipt.
- Spillages or leaks are immediately responded to and reported to the Site Operations Supervisor and Environment Health and Safety Coordinator.
- All deliveries are recorded promptly in the BOS Hazardous Substances SDS Register and Hazardous Goods Manifest.

3.3 Hazardous Substances SDS Register and Hazardous Goods Manifest

The hazardous substances register is required to be updated whenever receipt of a new substance is to be added. The BOS Warehouse Technician is to pass all details of new substances to the Facilities Technician for inclusion in SDS Chemical Register.

All substances added to the register must also be accompanied with a corresponding SDS. Copies of SDSs must be maintained at theplaced in the front of each of the 3 physical SDS folders stored at BOS at the following locations:

1. On the bench next to the lockout station in the VAB Main Office.

2. In the fire box attached to the fire shed next to the VAB front gate.

3. In the fire box attached to Gilmour sign at the cattle grid main entry to BOS.

The hazardous goods manifest will be utilised at the site throughout operations for any goods for which the maximum storage capacity or actual amount held exceeds placard quantities. The Facilities Technician is to update the Manifest for hazardous chemicals.docx at each delivery and weekly during periods of operation.

The hazardous goods manifest will include the following information:

- Substance Name
- Chemical Composition
- Storage Method and Location (Package, IBC, Self-bunded Tank, ISO Tank)
- Storage Max capacity (L, m^3, %, kg)
- Storage Quantity (L, kg, m^3)
- State (solid, liquid, gas)
- Hazardous Substance / Dangerous Goods Classification

3.4 Storage of Hazardous Substances

Storage facilities shall comply with the *managing risks of hazardous chemicals in the workplace* code of practice 2021.

Wherever required, storage areas and compounds have been adequately compounded and bunded to ensure containment of any hazardous substance. Separation and segregation and bund construction complies with AS/NZS 1940:2017 Flammable Liquids Storage and Handling, or AS/NZS 4326:2008 Oxidizing Agents Storage and Handling, AS 1894:1997 Storage and Handling of Non-flammable Cryogenic and Refrigerated Liquids and other codes or standards applicable.

3.5 Labelling

Hazardous substances are to be labelled in accordance with the *labelling of workplace hazardous chemicals* code of practice 2021 published by Workplace Health and Safety Queensland.

Below are the requirements that a hazardous chemical label must include as per the code (written in English):

- The product identifier.
- The name, Australian address, and business telephone number of either the manufacturer or importer.
- The identity and proportion disclosed, in accordance with Schedule 8 of the WHS Regulation, for each chemical ingredient.
- Any hazard pictogram(s) consistent with the correct classification(s) of the chemical.
- Any hazard statement(s), signal word and precautionary statement(s) that is consistent with the correct classification(s) of the chemical.
- Any information about the hazards, first aid and emergency procedures relevant to the chemical, which are not otherwise included in the hazard statement or precautionary statement.
- The expiry date of the chemical, if applicable.
- As a person conducting a business or undertaking (PCBU), you may include any information on the label that does not contradict or cast doubt on any other information that is required on the label.

The following additional information should also be included on the label, where available:

- An emergency phone number for specific poisons or treatment advice.
- The overseas name, address and telephone number of the manufacturer or supplier.
- A valid website or internet address.
- Reference to the safety data sheet (SDS), for example a statement on the label that says: ‘Additional information is listed in the safety data sheet’.

If an emergency information service or Poisons Information Centre phone number is provided on the label, this arrangement should be confirmed with the service beforehand and copies of the SDS should be provided to them.

3.6 Hazard Pictograms and ADG Code Class Labels

Signage and labelling of dangerous goods storage and use areas should where feasible, align with the Globally Harmonized System of Classification and Labelling of Chemicals.

3.7 Inventory Management

The Facilities Technician or BOS staff trained in the conduct of the BOS OPEN and CLOSE checklists is to conduct inspection of bunding and the monitoring of storage levels of hazardous substances at least daily to facilitate the identification of loss or leakage.

3.8 Fire Protection

The BOS facility maintains fire extinguishers of suitable types and quantities at locations where the risk of fire is present. The selection and location of fire extinguishers is consistent with AS/NZS 2444:2001 Portable Fire Extinguishers and Fire Blankets.

Requirements of AS/NZS 1940:2017 Storage and Handling of Flammable and Combustible Liquids and AS/NZS 4326:2008 Storage and Handling of Oxidisers relating to fire safety is observed.

Specialist systems are available for the potential for experimental battery fires within the launch vehicle body (N_2 / CO_2 flood systems) when launch vehicles are being assembled.

3.9 Removing and Disposing of Hazardous Substances

All waste or unused hazardous substances must be removed from site in line with legislative and code of practice requirements, as well as the BOS Waste Management Plan.

Details of any disposal or removal of waste or unused hazardous substances shall be approved by the Site Operations Supervisor prior to disposal or removal. All documentation or removal is kept Hazardous Waste Register in accordance with the Gilmour Space Document Management Policy.

4 Emergency Response

4.1 Emergency Response Plan

The Site Operations Supervisor shall maintain an emergency response plan for the BOS facility in order to minimise damage to people, property and the environment as a result of any emergency involving the launch site. The plan will ensure appropriate responses to emergencies or incidents that that may arise from launch site activities or other incidents that may impact the integrity or safety of the launch site.

The Emergency Response Plan (ERP) dictates procedures for responding to medical, fire and dangerous goods incidents, and notification and reporting procedures for incidents. The ERP will be made available to personnel through site induction and copies will be available in the Management Plans folder located in the VAB main office next to the lockout station, as well as in the (09 Emergency Management) folder on SharePoint.

The plan will be reviewed annually or when any changes are made that may materially affect the plan.

Incidents will be subject to investigation and further reporting as detailed in the Work Health & Safety Policy & Procedures.docx

5 Launch Site Hazardous Substances

The BOS is a Manifest Quantity Workplace as defined in the Work Health and Safety Regulation 2011 and notifies the regulator of its status via form 73, displays placarding for all Schedule 11 chemicals on site and maintains SDS lockers for use by responding emergency services.

Whilst not a Major Hazard Facility as defined in the Work Health and Safety Regulation 2011, the BOS does at times have holdings of schedule 15 chemicals that exceed 10% of threshold quantities in the regulation and therefore needs to notify the regulator via form 69. These forms are stored in sharepoint at Safety.

The hazardous and non-hazardous materials expected to be used during the operational phase of the BOS are shown below in Table 1 and the layout of hazardous materials storage and signage areas are show below in Figure 2 and Figure 3.

Table 1 – Manifest for Hazardous Chemicals

Person conducting the business or undertaking (PCBU)	*Gilmour Space Technologies Pty Ltd*
Trading name	*Gilmour Space Technologies Pty Ltd*
Address of premises	*Abbot Point Road Lot 10 on SP295408*
Date of preparation	*14 November 2022*

Emergency contacts

Name	Position	Telephone
Adam Williams	*Launch Operations Manager*	*0402 462 228* *07 5549 2370*
Scott Shimmen	*Launch Site Operations Supervisor*	*0455 742 727*

Oxidiser Pad

Storage area	Dangerous Goods and Hazardous Chemicals					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
HPT1001	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*20,000 L*

HPT1002	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*20,000 L*
HPT TX	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*20,000 L*

Cryogenic Pad

Storage area	Dangerous Goods and Hazardous Chemicals					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
LOT1001	*Liquid Oxygen*	*1073*	*5.1, 2.2*	*2*	*n/a*	*4,500L VIE*
LNT1001A	*Liquid Nitrogen*	*1977*	*2.2*	*n/a*	*n/a*	*1,334Kg VIE*
LNT1001B	*Liquid Nitrogen*	*1977*	*2.2*	*n/a*	*n/a*	*1,334Kg VIE*

Fuel and Gas Pad

Storage area	Dangerous Goods and Hazardous Chemicals					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
HEMP1001	*Helium*	*1046*	*2.2*	*n/a*	*n/a*	*337.5 SM3 (3 x 15 pack, G size)*
GNMP1001	*Nitrogen*	*1066*	*2.2*	*n/a*	*n/a*	*337.5SM3 (3 x 15 pack, G size)*
RPT1001	*Kerosene*	*1223*	*3*	*n/a*	*III*	*2,000L*
RPT1001	*Kerosene*	*1223*	*3*	*n/a*	*III*	*2,000L*
DT02	*Diesel*	*1202*	*3*	*n/a*	*III*	*4,000L*

Vehicle Assembly Building

Storage area	Dangerous Goods and Hazardous Chemicals					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
DT02	*Diesel*	*1202*	*3*	*n/a*	*III*	*4,000L*
PAD	*Citrisurf*	*n/a*	*8*	*n/a*	*III*	*400L*
READY USE	*Smootharc Stainless Steel Pickling Gel*	*2922*	*8, 6.1*	*n/a*	*II*	*5kg*
READY USE	*Acetone*	*1090*	*3*	*n/a*	*II*	*1 L*
INTEGRATION BAY	*Helium*	*1046*	*2.2*	*n/a*	*n/a*	*E size*
INTEGRATION BAY	*Argon*	*1006*	*2.2*	*n/a*	*n/a*	*G size*

Test Pad 1 (HRE)

Storage area	Dangerous Goods and Hazardous Chemicals					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
HTP ISO CONTAINER	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*20,000 L*
HTP REEFER TANK 1	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*2,000 L*
HTP REEFER TANK 2	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*2,000 L*
HTP REEFER TANK 3	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*2,000 L*
GENERATOR	*Diesel*	*1202*	*3*	*n/a*	*III*	*4,000L*
WORKSHOP	*Citrisurf*	*n/a*	*8*	*n/a*	*III*	*20L*

WORKSHOP	*Smootharc Stainless Steel Pickling Gel*	*2922*	*8, 6.1*	*n/a*	*II*	*5kg*
WORKSHOP	*Acetone*	*1090*	*3*	*n/a*	*II*	*1 L*
WORKSHOP	*Isopropyl Alcohol*	*1219*	*3*	*n/a*	*II*	*5 L*
GAS STORAGE	*Nitrogen*	*1006*	*2.2*	*n/a*	*n/a*	*12x Manpack (15x G size)*

Test Pad 2 (LRE)

Storage area	**Dangerous Goods and Hazardous Chemicals**					
	Name	**UN No.**	**Class**	**Sub risk/s**	**PG**	**Largest quantity**
LOX STORAGE TANK	*Liquid Oxygen*	*1073*	*5.1, 2.2*	*2*	*n/a*	*3000L VIE*
HTP STORAGE TANK	*Hydrogen Peroxide, Aqueous solution, Stabilised*	*2015*	*5.1*	*8*	*I*	*200 L*
GENERATOR	*Diesel*	*1202*	*3*	*n/a*	*III*	*2,000L*
GENERATOR	*D60 Solvent*	*CAS: 64742-48-9*	*n/a*	*n/a*	*n/a*	*1000L*
WORKSHOP	*Citrisurf*	*n/a*	*8*	*n/a*	*III*	*20L*
WORKSHOP	*Smootharc Stainless Steel Pickling Gel*	*2922*	*8, 6.1*	*n/a*	*II*	*5kg*
WORKSHOP	*Acetone*	*1090*	*3*	*n/a*	*II*	*1 L*
WORKSHOP	*Isopropyl Alcohol*	*1219*	*3*	*n/a*	*II*	*5 L*
GAS STORAGE	*Helium*	*1046*	*2.2*	*n/a*	*n/a*	*2x Manpack (12x G size)*
GAS STORAGE	*Nitrogen*	*1006*	*2.2*	*n/a*	*n/a*	*6x Manpack (15x G size)*

