RESPONSE DOCUMENT / WHALERS WAY ORBITAL LAUNCH COMPLEX / SOUTHERN LAUNCH / AUGUST 2022

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WHALERS WAY ORBITAL LAUNCH COMPLEX

RESPONSE DOCUMENT

SOUTHERN LAUNCH

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GLOSSARY

GLOSSARY

The following terms are referred to throughout this response document by their acronyms.

Table G1: Glossary

ACRONYM	MEANING
AAR	Aboriginal Affairs and Reconciliation - Department of the Premier and Cabinet
AGD-PLUS	Attorney General's Department – Planning and Land Use Services
Air EPP	South Australian Environment Protection (Air Quality) Policy 2016
AMSA	Australian Maritime Safety Authority
ASA	Australian Space Agency
ASBTIA	Australian Southern Bluefin Tuna Industry Association
BoM	Bureau of Meteorology
CEMP	Construction Environment Management Plan
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCLEP	District Council of the Lower Eyre Peninsula
DEW	Department for Environment and Water (SA Government)
DIT	Department for Infrastructure and Transport
DNL	Day-night Levels
EIS	Environmental Impact Statement
EPA	Environment Protection Authority (SA Government)
EPBC	Environment Protection and Biodiversity Conservation Act 1999
FAA	Federal Aviation Administration
HCl	hydrogen chloride
LAeq	Equivalent Continuous Sound Level
LAMax	Maximum instantaneous A-weighted sound pressure level
LCPVEA	Landscape Character and Probable Visual Effect Assessment
NOTAM	Notice to Airmen

ACRONYM	MEANING
NOTMAR	Notice to Mariners
NP&W	National Parks and Wildlife Act
OEMP	Operational Environmental Management Plan
PIRSA	Primary Industries and Regions SA
SAPOL	SA Police
SARDI	South Australian Research and Development Institute
SASIA	South Australian Sardine Industry Association
SCAP	State Commission Assessment Panel
SEDMP	Soil Erosion and Drainage Management Plan
SEW	Southern Emu-wren (Eyre Peninsula)
SGWCPFA	Spencer Gulf and West Coast Prawn Fishermen's Association
SPC	State Planning Commission
TAPM	The Air Pollution Model
TIA	Transport and Access Impact Assessment
VMR	Volunteer Marine Rescue
WONS	Weeds of National Significance
WWB	Western-Whipbird
ZTVI	Zone of Theoretical Visual Influence

1 INTRODUCTION

1.0 INTRODUCTION

On 22 August 2019, the Minister for Planning (the Minister) declared the proposed project by SouthernLaunch.Space Pty Ltd ('Southern Launch' and referred to in this EIS as 'the proponent') to establish a multi-user rocket launch facility at Whalers Way, Sleaford, South Australia, a "Major Project" pursuant to Section 46 of the *Development Act, 1993*.

Subsequently the proponent lodged an application seeking approval for the facility under the *Development Act, 1993* on 20 November 2019.

On 23 July 2020, the State Planning Commission ('SPC') determined that the level of assessment for the application would be an Environmental Impact Statement ('EIS') and issued Assessment Guidelines ('Guidelines') for its preparation. The purpose of the EIS is to provide information relevant to the assessment of the environmental, social, and economic impacts of the proposed development.

An EIS prepared by Southern Launch, in accordance with the guidelines issued by the SPC was prepared, and subsequently exhibited, from 5 August 2021 to 16 September 2021.

Two public information sessions on the proposal were held on 24 August 2021 at Port Lincoln Hotel.

At each session, staff from the Attorney General's Department – Planning and Land Use Services (AGD-PLUS), outlined the major development assessment process, followed by a presentation from Southern Launch on the development proposal, and a question and answer session that was incorporated as part of the presentation by Southern Launch.

1.1 Submissions

A total of 268 written submissions were received during the exhibition period, comprising of:

- 261 public submissions;
- six submissions from State Government agencies; and
- one submission from Local Government.

For reference purposes, the following tables record the authors of the submissions. An alphanumeric reference number has been provided for each submission, where:

- P represents a private submission;
- G represents a submission from a State Government agency; and
- L represents a submission from Local Government.

A total of 261 written submissions were received from the public during the exhibition period.

Table 1.1 – Public Submissions

REFERENCE	AUTHOR
P1	Adrian Potter
P2	Chris Hosking
P3	Dr Andrew Lothian
P4	Bruce M Linn AM
P5	Deb Hicks
P6	Dr Todd Dearing
P7	Cameron Dorrough
P8	Alex Koutoulogensis
P9	Alexander Sanzo
P10	Bethany Pollock
P11	Robert Sordillo
P12	Peter Geronymakis
P13	Damian Bastiras
P14	Nathan Hartley
P15	Jemma El-Mohamad
P16	Kyia Sordillo
P17	Dimitrious Koutolougensis
P18	Travis Swigart
P19	Stuart Rogers
P20	Sam O'Neill
P21	Pamela Price-Besold
P22	Hamish Robertson
P23	Joshua Thyer
P24	Tim Buscombe
P25	V Scholz
P26	Frances Solly
P27	Anthony Warren
P28	Rob Kelman

REFERENCE	AUTHOR
P29	BM & K Tattersall
P30	Trevor Prow
P31	John R Kroezen
P32	Phillip Threadgold
P33	Shivawn Young
P34	Kathleen Firth
P35	Michael Haritos
P36	John Hussey
P37	Janet Hussey
P38	Allan Murray
P39	Casey Porter
P40	Kate Russell
P41	Zareena Gynell
P42	Rose & Alan Berrett
P43	Richard Lloyd
P44	Sue Olsen
P45	Sue Schilling
P46	Tim Nicholson
P47	Eliza Sherrard
P48	Mark Spalding
P49	Mark Hood
P50	Dr Rebecca Coleman & Mr Ian Smith
P51	Karlie Bell
P52	Malcolm Shaw
P53	Sharon J LeBrun
P54	Ian Polden
P55	Samuel Gigger
P56	Jim McGuire
P57	Peninsula Pedallers
P58	Jim Egan

REFERENCE	AUTHOR
P59	Erik Dahl
P60	Jessica Lacorte
P61	Eyre Peninsula Landscape Board, Andrew Freeman
P62	Kelly Thorpe
P63	Indah Gynell
P64	Edward Hage
P65	Tessa Bishop
P66	Andrew Black
P67	A & S Chappell
P68	Barry Hockaday
P69	Terry Dennis
P70	Zareena Gynell
P71	Sharon J LeBrun
P72	Janine LeBrun
P73	Samuel Amadeus Taylor
P74	Ngahuia Trewartha
P75	Noeleen Curran
P76	Kayla Rundle
P77	Submission withdrawn
P78	Nathan Schwartz
P79	Jacqui Scroop
P80	Gavin Scotton
P81	Gary Glynn-Roe
P82	Adam Sweeney
P83	Dean Brain
P84	Isabella Curran
P85	Sheridan Grace
P86	Karen Dawson
P87	Malia Gynell
P88	Brett Dawson

REFERENCE	AUTHOR
P89	Tiffany Jones
P90	Amanda Riley
P91	Darren Lewis
P92	Mark Bacon
P93	Arthur Winkler
P94	Dianne Thompson
P95	Guy Langford
P96	Gemma Dally
P97	Kara Wittwer
P98	Brianna Houghton
P99	Jane Becktel
P100	Megan Greenwood
P101	Kim LeBrun
P102	Victoria Sheldon
P103	Wilson Chan
P104	Peter Marshall
P105	Anthony Tsotras
P106	Giovanna DeNicola
P107	Angela Hearn
P108	John Brook
P109	David Bailey
P110	Jamie Turner
P111	John Leslie
P112	Christine Lawrence
P113	David Farlam
P114	Jayne White
P115	Brendan Curran
P116	Anthony Plumb
P117	Scott Truman
P118	Jayne Launt

REFERENCE	AUTHOR
P119	Joel De Shannon
P120	Andrew Barton
P121	Joss Adele
P122	Ian Taylor
P123	Penelope Taylor
P124	Sleaford Bay Action Committee
P125	Shannon Haapanen
P126	Charlie Blacker
P127	Cherie Duncan
P128	Michael J Gorvel
P129	Heather Hankins
P130	Kevin Hankins
P131	David Horlin-Smith
P132	Ashleigh Kennedy
P133	Wayne Launt
P134	John Chataway
P135	Glyn Hancock
P136	Ahmed J Naseem
P137	Catherine Veldhuyzen
P138	Nigell Hall
P139	Debra Jane Hicks
P140	Victoria Vizzari
P141	Oliver Thomas
P142	Dane Filipponi
P143	Brodie Curtis
P144	Angela Casanova
P145	Athena Taylor
P146	Khuong Nguyen
P147	Rebecca Charles
P148	Jessica Haagmans

REFERENCE	AUTHOR
P149	Joe Judge
P150	Laura Phillis
P151	Ady James
P152	Tobias Threadgold
P153	Desmond Menz
P154	Michael Podhorodecki
P155	Ian and Marianne Stockham
P156	Peter Thomas
P157	Jarrod Schilling
P158	Michael Todd
P159	Sarah Hayes
P160	Mahdy Alhameed
P161	Jeff Groves, Birds SA C/- SA Museum
P162	Emile Pearson
P163	Tim Kelly
P164	Dr Nicole Hancox, Abalone Industry Association of South Australia Inc.
P165	Dion Clarke
P166	Isaac Taylor
P167	Gabrielle Coard
P168	Geoff Rayson
P169	Penelope-Anne Damp
P170	Melissa Balantyne, Environmental Defenders Office
P171	Andrew McLean
P172	Elizabeth Thompson
P173	Mitchell Green
P174	The Di Fava Group
P175	Bruce Llewellyn
P176	Jason Bender
P177	Sally Hodson & Carmel Barry
P178	Richard Lloyd

REFERENCE	AUTHOR
P179	Kristen J Lawler
P180	Nikki Macor
P181	Nigel Anthony Spooner
P182	Samantha Vine & Dr Rebecca Boulton, BirdLife Australia
P183	Rachel Wilson
P184	Alexander Haldane
P185	Rebecca Veldhuyzen
P186	Uta Ennekin-McQuillan
P187	Ben Adams
P188	Ian Spencer
P189	Craig Simpson
P190	Alan Edwards
P191	Patrick O'Connor, Nature Conservation Society of SA
P192	Eliza Sherrard
P193	Geoff Barker
P194	Therese Pedler
P195	Tristan Rogers
P196	Natasha Davis, Trees For Life
P197	Michael Eiffe
P198	Amy Cabot
P199	Jennifer Theakstone w/ Wallmans Lawyers
P200	Dianne DeLaine
P201	Steven Davies
P202	John T
P203	Kidcoach
P204	David Farlam
P205	Leanne Agars
P206	Suzanne Marie Theakstone Stagg
P207	Fiona & Jovan Parenta
P208	Ian Stockham
P209	Kerry Manthorpe

REFERENCE	AUTHOR
P210	Brian Jeffries & Kirsten Rough, Aust Southern Bluefin Tuna Industry Association Ltd
P211	Rebecca Laidlaw
P212	Sarah Owen
P213	Richard Davison
P214	Ali Rawling
P215	Jovan Parenta
P216	Hayden Lewis
P217	Kevin Timoney
P218	Chantelle Boys
P219	Matthew Trewartha
P220	Katrina Dawson
P221	Greg Stevens
P222	Tony Lawder
P223	Nikki Barns
P224	Christian Thaler-Wolski
P225	Alexander Minchin
P226	Robyn Archer
P227	Darren Longbottom
P228	Tiffany Hill
P229	Tom Warner
P230	Steven S Pietrobon
P231	Jo-Anne Lloyd
P232	Holly Koen
P233	Mike Damp
P234	Sam Di Fava
P235	Loretta Rowlands
P236	Angela Vanderklugt
P237	Pat Moran
P238	Ann Prescott
P239	Brenda Paynter
P240	Paul Force
P241	Robert and Katrina de Keijzer

REFERENCE	AUTHOR
P242	George Strungaru
P243	Sean
P244	Josh Stucken
P245	Taylor Tudisco
P246	Jesse Singh
P247	Chad Owen
P248	Chris Gehrke
P249	Molly Ayers-Lawler
P250	Geoff Robertson
P251	Adam Gajda
P252	Nick Miller
P253	K Thomas
P254	Scott Lombe
P255	Kiarna Lombe
P256	Masto Myles
P257	Cat Menz
P258	Leslie A Menz
P259	Heather Ellis
P260	Graham S Ellis
P261	Andrew Haldane

A total of six submissions were received from government agencies during the exhibition period.

Table 1.2: Government Agency Submissions

REFERENCE	AUTHOR
G1	Department for Energy and Mining (DEM)
G2	Department for Environment and Water (DEW)
G3	Department for Infrastructure and Transport (DIT)
G4	Environment Protection Authority (EPA)
G5	Department of Premier and Cabinet – Aboriginal Affairs and Reconciliation (DPC – AARD)
G6	Primary Industries and Resources SA (PIRSA)

A total of one (1) submission was received from Local Government during the exhibition period.

Table 1.3: Submissions Received from Local Government

REFERENCE	AUTHOR
L1	District Council of Lower Eyre Peninsula

Each of the public submissions received sets out the position of the author of the submission. The table below sets out the distribution of stated positions across the 261 public submissions received:

Table 1.4: Public Submissions Position

POSITION	NUMBER OF SUBMISSIONS
Supports the proposal	131
Opposes the proposal	119
Neither Supports nor Opposes however has Questions	3
Second Response/additional information from same submitter	7
Representation withdrawn	1
Total	**261**

Of the submissions received, a number of consistent matters were raised in multiple submissions. The issues raised in each submission have been reviewed and categorised to enable responses to be made based on issues rather than each submission.

The table below provides a summary of the issues raised in the public submissions, and the number of times each issue was mentioned:

Table 1.5: Issued Raised Summary

ISSUE	NUMBER OF MENTIONS
Bushfire Risk	67
Southern Right Whale	38
Water Supply use and water contamination (town water used for the facility)	37
Habitat loss	35
Tourism negative impacts	34
Traffic impact heavy vehicles, increase - safety, maintenance including school bus route	29
Endangered species	26
Southern Emu-wren (Eyre Peninsula)	26

ISSUE	NUMBER OF MENTIONS
Noise and Vibration	24
Chemical toxic fallout from launch	21
Access restrictions beach, site	21
Australian Sea Lion	19
Mallee Whipbird	19
Heritage Agreement concern	19
White-bellied Sea-eagle	18
Native Vegetation impact	17
Coastal erosion	17
Eastern Osprey	15
Climate Change impacts	14
Other Fauna Species impacts	13
Ocean dumping	12
Fishing/seafood industry impact	11
Hearing loss - animals	10
Long Nose Fur Seal	9
Emergency Services use as a private company	8
Landscape quality assessment and visual impact assessment	7
Cultural Heritage impacts	7
Air pollution	6
Greenhouse Gas 1.6% of SA annually	6
Military target concern	6
Exclusion Zone management	4
Roadkill	4
Cycling safety	4
Inconsistent with Zone	4
Introduced species risk	3
Livestock spooking	3
Clean green image impact	3
Conflict of interest with Mayor	3

ISSUE	NUMBER OF MENTIONS
Economic generation issues (jobs etc)	2
Transparency - redacted reports	2
Local Community negative impact	2
Privacy	2
Raptor assessment qualifications	1
Credibility of bird experts	1
Biodiversity loss	1
Marine Park concern	1
Pointy Nosed Seals	1
Shipping Lane impact	1
Space junk management	1
Environmental damage	1
Inadequate wind modelling	1
Lack of adequate disaster response plan	1
Diesel vs renewable energy for site	1
Bore Water Details	1
Tests should be concluded prior to the application proceeding	1
Public access	1

A list of these issues, and the corresponding section in which these issues are discussed, is located in **Appendix Q**.

1.2 Response Document

Copies of all written submissions to the EIS were provided by AGD-PLUS, pursuant to Section 46B(7) of the *Development Act, 1993*. This response document represents the proponent's written response to the submissions on the EIS as required by Section 46(8) of the *Development Act, 1993*, which states the following:

> *(8) The proponent must then prepare a written response to—*
>
> *(a) matters raised by a Minister, the Environment Protection Authority, any council or any prescribed or specified authority or body, for consideration by the proponent; and*
>
> *(b) all submissions referred to the proponent under subsection (7), and provide a copy of that response to the Minister.*

It is noted that, notwithstanding the commencement of operation of the *Planning, Development and Infrastructure Act, 2016*, the proposal will continue to be assessed against the provisions of the *Development Act, 1993*, pursuant to Regulation 11(3) of the *Planning Development and Infrastructure (Transitional Provisions) Regulations, 2017*, as follows:

> *(3) The repealed Act will continue to apply to and in relation to a proposed development or project that is the subject of a declaration made under section 46 of the repealed Act before the relevant day in relation to the area within which the development or project would be undertaken (and that has not been the subject of a decision of the Governor under section 48 of the repealed Act before the relevant day), except that—*
>
> *(a) section 48 of the repealed Act will, on or after the relevant day, apply in relation to the development or project as if a reference to the Governor were a reference to the Minister (and a decision of the Minister in relation to the development or project will have effect as if it were a decision of the Minister under section 115 of the PDI Act); and*
>
> *(b) sections 46B(9) to (12), 46C(9) to (12), 46D(8) to (10) and 47(3) of the repealed Act will, on or after the relevant day, apply in relation to the development or project as if a reference to the Minister were a reference to the Commission (and the Commission may adopt any findings or determinations of the Minister under those subsections made before the relevant day to give effect to this subregulation).*

In response to the public engagement process, further investigations have been undertaken to clarify, improve and detail the proposal. This has resulted in an amended and improved proposal as set out in **Section 2.0** of this response document. This is followed by the response to the submissions, referenced by type and number.

This document, therefore, represents the proponent's written response to the EIS submissions.

In the preparation of the Response Document, noting that many submissions have referred to similar issues, the responses have been provided on an issue basis, rather than addressing each submission separately. This approach avoids excessive duplication and repetition in the document.

The document is concluded by a matrix which references the responses, identifies the location within the response document where each issue is addressed, and highlights the key elements of the proposal and its impacts.

1.3 Methodology

The following process was undertaken to ensure the output provided in the Response Document is relevant and efficient:

- review of each submissions received;
- identify any issues;
- summarise issues for each submission;
- review summary table;
- collate issues under key issue headings;
- prepare preliminary draft response to each issue;
- determine further information, or research to be incorporated in response;
- undertake further studies as identified;
- incorporate further information;
- cross reference of submission issues with responses to ensure relevance and efficiency of response; and
- finalise response.

1.4 Project Team – What Each Member Has Done and Contributed

Since the original EIS was completed, the project team has been broadened to incorporate additional expertise in respect of identified issues.

Additional members of the project team since the preparation of the EIS include:

Table 1.6: Additional Team Members

TEAM MEMBER	ROLE
SA Bushfire Solutions	Bushfire risk mitigation and response
Resonate	Acoustic Impacts
EBS Ecology	Ecology (migratory avian species)
Malcolm Davis	Economic Impact
Regional Development Australia – Eyre Peninsula	Economic Impact – Test Launch 1

The following team original members have provided significant additional input into the response document:

Table 1.7: Original Team Members

TEAM MEMBER	ROLE
Southern Launch	Project Management, Operations and Management
AECOM	Ecology
Ecosphere	Ecology
AECOM	Acoustic Impacts
WGA	Civil Engineering
WGA	Traffic Assessment
WGA	Geotechnical
MasterPlan	Planning
WAX	Visual Amenity
EnviroAdvice	Surface and Groundwater Management
SLR	Air Quality Impacts
J Diversity	Marine Ecology
South Australian Centre for Economic Studies	Economic Impact

The additional work undertaken by the team members has been detailed in updated reports or addendum technical memos, which form appendices to this Response Document.

Specifically, the reports prepared are as follows:

- Proposal Plan Set (WGA) – March 2022.
- Environmental Assessment Report – Noise and Vibration (AECOM) – March 2022.
- Whalers Way Orbital Launch Complex – Environmental Noise Advice (Resonate) – June 2022
- Southern Launch – Haptih I Motor Static Test (Resonate) – July 2022.
- Terrestrial Biodiversity Technical Report (AECOM) – August 2022.
- Updated Marine Ecological Assessment (J-Diversity) – August 2022.
- Raptor Review Memo (EBS Ecology) – February 2022.

- Response to Public Submissions (WAX) – February 2022.
- Response to Public Submissions (SLR Consulting) – November 2021.
- Engine Test Air Quality Update (SLR Consulting) – February 2022.
- Technical Memorandum – Proposed Relocation of Site A (EnviroAdvice) – February 2022.
- Response to Public Submissions – Traffic (WGA) – October 2021.
- Site A Relocation – Stormwater (WGA) – February 2022.
- Bushfire Emergency Plan (SA Bushfire Solutions) – August 2022.
- Economic Impact Assessment (SACES) – May 2022.
- Economic Impact Assessment – Test Launch 1 (RDAEP) – September 2021.
- Economic Impact Analysis (Malcom Davis) May 2022.

2 AMENDED PROPOSAL

2.0 AMENDED PROPOSAL

On the basis of submissions received and further data gathered by Southern Launch since the preparation of the EIS, it has been elected to amend the proposal to improve its performance, mitigate impacts and address the issues raised in the submissions.

It is noted that in this process, consideration was not given to the option of an alternative site for the proposed development. The site selection process outlined in the EIS provided a clear indication of the limitations in finding suitable sites for an orbital launch facility. It is noted that, notwithstanding, the time elapsed since the project was originally proposed and declared a major development, no competing proposals for orbital launch facilities along the southern coast of Australia have emerged.

2.1 Basis of Revised Proposal

The basis of the revised proposal emanates from investigations to determine how the development of the site could be modified to reduce the impacts of the proposal. During the process of the proposal being developed, and the EIS prepared, the impact of the proposal was reduced significantly by a reduction in the footprint of the proposal from 70.58 hectares to 23.76 hectares.

For reference, the original concept which was presented in the EIS is detailed in **Figure 2.1**.

Review of further options to reduce the footprint of the proposal were considered following the receipt of the submissions. It was determined that for the proposal to be a sustainable and economic development, it needed to retain the four elements present in the proposal described in the EIS, being:

- two launch sites;
- one site for supporting infrastructure; and
- one site for range operations and control, outside of the launch safety buffer for the largest vehicles to be launched from the facility.

Given the requirement for all of these elements to be included in the proposal, it was determined that there was limited ability for further significant reduction in project footprint. Whilst it is considered that detailed design may provide for further footprint reductions, these are not considered feasible to include in the proposal at the current point of assessment.

The variance in the footprint of the proposal, resulting from the revisions following the exhibition, is a minor further reduction from 23.76 hectares to 23.4 hectares.

With the ability to significantly reduce the site footprint ruled out, further review sought to consider whether a reconfiguration of the site could be undertaken that would reduce the overall level of impact of the proposed development.

Subject Allotment	SITE A	Launch Facilities	Radius 3120m to Site A Launchpad
Key Site Access	SITE B	Launch Facilities	Radius 2100m to Site B Launchpad
Key Road	SITE D	Infrastructure	
Lease Boundary	SITE E	Range Control	

Figure 2.1 - Site Plan - EIS Development Concept

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Significant further investigations in respect of acoustic impact, ecology, cultural heritage and operations were undertaken. These involved an internal site section process, followed by further targeted ecological surveys and cultural heritage surveys. The result of these investigations was as follows:

- the proposed relocation of Site A;
- confirmation of Launch Site B;
- confirmation of Infrastructure Site D; and
- confirmation of Range Control Site E.

Further negotiations between Southern Launch and the owner of the property have resulted in a revised proposal for land division by lease, which relocates the lease boundary northwards, and includes more land within the proposed lease to Southern Launch. This relocation of the lease boundary locates more of the safety buffers required for individual launches within the extent of the lease.

The description of the development, and the description of the operations proposed, have also been reviewed since the EIS was prepared and have been updated to ensure clarity and consistency with the revised proposal.

The revised concept, including the relocation of Launch Site A is detailed in **Figure 2.2**.

The updated description of the proposed development is detailed in **Section 2.4**.

The updated description of operations is detailed in **Section 2.5**.

2.2 Site A Relocation

The key change to the physical development of the subject site is the relocation of Site A from its existing position in the southern western part of the site to a position located further east, approximately 400 metres west of Launch Site B.

The relocation of the site follows an extensive internal site selection process, which emanated from further targeted ecological investigations, following the exhibition of the EIS and those associated with the first Test Launch.

The internal site selection process involved the identification of six candidate locations for the relocation of Site A, which were then tested against a range of assessment criteria, including construction and operational requirements, ecological assessment and cultural heritage assessment.

The six candidates for the revised location of Site A are shown on **Figure 2.3**.

Subject Allotment	
Key Site Access	
Key Road	
Lease Boundary	

SITE A	Launch Facilities
SITE B	Launch Facilities
SITE D	Infrastructure
SITE E	Range Control

Radius 3120m to Site A Launchpad
Radius 2100m to Site B Launchpad

Figure 2.2 - Site Plan - Revised Development Concept

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Subject Allotment	SITE A	Launch Facilities	Radius 3120m to Site A Launchpad
Key Site Access	SITE B	Launch Facilities	Radius 2100m to Site B Launchpad
Key Road	SITE D	Infrastructure	Site A Options
Lease Boundary	SITE E	Range Control	

Figure 2.3 - Site Plan - Site A Options

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The six sites were considered on an operational basis. Whilst the operational suitability of the six sites was variable, and ideally the separation between Launch Site A and Launch Site B would be maximised, it was determined that all six sites would be suitable from an operational perspective. On this basis, Southern Launch confirmed all six of the sites as suitable candidates. It is noted that several other preliminary sites were considered, however, were excluded on an operational basis due to their proximity to Launch Site B, or other topographic features of the site which would have fundamentally limited their operational ability.

The six sites were considered on a construction basis. The differences between the sites in this regard were principally assessed on the basis of their topography, and the amount of earthworks required to construct each of the sites. Whilst there was variability in this regard, all of the sites were deemed appropriate from a constructability perspective and further ecological and cultural heritage investigations were initiated.

Cultural heritage investigations proceeded concurrently with ecological investigations. The cultural heritage investigations were narrowed down by the concurrent ecological and operational investigations, and also served to narrow down the ecological investigations.

Site Candidate 1 was not endorsed from a cultural heritage perspective, meaning that no further ecological investigations were undertaken in respect of this site.

Site Candidate 2 became a preferred site in respect of the ecological investigations, with subsequent cultural heritage investigations focusing on this site, resulting in it being endorsed from a cultural heritage perspective.

The assessment process for the six sites is detailed in **Section 4.7** responding to terrestrial ecological issues, and in the updated Terrestrial Ecological Assessment contained in **Appendix D**.

2.3 Revised Lease Area

Since the release of the EIS for exhibition, Southern Launch has held ongoing discussions with the owner of the allotment on which the WWOLC is proposed. The initial negotiations for the lease of a portion of the allotment for the WWOLC occurred early in the concept design process and were based upon the understanding of the concept at the time those negotiations took place. Since that time, the proposed development has evolved significantly, including the changes which have been made since the exhibition of the EIS.

The previous proposed lease area was defined by a line of latitude, bisecting the site at 34.923 degrees south.

The previous lease boundary and revised lease boundary is shown on **Figure 2.4**.

Subject Allotment
Council Boundary
Key Road Link
Original Lease Boundary
Revised Lease Boundary

Figure 2.4 - Site Plan - Lease Boundary

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Further negotiations with the owner have resulted in a revised proposal for the lease that has greater regard for both the site conditions and the proposed development.

The revised proposed lease still commences at a position on the western boundary of the site, at 34.923 degrees south, where the previous lease boundary also bisected the western boundary. The revised proposed lease boundary now extends in a north-easterly direction for 1,041.75 metres, before turning in an east-northeast direction and extending for 3,799.66 metres to the point where it intersects the north-eastern boundary of the site on the unmade public road.

The revised proposed lease boundary increases the area to be contained within the lease for the WWOLC from approximately 1,200 hectares to approximately 1,590 hectares.

The revised lease area offers the following advantages:

- The revised lease boundary offers greater separation of the development areas, most particularly Infrastructure Site D and Range Control Site E from the lease boundary.
- The revised lease boundary allows for the northern emergency egress from the site, to be entirely contained within the lease area, to the point where it intersects the unmade public road.
- All of the areas excluded from the Heritage Agreement over the allotment, which are proposed to be reconfigured, are contained within the revised lease boundary.
- A greater proportion of the launch safety buffers are contained within the lease area, meaning there will be a lesser requirement for buffers to extend onto land within the Allotment, but not located within the lease.
- A larger area is provided for which Southern Launch is responsible for ongoing rehabilitation, management and maintenance.

These advantages of the revised lease are detailed further as follows.

2.3.1 Development Area Separation

The revised lease boundary increases the separation distance of all four development sites from the lease boundary.

This is considered to be of significant advantage in securing a legal ability to ensure separation from persons not authorised to be on the site during operations. Previously, Range Control Site E was located immediately adjacent the lease boundary and Infrastructure Site D was located within 300 metres of the lease boundary.

The revised lease boundary increases the distance of Range Control Site E site from the lease boundary to approximately 400 metres and the distance of Infrastructure Site D to approximately 1,100 metres, enhancing the ability to maintain security and ensure the exclusion of unauthorised persons during operations.

2.3.2 Emergency Egress

The proposed development features a secondary emergency egress via an existing track which extends northwards from the location of Infrastructure Site D to the point where it intersects with existing cleared land and the unmade public road to the northeast of the Allotment.

Under the previous lease, the position of this track ran through the portion of the allotment which was not within the boundary of the proposed lease to Southern Launch. Whilst this outcome was considered workable for a secondary emergency egress, it did raise complications in respect of both tenure and ongoing maintenance.

The revised lease allows the emergency egress track to be located entirely within the boundary of the proposed lease to Southern Launch, which resolves any tenure questions and confirms the responsibility of Southern Launch for the ongoing maintenance and upkeep of the secondary emergency egress.

2.3.3 Heritage Agreement Exclusions

Southern Launch has an in-principle agreement with the Native Vegetation Council, should the proposal be granted Development Approval, to reconfigure the existing Heritage Agreement such that the excluded areas match those areas of the site where the development sites are located.

The previous lease boundary would have bisected several of the existing areas excluded from the Heritage Agreement and located other excluded areas outside of the area proposed to be leased to Southern Launch. The revised lease boundary encapsulates all of the areas excluded from the Heritage Agreement (which are proposed to be reconfigured) located within the boundary of the proposed lease area.

A plan showing the relationship of the previous lease boundary, and revised lease boundary, in relation to the areas excluded from the Heritage Agreement, is shown on **Figure 2.5**.

2.3.4 Launch Safety Buffers

The launch safety buffers, required from Launch Site A, and Launch Site B, are calculated for each individual launch based on the size and type of launch vehicle, the nature of the fuel used, the payload, launch trajectory and other relevant factors. The launch safety buffers will therefore vary for each launch.

Nominal launch safety buffers have been calculated at 3,120 metres for Launch Site A and at 2,100 metres for Launch Site B, with radiuses showing these buffers illustrated in the plans contained in the EIS. These nominal launch safety buffers represent a calculation of the likely worst-case scenario based on the largest launch vehicles proposed to be launched from Launch Site A and Launch Site B, respectively. In actual operation, it is likely that the buffers will be smaller, and often significantly smaller than these nominal figures.

Subject Allotment
Key Road Link
Original Lease Boundary
Revised Lease Boundary
Existing Heritage Agreement Areas Excluded

Figure 2.5 - Site Plan - Existing Heritage Agreement

WHALERS WAY
ORBITAL LAUNCH COMPLEX
for Southern Launch

1:35000 @ A3
0 1000m

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SA | NT | QLD

MASTERPLAN
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Under the previous configuration, the nominal buffers for both Launch Site A and Launch Site B extended beyond the lease boundary onto those portions of the Allotment not within the lease. Whilst in many cases the actual buffers calculated for a launch would have been located within the lease, there would have been circumstances where they would extend into the portion of the Allotment not within the lease. This would have resulted in a requirement to negotiate with the owner of the Allotment to ensure that the buffers were implemented where they extended beyond the lease boundary.

The revised proposed lease boundary significantly increased the proportion of the nominal launch safety buffers located within the lease. In respect of Launch Site B, the entirety of the 2,100 metre radius nominal launch buffer is located within that portion of the Allotment within the lease boundary. In respect of Launch Site A, a greater portion of the 3,120 metre radius nominal launch buffer is located within the lease, notwithstanding the relocation of Launch Site A.

Whilst there will still be launches where the buffer extends beyond the boundary of the lease, the proposed revised lease boundary will significantly reduce the proportion of launches where this occurs. Such a circumstance will likely only occur for the largest launch vehicles proposed to be launched from the site, the launches of which should occur relatively infrequently, only making up approximately 15 per cent of all launches from the WWOLC.

2.3.5 Area for Ongoing Management

Southern Launch will take on responsibility for the ongoing management, maintenance and rehabilitation of land within the lease, including that covered by a reconfigured Heritage Agreement.

The revised proposed lease boundary increases the area for which Southern Launch will be responsible to approximately 1,590 hectares. Southern launch is committed to the improvement of the environmental values within this area through appropriate ongoing management including the removal of rubbish, rehabilitation of previously cleared areas and better management of tourism and recreation uses so as to reduce their existing impacts on-site.

In summary, the revised lease is considered to constitute an improved configuration of the lease boundary for the WWOLC, on the basis that it better includes the operational and impacted areas of the site, more clearly defines the responsibilities of Southern Launch for the maintenance and upkeep of infrastructure, and better includes the launch safety buffers required to support operations.

As was previously the case, the proposed lease constitutes land division due to the length of time for which lease is proposed to be granted, and therefore forms part of the development proposal for the WWOLC.

2.4 Project Description

In respect of the WWOLC project, this section describes the:

- Nature of the project.
- Location and nature of all buildings, structures, and infrastructure in relation to the key elements of the site, as follows:
  - Launch Facility A;
  - Launch Facility B;
  - Infrastructure Facility (Site D);
  - Range Control Facility (Site E); and
  - General site infrastructure.
- Construction materials and processes as relevant.
- The operational and management procedures for the activities to be undertaken on the site.
- Construction staging and timing.
- Construction management.

2.4.1 Project Overview

The WWOLC project is proposed to establish a multi-user rocket launch facility that will service the growing demand for the launch of domestic and international vehicles for Polar and Sun Synchronous orbit satellite insertion.

The complex will be designed to launch the latest technology 'smallsat' satellites which are typically weighted between several kilograms ('cubesat') to a maximum of several hundred kilograms. Consequently, the launch vehicles (rockets) will also be relatively small (in comparison to earlier satellite launch vehicles and heavy-lift rockets), typically being in the range of 10 to 30 metres tall.

It is expected the operation of the WWOLC will initially accommodate in the order of one rocket launch per two months, increasing over time to in the order of one rocket launch per fortnight to an approved maximum of 36 orbital launches and six sub-orbital launches per year. Whilst several weeks of preparation will be involved in preparing for a launch, the actual launch itself, from ignition to orbit, will take approximately 45 minutes. Of this time, the launch itself will only result in impacts on the terrestrial site and locality for a period of up to a maximum three minutes.

The WWOLC is proposed to be developed in stages over time in response to emerging market opportunities and conditions.

The current proposal represents the initial development of the complex and is the subject of this EIS. It comprises two separate rocket launching sites and supporting infrastructure.

The proposed layout of the site is shown in **Figure 2.6**.

FIGURE 2.6

PROPOSED LAYOUT

SOURCE: WGA

The main elements of the initial development are outlined in **Table 2.1**.

Table 2.1: Project Elements

ELEMENT	DESCRIPTION	TIMING
Launch Site – Site B	A rocket launch facility sited and designed to support small lift launch vehicles with sizes from micro to small conventional (less than 10 tonnes up to approximately 60 tonnes).	Stage 1 – 2022
Range Control Facility – Site E	A permanent range control facility which will provide facilities for launch control, range control, security, office, administration, and visitor facilities.	Stage 2 – 2022/2024
Infrastructure Site – Site D	Infrastructure facilities including a dam, magazine, and ancillary storage facilities.	Stage 3 – 2022/2024
Launch Site – Site A	A rocket launch facility which will predominantly be utilised for larger launch vehicles (greater than 30 tonnes to up to approximately 100 tonnes).	Stage 4 – 2024/2025
Access Upgrades	Existing access tracks will be upgraded as required to provide appropriate, all-weather access to each of the sites. New access connections will be provided to connect the sites to the existing and upgraded access tracks.	Progressively from the commencement of the project.
Supporting Infrastructure	• Diesel and/or Hydrogen Fuel Cell Powered Generators. • Helicopter Pad(s). • Water Tanks. • Water Capture and Treatment Systems associated with each site. • Lightning Rods. • Anemometer Towers. • Engine test stands. • Propellant (Liquid, Hybrid and Solid) Storage. • Secure Block Houses. • Blast Walls. • Bunding (for Blast Wave Deflection). • Installation of Fibre Optic and Satellite Communication Systems. • Construction of internal access roads. • Visitor viewing area and interpretative facilities. • Signage. • Lighting. • Noise monitoring equipment. • Radar and telemetry equipment. • Safety and security related upgrades including fencing, gates, cameras, sensors etc.	Progressively from commencement of project as each launch site is developed.

ELEMENT	DESCRIPTION	TIMING
Temporary facilities required during construction	• Temporary concrete batching plant. • Temporary site and construction offices and facilities. • Temporary water storage. • Temporary laydown areas. • Temporary access tracks.	At the commencement of each stage of construction.

Additional non-conventional launching facilities, as a component of the ultimate development of the WWOLC, are currently under investigation and may be sought on the site in the future; however, these will form subsequent phases of development and will be subject to a further application and assessment at the appropriate time. Non-conventional launch facilities do not form part of the current application considered in the EIS or this Response Document.

The design development of the site layout and launch sites originally provided candidates for up to six launch sites having regard to key site selection criteria, including buffer distances, exclusion zones, extent of native vegetation, accessibility, and topography. Following further detailed review and investigation, the two selected launch sites have been confirmed and form the proposal. This has included an update to Site A as a result of comments from the SA Government and feedback received as part of the public consultation.

2.4.2 Proposal Plans

The physical footprint of the proposed WWOLC together with the buildings, structures, and ancillary elements is set out on proposal plans prepared by WGA and Greenway Architects.

The proposed project elements are detailed on the proposal plans contained in **Appendix A**.

The following plans comprise the Proposal Plan Set:

<u>Launch Sites, Infrastructure Site & Range Control</u>

- Overall Site Plan DR-CC0001 Rev 0 15/02/2022;
- Site A Sheet 1 of 2 DR-CC0002 Rev 0 15/02/2022;
- Site A Sheet 2 of 2 DR-CC0003 Rev 0 15/02/2022;
- Site B Sheet 1 of 2 DR-CC0004 Rev 0 15/02/2022;
- Site B Sheet 2 of 2 DR-CC0005 Rev 0 15/02/2022;
- Site D DR-CC0006 Rev 0 15/02/2022;
- Site E DR-CC0007 Rev 0 15/02/2022;

SOUTHERN LAUNCH

•	Site A – Preliminary Earthworks	DR-CC0010 Rev 0	15/02/2022;
•	Site B – Preliminary Earthworks	DR-CC0011 Rev 0	15/02/2022;
•	Site D – Preliminary Earthworks	DR-CC0012 Rev 0	15/02/2022;
•	Site E – Preliminary Earthworks	DR-CC0013 Rev 0	15/02/2022;

Access Upgrades

•	Overall Site Plan	DR-CC0100 Rev 0	15/02/2022;
•	Site Plan Sheet 01	DR-CC0101 Rev 0	15/02/2022;
•	Site Plan Sheet 02	DR-CC0102 Rev 0	15/02/2022;
•	Site Plan Sheet 03	DR-CC0103 Rev 0	15/02/2022;
•	Site Plan Sheet 04	DR-CC0104 Rev 0	15/02/2022;
•	Vertical Alignment Sheet 1	DR-CC0105 Rev 0	15/02/2022;
•	Vertical Alignment Sheet 2	DR-CC0106 Rev 0	15/02/2022;
•	Vertical Alignment Sheet 3	DR-CC0107 Rev 0	15/02/2022;

Buildings

•	Cover Sheet	A0.00 Rev 2	20/08/2020;
•	Assembly Building – Ground Floor Plan	A3.01 Rev 2	20/08/2020;
•	Assembly Building – First Floor Plan	A3.02 Rev 2	20/08/2020;
•	Assembly Building – Roof Plan	A4.01 Rev 2	20/08/2020;
•	Assembly Building – Elevations	A8.01 Rev 2	20/08/2020;
•	Assembly Building – Sections	A9.01 Rev 2	20/08/2020;
•	Assembly Building – 3D Views 1	A20.01	20/08/2020;
•	Assembly Building – 3D Views 2	A20.02	20/08/2020;
•	Water Deluge Tank – Plan & Elevation	A3.03 Rev 1	20/08/2020;
•	Maintenance Building – Floor & Roof Plan	A3.03 Rev 1	10/07/2020;

•	Maintenance Building – Elevations & Sections	A8.02 Rev 1;	10/07/2020;
•	Maintenance Building – 3D View	A20.04	20/08/2020;
•	Range Control – Plan and Elevations	A3.05 Rev 2	20/08/2020;
•	Range Control – Perspectives	A9.02.2021	20/08/2020;
•	Range Control – 3D Views	A20.03	20/08/2020

Details for each of the elements of the project are set out in the following sub-sections. Where details contained within proposal plans are expressed in figures in the following sections, the proposal plans in **Appendix A** prevail to the extent of any inconsistency.