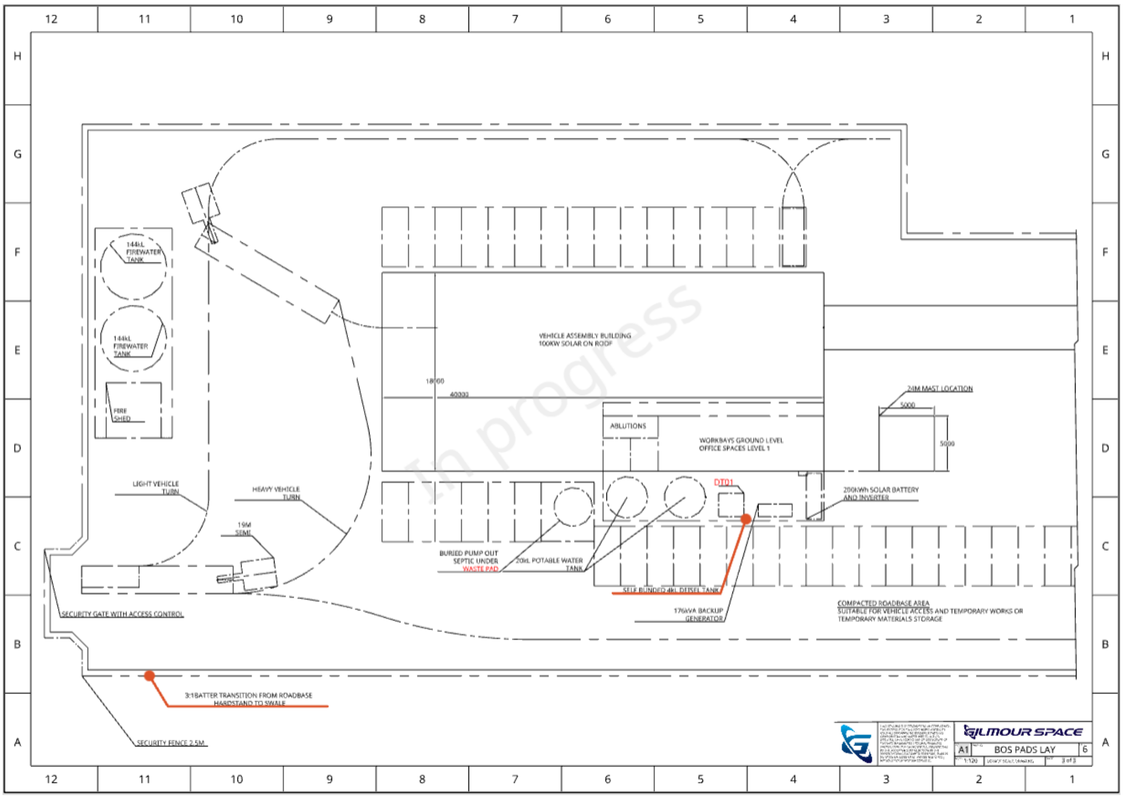

Figure 2 - Hazardous and Dangerous Goods Storage Areas Layout for VAB

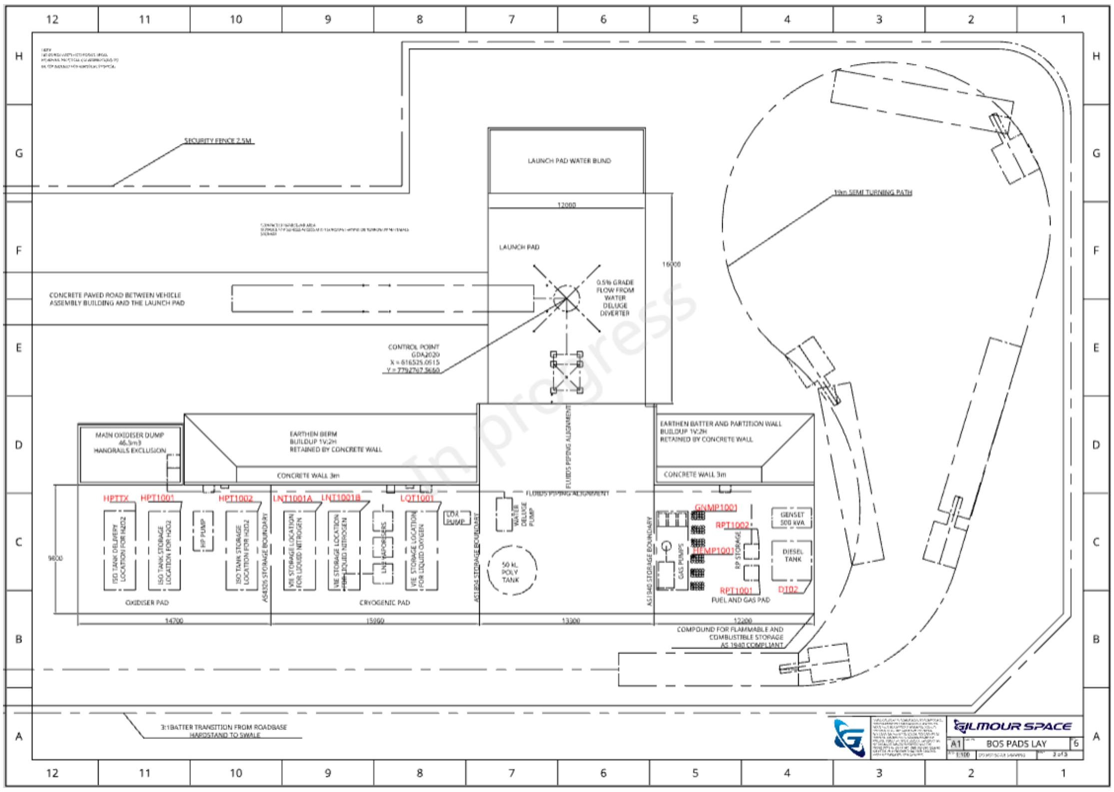

Figure 3 - Hazardous and Dangerous Goods Storage Areas Layout for Launch Pad and Storage Pads

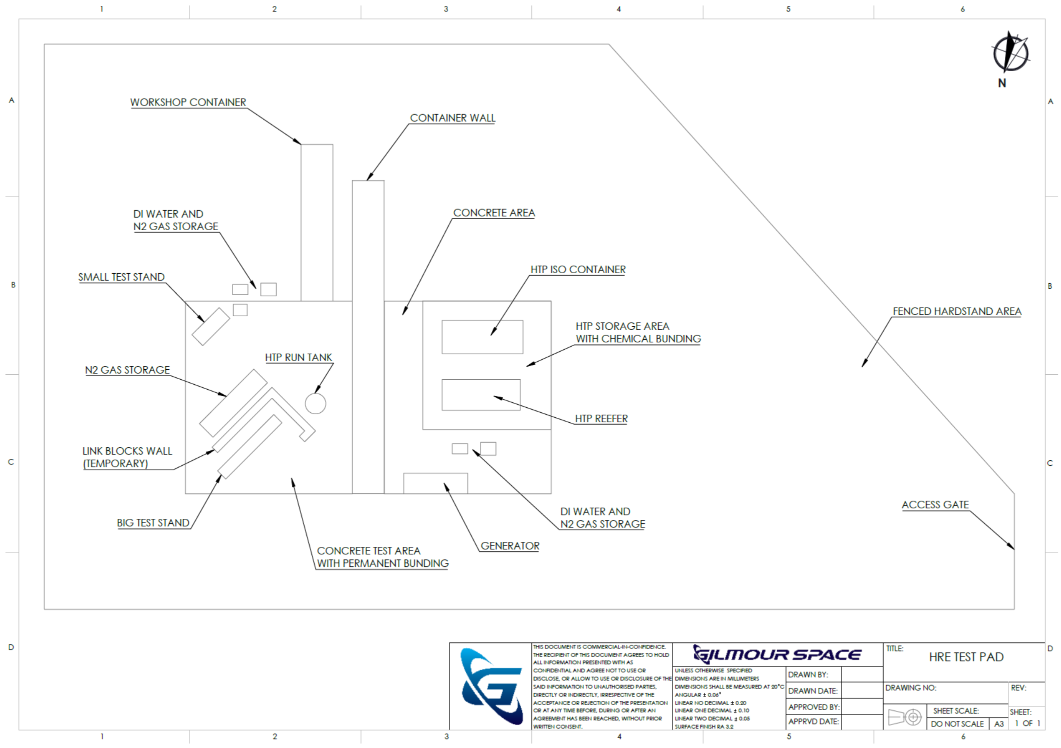

Figure 4 - HRE Test Pad Typical Layout

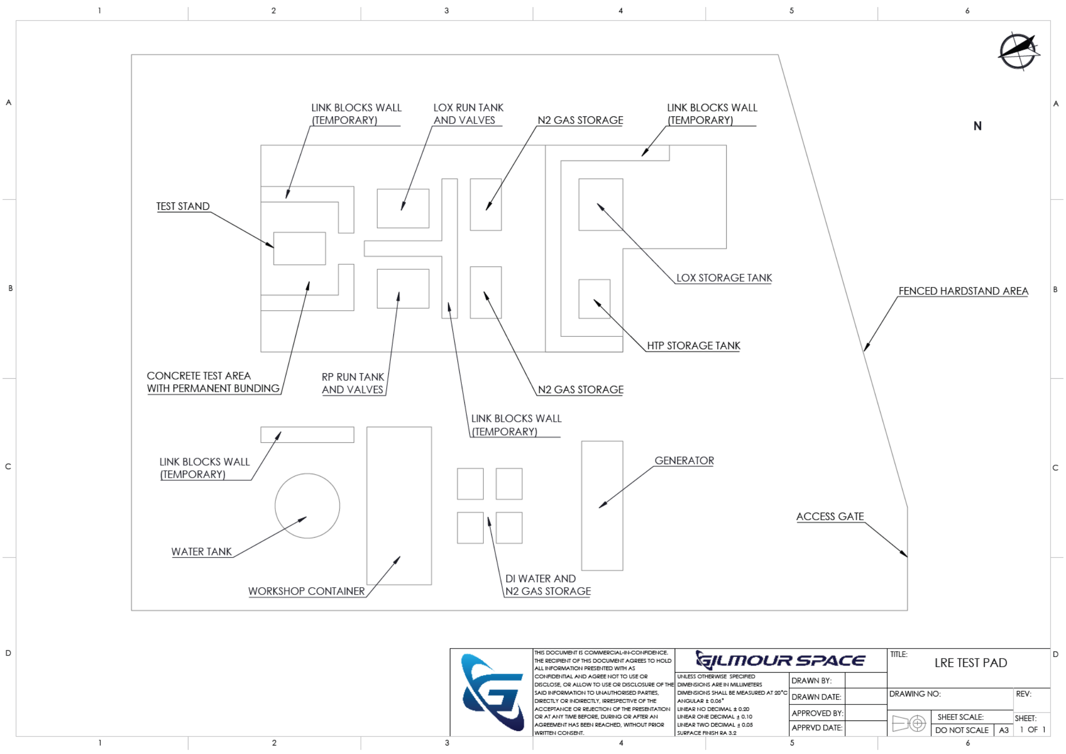

Figure 5 - LRE Test Pad Typical Layout

6 Training

All personnel working with hazardous substances are to ensure they have suitable training and have been assessed as competent by the Site Operations Supervisor or the Workplace Health and Safety Officer. Training must include elements in the identification, safe use, storage, handling and spill response procedures for hazardous substances in accordance with the relevant SDS for each hazardous substance.

Successful training to enable work with hazardous substances is recorded by a verification of competency or training assessment record. Training records are approved by a competent person. Records of training are stored by the Workplace Health and Safety Officer prior to a person undertaking work activities.

Abbreviations

Abbreviation	Definition
1080	Sodium Fluoroacetate
ACH	Aboriginal Cultural Heritage
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
AMSA	Australian Maritime Safety Authority
APSDA	Abbot Point State Development Area
ASA	Australian Space Agency
AusSpOC	Australian Space Operations Centre
BOM	Bureau of Meteorology
BOS	Bowen Orbital Spaceport
CSMP	Coral Sea Marine Park
DA	Development Application
DFO	Distant Focusing Overpressure
DGR	Dangerous Goods Regulations
EAA	Emergency Assembly Area
EC	Emergency Controller
ECG	Emergency Control Group
ECSS	European Cooperation for Space Standardization
EDQ	Economic Development Queensland
EMP	Environmental Management Plan
EP Act	Environmental Protection Act
ERA	Environmentally Relevant Activity
ERP	Emergency Response Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Management Plan
EW	Emergency Warden
EWLCC	LCC Emergency Warden
EWLPAD	LPAD Emergency Warden
EWVAB	VAB Emergency Warden
FMECA	Failure Modes, Effects, and Criticality Analysis
FMP	Facilities Management Plan
FSS	Flight Safety System
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GP	General Public
GST	Gilmour Space Technologies
H_2O	Water
H_2O_2	Hydrogen Peroxide
HDGMP	Hazardous and Dangerous Goods Management Plan
IAASS	International Association for the Advancement of Space Safety
IATA	International Air Transport Association

IIP	Instantaneous Impact Point
IMDGC	International Maritime Dangerous Goods Code
Kero	Kerosene
LCC	Launch Control Centre
LDMG	Local Disaster Management Group
LEO	Low Earth Orbit
LMP	Land Management Plan
LOx	Liquid Oxygen
LPAD	Launch Pad
MCU	Material Change of Use
MEDQ	Minister for Economic Development of Queensland
MSDS	Material Safety and Data Sheets
NASA	National Aeronautics and Space Administration
NEW	Net Explosive Weight
NQBP	North Queensland Bulk Ports
O_2	Oxygen
PCBU	Person Conducting a Business or Undertaking
PPE	Personal Protective Equipment
QFES	Queensland Fire and Emergency Services
QPOL	Queensland Police Open Learning
QPS	Queensland Police Service
SDA	State Development Area
SDS	Safety Data Sheet
SO	Safety Officer
SPP	State Planning Policy
SSP	Site Security Plan
TAP	Transport and Access Plan
TBC	To be Confirmed
TNT	Trinitrotoluene
UN	United Nations
VAB	Vehicle Assembly Building
VMR	Volunteer Marine Rescue
WHS	Workplace Health and Safety
WMP	Waste Management Plan
WRC	Whitsunday Regional Council

Appendix 11

Bowen Orbital Spaceport

Emergency Response Plan

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1 Introduction

Gilmour Space is committed to achieving sovereign orbital launch capabilities for Australia. The Australian space sector represents a small but significant sector of the Australian economy with significant growth potential. The establishment of an operational orbital launch facility will enable greater market participation for Australian space companies in both domestic and international markets.

This Emergency Management Plan has been prepared with reference to information provided by the Queensland Disaster Management Committee, and the Whitsunday Regional Council Local Disaster Management Group.

1.1 Purpose

This Emergency Management Plan has been prepared to inform the actions and responses of BOS staff and launch customers in the event of an incident / accident or other emergency. It lays out structures, communication lines and checklists for response by BOS staff and should be regularly reviewed and exercised.

1.2 Scope

This plan includes:

- Descriptions of emergency policy, preparedness, and structures.
- Lists of significant hazards and resources.
- Emergency Coordination Group activation triggers and process.
- Evacuation procedures.
- Response measures for domestic emergencies.
- A supplement for launch related emergencies.
- Requirements for testing, training, reporting, and record keeping related to this plan.

This response plan presents material in narrative and abbreviated checklist form to support planning, preparation, and execution of responses.

2 BOS Emergency Management Philosophy

The BOS is a unique capability within the Australian context by virtue of the risks associated with operation of an orbital class launch vehicle, but it shares the characteristics of many other work environments with high value equipment, critical infrastructure, hazardous chemicals, and processes interacting with employees and the general public. These hazards can be influenced by all the circumstances that our Australia experience can arise from extreme weather through natural disasters to medical emergencies and the democratic right to protest. Once they arrive on scene, the local and regional emergency services are expected to have primacy in any response to any emergency – domestic or launch and therefore provide the function of incident site commander.

The successful response of the BOS to an emergency rests on the philosophy that:

All BOS staff are informed, prepared, and authorised to act swiftly in partnership with local and regional emergency services, to secure the safety of personnel, the environment and property at and around the BOS in the event of an emergency.

The BOS Emergency Response Plan aims to direct the actions of all staff through clear establishment of a response structure, informed by detailed understanding of the hazards and capabilities within the BOS and the provision of standard checklists that can be modified to suit the circumstances encountered in each specific event.

During the conduct of any incident response, without further endangering human life or property, any evidence that may be material to the future investigation of the incident should be preserved to the extent possible.

3 BOS Emergency Management Response Support

3.1 Training

A successful emergency response requires a plan that is well understood and executed. Such a plan needs regular training, testing and can only be demonstrated as effective through well understood reporting and record keeping that informs regular review and improvement.

3.1.1 Induction

All staff at the BOS (employees, contractors, and launch customer representatives) and all BOS visitors must undergo induction training as a condition of entry to the site. This induction will include at a minimum, introduction to the hazards present at the BOS, emergency evacuation assembly points, and emergency signals and notifications at the BOS. A summary of this induction is to be issued with all ID / Visitor passes for the BOS in the form of a single card aide memoir (see appendix A).

3.1.2 Resident Staff

All staff (employees, contractors, and launch customer representatives) who are resident for work purposes at the BOS for a period of more than 20 days per annum are to be made familiar with this Response Plan and their general duties in the event of an emergency. All staff at the BOS with explicit safety or emergency response duties are to receive additional role specific training to familiarise themselves with this plan and gain a clear understanding of their personal roles and responsibilities in support of the plan.

3.1.3 Training Records

The conduct of induction training shall be recorded at time of conduct and an induction register maintained. Resident staff training is to be recorded in the WHS safety training register.

3.2 Testing

This plan is to be exercised to test its fitness for purpose, currency of information and the familiarity of staff with its contents at least twice per year through conduct of an emergency drill. An emergency drill incorporating participation from local emergency services is to be conducted at least once per year.

The plan may be exercised more often in conjunction with the arrival of each new launch customer if required.

Testing of the plan is to be recorded by the Launch Operations Supervisor.

3.3 Reporting

Activation of the emergency response plan for testing or in response to an emergency is to be reported as soon as practicable to the Gilmour Space Safety Team and Executive with a summary of the emergency, response, outcomes, and suggestions for improvement. (See the Emergency Response Plan reporting template at Appendix B).

Any follow up investigation outcomes are to be reported as soon as they become available. Where the investigation is conducted by or on behalf of the ASA, that agency's reporting shall be reviewed for recommendations to improve this plan.