2.4.3 Launch Sites – Site A and Site B

Two (2) launch sites are proposed containing a range of elements and structures and will provide integrated, and largely self-contained facilities for the assembly, preparation, staging and launch of the various vehicles to be launched from the WWOLC.

As a result of the comments received from the SA Government, public submissions provided, and further analysis undertaken by Southern Launch's ecology and cultural heritage advisors, an alteration to proposed Site A has been made. This alteration has resulted in the proposed launch site being moved 700 metres to the north-east.

Site A as detailed in the EIS was originally located closer to the coast. Assessment of the original site suggested the disturbance to this vegetation would negatively impact upon listed species such as the Western Whipbird and Southern Emu-Wren (Listed Species) found in this area.

A thorough analysis has therefore been undertaken to identify not only a better location from an ecological standpoint, but also from a cultural heritage perspective. Several sites were identified and determined to be inappropriate from a cultural heritage perspective. Therefore, the new site selected is considered to be superior from both an ecological and a cultural heritage standpoint.

The revised location for Site A has been surveyed with limited evidence of listed species, and no evidence of cultural artifacts or habitation. This is seen as a very positive outcome to ensure that Southern Launch will continue to strive for a balance between its operations, the environment and social matters.

Each of the two launch sites will contain a similar range of elements and structures, with the configuration of each varying in response to the prevailing conditions at each site, and the need for Site A to cater for larger launch vehicles than Site B.

The launch sites are essentially rectangular in shape, oriented in a generally north-south direction, with the launch pad located near the southern end of the site and the assembly building located near the northern end of the site. A dam is located adjacent each of the launch sites, being at the northern end of each launch site.

Each launch site has two connections to the access roadways external to the sites, one at the northern end and one at the southern end. The locations of the access points to the sites are based on the topography in the immediate vicinity of the launch site and the proximity of access roadways external to the sites themselves.

The perimeter of each launch site will be fenced, with gates located at the access points, and additional emergency egress gates located around the perimeter. The extent of fencing will include the dam, which will also be separated by fencing from the remainder of the launch site.

Each launch site will have a clearance footprint which is larger than the site to accommodate batter slopes and enable suitable external access to the surrounding fencing and also a nominal 10.0 metre width buffer beyond this. It is on this basis that the clearance envelopes for the site have been calculated. Notwithstanding the calculated clearance envelopes, these are considered to represent conservative figures and the clearance required for each site will be minimised where possible during the design and construction process, and it is likely that the final clearance envelopes can be reduced from those indicated on the proposal plans, in the EIS, this Response Document and the supporting technical reporting.

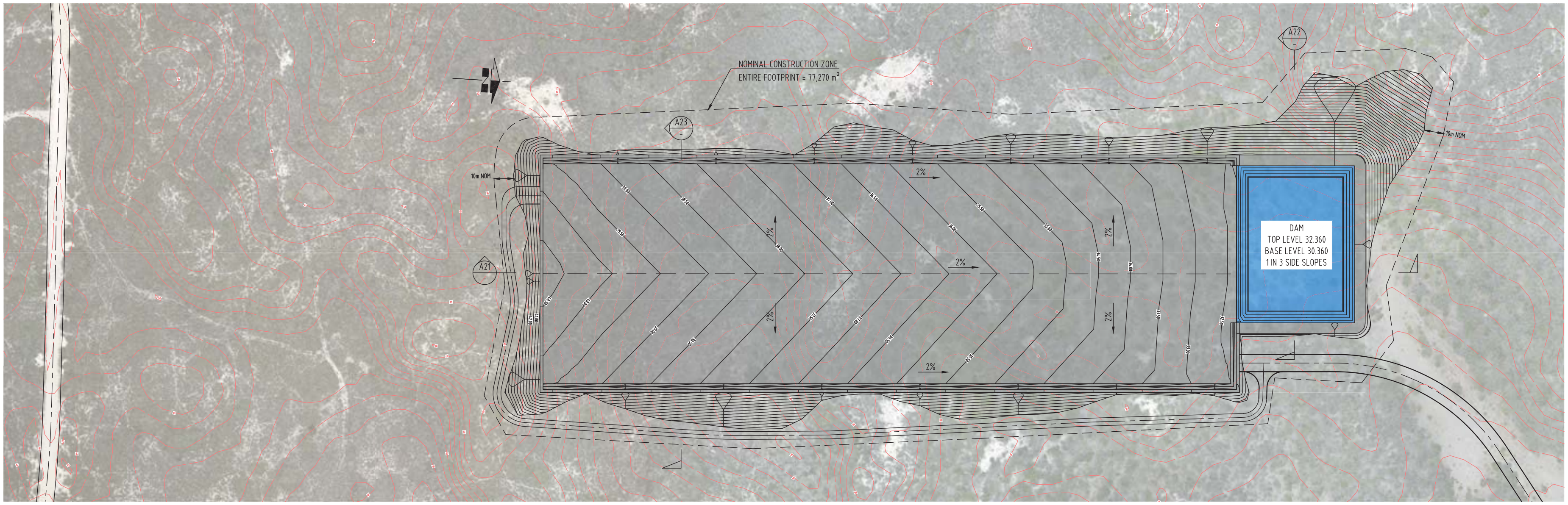
A key criterion in the selection of each of the launch sites was to ensure that the requirements for earthworks was minimised, including the requirement for external batters to create a level area for each site. This is relevant for Sites B, D and E. Proposed Site A, however, has an increased amount of earthworks due to greater variation in natural ground level in the selected location. It was deemed more important to ensure the site did not interfere with listed species, and appropriate from a cultural heritage perspective, and therefore, the preferred option does require additional earthworks.

The clearance footprint of Launch Site A is shown in the **Figure 2.7**.

The configuration Launch Site A is shown in **Figure 2.8**.

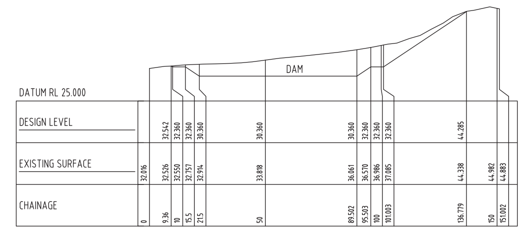
The clearance footprint of Launch Site B is shown in **Figure 2.9**.

The configuration Launch Site A is shown in **Figure 2.10**.

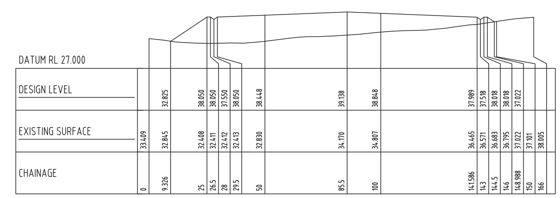


DESIGN VOLUME (TO FSL)		
ZONE	CUT m3	FILL m3
AREA 'A' Option 2	65,677	64,803

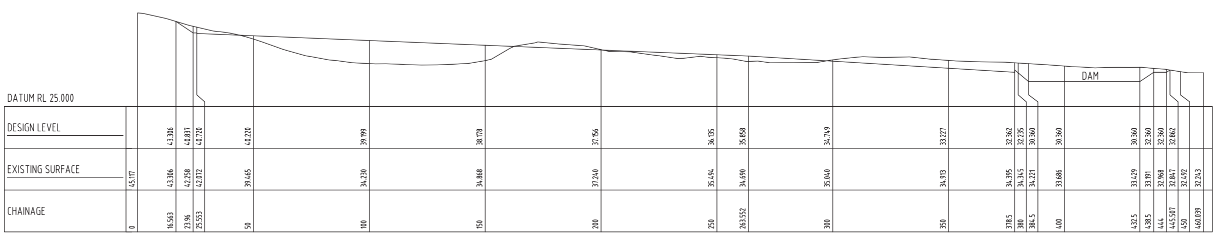
NOTE: DETENTION BASIN YET TO BE SIZED AND INCLUDED IN VOLUMES



SECTION A22
SCALE 1:1000H 1:500V



SECTION A23
SCALE 1:1000H 1:500V



SECTION A21
SCALE 1:1000H 1:500V

FIGURE 2.7

CLEARANCE FOOTPRINT - SITE A

SOURCE: WGA

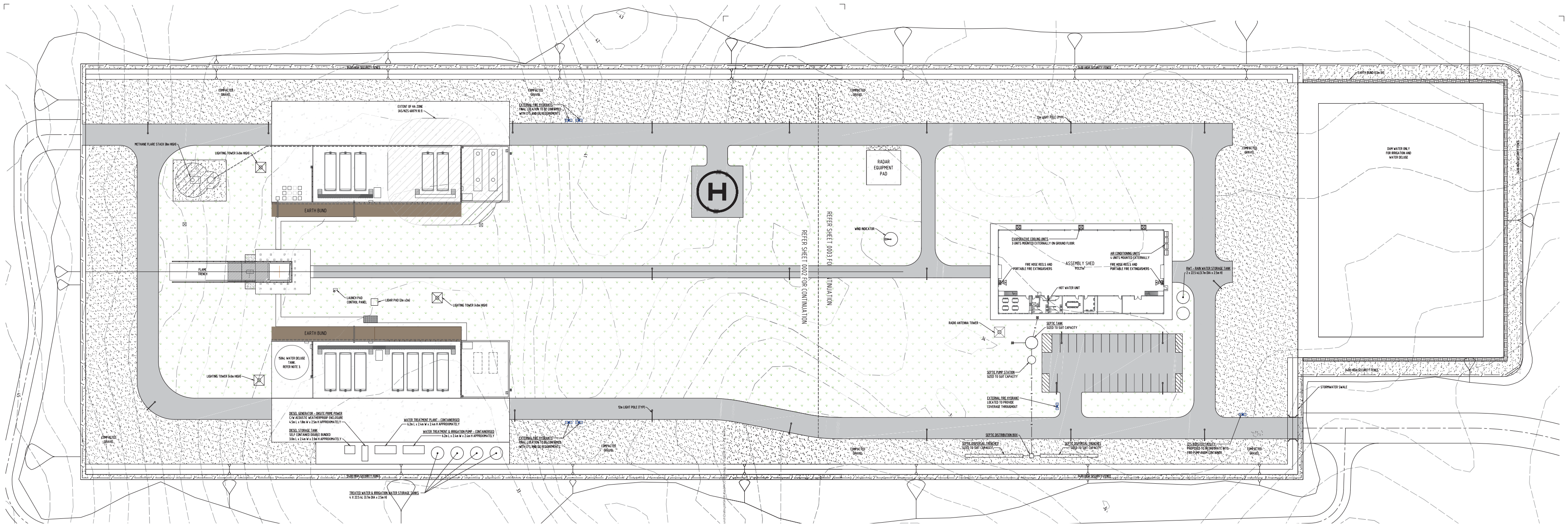
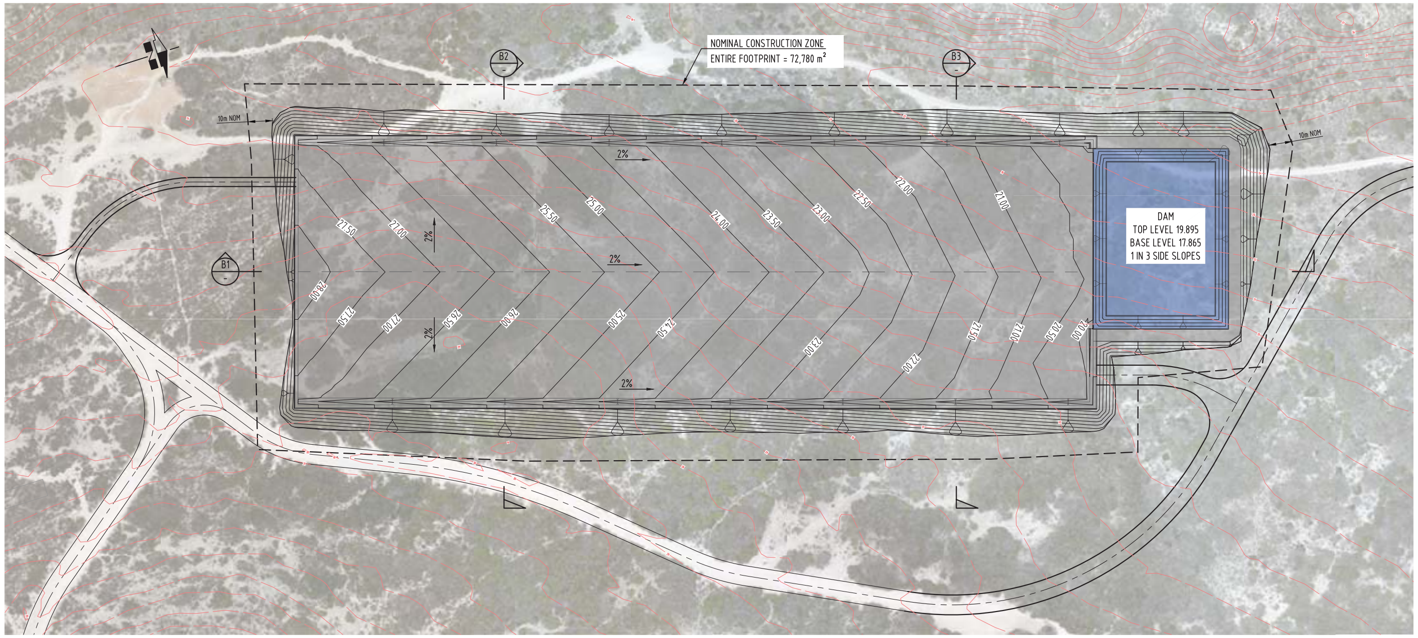
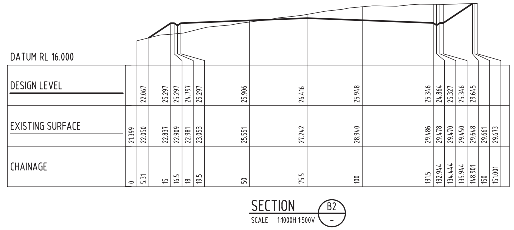


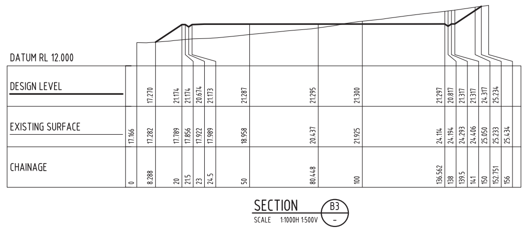
FIGURE 2.8

CONFIGURATION - SITE A

SOURCE: WGA







DESIGN VOLUME (TO FSL)		
ZONE	CUT m3	FILL m3
AREA 'B'	52295	52044

FIGURE 2.9

CLEARANCE FOOTPRINT - SITE B

SOURCE: WGA

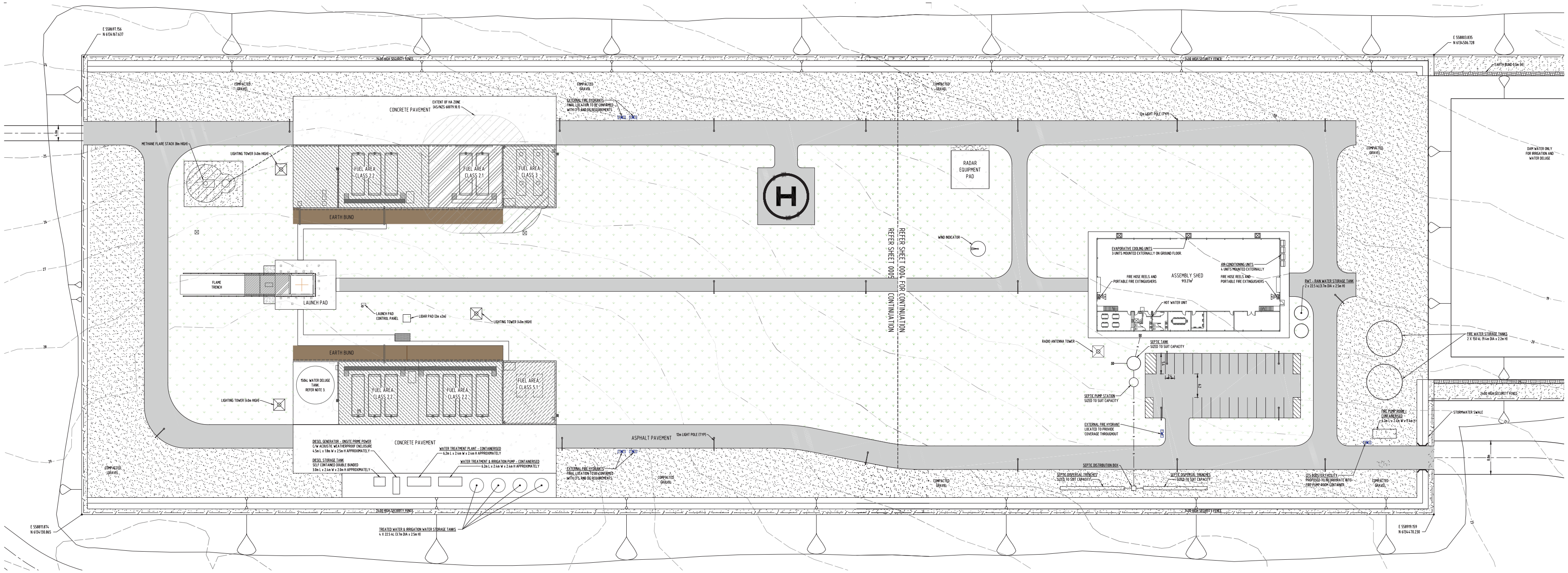


FIGURE 2.10

CONFIGURATION - SITE B

SOURCE: WGA

The elements comprising each of the two launch sites are described in the following sections.

2.4.3.1 *Earthworks*

Earthworks are required to prepare suitably level pads for each of the launch sites. These earthworks will involve cut and fill, together with the importation, placement and compaction of suitable material to create pads for the development of the launch facilities.

The level pad will have nominal slopes of two per cent longitudinal and two per cent lateral. The lateral slopes will be towards the outside where a swale will be located, ensuring that all runoff from the site is not allowed to enter the surrounding environment.

Batter slopes at the outer edges of the launch sites will blend the sites into the surrounding topography.

2.4.3.2 *General Site Layout*

Launch Site A is intended to cater for larger launch vehicles typically of greater than 30 tonnes up to approximately 100 tonnes.

The site is rectangular in shape measuring 350 metres by 120 metres (42,000 square metres) with an adjoining stormwater basin measuring 90 metres by 65 metres (5,850 square metres) at the northern end of the site. The site contains a launch pad (with flame trench) at the southern end of the site, and assembly building and car park at the northern end. A dam is located adjacent the northern end of the site. Nearer to and either side of the launch pad are two bunded service areas containing fuel and oxidiser storage, waste tanks and diesel/hydrogen powered generator and associated fuel storage, and water treatment equipment. A helipad is located centrally and to one side between the launch pad and assembly building. Access roads are proposed inside the perimeter of the site connecting all facilities and providing access to the external road system. Other infrastructure includes lighting towers, earth bunds, lightning towers, flare stack, radar pad, fire control equipment, septic tank, and pump, and launch control equipment.

Launch Site B is intended to cater for smaller launch vehicles typically of up to approximately 60 tonnes.

The site is rectangular in shape measuring 350 metres by 120 metres (42,000 square metres) with an adjoining stormwater basin measuring 90 metres by 65 metres (5,850 square metres) at the northern end of the site. The site contains a launch pad (with flame trench) at the southern end of the site and assembly building and car park at the other end. A dam is located adjacent the northern end of the site. Nearer to, and either side of the launch pad, are two bunded service areas containing fuel and oxidiser storage, waste tanks and diesel generator and associated fuel storage, and water treatment equipment. A helipad is located centrally and to one side between the launch pad and assembly building.

Access roads are proposed inside the perimeter of the site connecting all facilities and providing access to the external road system. Other infrastructure includes lighting towers, earth bunds, lightning towers, flare stack, radar pad, fire control equipment, septic tank, and pump, and launch control equipment.

A more detailed description of the above elements follows.

2.4.3.3 Assembly Building

Both Launch Site A and Launch Site B will feature an assembly building at the northern end of the site that will cater for the assembly of the launch vehicles after the transport of their components to the site.

The ground floor plan layout of the assembly buildings is shown on **Figure 2.11**.

The first-floor plan layout of the assembly buildings is shown on **Figure 2.12**.

The elevations of the assembly buildings are shown on **Figure 2.13**.