The Launch Operations Supervisor is to include a summary of emergency response reporting in the BOS Annual Report (which is shared with the Australian Space Agency as noted in the Facility Management Plan).

3.4 Review

This plan is to be reviewed for currency and completeness at least annually by BOS safety staff and once per launch campaign in conjunction with the launch customer organisation and local emergency services. Each review must include a survey of currency to confirm that all information in the plan (HAZCHEM holdings, PPE / spill / response kit stock and contact numbers) remain valid.

4 BOS Layout and Significant Safety Information

The BOS is located within the Abbot Point State Development Area, west of the town of Bowen in North Queensland. This Emergency management Plan has been prepared cognisant of the location of the BOS within the Whitsunday Regional Council Local Government Area to align with the general disaster management plans of the Local Disaster Management Group (LDMG).

4.1 Site Layout

The BOS is an industrial facility with resident hazards and response capabilities spread out over two main sites. These sites differ in character and level of response required in the event of an incident. Staff should be familiar with the hazards and response capabilities within any work area to which they are assigned. The entry to the BOS facility will display placarding to ensure all staff are aware of current hazardous goods onsite and the daily standup board will note environmental danger ratings including fire danger rating and tropical cyclone alert status. This dashboard will be updated daily when the facility is active.

The two sites include the Launch Control Centre (LCC) and Lot 10. The LCC is a temporary facility comprising two demountable buildings, a telemetry antenna stand and a power and water pad housing generator infrastructure and potable water. Lot 10 hosts the Vehicle Assembly Building (VAB), the Launch Pad (PAD) and two small, remote pads for test and verification activity.

4.2 Emergency Assembly Areas

The BOS has four nominated Emergency Assembly Areas (EAA). EAAs are designated locations for staff to gather during an evacuation and a location for responsible Gilmour Space staff to meet with local emergency services who are responding to an incident. The layout of the BOS and its nominated EAAs is depicted in Figure 1-3.

Figure 1 - BOS Layout and EAAs Overview

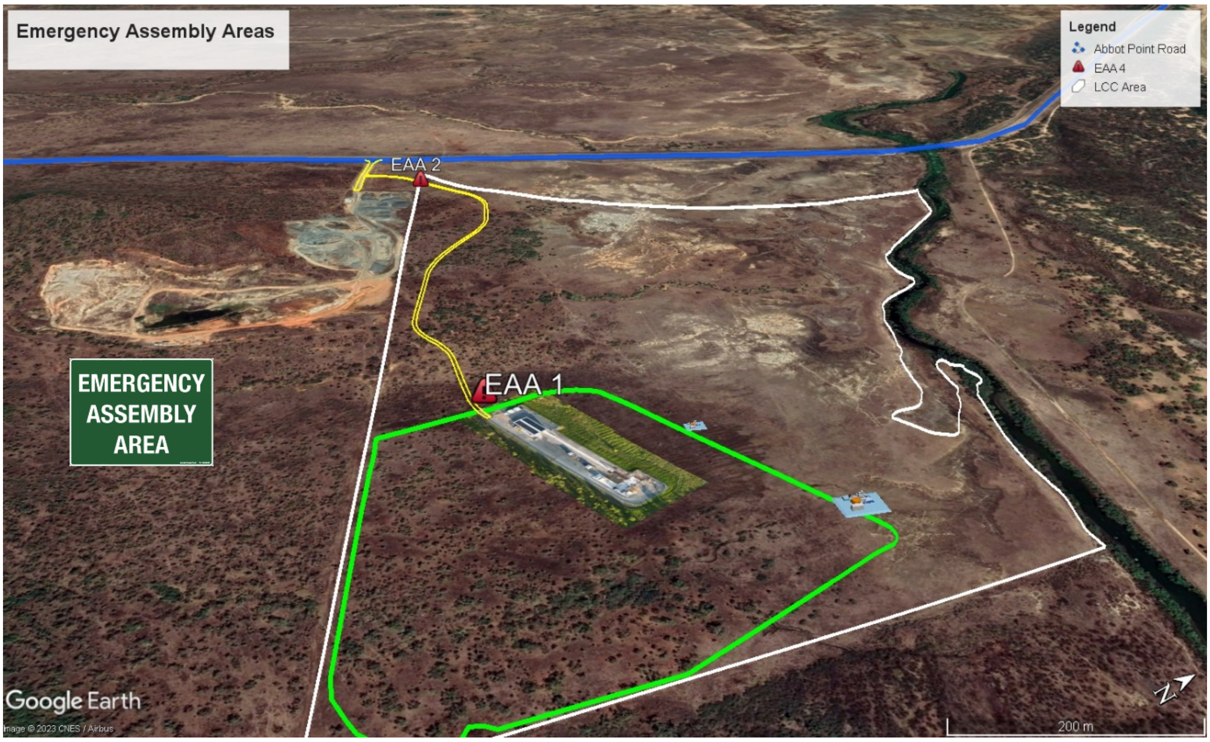


Figure 2 EAAs on Lot 10

Figure 3 EAA at LCC

A hazardous and dangerous goods register is maintained by the BOS staff in accordance with the Hazardous and Dangerous Goods Management Plan. This register, including materiel safety and data sheets (MSDS) for all hazardous and dangerous goods on site, is available at EAA 1 & 2 to inform response personnel.

A guide for dealing with the most likely hazardous chemicals at the BOS can be found in section 8 of this plan.

If access to or from the BOS or LCC is restricted for an extended period, resilience stores have been provided at each location (LCC and VAB). Should the isolation be extended by flood or similar interruption to trunk infrastructure, alternate transport will be sought by Gilmour Space (via air or sea).

4.3 The Vehicle Assembly Building (VAB)

The VAB is an industrial shed at the south-eastern corner of the site for the assembly integration and test of launch vehicle and payload components. The VAB houses industrial machinery including lifting and pressure apparatus, hazardous chemicals storage and fall hazards. The VAB is furnished with PPE and medical stores, spill response kits, firefighting equipment and resilience stores. The VAB may house the Emergency Control Group in certain circumstances. The VAB will usually host 2-4 personnel but will surge to host up to 40 personnel during peak use periods.

VAB significant hazards and response capabilities are depicted in the 4.

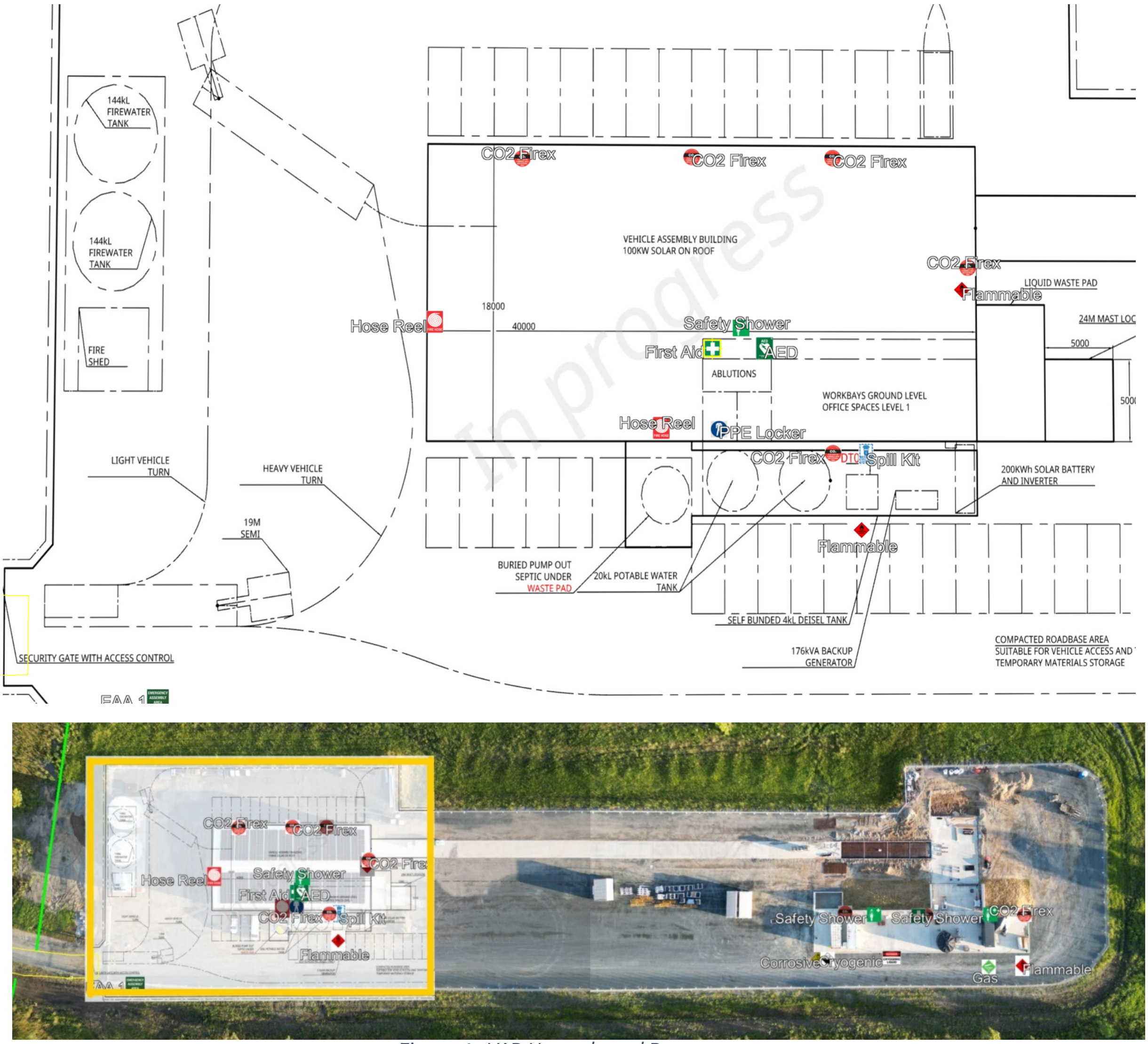


Figure 4 - VAB Hazards and Resources

4.4 The Launch Pad (PAD)

The PAD is situated north of the VAB and consists of a set of self-bunded concrete pads for the erection of the launch vehicle and storage of launch gasses and fluids. The PAD houses industrial machinery, high-pressure piping, and a significant quantity of hazardous chemicals. The PAD is furnished with holdings of PPE, spill response kits, firefighting equipment, resilience stores and emergency shutdown controls. The LCC will usually be unattended but will surge to host up to 16 personnel during peak use periods.

PAD significant hazards and response capabilities are depicted in 5.

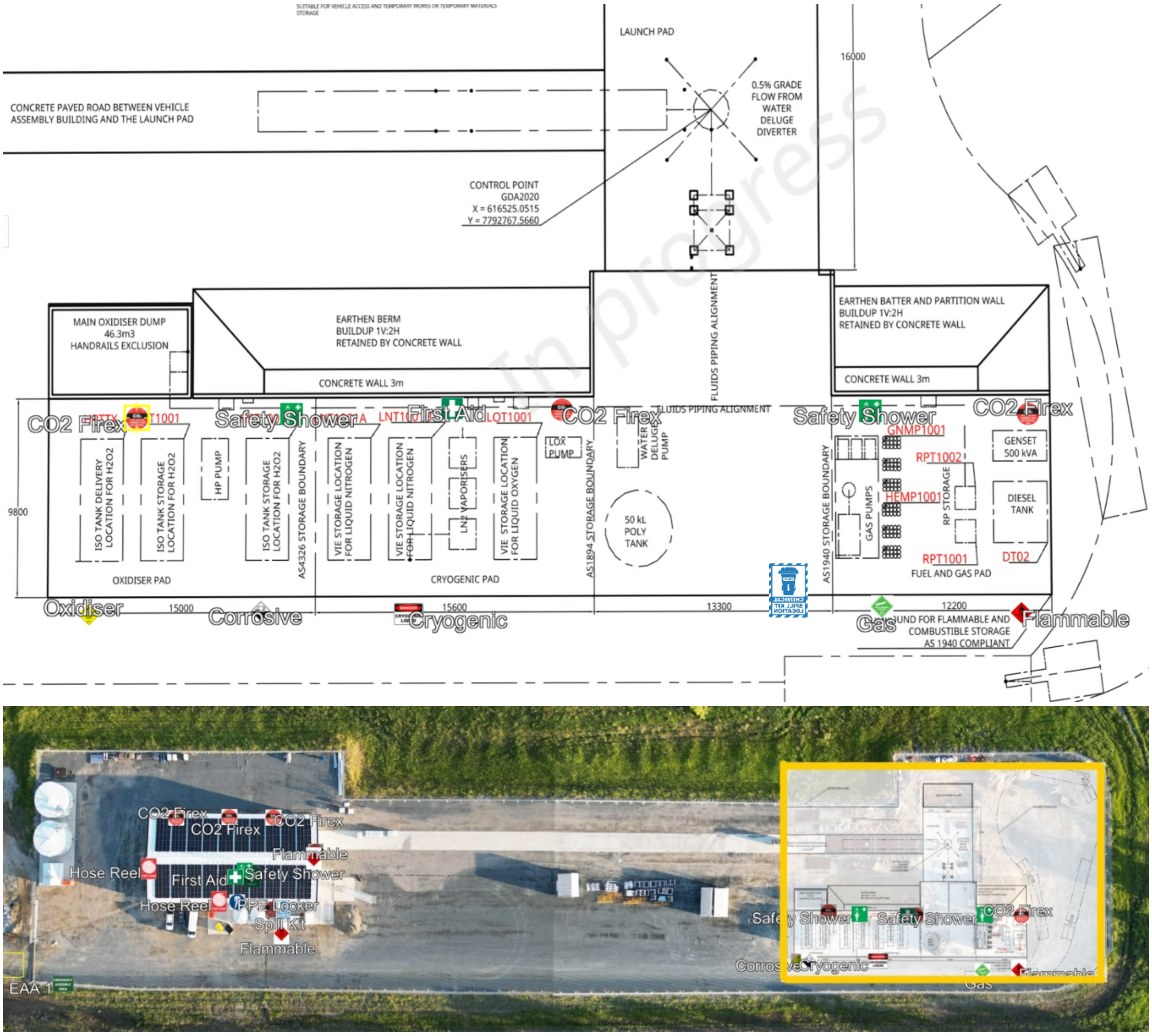


Figure 5 - PAD Hazards and Resources

4.5 Test and Verification Pads

The two small, remote test and verification pads are accessed via the Lot 10 fire trail. The hazards present on these pads will vary with the activity as will the response capabilities. The location of these test pads is shown in figure 6.