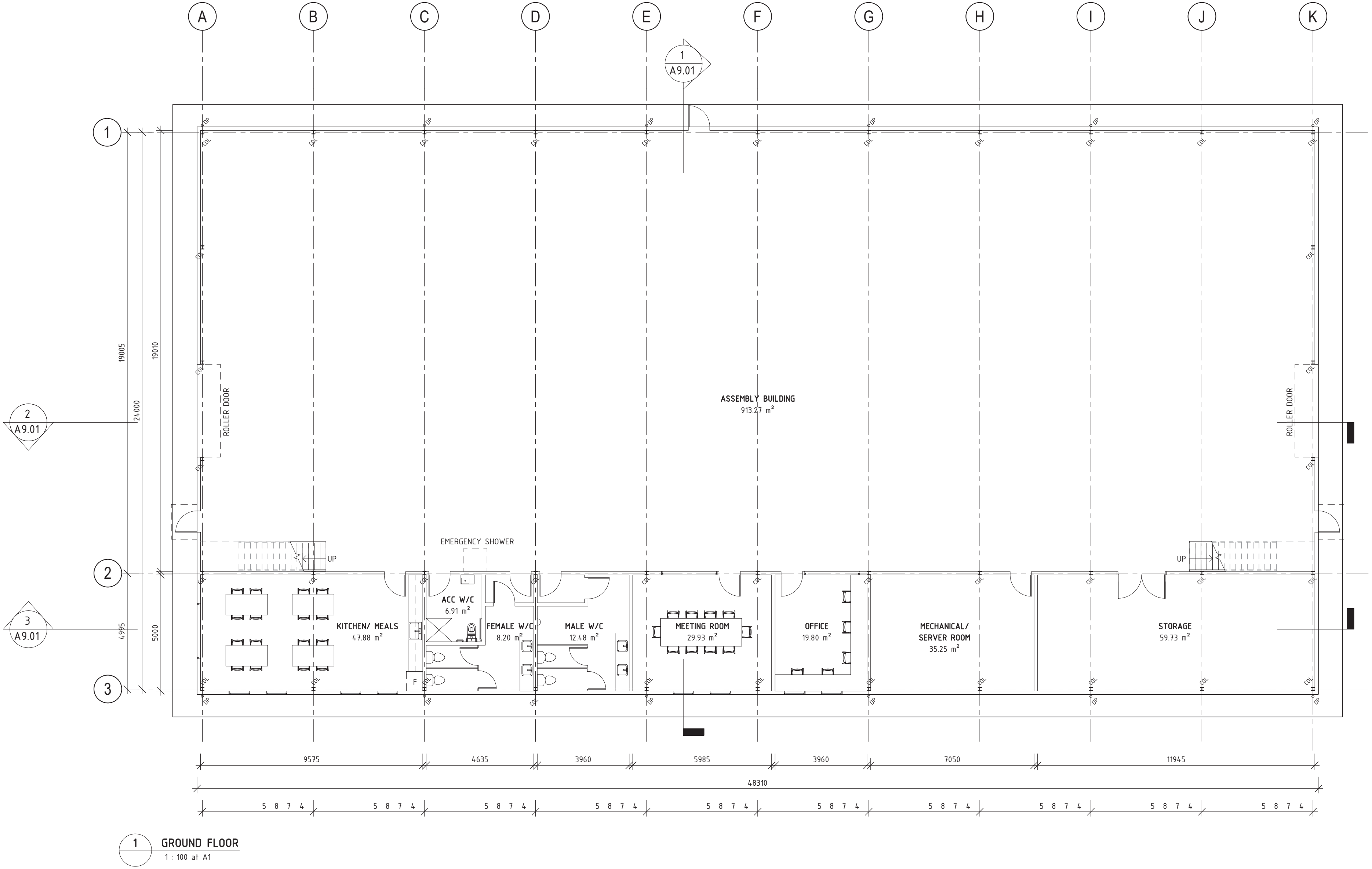


FIGURE 2.11

ASSEMBLY BUILDING - GROUND FLOOR

SOURCE: GREENWAY ARCHITECTS

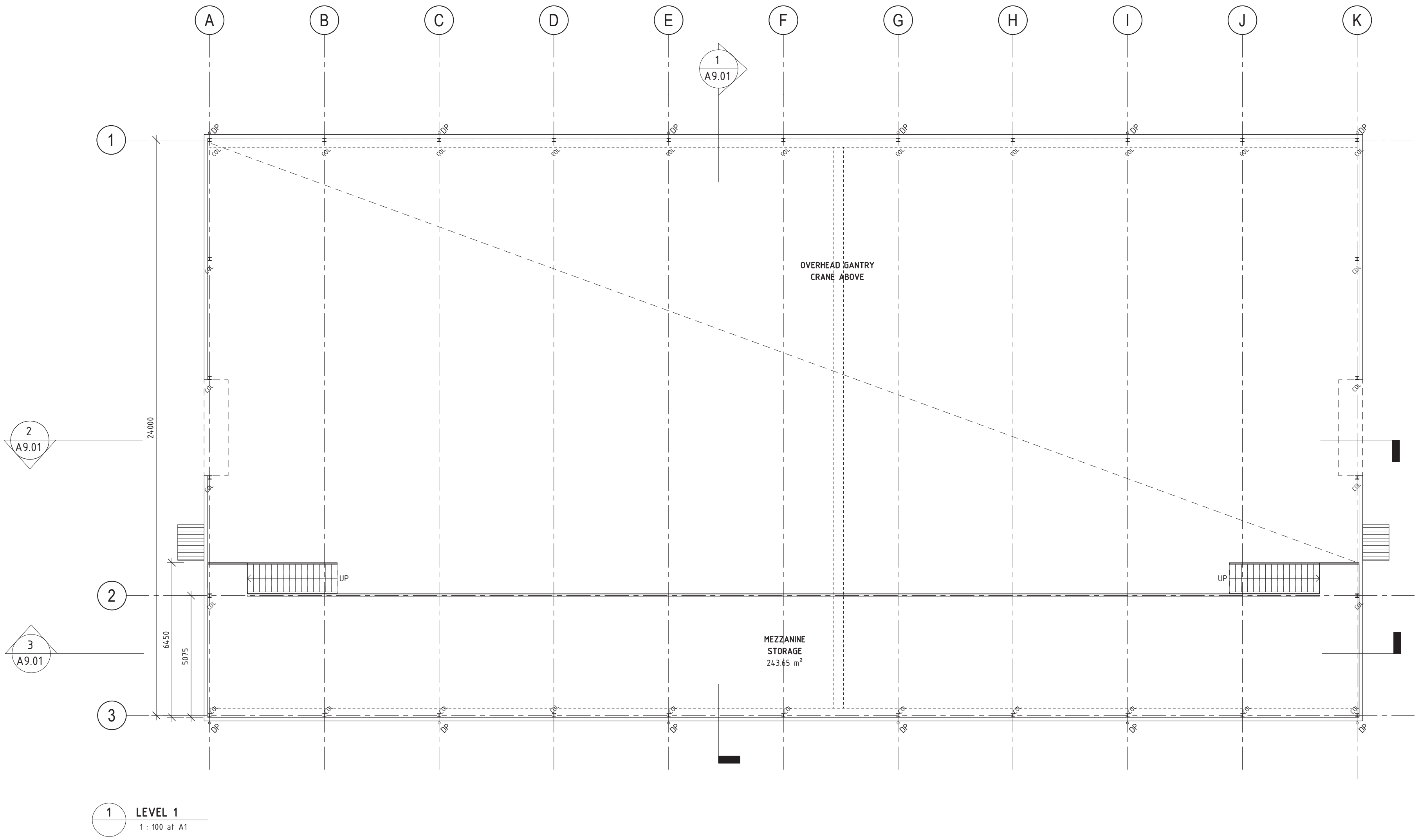


FIGURE 2.12

ASSEMBLY BUILDING - FIRST FLOOR

SOURCE: GREENWAY ARCHITECTS

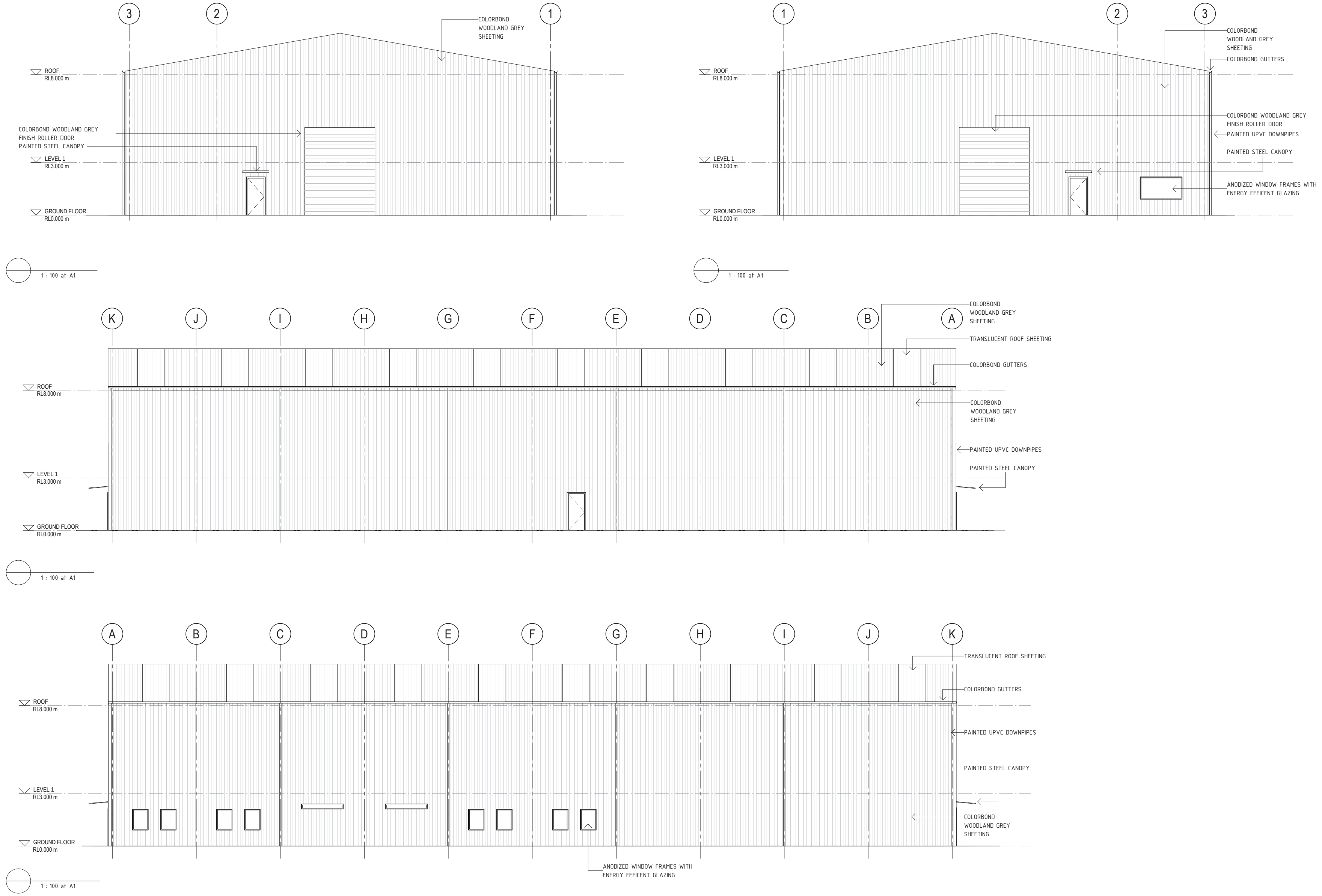


FIGURE 2.13

ASSEMBLY BUILDING - ELEVATIONS

SOURCE: GREENWAY ARCHITECTS

The assembly buildings will be 48 metres in length and 24 metres in width with an eave height of 8.0 metres and an overall height of 11.0 metres. The buildings will have internal crane facilities and will allow the design vehicle to enter the building for internal unloading.

The bulk of the floor area of the buildings will accommodate the assembly of the launch vehicles, with internally partitioned office and amenities rooms down one side. The building will have integrated facilities to allow for occupation by between 20 and 40 staff at peak periods with facilities including toilets and changing room facilities, kitchen facilities and offices.

Airconditioning and fire services will be provided. The buildings will be designed to maintain positive pressure for vehicle hygiene purposes.

2.4.3.4 Internal Access and Runway

The internal access with each launch site, termed the 'runway' connecting the assembly building to the launch pad will be constructed in concrete and asphalt to allow for the transport of launch vehicles between the assembly building and the launch pad.

The runway will be approximately 200 metres in length and 5.0 metres in width.

2.4.3.5 Stormwater Capture and Detention Basin

A site stormwater system will capture and retain all stormwater on the site footprint. Water will be stored in a lined multi-function detention basin at the downstream end of the site. The detention basin will also be utilised for the storage of launch deluge water – a description of the water deluge system is provided in **Section 2.4.3.6**. Subject to meeting ongoing quality requirements, the basin will also provide water for irrigation and firefighting purposes.

The detention basin for Site A measures approximately 90 metres by 65 metres (5,850 square metres) with a capacity of approximately 6,380 cubic metres. The basin will have a nominal depth of 2.0 metres with 1 in 3 batter walls.

The detention basin will for Site B measures approximately 90 metres by 65 metres (5,850 square metres) with a capacity of approximately 6,380 cubic metres. The basin will have a nominal depth of 2.0 metres with 1 in 3 batter walls.

Both basins will be lined with geotextile lining and will be within the fenced enclosure of the whole launch site. The basins will also be covered and externally sealed with a floating geotextile covers to avoid presenting an artificial water source attractive to birds.

Upstream of each of the launch sites overland flows will either be captured and retained or intercepted and diverted around the site past the detention basin.

Captured stormwater will be utilised in the water deluge system which ameliorates acoustic impacts during the launch. The deluge system will result in demand for retained stormwater, through water being converted to steam during the launch process.

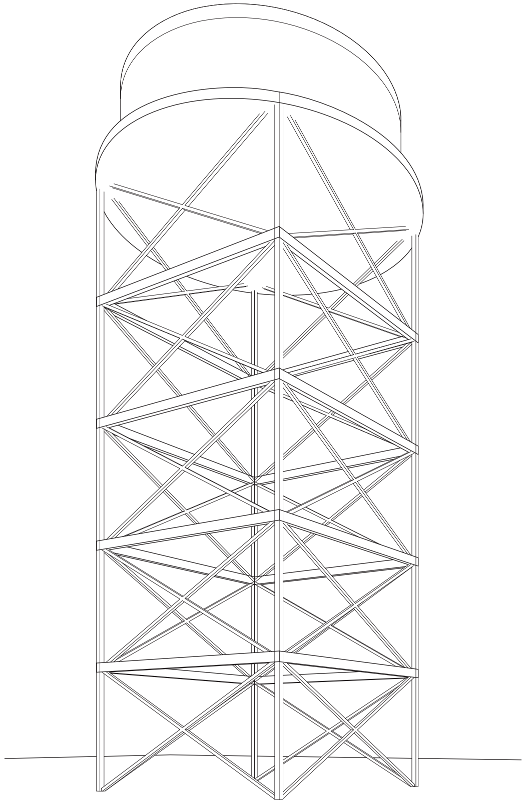
The basin will also be capable of being refilled from the main dam at the infrastructure site on an as needs basis once the main dam has been developed.

2.4.3.6 Water Deluge System

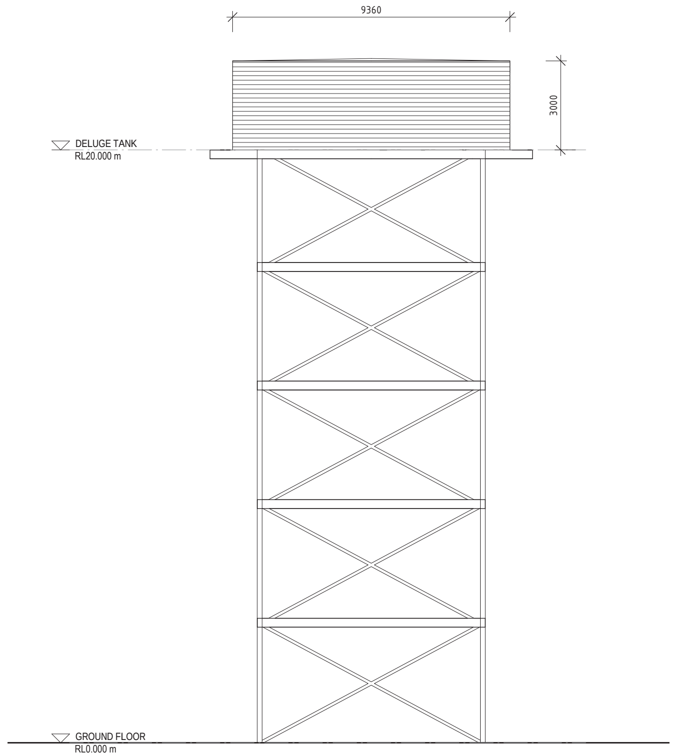
Water deluge is required to mitigate two impacts resulting from a launch. Primarily, the water deluge system reduces noise effect by generating water droplets. The water droplets interact with the generated sound waves and convert them to heat energy through the water being turned to steam. The secondary impact is the heat generated by the launch vehicle. The water deluge reduces the heat impact on surrounding concrete and other infrastructure, protecting it and extending its life.

The design of the water deluge system is to cater for 1,600 litres per second at 20 metres head with the water storage being in a 150,000-litre tank elevated on a 20-metre tower. Water is to be pumped into the tower over an eight-hour period prior to a launch with delivery by gravity operation.

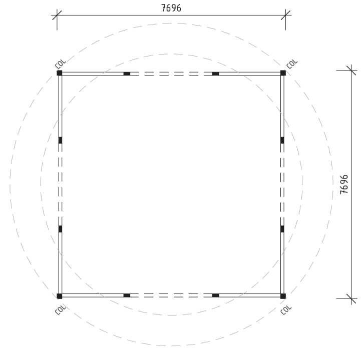
The plans and elevations of the elevated tank are shown on **Figure 2.14**.



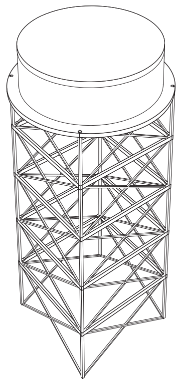
1 PERSPECTIVE AT GROUND LEVEL



2 NORTH ELEVATION



3 GROUND FLOOR
1 : 100 at A1



4 PERPSPECTIVE FROM ABOVE

FIGURE 2.14

WATER DELUGE TANK

SOURCE: GREENWAY ARCHITECTS

The water deluge infrastructure is connected to the elevated tank and situated within the launch pad and flame trench. Infrastructure around the launch site will be in the form of a number of standing nozzles which release water in the required pattern.

The launch pad and surrounds are designed so the water generated during a launch, flows into the flame trench. The water will be tested for contaminants against appropriate guidelines. If the water is below the determined contaminant limit levels, it will be pumped into the detention basin. If the water tests above the contaminant limit levels, it will either be treated prior to being pumped into the detention basin, or it will be pumped into a truck for offsite disposal by a licensed contractor in accordance with relevant legislative requirements.

2.4.3.7 Launch Pad

The Launch Pad is to be constructed of reinforced concrete and will be designed to withstand the weight of the largest rocket anticipated to operate from the site and associated support infrastructure together with enough durability to withstand the heat and thrust produced during launch. Support infrastructure includes vehicles used to transport the rocket to the pad, cranes used to lift the rocket into the vertical orientation, the "pedestal" upon which the rocket is seated and piping to deliver fuel and oxidiser to the rocket.

Subject to detailed construction design, the launch pad will be approximately 1.0 metre thick and could potentially require piles to counter the bending moment imposed by lifting a launch vehicle into place. Anchor bolts are to be designed and installed in the launch pad to allow for the launch pedestals to be secured in position. Those anchor bolts are to be of an appropriate size and are to be connected into the pad reinforcement to cater for the bending moment imposed by lifting a launch vehicle into place.

The launch pad will have removable sections over the flame trench. These will take the form of three concrete platforms which can be craned into, and out of position over the flame trench. Each platform is to be appropriately reinforced and supported by 250-millimetre-thick reinforced concrete. Each platform is to be wide enough to fit over the trench and 4.0 metres long. Each platform is to be securable in position to ensure the launch vehicle thrust does not lift it out of position.

2.4.3.8 Flame Trench

The flame trench will be approximately 5.0 metres wide and 35 metres long. The trench will have a sump at the low point. Any water which remains in the flame trench after a launch needs to be collectable and able, after testing, to either be returned to the detention basin or removed offsite for disposal and not to enter the surrounding environment. The water will be tested and disposed of as described in **Section 2.4.3.6** above. All deluge water over the launch pad will be directed to flow into the flame trench to ensure capture.

2.4.3.9 Launch Pad Lightning Rods

The launch site will be surrounded by up to four large lightning rods, depending on analysis undertaken during detailed design. These will take the form of slender metal poles extending vertically from the ground. At roughly 35 metres tall, these rods are a critical safety feature used to channel any lightning in the area away from the rocket and other infrastructure located on the launch pad, earthing it into the ground.