Figure 6 - Test / Verification Pads

Test pad 1 provides a venue for Liquid Rocket Engine (LRE) test activity. The pad is contained within a fenced yard and is configured through the placement of link blocks to protect and host fuel and oxidiser tanks, a thrust structure and support equipment. A typical layout is shown below in

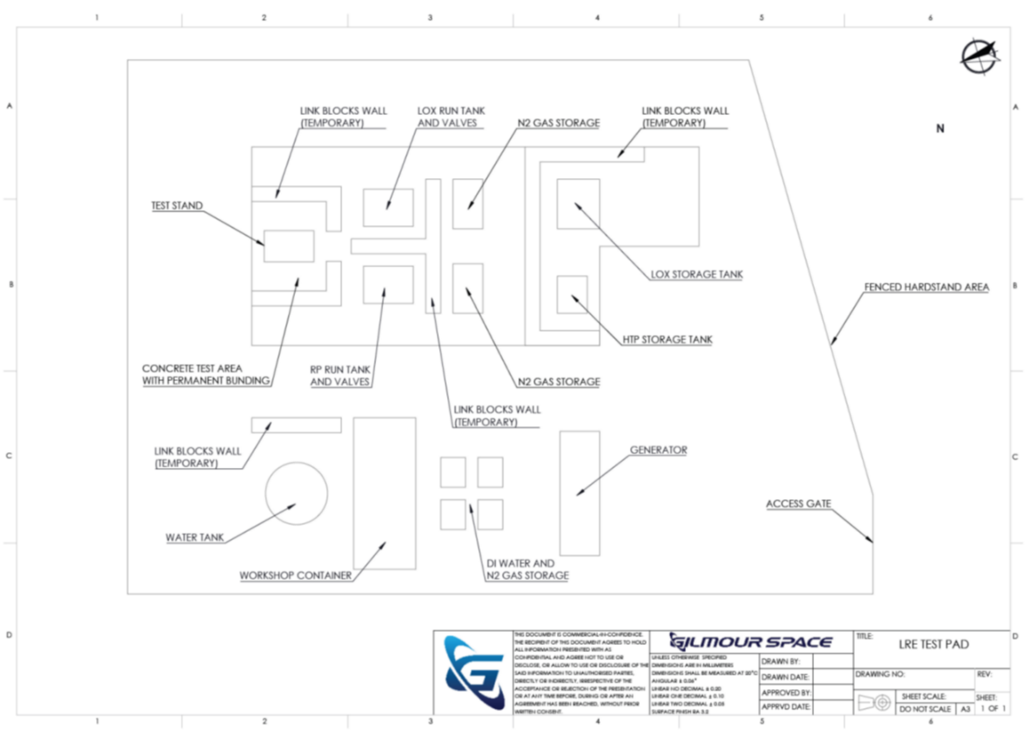


Figure 7 - LRE Test Pad Typical Layout

Test pad 2 provides a venue for Hybrid Rocket Engine (HRE) test activity. The 15m x 30m pad is contained within a fenced yard and hosts a permanently embedded thrust structure and can be further configured through the placement of link blocks and containers to protect and host oxidiser tanks and support equipment. A typical Layout is shown below in

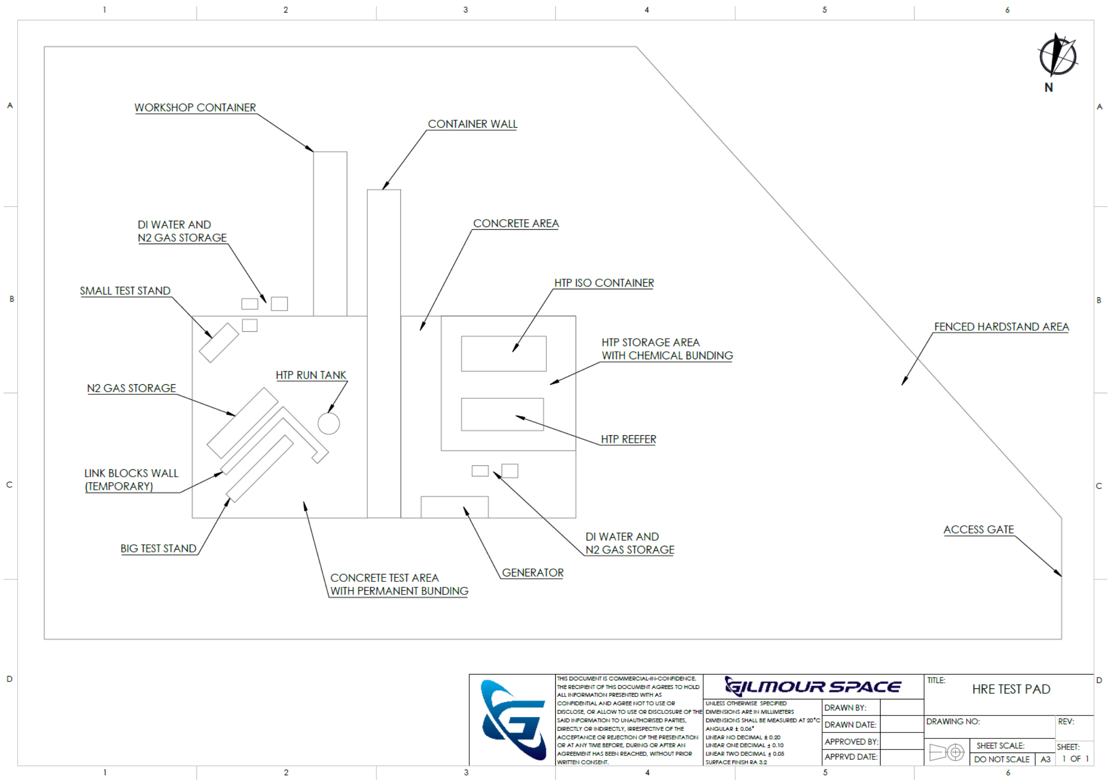


Figure 8 - HRE Test Pad Typical Layout

4.6 The Launch Control Centre (LCC)

The LCC is collocated with North Queensland Bulk Ports (NQBP) facilities approximately 6 km from the PAD. It is a self-contained set of demountable structures housing administrative and information technology suites. The LCC is furnished with medical stores and firefighting equipment.

LCC response capabilities are depicted in 7.

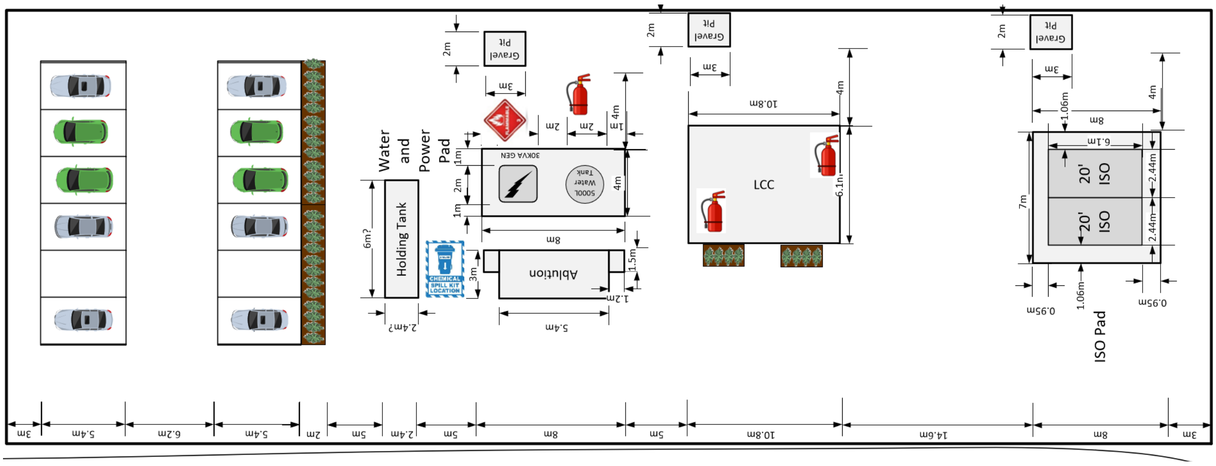


Figure 9 - LCC Hazards and Resources

4.7 BOS Communications Equipment

The BOS communication system will leverage, satellite broadband, fibre optic broadband, dark fibre, RF and wi-fi to provide connectivity between sites and staff. The architecture of this system will provide operational and safety staff access to:

- Push to talk internal wi-fi communications at LCC, VAB and all PADs
- UHF CB communications with staff in transit between LCC and VAB
- High Speed secure data link between LCC and VA and PADs
- High Speed broadband internet access at LCC and VAB
- Range Safety VHF Air Band Communications
- Range Safety VHF Marine Band Communications

The diagram below is indicative of the system for range safety and operational communications on site.

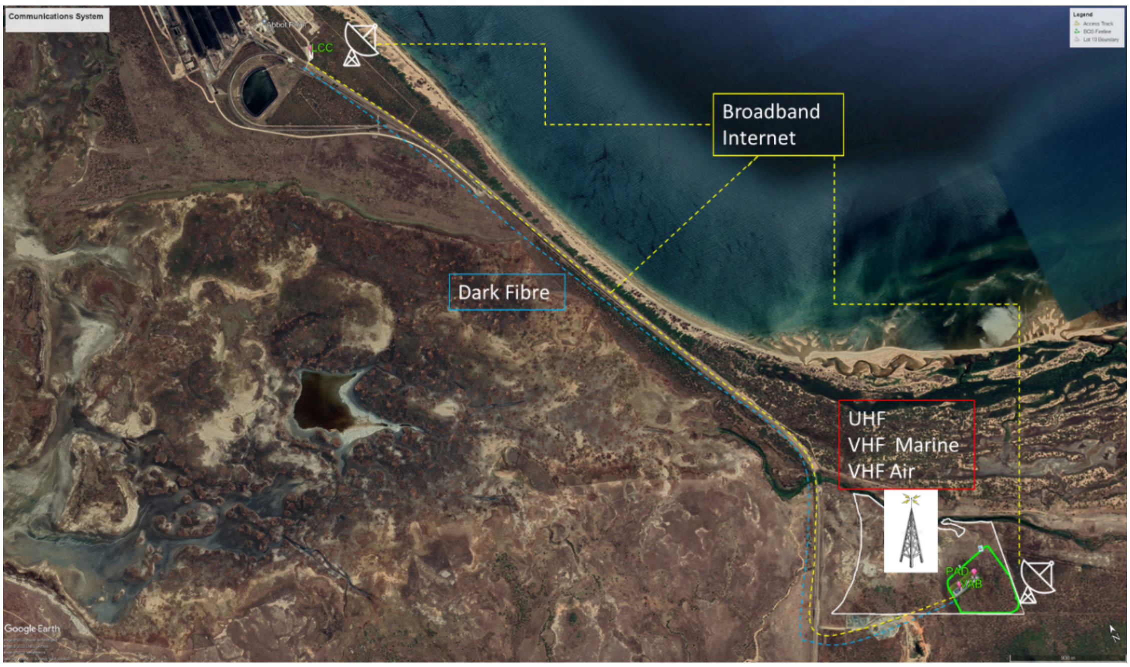


Figure 10 - BOS Comms System

4.8 BOS Emergency Warning System

The BOS is fitted with a visual and aural warning system (Cygnus Wireless) that will be sounded in the event of an emergency requiring staff action and awareness. The system will use two distinct warning modes displaying coloured amber or red strobe lights sounding different (120dB) tones.

Figure 11 - BOS Warning System

4.8.1 Alert (LOCKDOWN) Warning

The alert warning will be activated when any incident occurs requiring BOS staff awareness and action. The alert warning will present as flashing amber lights and a series tones repeated in groups of 3 for the duration of the emergency response. Upon activation of the alert warning, staff should check their immediate area for a threat, if safe to do so - secure their immediate work area and seek guidance from their respective emergency warden.

4.8.2 Evacuation (FIRE) Tone

The evacuation warning will be activated for any incident requiring BOS staff to vacate the facility. The evacuation warning will present as flashing red lights and a continuous sinusoidal wave or siren. Upon activation of the evacuation warning staff should, if safe to do so, expeditiously secure their workspace, move towards their nearest safe Emergency Assembly Area (EAA), and cooperate with instructions from their Emergency Warden.

4.9 BOS Local Response Team (LRT)

BOS will maintain staff and equipment onsite to stand-up a local response capability during all hazardous activities.

The intent of the LRT is to provide a limited, immediate response to any fire, spill or injury on site in order to variously: preclude the need for external emergency services support; stabilise the situation until external emergency services arrive; or control the scene to prevent access by personnel or equipment until control can be restored.

To achieve these aims, the LRT has equipment to allow it to: extinguish small fires, or protect small assets from fire, contain or dilute small chemical spills, render first aid (applicable to hazards that exist at BOS) and secure or cordon off danger areas including:

- Dedicated Vehicle for mobile response
- Portable Fire Fighting Equipment
- Personal Protective Equipment for fire
- Personnel Protective Equipment for chemical responses
- Chemical Spill response kit
- Advanced First Aid Kit
- Supplemental Oxygen Kit
- Patient Movement kit
- Warning Markers / Barriers

Select members of the BOS team will be capable of forming part of the LRT. To ensure they can safely respond to requirements their training and assessment program will be expanded to include:

- Basic Wildfire response training
- Advanced First Aid training
- Spill Management training

The LRT will conduct continuation training at least Monthly to ensure currency in role.

5 Roles and Responsibilities

Each member of the BOS staff may have a role to play in emergency response situations and must be aware of the contents of this document and their general obligations in the event of an emergency. Employees with nominated emergency response and safety positions and their allocated responsibilities are listed below in Table 1.

Table 1 - Emergency Response Roles and Responsibilities

Role	Incumbent	Responsibilities
Emergency Controller EC	TBD	Sponsor and approve the BOS emergency response plan. Liaise with the Whitsunday Regional Council Local Disaster Management Group (LDMG) Activate and Form the ECG as required in response to any emergency. Coordinate the activity of the ECG including notifications to emergency services and responsible agencies and the Gilmour executive. Coordinate release of emergency safety information to the public.
Safety Officer SO	TBD	Draft, Review and improve this plan. Conduct audits and evaluations of the effectiveness of this plan after each test or execution. Conduct surveys of currency in accordance with section 3.4. Provide advice to the EC during ECG activity.
BOS Emergency Warden EWVAB	TBD	In conjunction with the SO conduct surveys in accordance with section 3.4. Maintain current knowledge of the total number of personnel within Lot 10 at any time. Maintain current knowledge of first aid qualified individuals within Lot 10 at any time. Inform the EC as soon as possible if an emergency condition arises at or near Lot 10. Lead evacuations of Lot 10 where required including providing an accurate personnel count. Conduct, where safe, any immediate emergency response at Lot 10.
LCC Emergency Warden EWLCC	TBD	In conjunction with the SO conduct surveys in accordance with section 3.4. Maintain current knowledge of the total number of personnel within the LCC at any time. Maintain current knowledge of first aid qualified individuals within the LCC at any time. Inform the EC as soon as possible if an emergency condition arises at or near the LCC. Lead evacuations of the LCC where required including providing an accurate personnel count. Conduct, where safe, any immediate emergency response at the LCC.

Role	Incumbent	Responsibilities
BOS LRT Staff	TBD	Maintain Training and qualification in : Fight Wildfire Advanced First Aid Oxygen Therapy Spill Response (Hydrocarbon, Chemical and HTP) Drivers License Participate in regular exercises to maintain currency Under direction of EW / EC respond to incidents on or in the immediate vicinity of the BOS
BOS Staff	All	Maintain familiarity with the plan and the likely response required in your workplace. Assist the EC when asked to form part of the ECG Assist the EW at the location you work in.

6 Emergency Control

Upon becoming aware of a situation potentially requiring a central response the EC will consider the activation status of the BOS. In accordance with the Queensland Disaster Management Arrangements, levels of activations for disaster coordination centres are broken into four phases, Alert, Lean Forward, Stand Up and Stand Down. The movement of disaster/emergency groups through these phases is not necessarily sequential. It is based on flexibility and adaptability to the location and event.

The Emergency Control Group (ECG) will activate as required by the BOS emergency activation status (in Table 2 below) or at the discretion of the EC in order to prepare for or control and coordinate response to, communication regarding and reporting on, any emergency within, emanating from or threatening the BOS.

The ECG may gather at a common location or may operate remotely via telecommunications. The ECG is scalable according to need assessed by the EC and may include any or all of the nominated positions in Table 1.

The ECG will act as the central point of contact for all information into and out of the BOS, activation of the LRT and coordination with emergency services and regulatory authorities. The ECG will stand down once the situation has been resolved and all BOS staff and visitors have been accounted for. The EC will conduct post activity reporting in accordance with section 3.3.

Table 2 - BOS Emergency Activation Status

Status	Description
Alert	A heightened level of vigilance due to the possibility of an event in the area of responsibility. No action is required; however someone capable of assessing the potential of the threat should monitor the situation.
Lean forward	An operation state characterised by a heightened level of situational awareness of a disaster event (whether current or impending) and a state of operational readiness. ECG may be put on standby and prepared but not activated.
Stand up	An operational state where resources are mobilised, personnel are activated, and operational activities commenced. ECG is activated.
Stand down	Transition from responding to an event back to normal core business and/or continuance recovery operations. There is no longer a requirement to respond to the event and the threat is no longer present

Upon activation of this plan an incident log (appendix B) is to be initiated either physically or electronically and must be maintained throughout the event and referred to in any post event reviews.

Table 3 below details the actions to be considered and guides the required communications in the event of any activation of this plan.

Table 3 - BOS Emergency Triggers and Actions

	Triggers	Actions	Communications
Alert	Awareness of a hazard that has the potential to affect the BOS	- Hazard or risk identified - EC Commence Incident Log - EC provides initial advice to BOS Staff / customers and corporate - Information sharing with warning agency - EC monitor and assess threat - Establish best linkages with warning agency for regular updates and alerts	EC on mobile SITREP Email Group established
Lean Forward	Potential hazard is likely to affect BOS Threat Quantified but not yet imminent Need for all stakeholder awareness ECG required to manage event	- EC to analyse likely effects to BOS - Convene ECG to decided likely course of action - Prepare ECG roster - Decide trigger point for transition to Stand Up - update advice to BOS Staff / customers and corporate - Prep BOS and staff for Stand Up - Enhance readiness of LRT - Establish best linkages with response agencies for coordination - Prepare / dispatch any likely Requests for Assistance	EC and ECG on mobile BOS Staff via Comms system Regular Update Cycle established on SITREP Email Group Regular Warning Agency Updates
Stand Up	hazard is imminent BOS will be or is being affected Requests for assistance received from LDCC or Abbot Point stakeholders ECG required to manage event	- Enact Emergency Response - Activate LRT - ECG Actively managing response - Regular updated advice to BOS Staff / customers and corporate	EC and ECG on mobile or established in safe facility Regular Update Cycle established on SITREP Email Group As required SITREP and updates to response agencies

Stand Down	No Hazard ECG no longer required to manage event Remediation and reporting underway	- Debrief ECG (HOTWASH) - Stand down / reconstitute LRT - Stand Down ECG - Close Incident Log - Re-establish BAU - Conduct Post Emergency Plan reporting - update advice to BOS Staff / customers and corporate	EC on mobile Closeout Email to SITREP Email Group Post Emergency Report Distributed

7 Domestic Emergency Response Checklists

The following checklists are intended to provide prompts for the actions of staff responding to situations in and around the BOS. They are generally neither prescriptive nor proscriptive. Where appropriate, in the judgement of staff, emergency activation levels may not be sequential, extra measures may be enacted or checklist steps may be disregarded in order to avoid or reduce harm to persons or property.

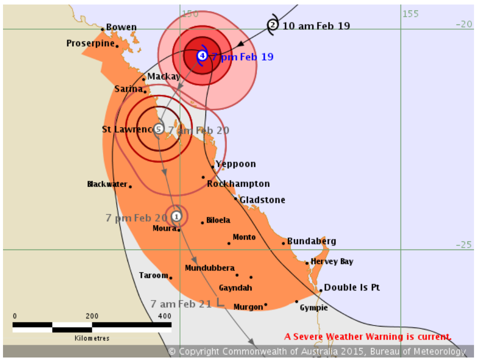
Where checklist steps are compulsory (particularly in the case of legislated notifications) this will be indicated by **BOLDED** checklist items. Response actions that may in themselves introduce hazards will be indicated in the checklists by a CAUTION annotation directing staff to give consideration that extra measures may be required.

Table 4 - Emergency Contact Details

Emergency Contact	Primary	Alternate
BOWEN POLICE	000	07 4761 3500
WHITSUNDAY WATER POLICE	07 4967 7222	07 4969 8999
TOWNSVILLE WATER POLICE	07 4759 9790	
BOWEN FIRE STATION	000	07 4786 1811
MACKAY AREA AMBULANCE	07 4965 6601	07 4793 5701
BOWEN HOSPITAL	07 4786 8222	
BOWEN VOLUNTEER MARINE RESCUE	07 4786 1950	
BOWEN STATE EMERGENCY SERVICE	07 4965 6651	13 25 00
WHITSUNDAY REGIONAL COUNCIL – LOCAL DISASTER MANAGEMENT COORDINATOR	1300 972 006	
AISS – NQBP GATE	0448 745 637	VHF Ch1
NQBP 24HR CONTACT	0417 761 086	
ABBOT POINT TERMINAL OPERATIONS	07 4786 0314	0476 551 896
HILLARY'S QUARRY – QUARRY MANAGER	0438 633 491	07 4786 5100
AUSTRALIAN SPACE AGENCY	Christine and Adam	
AUSSPOC	Christine and Adam	
AIRSERVICES AUSTRALIA REEF AREA TRAFFIC	07 3866 3224	
AIR TRANSPORT SAFETY BUREAU	1800 011 034	
AUSTRALIAN MARITIME SAFTEY AUTHORITY	02 6230 6811	02 6230 6899
MARITIME SAEFTY QUEENSLAND	07 4421 8100	
GREAT BARRIER REEF MARINE PARK AUTHORITY	07 4750 0700	
CORAL SEA MARINE PARK DUTY OFFICER	+61 419 293 465	

TELSTRA	13 22 00	
ERGON	13 16 70	
EVONIK	+49 172 348 5183	
BOC GASSES	1800 653 572	
CORAL COAST OCEANEERING	+61 418 635 600	
SUB SEA	+61 402 758 009	
GILMOUR SPACE CHIEF EXECUTIVE OFFICER **ADAM GILMOUR**	0449 602 029	
HEAD OF LAUNCH SITE OPERATIONS **JAMES GILMOUR**	0408 973 296	
DIRECTOR OF MARKETING **MICHELLE GILMOUR**	0433 908 084	

TROPICAL CYCLONE AND STORM TIDE PREPARATION AND RESPONSE

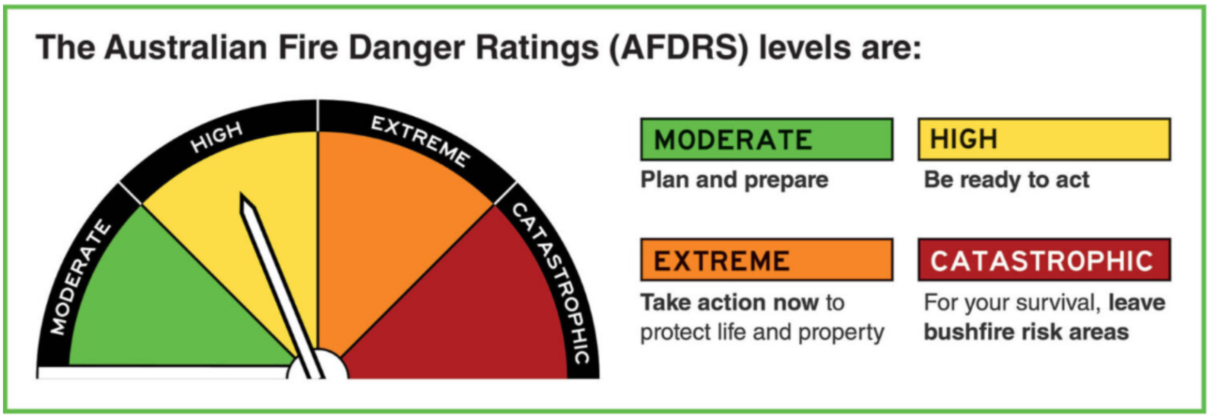


The Bureau of Meteorology issues cyclone alerts in Phases – This checklist will specify actions to be taken by alert phase and Cyclone distance from the facility in order to ensure the facility and personnel are prepared for the possibility of cyclonic effects.

	Triggers	Actions
Alert	Tropical Cyclone within 800km of BOS	1 EC check all cyclone information from BOM and institute regular update cycle. 2 Convene ECG 3 EC and EWs confirm inventory of all bulk hazardous goods on site 4 EC and EWs check property to ensure all loose items are secured or stored in VAB, check all water tanks are full and portable buildings and telemetry trailer are either secured or prepared for transport to a safe location 5 EWs confirm all first aid and emergency kits are intact 6 EC and EWs brief staff on actions to be taken in the event of a cyclone warning
Lean Forward	Tropical Cyclone WATCH issued by BOM Tropical cyclone within 500km of BOS	1 Stand down launch preparation activity occurring outside the VAB 2 Consider transport of bulk hazardous goods to a safe location 3 Secure the PAD and Test Pads 4 Transport demountable buildings to a safe location if necessary 5 Transport telemetry trailer to a safe location 6 Consider evacuation of non-essential staff to Bowen or home location 7 Ensure launch customers have safe arrangements for potential cyclonic effects

Stand Up	Tropical Cyclone WARNING Issued by BOM Tropical Cyclone within 250km of BOS -------------------------------- Tropical Cyclone within 100km of BOS or winds exceed 100km/hr	1 Secure all BOS facilities 2 **EVACUATE BOS** – if local evacuation orders in force, consider transporting remain staff to domestic accomodation or local cyclone shelter - Bowen State High School 54-86 Richmond Road, BOWEN QLD 4805 3 EC Establish regular contact roster for all staff in region to conduct welfare checks -- 1 **IF NOT ALREADY EVACUATED – SEEK SHELTER IN VAB – WORKBAY 3 or ABLUTIONS** CAUTION *A drop in wind may mean you are experiencing the eye of the cyclone. Destructive winds will return very soon. Do not go outside until the All Clear has been announced.*
Stand Down	BOM or Local Emergency Services Issue ALL CLEAR	1 EC confirm welfare of all staff in region 2 WHEN SAFE TO DO SO EC and EW travel to BOS to inspect for damage 3 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 4 EC Conduct post incident reporting

BUSHFIRE PREPARATION AND RESPONSE



The Bureau of Meteorology issues daily Fire Danger Ratings based upon environmental conditions and the Queensland Fire and Emergency Servicve issues Fire Warning Levels in response to active fires – This checklist will specify actions to be taken by Danger Rating and Warning Level in order to ensure the facility and personnel are prepared for the possibility of fire effects.

	Triggers	Actions
Alert	Declared Fire Danger Level HIGH or above Issue of Fire Advice from QFES	1 EW conduct inspection of facility to ensure no extraneous fuels or ignition sources are present 2 EC Convene ECG **On Issue of fire ADVICE by QFES** 1 EC Determine location of fire and likely path – consider suspending activity on PAD and Test Pads 2 EW confirm all structures are free from external fire hazards (combustibles in vicinity etc) 3 EC Brief all staff on potential response to bushfire threat to BOS

Lean Forward	Declared Fire Danger Level EXTREME or Above Issue of WATCH and ACT from QFES	1 Cease any transfer of launch fluids on the PAD 2 Ensure all water tanks are not less than ¾ full and water pumps for fire fighting are fully functional, and standup LRT 3 ECG consider Securing and Evacuating BOS **On issue of WATCH and ACT from QFES or on becoming aware of a fire that is likely to affect BOS** 1 Stand down launch preparation activity occurring outside the VAB 2 Consider transport of bulk hazardous goods to a safe location 3 Secure the PAD and Test Pads 4 Transport demountable buildings to a safe location if necessary 5 Transport telemetry trailer to a safe location 6 Consider evacuation of non-essential staff to Bowen or home location 7 Ensure launch customers have safe arrangements for potential bushfire effects
Stand Up	Declared Fire Danger Lave of CATASTROPHIC or Fire Sighted on or near BOS. Issue of EMERGENCY WARNING by QFES	1 EW Secure all work areas if safe to do so 2 EC **EVACUATE BOS** if safe to do so 3 EW (if fitted) Activate fire suppression systems 4 EW Activate LRT if appropriate 5 If Evacuation route is compromised – seek shelter in nearest safe location (VAB, NQBP, Beach)
Stand Down	Fire Danger Passed	1 EC confirm welfare of all staff in region 2 WHEN SAFE TO DO SO EC and EW travel to BOS to inspect for damage 3 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 4 EC Conduct post incident reporting

EVACUATION CHECKLIST

The evacuation of the BOS will be prompted by any incident occuring in or on the facility that will lead the EC to decalre evacuation necessary. The EC should – if time permits – notify Gilmour Executive and emergency services that the BOS will evacuate.

	Triggers	Actions
Alert to Immediate Stand Up	MOVE TO IMMEDIATE STANDUP	MOVE TO IMMEDIATE STAND UP
Stand Up	Evacuation Necessary	1 EC If an incident renders the facility unsafe **ACTIVATE THE EVACUATION ALERT** 2 Upon hearing the Evacuation Tone – check immediate area for threat 3 IF SAFE TO DO SO – expeditiously secure immediate work Area 4 Move quickly and carefully to nominated Emergency Assembly Area 5 EW Control staff evacuation from work area to nearest safe Emergency Assembly Area 6 EW Conduct personnel head count at nearest safe Emergency Assembly Area 7 EW As soon as possible – inform EC of evacuation location, Staff headcount and any discrepancies. 8 EC Confirm personnel including visitors accounted for or coordinate search for any missing personnel. 9 EC If necessary – coordinate transport of staff from Assembly Areas offsite.
Stand Down	Danger Passed	1 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 2 EC Conduct post incident reporting

FIRE / EXPLOSION CHECKLIST

In the event of a Fire in your immediate work area, immediate action should be taken to ensure your safety and that of those around you before deciding whether to fight the fire.