2.4.3.10 Propellant, Water storage and Pumping

All the propellants used by the rocket during the launch will be located approximately 20 metres from the launch pad within suitably designated storage tanks. Specially designed pumps and piping will remotely transfer the propellants from the tanks into the rocket before it is launched.

Located near the propellants will be large water tanks connected to automated firefighting equipment and the water deluge system.

A dedicated generator and self-bunded fuel tank will be located within this facility and will be used to power the rocket during the pre-flight checks, propellant pumps during fuelling, and drive the water pumps during the launch event.

2.4.3.11 Blast Walls and Bunding

All of the above infrastructure will be placed behind reinforced concrete blast walls and earth bunds protecting it from any debris kicked up by the rocket exhaust or from any unexpected launch failure.

All liquid storage will occur in accordance with regulatory requirements for bunding, either in self-bunded vessels or with bunds being constructed around vessels. As a secondary level of protection, should bunding fail, all runoff from the entire launch pad is directed to the retention basin, meaning that secondary failures will not extend beyond the basin and enter the surrounding environment.

2.4.3.12 Flare Stack & Cold Box

The flare stack will allow for the disposal of surplus fuels by burning off.

Surplus oxidisers will be disposed of though disposal into the cold box whereby they evaporate into the atmosphere.

The fuel and oxidiser requirements for launches can be accurately predicted, meaning the surplus quantities requiring disposal will be limited.

2.4.3.13 Utilities

Potable Water

All assembly activities associated with the proposed development are 'dry' and do not involve processes which require large quantities of potable water. Water demand will primarily be human requirements for kitchen, ablution, and hygiene purposes. The potable water demand is therefore sufficiently low, that on-site capture and storage will be able to supply the majority of demand, with tanker augmentation by road as required.

Initially, potable water will be supplied by truck and stored on-site in tanks. To cater for up to 40 staff on-site during peak periods, potable water will be stored in up to four 25,000 litre water tanks located at each launch site.

Power

Power requirements for the proposed development are low. Initially, all power needs for the site will be provided by generators located adjacent the fuel storage area of each launch site.

Ultimately as the entire site is developed, it is anticipated that the site will either have access to mains electricity or centralised on-site power generation with a system including solar and battery storage. Such infrastructure does not form a part of this proposal and would be subject to future assessment and approval as necessary at the time it is proposed.

Wastewater

The proposed use is not anticipated to generate large quantities of wastewater, which will predominantly derive from kitchen and ablution facilities. Site operations, other than the deluge water for the launches, the management of which is addressed separately, will have a low water demand and therefore low generation of wastewater. Each launch site will have a package wastewater treatment system with the capacity to cater for the requirements of 40 people.

Either a soakage system or an aerobic system which irrigates onto landscaped areas of the launch site is anticipated to be used.

Fire

Initially, water for firefighting needs will be trucked in and stored in two 150,000 litre tanks between the assembly building and the perimeter of the site. Fire hydrants, pumps and associated infrastructure will be distributed around the site as indicated on the site plan.

Once developed, water for firefighting needs will be supplied from the main dam at Infrastructure Site D.

Irrigation

Areas surrounding the assembly building, launch pad and roadway will be landscaped with grasses and low shrubs, which are to be irrigated. Native species will be utilised to minimise irrigation water demand and reduce the potential for non-indigenous species to spread into the surrounding environment.

Irrigation water will be sourced from the wastewater treatment system and also supplied by the retention basin (subject to water quality analysis detailed previously).

Lighting

Whilst the majority of launches are anticipated to occur in daylight hours, some launches will occur in low-light conditions or at night and, therefore, lighting of the launch facilities will be provided for both security and operational purposes.

The primary lighting of the launch pads will be located on top of lighting towers directed into each launch site.

Area lighting will also be provided from buildings and potentially poles of up to a maximum of 12.0 metres in height.

The lighting will be designed in accordance with relevant standards to ensure that spill beyond the fenced areas of the launch site is minimised.

Only very limited security lighting around buildings will be required when a launch site is unoccupied.

2.4.3.14 Pads – Heli, Lidar and Radar

The launch site will contain a helipad of asphalt construction, and which will include lighting, windsocks, and painting to the appropriate standard. The helipad provides for emergency access to the site and will not be used for regular transport and operational purposes.

The lidar and radar pads are to be concrete with access to electricity and communications connectivity. These facilities will allow for tracking of the vehicles post launch.

2.4.3.15 Camera Towers

Two camera towers are to be 15 metres high and will provide for the capture of high-speed footage of launches for subsequent review and analysis.

2.4.3.16 Commercial Vehicle Access and Parking

Roads for commercial vehicles within the launch sites are to be designed to cater for vehicle sizes up to a 19 metre semi-trailer. Road widths and swept paths will meet relevant Australian Standards.

Heavy vehicle movements to the launch sites are expected to be low, averaging as follows when a launch is being prepared to occur:

- Launch Vehicle Fuel delivery (three per week).
- Oxidiser delivery (three per week).
- Generator Fuel delivery (one per week).
- Waste Pump Out (one per week).
- Launch Vehicle transport to site (one per week).
- Crane movements (three per week).

Two vehicle parking aprons for delivery vehicles, one adjacent to the fuel bund and one adjacent to the oxidiser bund, will be of concrete construction. The remainder of the access roads will be paved in asphalt.

2.4.3.17 Site Security and Fencing

The entire perimeter of the launch site including the retention basin is proposed to be fenced with 1.8 metre-high chain wire mesh topped with three stands of barbed wire for a total height of 2.4 metres. Two double gates are required for access control at the perimeter fence where the access roadways intersect the launch site.

In addition, the flame trench will be separately enclosed by a 1.2 metre tubular steel edge protection fence. A portion of the edge protection fencing is required to be removable to allow the installation of the launch platform.

In addition to the physical security, IP CCTV is to cover the site entrances and throughout the site. All buildings and structures will be alarmed.

2.4.3.18 Hard Waste

All waste is to be contained on-site in appropriate receptacles and trucked off-site by a licensed contractor in accordance with legislative requirements.

Waste types are typical for an office structure and will include kitchen and office waste. Waste from the preparation and launch activities will be limited and will be removed from site in accordance with legislative requirements for the specific type of waste generated.

Waste fuels will be burnt off using the flare stack. Waste oxidisers will be disposed of in the cold box. Any materials which cannot be disposed of in the flare stack or cold box will be trucked off-site by a licensed contractor in accordance with regulatory requirements.

No waste will be disposed of on-site.

2.4.3.19 Car Parking

The staff parking area is to be of asphalt construction to meet the relevant Australian Standards in respect of parking dimensions and number of disabled carparks.

A minimum of 25 parking spaces will be provided at each launch site.

2.4.3.20 Landscaping

Groundcover landscaping will be established over the unsealed areas of each launch site inside the access road which runs adjacent the fenced perimeter. This landscaping will be a mixture of appropriate native species with low water demand. This landscaping will function to reduce dust generation during windy conditions and stabilise the site surface.

The unsealed areas between the access roads and the fenced perimeter of the site will have a gravel surface which, in addition to reducing dust, will function as a fire break between the facility and the surrounding vegetated environment.

2.4.4 Infrastructure Site – Site D

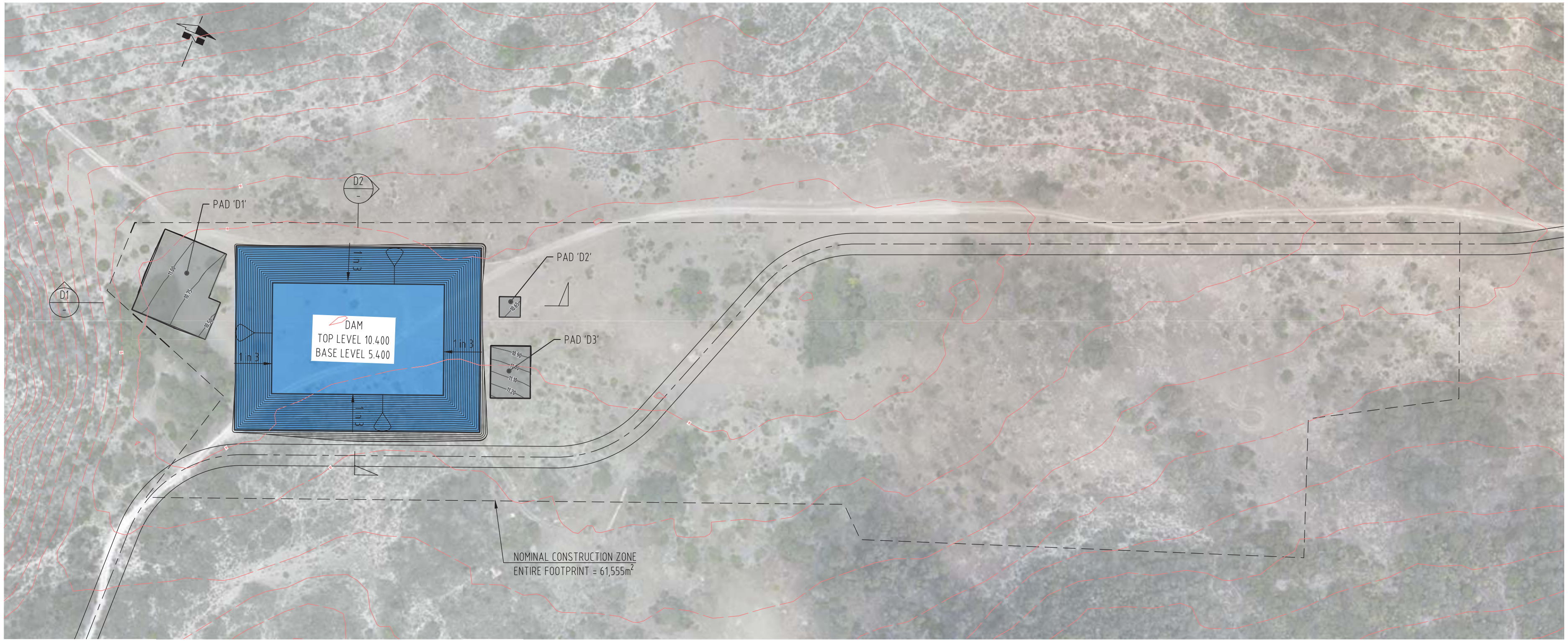
The Infrastructure Site is a construction and operational compound proposed to accommodate activities and facilities that will support the construction and, subsequently, the on-going maintenance of the overall WWOLC facility.

The Infrastructure Site will consist of the following:

- A quarry (to produce engineered pavement materials in the initial stage of the development), which will subsequently be converted to a water storage dam.
- Water storage dam – 30 megalitre capacity.
- Pump Station.
- Workshop/Maintenance Building.
- Provision for future Electrical Generation.
- A magazine for the storage of explosive compounds and other dangerous goods. This is in the form of a concrete pad. The storage will be in converted shipping containers or other such infrastructure which meet the required Australian Standards for explosive storage.
- The site will be enclosed by a 1.8-metre-high chain wire mesh fence topped with three stands of barbed wire for a total height of 2.4 metres and a lockable double gate or as deemed necessary by the relevant standards.

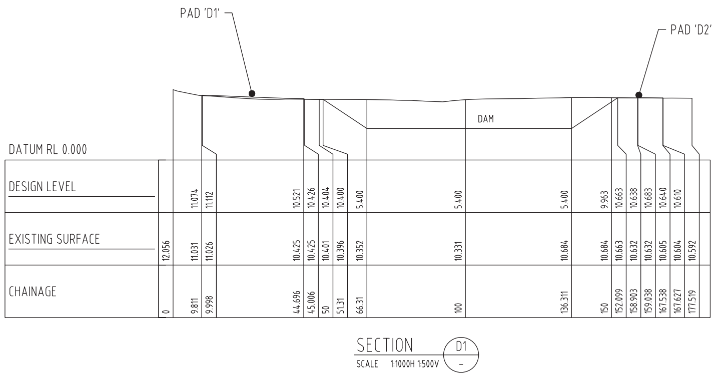
The clearance footprint of Infrastructure Site D is shown in **Figure 2.15**.

The configuration Infrastructure Site D is shown in **Figure 2.16**.



DESIGN VOLUME (TO FSL)		
ZONE	CUT m3	FILL m3
AREA 'D'	28347	224

NOTE: DETENTION BASIN YET TO BE SIZED AND INCLUDED IN VOLUMES



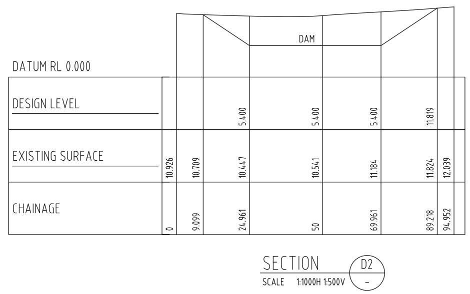


FIGURE 2.15

CLEARANCE FOOTPRINT - SIDE D

SOURCE: WGA

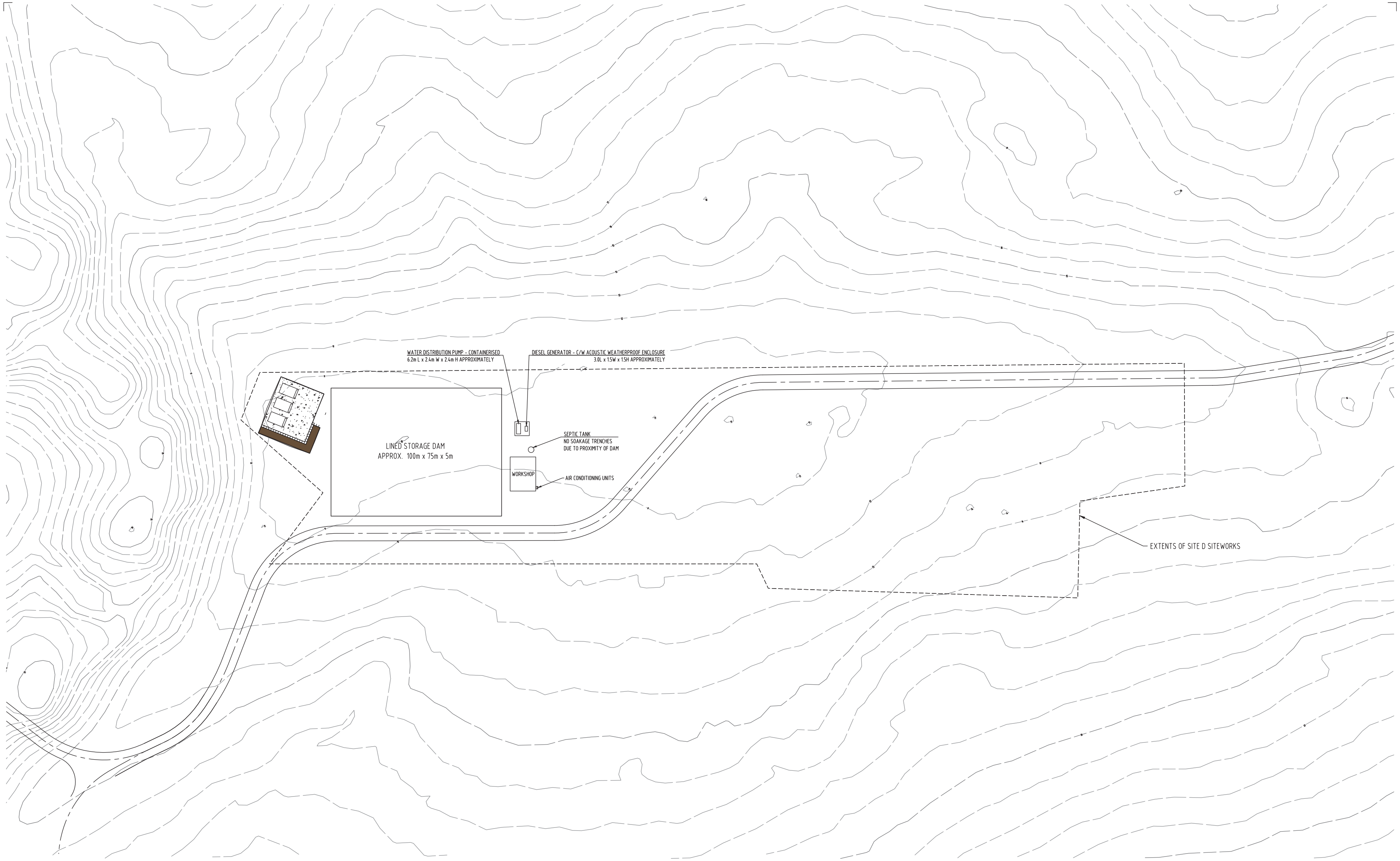


FIGURE 2.16

CONFIGURATION - SITE D

SOURCE: WGA

The elements comprising Infrastructure Site D are described in the following sections:

2.4.4.1 *Earthworks*

Earthworks for Infrastructure Site D will principally involve the excavation of the dam. The material won from the excavation will be utilised as fill on the remainder of the sites and upgraded access roadways. Any spoil material will be suitably stored at Infrastructure Site D (if required).

The dam will have side slopes with a 1 in 3 batter. The dam will have a base level of 5.4 metres AHD and a top level of 10.4 metres AHD.

Individual pads will be created for the magazine, workshop/maintenance building and ancillary structures to enable each building/structure to be matched to prevailing topographic conditions and the extent of earthworks to be minimised.

2.4.4.2 *Dam*

The location of the proposed dam has been identified to have suitable material for civil construction around the site.

The dam will measure approximately 100 metres long by 75 metres wide and have a nominal depth of 5.0 metres providing a capacity of 30 megalitres.

Sealing of the dam will be by polymer lining. The dam will be internally enclosed by a 1.8-metre-high chain wire mesh fence with three stands of barbed wire for a total fence height of 2.4 metres. The dam will be bounded by a gravel roadway to allow for vehicle access for maintenance and connected to the main complex access roadway. The dam will be covered to protect the water source from evaporation and the introduction of foreign objects. The cover will also prevent the dam from being an attractive water source to terrestrial and avian fauna. The materiality of the cover is expected to be a geotextile liner, however, will be formalised during the detailed design process.

2.4.4.3 *Pump Station*

The water stored in the dam will be pumped directly to water storage on Launch Site A and Launch Site B and Range Control Site E.

It is proposed that above ground pipes will be used to connect the dam to each of the sites, with the pipes being located within the corridors for the access roadways.

2.4.4.4 *Electrical Generation or Electrical Storage*

Initially, once the dam is finalised, the site will have a generator, sized to supply electricity to the pump station, workshop/maintenance building and magazine.

If future centralised power generation is developed, subject to a future application, it is anticipated to be located in the infrastructure area. This development is not included in the current proposal and a separate approval would be sought at the time such infrastructure is proposed.

2.4.4.5 Workshop

The proposed workshop will be the base for site-wide maintenance activities. These activities will be separate to those associated with launches and will involve maintenance and upkeep of site buildings, facilities, and roadways.

The workshop building will measure 18.0 metres by 12.0 metres with an internal clear height of 8.0 metres. The workshop will be a steel portal warehouse type structure on a reinforced concrete slab.

The floor plan layouts of the workshop/maintenance building are shown on **Figure 2.17**.

The elevations of the workshop buildings are shown on **Figure 2.18**.