	Triggers	Actions
Alert to Immediate Stand Up	MOVE TO IMMEDIATE STANDUP	MOVE TO IMMEDIATE STAND UP
Stand Up	Fire Reported / Observed	1 Assist any person in immediate danger IF SAFE TO DO SO. 2 **RAISE THE ALARM BY CONTACTING EC OR ACTIVATING THE FIRE ALARM SYSTEM – ACTIVATE LRT** 3 EC Contact Emergency Services 4 Fight the fire with appropriate equipment if trained, only IF SAFE TO DO SO. CAUTION *BOS is an industrial facility that contains chemical and mechanical hazards, only attempt to fight the fire if you are familiar with the hazards and have been trained in dealing with them. Section 7 contains an aide memoir for dealing with chemicals expected at BOS* 5 If not engaged in firefighting or assisting other persons – Secure your workplace IF SAFE TO DO SO and Evacuate the building towards the nearest safe Emergency Assembly Area 6 EW Meet Emergency Services, ensure MSDS / hazards conveyed, provide assistance as required 7 EW inform EC headcount and any discrepancies. 8 EC Confirm all personnel including visitors onsite are accounted for and if necessary coordinate search for any missing personnel.
Stand Down	Fire Extinguished	9 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 10 Reconstitute LRT 11 EC Conduct post incident reporting

SPILL / LEAK CHECKLIST

In the event of a Spill of hazardous chemicals in your immediate work area, immediate action should be taken to ensure your safety and that of those around you before deciding whether to treat the spill or leak.

	Triggers	Actions
Alert to Immediate Stand Up	MOVE TO IMMEDIATE STANDUP	MOVE TO IMMEDIATE STAND UP
Stand Up	Fire Reported / Observed	1 Assist any person in immediate danger IF SAFE TO DO SO. 2 **RAISE THE ALARM BY CONTACTING EC - ACTIVATE LRT** 3 EC Contact Emergency Services 4 Locate and don appropriate PPE for the hazard 5 Contain spill or control / stop the leak IF SAFE TO DO SO. CAUTION *BOS is an industrial facility that contains chemical hazards, only attempt to contain or treat a spill or leak if you are familiar with the hazards and have been trained in dealing with them. Section 8 contains an aide memoir for dealing with chemicals expected at BOS* 6 If not engaged in spill / leak containment or assisting other persons – Secure your workplace IF SAFE TO DO SO and evacuate the area towards the nearest safe Emergency Assembly Area 7 EW Meet Emergency Services, ensure MSDS / hazards conveyed, provide assistance as required 8 EW inform EC of Staff headcount and any discrepancies. 9 EC Confirm all personnel including visitors onsite are accounted for and if necessary coordinate search for any missing personnel.

Stand Down	Fire Extinguished	9 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 10 Reconstitute LRT 11 EC Conduct post incident reporting and water Quality testing as required by Environmnetal Management Plan.

MEDICAL EMERGENCY

In the event of a person experiencing a serious medical condition, isolate the person from danger, render first aid and contact emergency services.

	Triggers	Actions
Alert to Immediate Stand Up	MOVE TO IMMEDIATE STANDUP	MOVE TO IMMEDIATE STAND UP
Stand Up	Medical Emergency	1 Assist any person in immediate danger IF SAFE TO DO SO. 2 **RAISE THE ALARM BY CONTACTING 000 or EC** 3 **ACTIVATE LRT** 4 EC Contact Emergency Services 5 Render first aid – stay with individual 6 EW coordinate entry for and meet emergency services / ambulance
Stand Down	Emergency Passed	1 Reconstitute LRT 2 EC Conduct post incident reporting

POWER FAILURE

Although BOS is supplied with redundant power supplies from Solar Panels, Battery Storage and Diesel Generator systems, in the event of a disruption to electrical supply at the BOS several key safety and security systems including temperature stabilisation may be rendered inoperative.

BOS staff will need to take actions to secure the facility and any hazardous chemicals to avert damage or loss of control of stored hazardous goods.

	Triggers	Actions
Alert	Fault messages or indication of impending failure of 1 Primary Power Source	1 Contact contractor or supplier to determine nature of failure and time to rectify 2 Consider provision of backup generator for chemicals stored on Utility Pad
Lean Forward	Failure of 1 Primary Power Source	1 Stand down launch preparation activity occurring outside the VAB 2 Provide Backup Generator for Utility Pad or Test Pad 3 Ensure Monitoring of any Hazardous Chemicals or Dangerous Goods on Utility Pad or Test Pad remains unaffected 4 Consider supplementing BOS Site security with Manned checkpoint and regular manual monitoring of chemical storage units on Utility Pad
Stand Up	Failure of 2 Primary Power Sources at BOS	1 **Supply alternate power to all temp control units on Utility Pad** 2 Provide security for manned checkpoint BOS compound gate and regular manual monitoring of chemical storage units on Utility Pad 3 If temperature of Chemical storage units cannot be maintained - EC move to Spill / Leak Checklist and Evacuate BOS. CAUTION *BOS is an industrial facility that contains chemical hazards, only attempt to contain or treat a spill or leak if you are familiar with the hazards and have been trained in dealing with them. Section 8 contains an aide memoir for dealing with chemicals expected at BOS*
Stand Down	Restoration of 2 Primary Power Sources	1 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 2 EC Conduct post incident reporting

CIVIL DISTURBANCE / DEMONSTRATION / ATTACK

In the event of civil disturbance travel between the BOS and the Bruce Highway may be disrupted.

If protest action occurs past the Abbot Point Road access gate – expect BOS will cease work for safety reasons. The following actions are suggested if protest action is expected to include access to BOS working locations

	Triggers	Actions
Alert	Warnings and Indicators from QPS that intent exists	1 Contact Zone Group to coordinate security response 2 Convene ECG 3 Consider moving to lean forward based on threat
Lean Forward	Demonstration / civil disturbance or attack on nearby facility	1 Stand down launch preparation activity occurring outside the VAB 2 Consider transport of bulk hazardous goods to a safe location 3 Consider transport of the telemetry trailer to a safe location 4 Consider lowering the TE and secure the PAD and Test Pads 5 Consider evacuation of non-essential staff to Bowen or home location
Stand Up	Demonstration / civil disturbance or attack on BOS	1 **RAISE THE ALARM BY CONTACTING EC or 000** 2 Secure all fluids controls on PAD and lock front gate 3 Consider relocating telemetry trailer within VAB 4 EC Contact Emergency Services 5 EC coordinate response with QPOL and NQBP Security areas 6 All secure immediate work area 7 EW gather staff inside facility and conduct a headcount 8 EW consider securing buildings 9 EC consider evacuation of staff via bus 10 EW inform EC of Staff headcount and any discrepancies.
Stand Down	BOM or Local Emergency Services Issue ALL CLEAR	1 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 2 EC Conduct post incident reporting

BOMB THREAT

The Police have overall authority and control when dealing with bomb threats or an actual bomb placement. They must be notified in the first instance. Telephone threat checklists (are distributed in work locations.

There are many reasons why people may make a threat of the placement of a bomb in or around businesses. Threats usually originate from people who have a personal grudge. They may be staff or ex-staff or other people who wish to disrupt operations. In order to make a realistic evaluation of the threat, the Police, EC and Senior Management must be in possession of as much information as possible. Over-reaction to bomb threats will be avoided by sensible evaluation.

	Triggers	Actions
Lean Forward	Bomb Threat Received	1 Record details of the threat however received (use telephone threat checklist if possible) 2 Notify Queensland Police 3 EC and QPOL Confer to decide whether to A. Take no further action B. Search without evacuation C. Evacuate and search, or D. Evacuate (without search)
Stand Up	BOMB Threat Credible	1 EC - IF APPRPOPIATE – **EVACUATE** 2 In coordination with QPOL - Conduct Search Marking areas as clear after search CAUTION *Two way radios and mobile phones should not be used during the search* 3 If a suspect item is found - **EVACUATE** CAUTION *DO NOT TOUCH IT! - DO NOT MOVE IT! - DO NOT COVER IT!* *DO NOT DISTURB IT IN ANY WAY!* 4 EC - coordinate response with QPOL 5 EW inform EC of Staff headcount and any discrepancies.
Stand Down	EC or Queensland Police Issue ALL CLEAR	1 EC Before authorising personnel to return to work – confirm BOS is safe for reoccupation 2 EC Conduct post incident reporting

8 Guide to Handling Hazardous Goods at BOS in an Emergency

NOTE – any spill on the BOS may trigger a requirement for Water Quality testing on site and in Saltwater Creek in accordance with the BOS Environmental Management Plan.

	OXIDIZING SUBSTANCES: HYDROGEN PEROXIDE 875 HTP – UN2015 /UN2014
	HAZARDS
HYDROGEN PEROXIDE	**Fire or Explosion** ○ Will accelerate burning when involved in a fire ○ May explode from heating, shock, friction or contamination ○ May ignite combustibles (wood, paper, clothing and so on) ○ Fire may produce irritating, toxic and/or corrosive gases ○ Containers may explode when heated ○ Runoff may create fire or explosion hazard ○ May decompose explosively (D) when heated or involved in a fire **Health** ○ Inhalation or contact with vapour, dusts or substance may cause severe injury, burns or death ○ Runoff from fire control or dilution water may pollute waterways **Protective Clothing** ○ Wear Self Contained Breathing Apparatus and chemical splash suit ○ Structural fire-fighters uniform will provide limited protection **Public Safety** ○ **IMMEDIATELY CONTACT EMERGENCY SERVICES 000** ○ Spill or leak area should be isolated immediately for at least 25m in all directions ○ Keep unauthorised personnel away ○ Keep upwind and to higher ground **Evacuation** **Large Spill** ○ Consider initial downwind evacuation of areas within at least 100m **Fire** ○ When any large containers (including rail and road tankers) are involved in a fire, consider initial evacuation of areas within 800m in all directions

	EMERGENCY RESPONSE
HYDROGEN PEROXIDE	**FIRE** **Small fire** ○ **USE FLOODING QUANTITIES OF WATER** ○ **Do not** use dry chemicals, CO_2, or foam ○ If safe to do so, move undamaged containers from fire area ○ Do not move cargo if cargo has been exposed to heat **Large Fire** ○ Flood fire area with water from a protected position ○ Cool containers with flooding quantities of water until well after fire is out – If impossible, withdraw from area and let fire burn ○ Avoid getting water inside containers: a violent reaction may occur ○ Dam fire control water for later disposal ○ ALWAYS stay away from tank ends **SPILL OR LEAK** ○ Do not contaminate ○ Keep combustibles (wood, paper, clothing, oil and so on) away from spilled material ○ Do not touch damaged containers or spilled material unless wearing appropriate protect clothing ○ Use water spray to knock down vapours or divert vapour clouds ○ Prevent entry into waterways, drains or confined areas ○ Prevent exposure to heat **Dry Spill** ○ Use clean non-sparking tools to transfer material to a clean, dry plastic container and cover loosely ○ Move container from spill area **Small Liquid Spill** ○ Use a non-combustible material like vermiculite, sand or earth to soak up the product and place in a loosely covered container for later disposal **Large Liquid Spill** ○ Employ necessary means including temporary earthen berms and trenches to contain and progressively dilute the spill. Ensure barriers employed are not flammable and response personnel remain well clear of fumes and potential flow paths. **FIRST AID** ○ Remove victim to fresh air – Apply resuscitation if victim is not breathing – Administer oxygen if breathing is difficult ○ Remove contaminated clothing and shoes immediately ○ Remove material from skin immediately ○ In case of contact with material, immediately flush skin, or eyes with running water for at least 15 minutes ○ Keep victim warm and quiet – obtain immediate medical care ○ Ensure that attending medical personnel are aware of identity and nature of the product(s) involved and take precautions to protect themselves

LIQUID OXYGEN	**OXYGEN: LIQUID OXYGEN Compressed, liquefied or deeply refrigerated (cryogenic) – UN1073**
	HAZARDS
	Fire or Explosion ○ Oxygen does not burn but will increase intensity of fire ○ May ignite combustibles (wood, paper, clothing and so on) ○ Oxygen in liquid form may explode when in contact with combustible materials (oil, asphalt, hot tyres and so on) ○ Vapours from liquified gas are usually heavier than air ○ Containers may explode when heated – ruptured cylinders may rocket ○ Burning material may product irritating fumes **Health** ○ Prolonged inhalation of pure oxygen may cause pulmonary irritation and oedema ○ Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite **Protective Clothing** ○ Wear Self Contained Breathing Apparatus and structural firefighting uniform when handling leaking or damaged cylinders and equipment ○ Always wear thermal protective equipment when handling cryogenic liquids and associated equipment **Public Safety** ○ **IMMEDIATELY CONTACT EMERGENCY SERVICES 000** ○ Spill or leak area should be isolated immediately for at least 25m in all directions ○ Keep unauthorised personnel away ○ Keep upwind and to higher ground **Evacuation** **Large Spill** ○ Consider initial downwind evacuation of areas within at least 250m **Fire** ○ When any large containers (including rail and road tankers) are involved in a fire, consider initial evacuation of areas within 800m in all directions

	EMERGENCY RESPONSE
LIQUID OXYGEN	see below

LIQUID OXYGEN

FIRE

Small fire

- Use extinguishing agent suitable for type of surrounding fire
- If safe to do so, move undamaged containers from fire area
- Cool container by directing flooding quantities of water onto upper surface until well after fire is out

Large Fire

- Cool container and fight fire from protected position or use unmanned hose holders or monitor nozzles – Do not direct water at source of leak or venting safety devices as icing may occur
- Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank – tank may explode
- Always stay away from tank ends
- Damaged containers should only be handled following expert advice

SPILL OR LEAK

- **ELIMINATE** all ignition sources (no smoking, flares, sparks, or flame) within at least 50m
- Keep combustibles (wood, paper, clothing, oil and so on) away from spilled material
- Do not touch or walk though spilled material
- Stop leak if safe to do so – If possible, turn leaking container so that gas escapes rather than liquid – Prevent entry into waterways, drains or confined areas
- Use water spray, fog, or vapour-suppressing foam to knock down vapours or divert vapour clouds – Do not direct water at spill or source of leak
- Allow substance to evaporate – Ventilate the area

CAUTION: When in contact with cryogenic liquids, most materials become brittle and are likely to break without warning

FIRST AID

- Remove victim to fresh air – Apply resuscitation if victim is not breathing
- Administer oxygen if breathing is difficult
- Remove contaminated clothing and shoes immediately – Clothing frozen to the skin should be thawed before being removed – In case of frostbite, thaw with lukewarm water
- Keep victim warm and quiet
- Obtain immediate medical care – Ensure that attending medical personnel are aware of the identity and nature of product(s) involved, and take precautions to protect themselves

KEROSENE	LIQUIDS – FLAMMABLE KEROSENE D60 – UN1223
	HAZARDS

Fire or Explosion

- May be ignited by heat, sparks, or flames
- Vapours may form explosive mixtures with air
- Vapours may travel to source of ignition and flash back
- Most vapours are heavier than air and will spread along ground and will collect in low or confined areas (drains, basement, tanks)
- Many liquids are lighter than water
- Containers may explode when heated
- Fire may produce irritating, toxic and/or corrosive gases
- Vapours from runoff may create an explosion hazard
- Some may decompose explosively (D) or polymerise violently (P) when heated or involved in a fire