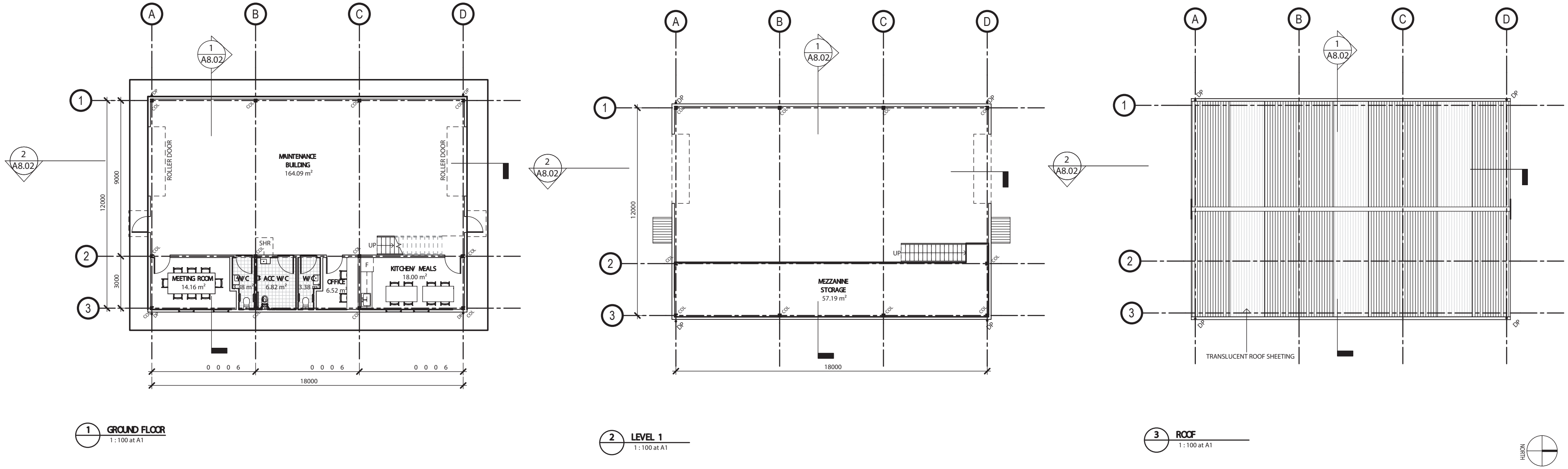


FIGURE 2.17

MAINTENANCE BUILDING - FLOORPLANS

SOURCE: GREENWAY ARCHITECTS

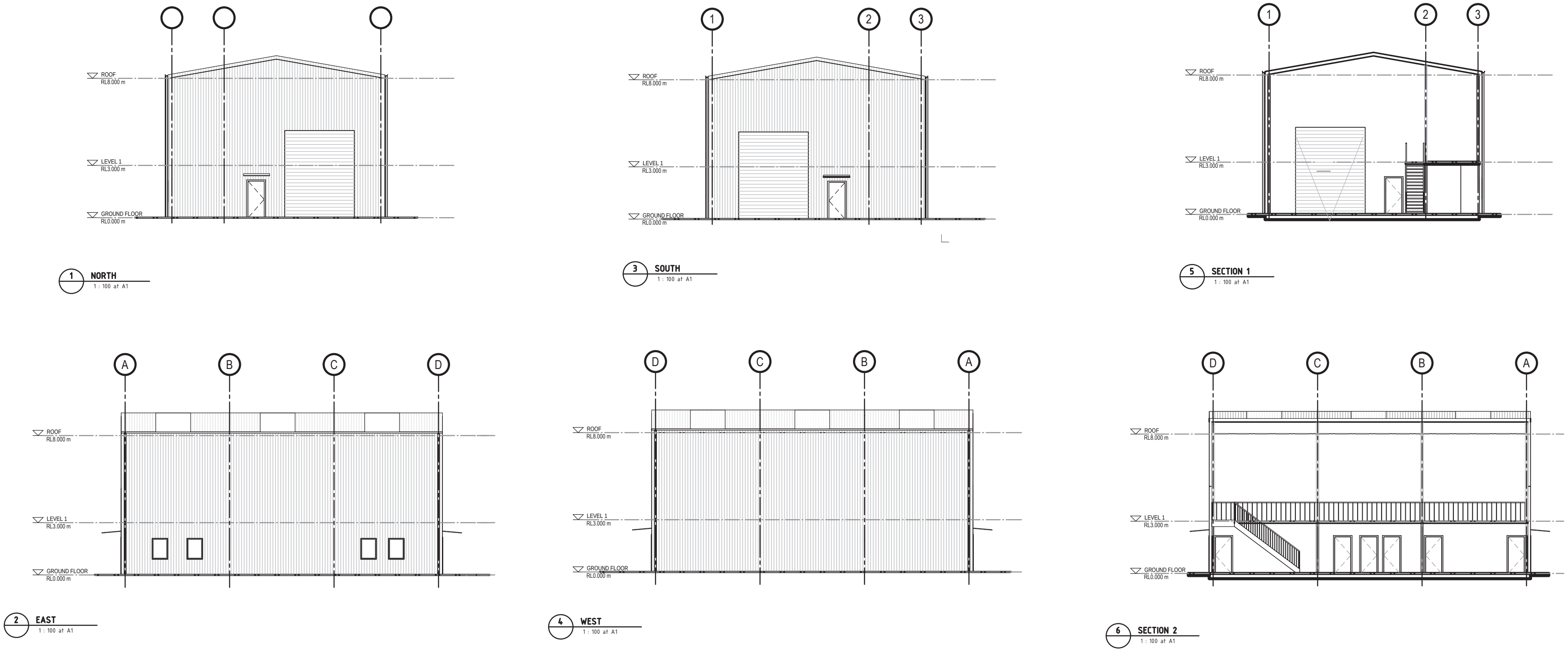


FIGURE 2.18

MAINTENANCE BUILDING - ELEVATIONS

SOURCE: GREENWAY ARCHITECTS

The workshop will contain office, toilet and kitchen facilities for staff. The open areas of the shed will feature space to undertake maintenance and repair works associated with plant and infrastructure on the site which are non-launch vehicle related.

The workshop will cater to an estimated staff level of five at the ultimate development of the site.

2.4.4.6 Magazine

The magazine will be in the form of a slab, on which equipment is stored in suitable facilities approved by SafeWorkSA.

The structure will have two blast walls located adjacent to it.

The magazine site will be connected to the main access road via a gravel access road.

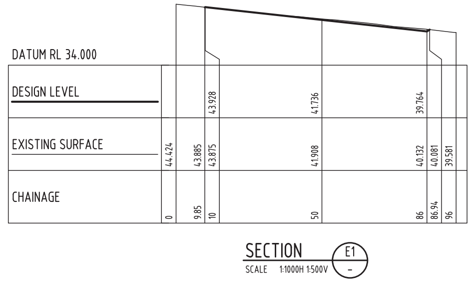
2.4.5 Range Control Site – Site E

Range Control Site E will accommodate the range control building to house the operational, security and emergency services of the complex which will oversee all operations on the site. The facility will also incorporate facilities catering to visitors to the site.

The site is located in the vicinity of the main entrance to the facility and will also provide perimeter access and security services to the WWOLC facility as a whole.

The clearance footprint of Range Control Site E is shown in the **Figure 2.19**.

The configuration Range Control Site E is shown in **Figure 2.20**.



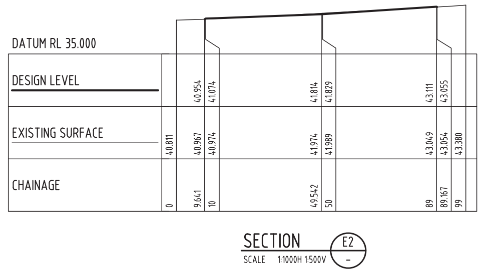


FIGURE 2.19

CLEARANCE FOOTPRINT - SITE E

SOURCE: WGA

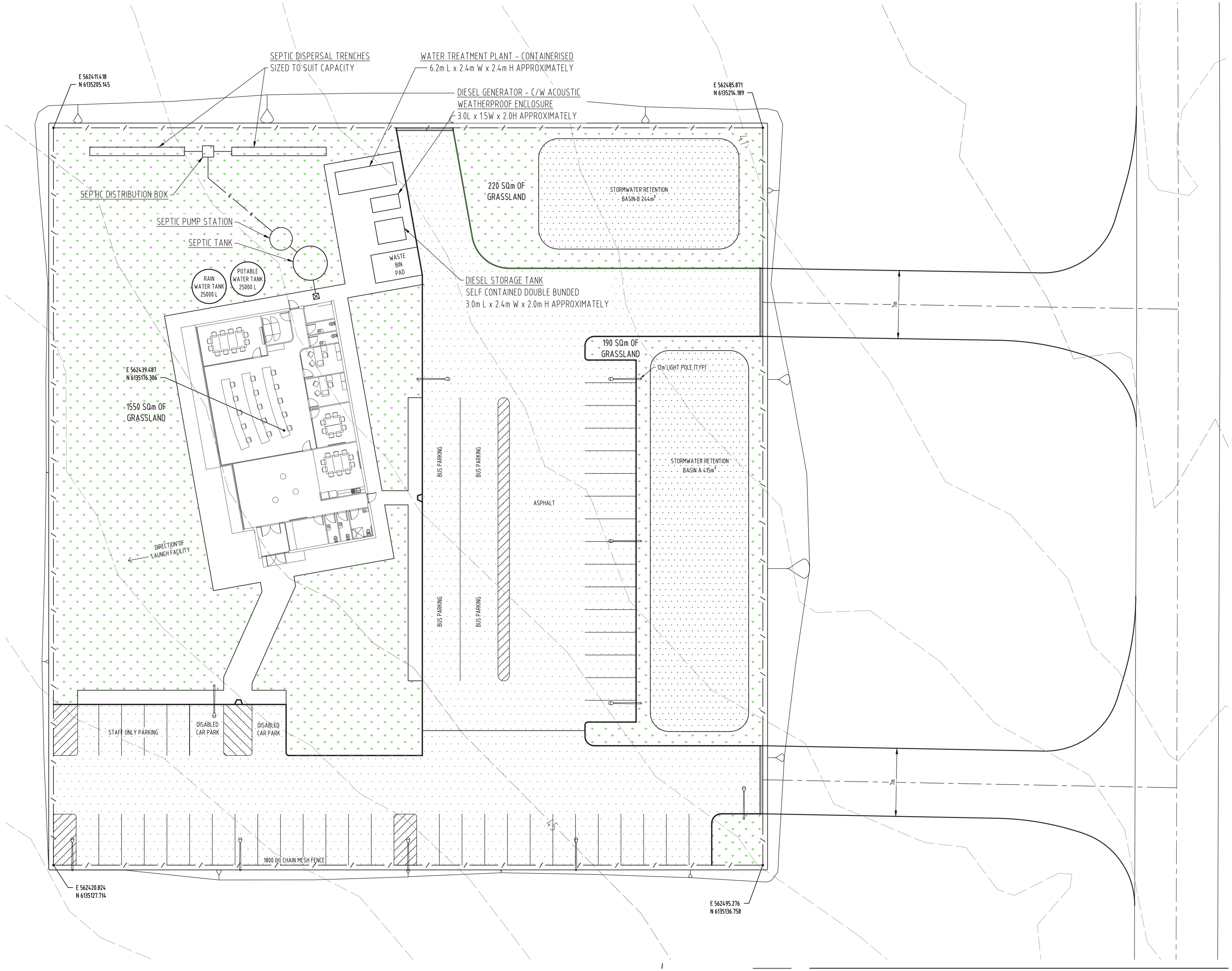


FIGURE 2.20

CONFIGURATION - SITE E

SOURCE: WGA

Range Control Site E is roughly square in configuration measuring approximately 55 metres long and 55 metres wide. The site is located on the western side of the existing access roadway near the entrance to the overall WWOLC site.

The southern and eastern portions of the site will feature two stormwater detention basins and a large car parking area. The car parking area features staff, visitor and bus parking areas, together with dedicated parking for emergency services and has been configured in such a manner that it can be utilised as a staging area in the event of an emergency at the WWOLC.

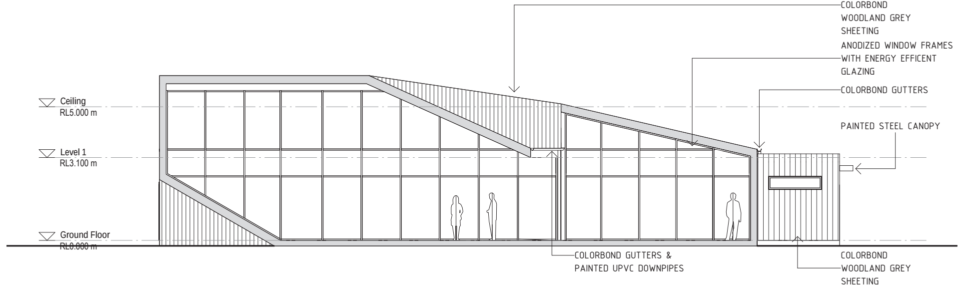
The eastern portion of the site will feature the range control building.

The floor plan layouts and elevations of the range control building are shown on **Figure 2.21**.

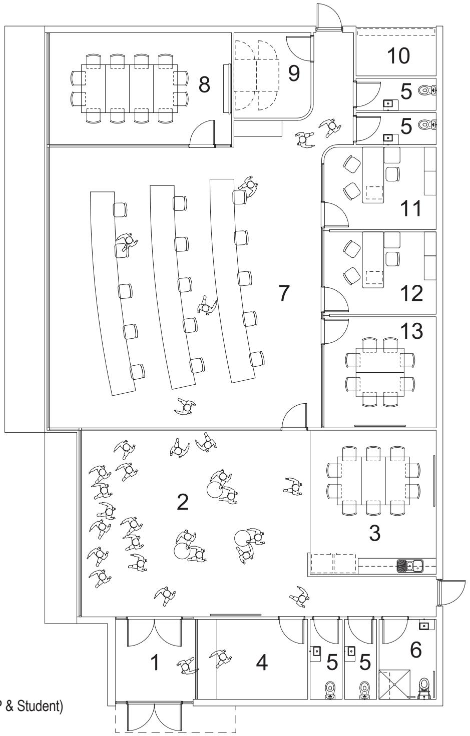
The building will be single storey measuring 25.0 metres by 12.0 metres and 6.5 metres in overall height. The building will be constructed of a mixture of colour coated steel and glazing and designed to complement both the character of the locality and enhance the launch experience for both staff and visitors. The building will contain integrated office accommodation, toilet facilities and kitchen facilities.

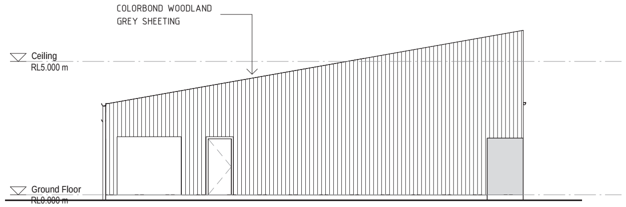
Perspectives showing the appearance of the range control building are shown on **Figure 2.22**.

3D renders showing the appearance of the range control site and building are shown on **Figure 2.23**.

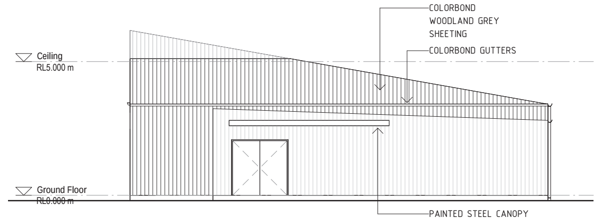


2 WEST ELEVATION
1 : 100 at A1



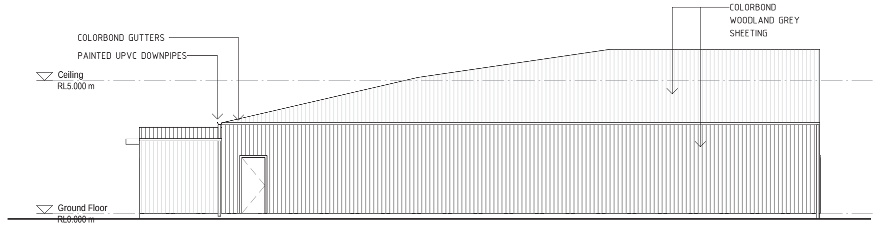


3 NORTH ELEVATION
1 : 100 at A1



5 SOUTH ELEVATION
1 : 100 at A1

SCHEDULE:
1. Airlock
2. Viewing Gallery (VIP & Student)
3. Kitchen / Cafe
4. Security Office
5. Unisex WC Amenities
6. Disabled Access WC Amenities
7. Launch Control
8. Briefing / Meeting Room (12p)
9. Comms/Data
10. Plant (external)
11. Client Office
12. Southern Launch Office
13. Meeting Room (8p)



1 Ground Floor
1 : 100 at A1

FIGURE 2.21

FLOORPLAN & ELEVATIONS

SOURCE: GREENWAY ARCHITECTS

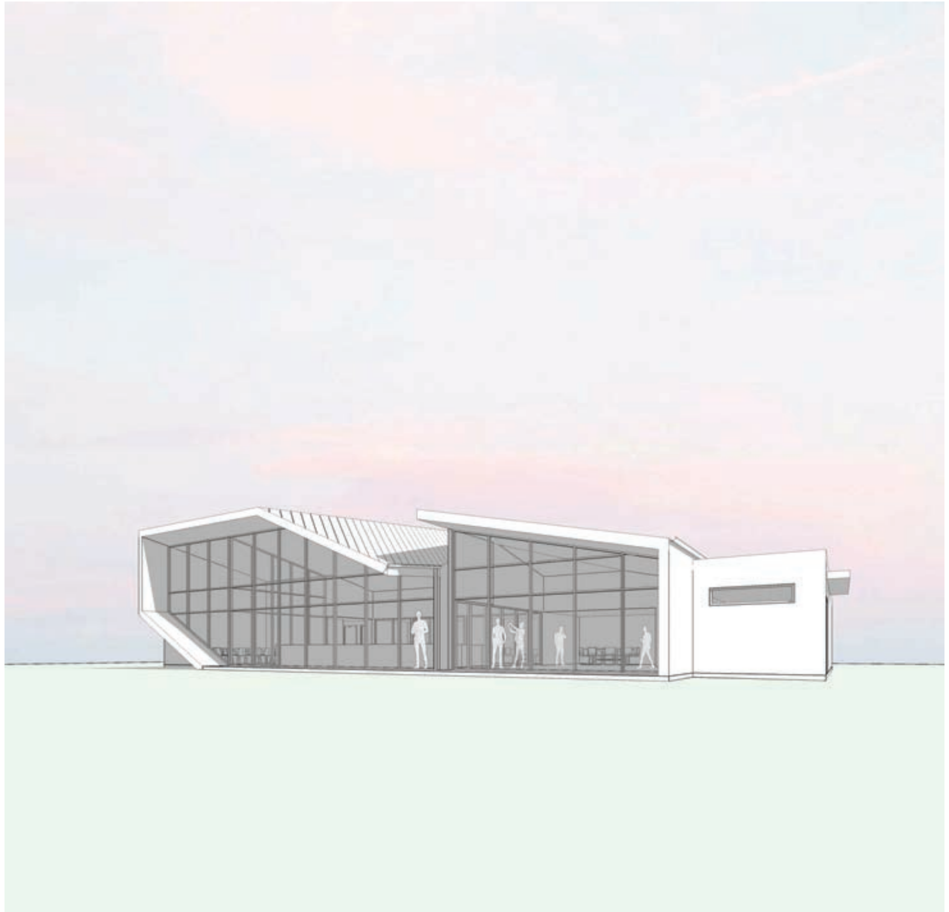


FIGURE 2.22

RANGE CONTROL - PERSPECTIVES

SOURCE: GREENWAY ARCHITECTS

FIGURE 2.23

RANGE CONTROL - 3D

SOURCE: GREENWAY ARCHITECTS

It is envisaged the facility will accommodate in the order of the following numbers during launch events:

- 40 staff;
- 20 regulatory observers;
- 20 emergency services staff; and
- an additional number of invited guests.

Infrastructure services will be located to the north of the range control building including water storage, wastewater treatment, waste receptacles and generator.

Roof stormwater will be captured and directed to three 25,000 litre tanks to be utilised as potable water and for firefighting requirements.

Swales will direct overland stormwater flows around the site into two stormwater detention basins located as shown on the Site Plan. Water quality treatment and detention will be provided for stormwater from carparking and other hard surface areas before water enters the detention basins.

The building will be serviced by a package aerobic wastewater treatment system and irrigated onto a dedicated area on the western and northern sides of the range control building.

Waste will typically be office and kitchen waste which will be stored in appropriate receptacles and removed from site by a licensed contractor. A bin storage area is proposed as shown on the Range Control Facility Site Plan and will be enclosed by suitable screening fencing.

2.4.6 Site Access

Vehicle access and circulation throughout the overall site is proposed by combination of upgrades to existing access tracks and the construction of new access tracks to connect Launch Site A, Launch Site B, Infrastructure Site D, and Range Control Site E to the upgraded existing access tracks.

The access roadway works are shown on the **Figure 2.24**.

FIGURE 2.24

EXISTING ALIGNMENT MODIFICATIONS

SOURCE: WGA

During operations, a number of vehicles will be utilised to deliver, operate and maintain the various site infrastructure, which consists of many interrelated systems such as civil (building), mechanical (air conditioning, extraction and exhaust) and hydraulic (plumbing and drainage, wastewater treatment, compressed air etc).

The launch vehicles themselves will be largely constructed off-site, containerised, and then delivered to site for final assembly prior to launch.

The following vehicles would be expected to be used during operations:

- Commercial vehicles of a size up to 19-metre semi-trailers for component deliveries.
- Small rigid vehicles (SRV) for smaller deliveries.
- Forklifts to unload and move containers. Forklift activities may occur at locations around the site.
- Commercial vehicles up to 19-metre semi-trailer (sealed tanker) for propellant deliveries.
- Various maintenance vehicles for mechanical and road maintenance and repairs.
- Passenger vehicles and small bus vehicles for staff and visitors.