Health

- May irritate or burn skin and eyes
- Runoff from fire control or dilution water may pollute waterways
- Vapour may cause dizziness or drowsiness

Protective Clothing

- Self Contained Breathing Apparatus and gas tight suits should be worn when dealing with damaged or leaking containers and where there is no risk of ignition
- Self Contained Breathing Apparatus and structural firefighting uniform provide limited protection where there is a risk of ignition

Public Safety

- **IMMEDIATELY CONTACT EMERGENCY SERVICES 000**
- Spill or leak area should be isolated immediately for at least 15m in all directions
- Keep unauthorised personnel away
- Keep upwind and to higher ground
- Ventilate enclosed spaces before entering

Evacuation

Large Spill

- Consider initial downwind evacuation of areas within at least 100m

Fire

- When any large containers (including rail and road tankers) are involved in a fire, consider initial evacuation of areas within 500m in all directions

	EMERGENCY RESPONSE
KEROSENE	**FIRE** **Small Fire** ○ Use foam, dry chemical, $CO_{2,}$ or water spray **Large Fire** ○ Use foam, fog, or water spray ○ Do not use water jets ○ If safe to do so, move undamaged containers from fire area ○ Cool container with flooding quantities of water until well after fire is out ○ Avoid getting water inside containers **Fire Involving Tanks** ○ Fight fire from protected position or use unmanned hose holders or monitor nozzles – When impossible, immediately from hazard area and let burn ○ Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank ○ ALWAYS stay away from tank ends **SPILL OR LEAK** ○ **ELIMINATE** all ignition sources (no smoking, flares, sparks, or flame) within at least 25m – All equipment used in handling the product must be earthed ○ Do not touch or walk-through spilled material ○ Stop leak if safe to do so – Prevent entry into waterways, drains or confined areas ○ Vapour-suppressing foam may be used to control vapours – Water spray may be used to knock down or divert vapour clouds ○ Absorb with earth, sand, or other non-combustible material ○ Use clean non-sparking tools to collect absorbed material and place it into loosely covered metal or plastic containers for later disposal ○ SEEK EXPERT ADVICE ON HANDLING AND DISPOSAL **FIRST AID** ○ Remove victim to fresh air – Apply resuscitation if victim is not breathing ○ Administer oxygen if breathing is difficult ○ Remove contaminated clothing and shoes immediately ○ In case of contact with material, immediately flush skin, or eyes with running water for at least 15 minutes ○ Keep victim warm and quiet – Obtain immediate medical care ○ Ensure that attending medical personnel are aware of identity and nature of the product(s) involved and take precautions to protect themselves

9 Launch Supplement – Eris Block 1

Public safety during launch is a paramount concern. For each launch from BOS a launch vehicle may experience an anomaly leading to loss of thrust, aerodynamic breakup or explosive breakup. In any of these cases the trajectory of the vehicle or any debris will have been modelled as a part of the launch permit application.

Preparation for each launch campaign will include information briefings and planning meetings with local emergency services to agree appropriate posture for response for a launch. In the event of a launch vehicle accident / incident on land, it is expected that local emergency services will respond and function as the Incident Site Commander. Gilmour staff will coordinate closely with the Incident Site Commander to ensure that all hazards are clearly understood, and the most accurate information is provided in terms of points of impact and hazardous chemical holdings are provided.

Any anomaly resulting in an impact on land will occur in a well defined area (with only 2.5km from PAD to high tide mark). Any anomaly within the immediate coastal waters will allow some opportunity to recover wreckage and debris. Anomalies beyond the immediate coastal waters are unlikely to allow this opportunity. This response plan is focussed on response to a launch incident in the immediate aftermath of an anomaly. Without prejudicing the efforts of emergency response teams to safeguard life and property, all legal steps are to be taken to preserve physical and digital evidence associated with the anomaly at VAB, PAD, LCC and where relevant, impact areas for future investigation.

Any post accident wreckage recovery will be conducted by a contracted salvage company with the VAB designated as the immediate storage facility until investigations commence.

Before Execution phase of the launch campaign, the launch vehicle provider is to have provided a table clearly annunciating time bound (expressed in T+ terms – accurate to within one second) limit for transition of the vehicle and associated debris cloud from anomaly effects brackets which will be known as IIP Brackets. The anomaly response checklists that follow are defined by these IIP Brackets and should be referred to based upon the launch customer provided table at time of anomaly unless telemetry indicates that vehicle or debris will impact / have impacted in a different IIP Bracket.

IIP Brackets will be defined within the bounding Launch Azimuths (25° and 71°) as follows:

IIP Bracket	Start	Finish
IIP LAND	Vehicle Filling Commence	Low Tide Mark
IIP COASTAL WATERS	Low Tide Mark	Western edge of Coral Sea Marine Park
IIP AUSTRALIAN WATERS	Western edge of Coral Sea Marine Park	Eastern edge of Australian Exclusive Economic Zone
IIP EXTRATERRITORIAL WATERS	Eastern Edge of Australian Exclusive Economic Zone	IIP Zero (perigee beyond earth)
IIP ZERO	IIP Zero	Remainder of mission

In the event of a launch anomaly, up to date information may be difficult to source and confirm. It is critical that only verified information is shared outside the launch team.

Actions to be carried out in accordance with the checklist will depend upon IIP Bracket of the anomaly and will include actions to SAFE the facility; actions to NOTIFY authorities; actions to SECURE the site, data and wreckage; and actions to COORDINATE responses where required. Many of these actions can and should be performed concurrently. The EC must be informed of all actions completed.

SAFE	Actions to Isolate Launch Pad and HAZCHEM at the BOS.
NOTIFY	Actions to alert relevant authorities and the Public where hazards exist
SECURE	Actions to isolate Telemetry, Instrument & Control and Computer & Communication Data
COORDINATE	Coordinate with Emergency Services and Relevant Authorities to protect life, property, and physical evidence where possible

After all hazards are isolated, the EC is to confirm all staff and visitors are safe and accounted for and control access to the site for the recovery and investigation activity that will follow.

ANOMALY CHECKLIST

Launch Team to remain onsite to assist with response

Script for the room

Any communication with representatives of the press or public is to be either in accordance with a pre-approved script or else conducted by an authorised company representative (Michelle Gilmour, Adam Gilmour, or James Gilmour). Please don't communicate any details of the anomaly with anyone outside Gilmour Space unless they are Emergency Service Personnel active in the response to the anomaly or an Australian Government Department with a regulatory responsibility in the response.

All records of the launch attempt will be required for analysis / investigation in due course. All staff are to ensure that in managing our response to this launch anomaly, no actions are taken that corrupt or damage records of the launch preparation or execution.

It is an offence to remove or interfere with any object or part of the launch vehicle unless required to:

- *extract persons (including deceased persons) from the wreckage of a space object;*
- *protecting the wreckage from being destroyed by fire or other cause;*
- *prevent immediate danger to the safety of persons or property; or*
- *to move the space object or the wreckage and its contents to a safe place when the object or rocket crashes on water or is wrecked on water.*

DETERMINE IIP BRACKET

IIP Bracket	Start (s)	Finish (s)
IIP LAND	Fill Commence T-?	[Launch Customer to Provide]
IIP COASTAL WATERS	[Launch Customer to Provide]	[Launch Customer to Provide]
IIP AUSTRALIAN WATERS	[Launch Customer to Provide]	[Launch Customer to Provide]
IIPEXTRATERRITORIAL WATERS	[Launch Customer to Provide]	[Launch Customer to Provide]
IIP ZERO	[Launch Customer to Provide]	

IIP LAND

CAUTION

In the event the vehicle impacts on land, unexpended oxidisers and propellants will pose HAZCHEM and fire risks and any intact components may pose an explosive risk. Emergency services should not approach the vehicle but should prepare to contain any resulting fire.

SAFE (PAD Console)	**PAD GSE: Command LAUNCH RECOVERY mode for:** RP1 LOX H_2O_2 N_2 He Compressed Air **He Tank – VENT** **PAD Fire Suppression System if fitted : ACTIVATE** **Determine remaining Quantities of each HAZCHEM on PAD. Pass list to EC** **Dispatch LRT** to potentially contain spot fires or identify / cordon hazard areas
NOTIFY (Range Console)	Contact Fire Response Commander with estimated location of vehicle / debris – **REQUEST FIRE RESPONSE** [000 / 07 4786 1811] Contact Police Response Commander with estimated location of vehicle / debris – **REQUEST PUBLIC SAFETY AND ACCIDENT INVESTIGATION CORDON** [000 / 07 4761 3500] Contact Ambulance Response Commander with estimated location of vehicle / debris – **REQUEST STANDBY MEDICAL RESPONSE** [07 4965 6601 / 07 4793 5701] Contact NQBP Operations Room – **Advise Activation of ERP for IIP LAND REQUEST STOP MOVEMENT** along Abbot Point Road (except emergency services) [0417 761 086] Contact Whitsunday Regional Council – **Advise Activation of ERP for IIP LAND** [1300 972 753] Regularly BROADCAST on Aero VHF 121.5 “All Stations in the vicinity of Bowen, Restricted Area RXXX Remains Active within 3nm Radius of Abbot Point, Surface to Flight Level 450 – remain clear” Regularly BROADCAST on Marine VHF Channel 16 “All craft in the vicinity of Abbot Point, Hazard Area NXXX remains active within a 3nm radius of Abbot Point – remain clear” Prepare **QUICKREP and DISPATCH (via EC)** Contact AusSpOC – **ADVISE NO ORBITAL EFFECTS** [Via ASA]

SECURE	RF Systems Engineer - **SAVE & ISOLATE** telemetry data from telemetry trailer RF Systems Engineer – deliver Data to EC IT Systems Engineer - **COPY & SAVE** Instrument & Control and Computer & Communication Data @ LCC IT Systems Engineer - **COPY & SAVE** all PAD and LCC camera data IT Systems Engineer – deliver data to EC [Responsible Console] – **COLLECT** all paper launch records / folders [Responsible Console] – deliver paper data to EC EC – Secure all Data in Anomaly Container for subsequent transport.
COORDINATE	EC – **DETERMINE** incident Site Commander and establish contact EC – **DETERMINE** through best means – actual location of vehicle / debris EC – **INFORM** Incident Site Commander of- **ESTIMATED QUANTITIES OF HAZCHEM at PAD** **ESTIMATED QUANTITIES OF HAZCHEM on VEHICLE @ Anomaly** EC – CONSIDER Activation of FIRE / EXPLOSION or SPILL / LEAK Checklist EC – **COORDINATE** with incident Site Commander until Hazards are isolated EC – **CONFIRM** all staff accounted for and safe EC – **CONTROL** access to site until investigation team arrive.

Refer to Appendix F– Land Salvage Plan to be enacted not before receipt of ministerial clearance

IIP COASTAL

CAUTION

In the event the vehicle impacts in coastal waters, transient HAZCHEM hazards may exist on the water and floating debris may pose a hazard to marine craft.

SAFE (PAD Console)	**PAD GSE: Command LAUNCH RECOVERY mode for:** RP1 LOX H_2O_2 N_2 He Compressed Air **Determine remaining Quantities of each HAZCHEM on PAD. Pass list to EC** **Dispatch LRT** to potentially contain spot fires or identify / cordon hazard areas
NOTIFY (Range Console)	Contact Water Police Response Commander with estimated location of vehicle / debris – **REQUEST PUBLIC SAFETY AND ACCIDENT INVESTIGATION CORDON** [000 / 07 4761 3500] Contact Regional Harbour Master with estimated location of vehicle / debris – **REQUEST CONTROL OF INTRA REEF TRAFFIC TO AVOID** [07 4421 8100] Contact NQBP Operations Room with estimated location of vehicle / debris – **Advise activation of ERP for IIP COASTAL** [0417 761 086] Contact Whitsunday Regional Council – **Advise Activation of ERP for IIP COASTAL** [1300 972 753] Contact Bowen VMR – with estimated location of vehicle / debris – request broadcast to recreational craft to remain clear [07 4786 1950] IF IIP within 3nm of launch site - Regularly BROADCAST on Aero VHF 121.5 “All Stations in the vicinity of Bowen, Restricted Area RXXX Remains Active within 3nm Radius of Abbot Point, Surface to Flight Level 450 – remain clear” Regularly BROADCAST on Marine VHF Channel 16 “All craft in the vicinity of Abbot Point, Hazard Area NXXX remains active remain clear” Prepare **QUICKREP and DISPATCH (via EC)** Contact AusSpOC – **ADVISE NO ORBITAL EFFECTS** [AusSpOC #]

SECURE	RF Systems Engineer - **SAVE & ISOLATE** telemetry data from telemetry trailer RF Systems Engineer – deliver Data to EC IT Systems Engineer - **COPY & SAVE** Instrument & Control and Computer & Communication Data @ LCC IT Systems Engineer - **COPY & SAVE** all PAD and LCC camera data IT Systems Engineer – deliver data to EC [Responsible Console] – **COLLECT** all paper launch records / folders [Responsible Console] – deliver paper data to EC EC – Secure all Data in Anomaly Container for subsequent transport.
COORDINATE	EC – **DETERMINE** through best means – actual location of vehicle / debris EC – **IF** vehicle impacts inshore and response in cooperation with Emergency Services is considered achievable and practicable: EC – **DETERMINE** incident Site Commander and establish contact EC – **INFORM** Incident Site Commander of- **ESTIMATED QUANTITIES OF HAZCHEM on VEHICLE @ Anomaly** EC – **COORDINATE** with incident Site Commander until Hazards are isolated EC – **CONFIRM** all staff accounted for and safe EC – **CONTROL** access to site until investigation team arrive.

Refer to Appendix G– Marine Salvage Plan to be enacted immediately

IIP AUSTRALIAN WATERS

CAUTION

In the event the vehicle impacts in the Coral Sea Marine Park waters, transient HAZCHEM hazards may exist on the water and floating debris may pose a hazard to marine craft.

SAFE (PAD Console)	**PAD GSE: Command LAUNCH RECOVERY mode for:** RP1 LOX H_2O_2 N_2 He Compressed Air **Determine remaining Quantities of each HAZCHEM on PAD. Pass list to EC** **Dispatch LRT** to potentially contain spot fires or identify / cordon hazard areas
NOTIFY (Range Console)	Contact Regional Harbour Master with estimated location of vehicle / debris – **REQEUST CONTROL OF TRAFFIC TO AVOID** [07 4421 8100] Contact Australian Maritime Safety Authority Nav Area 10 Coordinator with estimated location of vehicle / debris – **REQUEST NOTICE TO MARINERS OF POTENTIAL FLOATING DEBRIS** [02 6230 6811 / 02 6230 6899] Contact Whitsunday Regional Council – Advise Emergency Response Activation for IIP AUSTRALIAN WATERS [1300 972 753] Prepare **QUICKREP and DISPATCH (via EC)** Contact AusSpOC – **ADVISE NO ORBITAL EFFECTS** [AusSpOC #]
SECURE	RF Systems Engineer - **SAVE & ISOLATE** telemetry data from telemetry trailer RF Systems Engineer – deliver Data to EC IT Systems Engineer - **COPY & SAVE** Instrument & Control and Computer & Communication Data @ LCC IT Systems Engineer - **COPY & SAVE** all PAD and LCC camera data IT Systems Engineer – deliver data to EC [Responsible Console] – **COLLECT** all paper launch records / folders [Responsible Console] – deliver paper data to EC EC – Secure all Data in Anomaly Container for subsequent transport.
COORDINATE	EC – **DETERMINE** through best means – actual location of vehicle / debris EC – **CONFIRM** all staff accounted for and safe EC – **CONTROL** access to site until investigation team arrive.