The majority of the existing access track, commonly known as Whalers Way Drive, will be retained in its current condition, with localised grading and re-sheeting as required to maintain all weather access. These localised works will not affect the existing alignment and will not require an expansion of the existing footprint.

A new road alignment will be constructed to the east and north of Launch Site B, with existing access roadway sections being decommissioned and rehabilitated. The new sections of road will be constructed to a width of 8.8 metres at the northern end and 4.0 metres at the southern end.

A new access roadway alignment will similarly be constructed to a width of 8.8 metres to the south of Infrastructure Site D connecting with the existing road to the east of Site B with existing road sections being decommissioned and rehabilitated.

The 8.8 metre access road will continue approximately 200 metres to the east of Site D, where the upgraded access roadway will narrow to a 5.0-metre-wide track providing emergency egress to the northern boundary of the WWOLC site.

Site A will have access from the existing track to the south, with a new 8.8-metre-wide carriageway being provided. A 4.4-metre-wide emergency track would lead from this carriageway along the eastern edge of Site A and would give emergency access to the northern portion of Site A.

Launch Site A and Launch Site B will be provided connections to the above main circulation road for both general access (8.8-metre-wide carriageway) and emergency vehicle access (4.0-metre-wide carriageway).

Range Control Site E will be provided general vehicle access to the main circulation road via two short road carriageways 8.8 metres wide.

Where existing conditions are inadequate for the forecast vehicle movements, localised works will be required to both the horizontal and vertical alignments of the existing main access roadway throughout the site. The condition audit has identified twelve locations where upgrade works are required. Where these works will extend beyond the existing footprint of the access roadway, the area required to accommodate the localised upgrades has been calculated and included in the overall calculation of the clearance footprint of the site.

The new roads will be constructed of an all-weather rubble surface similar to the existing surface. Car parking and circulation roads within each facility, as detailed on the plans for each site, will be hard surfaced in either concrete or bitumen.

2.4.7 Construction Methodology

This section describes the construction methodology proposed and the order of the establishment of each of the site elements.

2.4.8 Project Scope for Construction

2.4.8.1 Project Scope Overview

Construction and project management activities comprise as follows:

<u>Pre-Construction</u>

- Project Management Plans development:
  - plans include overarching Project Management Plan (PMP), Work Health & Safety Plan (WHS), Construction Environmental Management Plan (CEMP) specific for the project and in accordance with scope of works and technical criteria, design, and project conditions of approval;
  - securing approvals required prior to the commencement of construction, including Early Works EMP if required; and
  - providing construction programme and environmental management information for community consultation requirements.
- Preliminary activities include:
  - establishment site access roads and site compound;
  - identification and signage of site services;
  - fencing of CEEC’s and Heritage sites;
  - fencing of the project Boundary;
  - install erosion and sediment controls; and
  - construction of transverse (clean water) drainage.

<u>Construction</u>

- Two traditional rocket launch sites and associated infrastructure.
- A range control facility.
- Assembly facilities.
- Supporting infrastructure including:
  - diesel and/or hydrogen fuel cell powered generators;
  - helicopter pad(s);
  - water tanks;
  - water capture and treatment systems;
  - launch pads;
  - lightning rods;
  - anemometer towers;
  - engine test stands;
  - propellant (liquid, hybrid and solid) storage;
  - secure block houses;
  - blast walls;
  - bunding (for blast wave deflection); and
  - installation of fibre optic and satellite communication systems.
- Upgrade and construction of internal access roads.
- Visitor viewing area and interpretative facilities.
- Temporary infrastructure associated with construction of the development, including but not limited to:
  - temporary concrete batching plant;
  - temporary site and construction offices and facilities;
  - temporary laydown areas;
  - temporary access tracks; and
  - tanks & turkey nest dam for construction water storage.
- Other Construction Work:
  - site stabilisation and rehabilitation; and
  - landscaping.
- Finishing works:
  - removal of temporary construction compounds;
  - remove and restore temporary construction compounds; and
  - general site clean-up.

2.4.9 Construction Method Statement

2.4.9.1 Site Establishment & Preparation

Release of Areas subject to environmental and cultural heritage inspection.

A regime shall be established with the Superintendent's Representative regarding the release of areas subject to required inspections.

These areas shall be identified at project commencement and fenced/barricaded off and signposted. The workforce will be advised of the locations where access is restricted at the project induction. Written evidence (Hold Point release or similar) shall be provided of the release of these areas prior to construction commencing in these areas.

<u>Ancillary Facilities</u>

Facilities specifically associated with construction are detailed on the Construction Facilities Plan in **Figure 2.25**.

The primary site compound with amenities, lunchrooms, training and meeting facilities and associated bathroom amenities will be located at Infrastructure Site D. Construction personnel and visitor carparking is also identified on the Construction Facilities Plan in **Figure 2.25**.

Laydown areas, plant and machinery parking and maintenance areas, and stockpile locations will be cleared with a suitable surface established and signposted as part of the site establishment program.

Access tracks will be routed to minimise impact on existing native vegetation and ecological vegetation communities where practical and in accordance with project approvals.

The installation of clean water drainage and diversions as well as erosion and sediment controls as part of the site establishment will ensure early set up of controls that will ensure impacts are kept to a minimum.

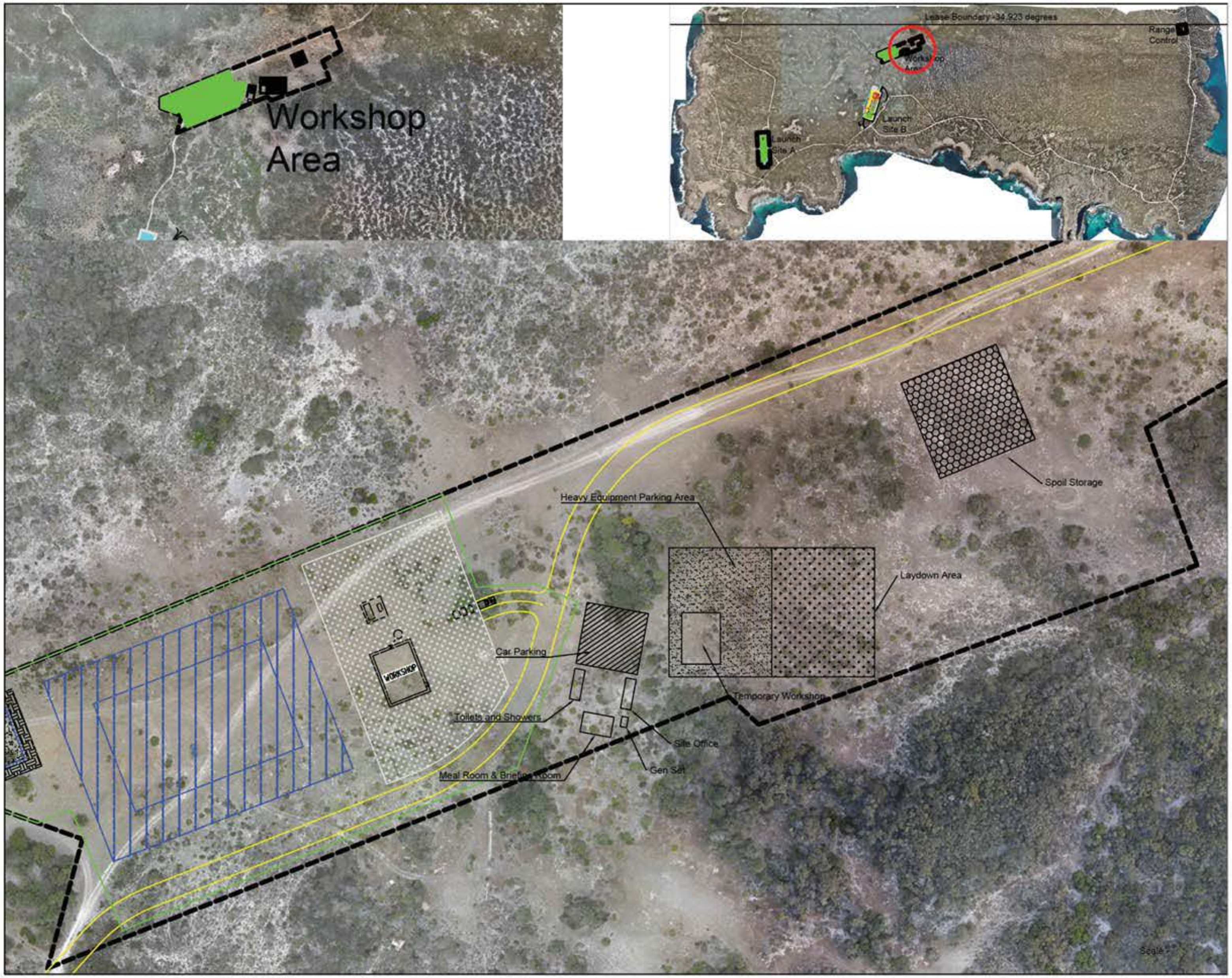


FIGURE 2.25

CONSTRUCTION FACILITIES PLAN

SOURCE: SOUTHERN LAUNCH

2.4.9.2 General Earthworks

Establish Survey Control and Set-out

Survey control will be setup at the commencement of the project by the project surveyor. The set out will be carried out using electronic design information received from the design consultants.

Clearing & Grubbing

The footprint area will be cleared and grubbed as required using a bulldozer and mulching equipment. The mulch will be moved to stockpile sites for later reuse, including for use as erosion and sediment control material during the earthworks phase of the project, as per CEMP. Where necessary, beneath the formation, grubbing will occur up to a depth of 500 millimetres below natural surface to remove all stumps and tree roots.

Strip Topsoil & Stockpile

Stripping of topsoil will be in accordance with requirements on the drawings; topsoil will be stripped and transported to nominated stockpile sites within the project area.

The topsoil stockpile will be wheel rolled during the stockpiling process to ensure the sides are compacted and stable. All necessary erosion controls will be installed around the topsoil stockpiles in accordance with the Erosion and Sediment Control Plans. Stockpiles may be seeded with a mix of suitable grass species to stabilise the surface and water carts will be available for dust control as required.

Foundation Preparation

Foundations will be jointly inspected by the earthwork's foreman, a geotechnical representative and the client representative following the removal of topsoil, to determine the suitability of the foundation. Any unsuitable material will be removed at this time. After the foundation has been approved, it will be ripped and compacted to a depth of 150 millimetres.

Removing Unsuitable Materials (Spoil)

All unsuitable areas will be removed by excavator and will be carted using dump trucks to a spoil stockpile. Unsuitable material will be removed as directed by the geotechnical representative and the client representative.

Access Tracks, Haul Roads

Minimum numbers of haul roads and tracks will be provided to carry out the works in order to minimise the disturbance to the surrounding areas. They will be formed from existing roads and tracks or within project footprints. The major haul route will be along the existing road between Launch Site B and Infrastructure Site D. Haul roads, where applicable, will require bunds to be constructed on the edges to prevent any vehicle run off and to control stormwater.

All haul roads will be adequately built to carry the type of plant utilised for the works. Graders and water carts will be utilised to maintain haul roads, to ensure both the efficiency of the haul, to minimise generation of dust and to maintain drainage to minimise erosion and sediment transport in accordance with the Site Erosion and Drainage Management Plan ('SEDMP').

Protection of the Work

All works will be protected as necessary for the length of the contract to ensure full compliance with contract specifications. Any identified damage during the course of works to the existing or finished surfaces will be maintained to the satisfaction of the client representative.

Materials

At this stage it is not fully known as to what pavement type materials will be won and processed on-site. A detailed material management plan, including the source material to be used and the method of processing, will be produced prior to commencing works. All the materials will be assessed and tested as described in the specifications and geotechnical report for the project.

Mass Haul & Material Management

Following an analysis of in-situ materials for the construction a mass haul diagram should be produced to determine the following:

- location and quantity of material in each structural zone;
- location and quantity of material required for each usage type;
- requirements for import material;
- stockpiling areas; and
- potential uses for spoil material and disposal provisions.

Blasting

Blasting is not envisaged to be necessary for this project. A worst-case scenario based on the geotechnical information obtained is believed to be the use of large trenching machines. In the unlikely event that blasting is required, a blasting plan will be developed in conjunction with the operations personnel at the WWOLC, the relevant authorities, contractor, and a blasting subcontractor.

Batter Stabilisation

A geotechnical consultant will determine if any batter stabilisation will be required.

Timing

The timing for individual activities will be determined from the overall construction program.

Major Plant & Equipment

In general, topsoil will be removed by scrapers, with assistance from graders as required. Excavators and dump trucks will be used in areas of deeper spoil.

The bulk earthworks will be moved by scrapers, with dozers and excavators used to assist loading, as well as dump trucks and excavators. There is the potential for the use of excavators equipped with rock breakers or trenching machines if hard rock is encountered.

Compaction will be carried out predominantly using compactors and pad foot rollers. The rolling pattern will be trialled after commencing on-site to determine the most effective compaction method.

Graders and water carts will be used for maintaining haul roads, spreading material in the embankments, applying water for conditioning, compaction purposes and dust control.

2.4.9.3 Structure Works

Assembly Buildings (Launch Site A and Launch Site B)

On completion of the earthworks, and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader will be used to trim the base to the required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising a mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Workshop Building (Infrastructure Site D)

On completion of the earthworks, and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader is used to trim the base to the required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising a mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Range Control Building (Range Control Site E)

On completion of the earthworks, and as it becomes available under a staged hand over, base installation shall commence. A GPS controlled grader is used to trim the base to the required level and line and the base is compacted with a roller.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines.

Portal frame is erected utilising a mobile crane and the outer skin fixed. Internal works including plumbing, electrical, lighting, HVAC, painting etc undertaken utilising mobile scaffolding and hand tools.

Launch Pad and Flame Trench (Launch Site A and Launch Site B)

The works area of the flame trench and launch pad will be cut to the required depths including benching using excavators. Shoring along the sides will be installed. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement for the flame trench. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

Once the concrete works have cured for the required time specified during detailed design, the void behind the flame trench will be backfilled. The backfill specification will be determined during detailed design.

Installation of trenches and sub-base pipework/conduit required for the launch pad follows until the site is prepped for installation of launch pad membrane, slab/footings formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units and hand trowel finishing machines. Curing compounds will then be applied.

Other Concrete Works (All sites)

Other concrete works primarily involve a series of concrete pads. On completion of the earthworks and as the works areas become available under a staged hand over, base installation shall commence. For large pads, a GPS controlled grader is used to trim the base to required level and line and the base is compacted with a roller. For smaller pads, the works may be completed utilising smaller equipment such as bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines. Curing compounds will then be applied.

Water Deluge System (Launch Site A and Launch Site B)

The water deluge system consists of a 20-metre-tall tank stand, 150,000-litre tank, pipework, and control system. Trenching will be undertaken from the tank stand to the launch pad. Excavation using bobcats and excavators will be undertaken to reach the desired depth. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, slab/footings formworks, reinforcement and hold down bolts. Concrete will be poured using concrete trucks supplied locally, either from a temporary on-site batching plant, or from an external batching plant and delivered to the site. Finishing will require handheld vibrating units, ride-on and hand trowel finishing machines. Curing compounds will then be applied.

The tank stand will be erected utilising cranes, scissor lifts and scaffolding. The 150,000 litre tank is lifted into position using cranes. Pipework will be installed from the tank to connect to the underground pipe network and a control system is installed.

Blast Walls (Launch Site A and Launch Site B)

Blast walls are to be installed to protect the fuel and oxidiser infrastructure. The walls will also reduce noise levels emanating outside the facility boundary.

The works area of the blast walls will be cut to required depths using excavators. Shoring along the sides will be installed if required. Base installation shall commence utilising bobcats and hand compactors.

Installation of trenches and subbase pipework/conduit follows until the site is prepped for installation of membrane, formworks and reinforcement. Concrete will be poured using concrete trucks supplied locally. Finishing will require handheld vibrating units and hand trowel finishing machines either from a temporary on-site batching plant or from an external batching plant and delivered to the site. Curing compounds will then be applied.

The walls will then be backfilled with gravel materials as per specification developed during detailed design.

Fuel and Oxidiser Facilities (Launch Sites A and Launch Site B)

Two areas are to be constructed behind blast walls. One area is for the storage of fuels. The other is for the storage of oxidisers.

The works area of the fuel/oxidiser's facilities will be cut to required depths using excavators. Shoring along the sides will be installed if required. Base installation shall commence utilising graders, rollers, bobcats, and hand compactors.

Installation of trenches and sub-base pipework/conduit follows until the site is prepped for installation of membrane, formworks, hold down bolts and reinforcement. Concrete will be poured using concrete trucks supplied locally. Finishing will require handheld vibrating units and hand trowel finishing machines either from a temporary on-site batching plant or from an external batching plant and delivered to the site. Curing compounds will then be applied.

Tanks, pumps, pipework, and pipe trays are trucked in. Lighter materials are hand lifted into position, whilst large items such as pumps, and tanks are craned into position. Pipe works and control systems are installed and then commissioned.

2.4.9.4 Drainage (All Sites)

Drainage works shall be carried out as soon as possible to enable the site to be well drained and reduce susceptibility to wet weather.

Installation of the stormwater detention basins and stormwater open swales shall be occur where possible along with the establishment of erosion and sediment controls at the start of the bulk earthworks.

Transverse drainage shall be installed as soon as possible subject to depth of cover over the drainage lines.

Stormwater drainage swales and outlet structures will be installed progressively along with the pipes, to ensure lines are completed with minimum disruption to the earthworks and following pavements.

Drainage works within the sites of works will be completed under appropriate safe working arrangements.

2.4.9.5 Communications, Lighting, Cameras, and IT Infrastructure (All Sites)

The actual communication, lighting and IT works required will be dependent upon the detailed design. This subsequent design process will detail the types of components required to be installed.

All communications, lighting and IT civil installation will be carried out in conjunction with the civil works under a joint program to ensure that all activities are completed in a timely manner to allow commissioning to be carried out at the correct time and to prevent unnecessary rework. This will include, but not be limited to, the installation of cable routes, pits, servers, poles, cameras, light fittings and main cable installation.

Cable terminations, pre-testing, final testing, commissioning, and systems integration will be carried out by the nominated contractor approved by Southern Launch.

2.4.10 Environmental Requirements

Control of Erosion & Sedimentation

Prior to commencement of any work, erosion and sediment control measures will be implemented as per the CEMP and associated SEDMP. The methodology will ensure that all the existing and finished surfaces are protected from damage due to work activities, contamination from site conditions and any climate conditions, and ensuring no damage would occur beyond the disturbance boundary downstream side of works area. The CEMP and SEDMP will always be in place during the course of individual operation and will be amended accordingly with site conditions to suit the works.

All necessary drain paths will be identified to separate clean and dirty water on-site and works will be performed for the diversion, restriction or management of any flow or seepage of surface or ground water around the works for water runoff. The plan will be prepared to show dispersing of clean water either in stable areas or natural watercourses, while all measures including, but not limited to, sediment traps and basins will be taken to collect dirty water and, where possible, reuse it for site works.

Temporary Drains

Catch drains will be formed along haul roads and access tracks for any potential hazards due to their steepness or soil erodibility. All drains will be formed to intercept and divert run off from roads to stable outlets. The configuration of these drains will include check dams, sandbags to decelerate runoff to non-erosive velocities. All drains will be formed with adequate plant type, capacity to perform the works.

Temporary Sedimentation Control Works

Temporary sediment trapping devices will be installed downstream of the embankment works area within the disturbance boundary. They will be provided during construction to filter sediment laden runoff or water from dewatering operations. They will be positioned to filter sediment before crossing the disturbance boundary and entering any natural watercourses downstream of the works area.

De-Watering

All water will be sampled, analysed and results assessed to ensure that any dewatering will comply with all regulatory requirements. All dewatering activities will be in accordance with the dewatering procedures within the CEMP and SEDMP. All dewatering activities are monitored with records maintained by the contractor and Southern Launch.

2.4.11 Testing and Inspection

A Quality Plan will be prepared in accordance with the CEMP and SEDMP prior to the commencement of works. This will include a detailed Testing and Inspection Plan. A NATA accredited testing authority will be employed to undertake all testing of earthworks and concrete on-site. All select materials to be incorporated into the works will be tested and certificates attached to quality documents.

2.4.12 Dust Control

All works will be conducted as per the CEMP and SEDMP, for the suppression control of dust. Any exposed areas which allow for revegetation to be used as dust control barriers, including stockpiles and mounds, will be applied as soon as practical, otherwise, a water cart or other appropriate method of dust mitigation will be allocated for works in these areas.

2.4.13 Noise Mitigation

Launch Sites A, Launch Site B and Infrastructure Site D are located a significant distance from the nearest sensitive receptors. As the works include large sized plant and equipment, a noise control plan will also be implemented to ensure works are conducted within mandated time periods, affording no disturbance to the surrounded community.

If it is required for the works to be conducted outside of mandated time periods, then the affected community will be notified prior to the works being conducted and with the client representative approval, subject to relevant EPA guidelines for the mitigation of construction impacts.