Refer to Appendix G– Marine Salvage Plan to be enacted immediately

IIP EXTRATERRITORIAL WATERS

CAUTION

In the event the vehicle impacts in international waters, floating debris may pose a hazard to marine craft.

SAFE (PAD Console)	**PAD GSE: Command LAUNCH RECOVERY mode for:** RP1 LOX H_2O_2 N_2 He Compressed Air **Determine remaining Quantities of each HAZCHEM on PAD. Pass list to EC** **Dispatch LRT** to potentially contain spot fires or identify / cordon hazard areas
NOTIFY (Range Console)	Contact Australian Maritime Safety Authority NAVAREA 10 Coordinator and SIMA with estimated location of vehicle / debris – **REQUEST NOTICE TO MARINERS OF POTENTIAL FLOATING DEBRIS** [AMSA 02 6230 6811 / 02 6230 6899 / SIMA +677 21609 / +677 27685] Contact Whitsunday Regional Council – Advise Emergency Response Activation for IIP INTERNATIONAL WATERS [1300 972 753] Prepare **QUICKREP and DISPATCH (via EC)** Contact AusSpOC – **ADVISE NO ORBITAL EFFECTS** [AusSpOC #] Contact DFAT with estimated location of vehicle debris – **ADVISE AUSTEMB FOR AWARENESS / ADVICE TO RELEVANT EEZ HOST NATION**
SECURE	RF Systems Engineer - **SAVE & ISOLATE** telemetry data from telemetry trailer RF Systems Engineer – deliver Data to EC IT Systems Engineer - **COPY & SAVE** Instrument & Control and Computer & Communication Data @ LCC IT Systems Engineer - **COPY & SAVE** all PAD and LCC camera data IT Systems Engineer – deliver data to EC [Responsible Console] – **COLLECT** all paper launch records / folders [Responsible Console] – deliver paper data to EC EC – Secure all Data in Anomaly Container for subsequent transport.
COORDINATE	EC – **DETERMINE** through best means – actual location of vehicle / debris EC – **CONFIRM** all staff accounted for and safe EC – **CONTROL** access to site until investigation team arrive.

Refer to Appendix G– Marine Salvage Plan to be enacted immediately

IIP ZERO

CAUTION

In the event the vehicle impacts in international waters, floating debris may pose a hazard to marine craft.

SAFE (PAD Console)	**PAD GSE: Command LAUNCH RECOVERY mode for:** RP1 LOX H_2O_2 N_2 He Compressed Air **Determine remaining Quantities of each HAZCHEM on PAD. Pass list to EC** **Dispatch LRT** to potentially contain spot fires or identify / cordon hazard areas
NOTIFY (Range Console)	Contact AusSpOC – **ADVISE LAST KNOWN TELEMTRY and ESTIMATED ORBITAL PARAMETERS** [AusSpOC #] Prepare **QUICKREP and DISPATCH (via EC)**
SECURE	RF Systems Engineer - **SAVE & ISOLATE** telemetry data from telemetry trailer RF Systems Engineer – deliver Data to EC IT Systems Engineer - **COPY & SAVE** Instrument & Control and Computer & Communication Data @ LCC IT Systems Engineer - **COPY & SAVE** all PAD and LCC camera data IT Systems Engineer – deliver data to EC [Responsible Console] – **COLLECT** all paper launch records / folders [Responsible Console] – deliver paper data to EC EC – Secure all Data in Anomaly Container for subsequent transport.
COORDINATE	EC – **LIAISE** with Launch Customers to execute follow on actions for response to anomalous orbit EC – **CONFIRM** all staff accounted for and safe EC – **CONTROL** access to site until investigation team arrive.

Abbreviations

Abbreviation	Definition
1080	Sodium Fluoroacetate
ACH	Aboriginal Cultural Heritage
ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
AMSA	Australian Maritime Safety Authority
APSDA	Abbot Point State Development Area
ASA	Australian Space Agency
AusSpOC	Australian Space Operations Centre
BOM	Bureau of Meteorology
BOS	Bowen Orbital Spaceport
CSMP	Coral Sea Marine Park
DA	Development Application
DFO	Distant Focussing Overpressure
DGR	Dangerous Goods Regulations
EAA	Emergency Assembly Area
EC	Emergency Controller
ECG	Emergency Control Group
ECSS	European Cooperation for Space Standardization
EDQ	Economic Development Queensland
EMP	Environmental Management Plan
EP Act	Environmental Protection Act
ERA	Environmentally Relevant Activity
ERP	Emergency Response Plan
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Management Plan
EW	Emergency Warden
EWLCC	LCC Emergency Warden
EWPAD	PAD Emergency Warden
EWVAB	VAB Emergency Warden
FMECA	Failure Modes, Effects, and Criticality Analysis
FMP	Facilities Management Plan
FSS	Flight Safety System
GBRMP	Great Barrier Reef Marine Park
GBRMPA	Great Barrier Reef Marine Park Authority
GP	General Public
GST	Gilmour Space Technologies
H_2O	Water
H_2O_2	Hydrogen Peroxide
HDGMP	Hazardous and Dangerous Goods Management Plan
IAASS	International Association for the Advancement of Space Safety
IATA	International Air Transport Association

IIP	Instantaneous Impact Point
IMDGC	International Maritime Dangerous Goods Code
Kero	Kerosene
LCC	Launch Control Centre
LDMG	Local Disaster Management Group
LEO	Low Earth Orbit
LMP	Land Management Plan
LOx	Liquid Oxygen
LRT	Local Response Team
PAD	Launch Pad
MCU	Material Change of Use
MEDQ	Minister for Economic Development of Queensland
MSDS	Material Safety and Data Sheets
NASA	National Aeronautics and Space Administration
NEW	Net Explosive Weight
NQBP	North Queensland Bulk Ports
O_2	Oxygen
PCBU	Person Conducting a Business or Undertaking
PPE	Personal Protective Equipment
QFES	Queensland Fire and Emergency Services
QPOL	Queensland Police Open Learning
QPS	Queensland Police Service
SDA	State Development Area
SDS	Safety Data Sheet
SO	Safety Officer
SPP	State Planning Policy
SSP	Site Security Plan
TAP	Transport and Access Plan
TBC	To be Confirmed
TNT	Trinitrotoluene
UN	United Nations
VAB	Vehicle Assembly Building
VMR	Volunteer Marine Rescue
WHS	Workplace Health and Safety
WMP	Waste Management Plan
WRC	Whitsunday Regional Council

Appendix A Aide Memoir Card

BOS SAFETY

Alert Warning — — —

3 Tones &Amber Lights—Check Surroundings / Follow Warden

Evacuation Tone

Siren & Red Lights— Move to EAA / Follow Warden

Appendix B Incident Log

Time	Action	Comment

Appendix C Emergency Response Plan Activation Report

To be completed after activation of this plan whether for exercise or in response to an emergency

Once complete – attach copy of Incident Log, save to SharePoint and dispatch to Gilmour Space Safety Officer, Head of Launch Operations and Chief of Staff.

Gilmour Space ERP Activation Report	
Report Completed By	
Date of Activation	
Reason for Activation	

10 Narrative

Include details of the circumstances surrounding the activation, actions taken and results including injuries sustained, damage to property and disruption to program.

11 Currency

Were all details (phone contacts, MSDS registers, EAA locations) current and accurate?

12 Procedures

Were checklists and procedures fit for purpose – if not – what improvements could be made?

13 Emergency Supplies

Were all emergency supplies in the location and quantity required? Were any used in the response? Has an order for more stock been completed?

14 Emergency Services Coordination

If emergency services attended – was coordination satisfactory – what improvements could be made?

15 Deficiencies / Improvements

Any other deficiencies or improvements noted for the ERP.

Appendix D Launch Anomaly Quick Report

Send Quick Rep as soon as practicable but within not more than 30 minutes of anomaly

Quickrep Addressees:

Australian Space Agency –	Launch Safety Officer
Airservices Australia –	Line Leader for Reef Airspace Sector
Maritime Safety Queensland –	Regional Harbour Master
Civil Aviation Safety Authority –	OAR
Australian Maritime Safety Authority –	Nav Area 10 Coordinator
Whitsunday Regional Council –	Local Disaster Management Coordinator
Gilmour Space Internal -	CEO, Chief of Staff, Head Launch Operations
Coral Sea Marine Park -	Duty Officer

INCLUDE ONLY FACTS

Anomaly QUICK REPORT	
Anomaly Nature	
Anomaly Time (UTC)	
Launch Second (T+)	
Position @ Anomaly (lat/lon)	
IIP @ Anomaly (lat/lon)	
IIP Bracket @ Anomoly	
Est Mass @ Anomaly (kg)	
ASTOS Debris Spread Radius @ Anomaly (nm)	
Next Actions	

Appendix E Telephone Threat Checklist

- KEEP CALM -

Recipient Name:	Telephone no:	Signature:

GENERAL QUESTIONS:	
What is it?	
When is the bomb going to explode?	
Where did you put it?	
What does it look like?	
How will it explode?	
Did you put it there?	
CHEMICAL / BIOLOGICAL THREAT QUESTIONS:	
What kind of substance is it?	
How much of the substance is there?	
How will the substance be released?	
Is substance liquid, powder or gas?	
BOMB THREAT QUESTIONS:	
What type of bomb is it?	
What is in the bomb?	
What will make the bomb explode?	
EXACT WORDING OF THREAT:	
CALLERS VOICE:	
Male or female:	Well spoken:
Accent:	Incoherent:
Age:	Taped:
Speech fast or slow:	Other:
BACKGROUND NOISES:	
Other voices:	Music:
Traffic:	Machinery:
Aircraft:	Other:
CALL TAKEN:	
Date:	Received by:
Time:	Reported to:
Call number:	Date reported:
Call duration:	Time reported:

Appendix F Land Salvage Plan

In responding to an anomaly over land the salvage and clean up portion of the activity will be a deliberate activity that may take weeks to complete - recall that in accordance with the Space Act “It is an offence to remove or interfere with any object or part of the launch vehicle unless required to:

- extract persons (including deceased persons) from the wreckage of a space object;
- protecting the wreckage from being destroyed by fire or other cause;
- prevent immediate danger to the safety of persons or property; or
- to move the space object or the wreckage and its contents to a safe place when the object or rocket crashes on water or is wrecked on water.”

It is likely that in the event of an anomaly over land the debris will immediately cause grass fires and will represent hazards to responders and salvage personnel. In accordance with the IIP Land response checklists, Gilmour Space will work with QPS, NQBP, EDQ and other landholders / graziers to control access to the site of debris impacts. Residual debris hazards include through exposure to hazardous substances (RP, HP, LOX) stored energy (Li Ion Batteries, COPVs) and heavy or unstable structural components.

Once clearance has been received to move the debris and in coordination with any investigation team from the nominated investigating agency (ASA, CASA, ATSB etc) it is likely that the debris will be moved to a secure location for further investigation.

Gilmour Space staff will conduct much of the salvage effort and may supplement numbers through a labour hire company.

Gilmour Space will nominate a salvage coordinator to act as liaison with investigators, landholders, traditional owners and labour hire contractors.

Care must be taken to properly identify and catalogue each piece of debris. The salvage coordinator will agree the catalogue process with the accident investigation team.

Before the debris is moved or lifted a knowledgeable Gilmour Space employee is to also determine whether the debris represents a residual hazard to salvage personnel.

Appendix G Marine Salvage Plan

In responding to an anomaly overwater the salvage and clean up portion of the activity will be a deliberate activity that may take weeks to complete but will commence very soon after the anomaly or report of any flotsam or jetsam. Salvage may be conducted for accident investigation or environmental compliance obligations, or both.

In either case - recall that in accordance with the Space Act "It is an offence to remove or interfere with any object or part of the launch vehicle unless required to:

- extract persons (including deceased persons) from the wreckage of a space object;
- protecting the wreckage from being destroyed by fire or other cause;
- prevent immediate danger to the safety of persons or property; or
- **to move the space object or the wreckage and its contents to a safe place when the object or rocket crashes on water or is wrecked on water.**"

Gilmour Space has compliance obligations with the Director of Marine Parks Australia for any debris event in the Coral Sea Marine Park – see activity License conditions 5.2 and 5.3 and the Minister for Environment – see EPBC Act Approval condition 3.

Key Points of Contact –

SubSea – Cory Brooks +61 402 758 009 cory@subsea.com.au
Coral Coast Oceaneering – Andrew Tyler +61 418 635 600 andrew@ccoceaneering.com
CSMP Duty Officer - +61 419 293 465 marine.compliance@dcceew.gov.au

It is likely that in the event of an anomaly over water that the majority of debris will immediately sink. In accordance with the response checklists, Gilmour Space will work with MSQ, AMSA and other landholders / graziers to control access to the site of debris impacts. Residual debris hazards include through exposure to hazardous substances (RP, HP, LOX) stored energy (Li Ion Batteries, COPVs) and heavy or unstable structural components.

Once clearance has been received to move the debris and in coordination with any investigation team from the nominated investigating agency (ASA, CASA, ATSB etc) it is possible that the debris will be moved to a secure location for further investigation.

Gilmour Space staff will retain the services of one or more marine salvage companies to conduct the actual salvage and clean up.

Gilmour Space will nominate a salvage coordinator to act as liaison with investigators, and salvage teams – it is likely a Gilmour space employee will accompany the salvage teams on the water. Before the debris is moved or lifted a knowledgeable Gilmour Space employee should determine whether the debris represents a residual hazard to salvage personnel.

Care should be taken to identify and catalogue each piece of debris as best as reasonably practical in the circumstances. The salvage coordinator will agree the catalogue process with the salvage team.

Appendix 12

GILMOUR SPACE

Bowen Orbital Spaceport

Security Plan

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1 Introduction

Gilmour Space is committed to achieving sovereign orbital launch capabilities for Australia. The Australian space sector represents a small but significant sector of the Australian economy with significant growth potential. The establishment of an operational orbital launch facility will enable greater market participation for Australian space companies in both domestic and international markets.

The Bowen Orbital Spaceport (BOS) is a purpose-built orbital launch facility within the Abbot Point State Development Area west of Bowen township in North Queensland. The facility is operated by Gilmour Space, Australia's leading space launch provider.

1.1 Purpose

This Security Plan has been prepared to detail the procedures and policies to be followed in order to protect the BOS facility from physical and cyber threats of intrusion, theft and malicious interference.

1.2 Scope

This plan includes:

- The security strategy for the BOS.
- A description of the BOS facilities and security design features.
- A list of security roles and responsibilities.
- ACTIVE Facility security procedures.
- IDLE Facility security procedures.
- Security reporting and governance requirements.

This plan presents material in narrative form to provide policy guidance and support execution of procedures.