2.4.14 Revegetation

Revegetation of disturbed areas and any areas beyond the embankment footprints will take place as soon as any of the area is available, to reduce potential for erosion and to have permanent vegetation as a barrier for water runoff. Seeding will be applied by an approved process and will include one application over each area. It will commence as soon as topsoiling is completed subject to the appropriate seasonality for the seeding of vegetation.

Storage tanks, containers and equipment used in the hydro seeding and mulching will be clean and free of contamination from previous operations. Mulch placement methods will be approved by the client representative, prior to the commencement of mulching.

2.4.15 Plant and Equipment

Earthworks and Drainage

For the cut to fill operation, the earthmoving equipment used is expected to include the following:

- 30 and 25 tonne excavators.
- Backhoes.
- Scrapers.
- Dump trucks.
- Loaders.
- Tippers.
- Bulldozers – potentially up to D11.
- Water Carts.
- Graders.
- Track Trenching Machines such as the Vermeer T555.
- Compactors.
- Smaller Machinery such as bobcat, hand operated compactors and hand tools.

Structural Works

Preparation of the sub-base and base will utilise equipment stated above. Other equipment required is expected to include the following:

- Cranes.
- Welding equipment.
- Scaffolding.
- Mobile elevated platforms.
- Hand tools.

Concrete Works

Concrete works are expected to include the following equipment:

- Concrete trucks – transport concrete from Port Lincoln.
- Concrete pumps.
- Formwork.
- Vibration equipment.
- Ride-on and hand operated trowel machines.
- Scaffolding.
- Hand tools.

2.4.16 Safety

Safety is paramount and Southern Launch is committed to an incident free worksite. A detailed Safety Management Plan will be developed in conjunction with the main contractor for the construction process. Southern Launch is committed to meeting all its legislative obligations in respect of safety.

Any construction site is a high-risk environment, particularly when heavy equipment is involved. Major safety considerations include:

- Heavy equipment movements.
- Working around heavy equipment.
- Vehicle movements.
- Working at height.
- Working at depth.
- Vibration related injuries.
- Hot works.
- Noise.
- Dust.
- Electrical related injuries.

- Crush related injuries.
- Tool related injuries (e.g., eye injuries, degloving).
- Environment related injuries (e.g., heat exhaustion, hypothermia).
- Slip and fall related injuries.
- Potential for unauthorised vehicles/people entering the site.

2.5 Project Operations and Management

This section sets out the typical operations of the facility through the lifecycle of the project.

2.5.1 Concept of Operations

The proposed orbital launch operations are a highly structured operation that will be the subject of significant operational planning coordinated between Southern Launch and their customers.

The proposed facility will be operated by Southern Launch allowing for customer use for the launch of rockets. Southern Launch will be responsible for the provision and maintenance of the infrastructure on the facility and for coordination with customers undertaking launch operations. Southern Launch will also be responsible for the security of the facility, for coordination with various tiers of government in respect of operational approvals and licences and also emergency planning, management and coordination.

Southern Launch will provide additional services to customers on an as-needed basis.

As the operator of the facility and holder of the various regulatory approvals and licences, Southern Launch will be responsible for compliance with those approvals and licences and will coordinate closely with launch customers to ensure that compliance is achieved at all stages of operations.

2.5.2 Delivery and Operation of a Rocket Launch

Following the completion of the off-site infrastructure assembly, the rocket components and payload will be delivered to the site and combined to form a launch vehicle.

This process will occur as follows:

- Vehicle stages are shipped to the site via proximate land, air or sea facilities where they will be loaded onto a suitable road transport for delivery to the site.
- Vehicle stages are transported to the Assembly Building at Launch Site A or Launch Site B and unloaded.
- Checking of the different vehicle stage electronics and systems are undertaken.

- Payloads (satellites) are delivered onsite and checked by technicians.
- Payloads are integrated into the final vehicle stage.
- The complete vehicle is assembled in the horizontal position within the Assembly Building at Launch Site A or Launch Site B.
- The assembled vehicle is driven to the launch pad and lifted into the vertical position.
- The vehicle is tested on the pad.
- The launch corridor (range) is cleared to ensure there are no aircraft, vessels, personnel, or ground traffic in the area.
- The vehicle is launched.

The above steps take approximately seven days to complete, hence a launch window (the amount of time allocated by the Australian Space Agency to undertake a launch within) is usually 21 days to account for variable weather. Some of the steps outlined above could potentially be done at an auxiliary site at another location to reduce the time spent at the launch site. During this period of time the immediate site surrounding the Launch Site would need to be closed to visitors.

As outlined above, the facility will cater for launches by a variety of customers. The number of launches based on the initial phase of the development is anticipated to commence with approximately six launches in the first year of operations, increasing to a maximum of 36 orbital launches and six sub-orbital launches per year in year five of operations.

The facility has been uniquely designed to enable the launch sites to be used by multiple customers, who will transport their equipment and launch vehicle stages to the site before undertaking final assembly in preparation for the launch. Once the launch is complete, the customer will remove their equipment and vacate the launch site ready for occupation by the next customer.

Typically, a launch cycle will run in the order of three to five weeks from occupation to vacation of a launch site; however, the exact timeframe will vary based on the nature of the launch vehicle and the specific requirements of an individual launch mission.

Following vacation of a launch site, routine inspection, maintenance, and repair operations will be undertaken.

When a launch site is not occupied, the intensity of activity will typically be very low, particularly in times where no maintenance or repair work is occurring. Accordingly, the intensity of use of the site will vary throughout the course of the year, with times where there is no material activity on-site and only routine security present. At other times, when multiple launch sites are occupied, the level of activity will be more significant with larger numbers of staff on-site.

2.5.3 Typical Launch Timeline

The nature and activity associated with each launch will be unique, based on the specific requirements of the mission. However, the process for launches will have a high degree of commonality in activities as the launch site is occupied and preparations for the launch proceed. Furthermore, launches are a highly structured operation requiring input and oversight of numerous government agencies.

A typical launch will see an increase in the intensity of site operations approximately 21 to 28 days prior to the launch. The following timeline indicates a typical sequence of activities leading up to and following a launch:

<u>4 weeks prior to launch date</u>:

- QA processes are completed at site and the launch site is verified as being suitable for occupation by the customer.
- Specific notification with and coordination with local stakeholders and regulatory authorities is undertaken.

<u>3-4 weeks prior to launch date</u>:

- Those launch vehicle components not manufactured in Australia will arrive to an off-site reception facility.
- Customs and import processes will be undertaken, followed by an initial acceptance inspection.
- It is anticipated that off-site installation of components will occur as required to minimise the amount of assembly (and assembly time) required at the WWOLC. It should be noted that the proposed concept of multi-use launch infrastructure is a relatively unique concept.
- To be cost effective and minimise the amount of time they spend at a launch site, it is anticipated that the initial installation processes for both launch vehicles and payloads will occur offsite. This could occur in Port Lincoln, Adelaide or elsewhere in Australia. The customer will undertake acceptance inspections of the launch site ready for formal occupation.

<u>2-3 weeks prior to launch</u>:

- The customer will occupy the launch site. Once this occurs, the customer will begin to bring equipment to the site. The number of personnel on-site (both customer and Southern Launch personnel) will begin to increase approximately three weeks prior to launch and will continue to increase progressively as the launch approaches.

1-2 weeks prior to launch:

- By this time the customer has occupied the launch site. Depending on the nature of the launch, the launch vehicle will be transported to site between seven to 14 days prior to the launch.
- The launch vehicle will be brought to site in the form of partially assembled stages for mating on-site.
- As the stages of the launch vehicle are brought to site by truck, they will be transported into the assembly building.
- During this period, the Southern Launch Range Operations Manager will continue coordination and liaison with local authorities in advance of the launch.
- The launch table/pedestal is moved into position at the launch pad in preparation for the installation of supporting infrastructure.
- At this point there will be a further increase in equipment being brought to site, with radiofrequency (RF) and IT equipment for the management and monitoring of the launch being delivered.
- In the assembly building, the vehicle assembly continues, with stages being mated and other external and internal components added to the launch vehicle.
- External systems including fuel, oxidiser, communications, and IT are connected to the launch table.
- There will be a continued increase in the number of staff at the site during this period.

7 days prior to launch:

- Fuels and oxidisers trucked to site and either decanted into the on-site storage at the launch pad or retained in transportable tanks.
- Vehicle assembly continues and the connection of systems to the launch table also continues.

2-7 days prior to launch:

- At this time, the major assembly of the launch vehicle will be close to complete. This enables one or more 'dress rehearsals' of the launch to be undertaken. These processes will test roll-out, erection and countdown procedures, however, do not involve engine firing although they can involve fuelling the launch vehicle. Typically, after a dress rehearsal is complete, the launch vehicle will be rolled back to the assembly building for storage.

- Coordination continues with local authorities and external regulatory authorities.
- There will be a continued increase in staff numbers, with peak staff numbers typically reached at some point during this period.

1 day prior to launch:

- The day prior to launch will be focussed on checking and testing of systems in preparation for the launch. This will include a run through of checks similar to launch day and verification of all systems associated with the launch are working.
- On the day prior to launch the flight readiness review will be undertaken and a go/no-go decision will be made. If a no-go decision is made, a rescheduled launch date may be determined and any NOTAM or NTM for the following day cancelled.
- Relevant liaison with government agencies to confirm regulatory arrangements are in place.

Day of launch:

- On the launch day there will be the final roll-out of the vehicle to the launch pad for launch. The vehicle will be attached to launch table and erected. Pre-launch system checks begin.
- One hour before launch, following completion of roll-out procedures, the final preparation of the vehicle for launch will proceed. This will include evacuation of staff from the launch pad to safe areas of the site. Once the evacuation is completed, fuelling of the launch vehicle commences which involves decanting the fuel and oxidiser into the internal tanks for the vehicle. Once fuelling commences, critical countdown commences, and final critical system checks undertaken.

30 seconds before lift-off:

- The deluge water system activates.

Lift-off:

- Vehicle engine(s) ignite for lift off.
- Umbilicals and collections to launch table disconnect and the vehicle commences vertical ascent.
- The vehicle clears the tower and continues on the launch trajectory.

Post-launch site activities:

- Following the launch of the vehicle, launch pad systems will be made safe. This will include initial checks, following which fuel, oxidiser and cryogenic lines will be checked and purged.
- Once the launch pad is made safe a comprehensive set of checks for foreign object damage at the launch pad and surrounding areas will be undertaken.
- Mission control and range control continue to monitor the launch vehicle until after payload separation, which will typically occur one to two hours after launch.
- Once the launch vehicle payload has separated, systems shutdown procedures begin, and disassembly of the launch pad and other equipment can proceed. This will include the launch table being disconnected and moved off the launch pad.
- The customer disassembles equipment and vacates assembly building and launch pad.
- Once the customer has vacated, acceptance checks are undertaken by Southern Launch. As required, maintenance and repair work undertaken on-site between customers and the launch sequence then starts again for subsequent customers.

Ongoing:

- Engagement and liaison with commercial air and maritime operators and, their peak bodies, that use the air and maritime areas south of the WWOLC.
- STEM and public outreach activities, providing the public with an insight into space launch activities.

2.5.4 Suborbital Rockets

Whalers Way will also be used to launch rockets and/or payloads that do not go into orbit around the Earth. These rockets are known as sounding rockets or suborbital rockets.

Typical purposes for sub-orbital rocket missions include:

- atmospheric research;
- other data gathering and research;
- testing and qualification of space systems; and
- STEM education.

The payloads of these rockets would potentially include electronics, metallic structures, optical materials like glass or ceramics, and batteries.

Given they have small payloads and address specific research questions, many sub-orbital rockets are designed to be low-cost and rapidly deployable. They will generally be smaller than orbital rockets. They still however may consist of more than one rocket stage. Thrust for sounding rockets is mostly provided by solid propulsion but can also be supplied through other propulsion technologies including hybrid and liquid.

Certain developers of orbital launch vehicles use suborbital flights to test stages. If these flights test the first stage of an orbital vehicle, the launch will more closely resemble an orbital launch. If these launches test upper stages, they will generally resemble scientific type sub-orbital rocket flights but have engineering payloads instead of experiments.

When launched at overland rocket ranges, sounding rocket payloads are normally recovered and reused, with the rocket body being single use and not reconditioned for a subsequent launch. Since launches at Whalers Way will be over the water, it may be impractical to recover the payloads and they would typically remain in the ocean.

2.5.5 Launch Frequency and Type

Given the potential complexity of retrieving payloads from the open ocean, sub-orbital rocket launches are anticipated to be less frequent on the Whalers Way site. It is envisaged that there would typically be in the order of
six sub-orbital launches per annum from the WWOLC.

This number is additional to the estimated 36 conventional launches per annum at the Whalers Way site.

A spectrum of rocket sizes are expected to be launched from Whalers Way with some potential examples of rocket sizes provided below. The exact rockets that would get launched from Whalers Way is based on concluding contract negotiations with potential rocket manufacturers and operators.

The T-Minus Engineering Dart is an example of a small two stage sounding rocket that Southern Launch could operate from the site. That vehicle consists of lightweight and powerful solid motor booster motor and a smaller second stage dart shaped payload compartment that separates from the booster and continues substantially further downrange. The dart component is between 900 and 1,500 millimetres with a diameter of less than 50 millimetres. The dart rocket will have a total mass, including payload, of between 3.0 and 5.0 kilograms. This component of the rocket will reach speeds of between Mach 5 and 6 (1,500 to 1,800m/s). The Booster is approximately 2.0 to 3.0 metres in length, up to approximately 400-millimetre diameter with a loaded mass of between 15 and 30 kilograms. The booster section of the sounding rocket will return to Earth between 3.0 to 8.0 kilometres downrange. The dart section will return to Earth between 40 to 150 kilometres downrange.

Larger sounding rockets include the Kestrel 1 rocket based on the Hapith design. The Kestrel 1 is developed to test the design for the second and third stages of the larger, orbital Kestrel V vehicle. The Kestrel 1 is a 10 metre tall, 3,100-kilogram, two-stage rocket capable of carrying a 150 kilogram payload up to 400 kilometres into space. After pushing the Kestrel I rocket to approximately 10 kilometre altitude and accelerating to over Mach 1, the first stage propellant is exhausted where the first stage is separated from the second, and the first stage returns to splash down in the ocean. The second stage engine ignites, propelling the payload out into space before it too falls back to Earth approximately 400 kilometres downrange from the launch site.

An example micro-lift orbital vehicle would be two meters in diameter and stand approximately 15 metres tall. Weighing approximately 15,000 kilograms at lift off these rockets carry approximately 200 kilograms into orbit. Examples of payloads of this size is a small Earth Observation (EO) satellite used for agriculture, fishing or climatic analyses. Some micro-lift vehicles would have a third stage used to complete insertion of the payload into orbit.

An example of a small-lift orbital vehicle would be approximately three meters in diameter and stand approximately 30 metres tall. Weighing approximately 100,000 kilograms at lift off these rockets could carry upwards of 2,000 kilograms of payload into orbit. Usually comprising three, or up to four, stages these rockets are generally used to carry radio frequency satellites into orbit that could supply global internet connectivity or other telecommunications functions.

2.5.6 Safety Zones

To ensure people are safe during the launch process, an exclusion zone is required to be established around the launch site (Launch Exclusion Area), and on the ground along the path the rocket will fly to get into space (Launch Exclusion Corridor). For safety reasons, no unauthorised persons or vehicles are allowed in these areas during a launch.

Exclusion Zones will only be in effect when they are needed, and the public will be given notice before they are put in place through the standard Notices to Airmen (NOTAM) and Notices to Mariners (NOTMAR). Additional notification of launches via media channels will be undertaken to inform the public through the processes defined by the Australian Space Agency.

The exact size and location of an exclusion zones will be based on the size of the rocket being launched at the time and the flight path the rocket will follow. Exclusion zones associated with the WWOLC will be designed to not encroach on any neighbouring properties or other private land beyond lease boundary without prior consent. Exclusion zones across public areas will be designed with the relevant Australian authority, taking into account input on existing commercial users.

Figure 2.26 shows the nominal launch safety zones overlaid on the site.

The final dimensions of the exclusion zones will be approved by the relevant Australian regulator for the airspace or maritime areas prior to being put in place. For the purpose of the assessment of the major development, nominal safety zones have been calculated based on the largest rockets expected to launch from the site. The calculated exclusion zones for individual launches are expected to be smaller, and often significantly smaller than the safety zones.

2.5.7 Overflight and Marine Danger Area

Commercial and private aviation may currently overfly the launch site, the rocket flight path, and the exclusion zone.

As part of any launch process, Notices to Airmen (NOTAM) for air traffic and Notices to Mariners (NOTMAR) for sea traffic are issued in accordance with Australian regulatory requirements.

Temporal and spatial separation between air and maritime users, and any rocket launch operations will be implemented with close coordination with Australian regulators.

Subject Allotment	CTP	Caravan and Tourist Park	SITE A	Launch Facilities	Key Site Access
Key Road	Con	Conservation	SITE B	Launch Facilities	Radius 3120m to Site A Launchpad
Lease Boundary	CWOI	Coastal Waters annd Offshore Islands	SITE D	Infrastructure	Radius 2100m to Site B Launchpad
	Ru	Rural	SITE E	Range Control	

Figure 2.26 - Site Plan - Launch Safety Zones

WHALERS WAY
ORBITAL LAUNCH COMPLEX

for Southern Launch

1:35000 @ A3
0 1000m

MASTERPLAN.COM.AU
SA | NT | QLD

MASTERPLAN
TOWN + COUNTRY PLANNERS

3 NOISE & VIBRATION

3.0 NOISE AND VIBRATION

3.1 Background

The acoustic and vibration impact of the proposal results from three key elements:

- the construction of the proposed facilities;
- the general operation of the facility, outside of the launch of vehicles or engine testing; and
- the launch of rockets or engine testing.

The launch of rockets or engine testing will result in very significant noise for a short duration, occurring irregularly.

The construction and general operation of the facility will result in lower noise levels but extending over a longer period.

The noise and vibration generated by the facility has the potential to cause impacts in two ways:

- amenity and environmental impacts on sensitive receivers in the vicinity of the subject site; and
- impacts on fauna on the subject site and surrounding areas, including in the marine environment.

The noise and vibration impacts of the proposal are quite different to those from the majority of development projects, both through the infrequent high-intensity impacts, and through the focus on the impact on fauna.

The Whalers Way Orbital Launch Complex – Environmental Assessment Report – Noise and Vibration, prepared by AECOM, undertaken for the project and referenced in the EIS sought to quantify the acoustic and vibration impacts in empirical terms, and considered the impact of the noise and vibration on sensitive receivers.

As the impact of the noise on fauna is assessed less often in environmental noise assessments, the predominant consideration of these impacts occurs in the Terrestrial Ecological Assessment and the Marine Ecological Assessment, rather than in the Noise and Vibration Report.

Following the exhibition of the EIS, there has been a significant volume of further work to better further understand the noise and vibration impacts of the proposal. The test launch campaign has proceeded, with the first launch being undertaken. Whilst the first launch attempt did not result in the successful launch of a vehicle, a representative noise source was realised, and it provided considerable additional understanding of the noise and vibration impacts of the proposal.

Following the exhibition of the EIS, the project has been refined to relocate Site A. The primary purpose of the site A relocation was to reduce the terrestrial ecological impact of the proposal. This relocation has resulted in an alteration of the noise impacts through the relocation of key noise sources.

Additionally, the modelling software which was used to generate the computational model of noise and vibration impacts has been updated and refined since the reporting which supported the EIS was prepared. The updated software includes additional vehicle options and refined information to generate acoustic outputs.

Following the exhibition of the EIS, AECOM were engaged to review the submissions which referenced noise and vibration impacts and provides input into this response document. This was additional to their input into the test launch campaign and the process of selecting a revised location for Site A.

AECOM have prepared an updated Environmental Assessment Report – Noise and Vibration, which includes the updated modelling, the outcomes of the test launch campaign and the revised location for Site A.

The updated report prepared by AECOM following the exhibition of the EIS in contained in **Appendix B**.

In addition to the updated report prepared by AECOM, specialist advice was sought in respect of the noise and vibration impacts on the marine environment. Resonate, a specialist acoustic consultancy firm was engaged to review the submissions and provide feedback. Additionally, Resonate has provided specialist advice in respect of further detailed analysis of the RUMBLE software, which has provided a more realistic acoustic outcome for the expected launches from the site. In addition, the transmission of noise from air to water and the specific impact on marine mammals and other marine fauna.

As a result, on the information gained during the work undertaken by Resonate in respect of the impacts on the marine environment, Resonate were subsequently for additional packages of work to further expand the understanding of the potential acoustic impacts of the project. This work entailed two further packages of work. The first of which involved monitoring of static rocket motor engine testing of the engines of the first stage of the Hapith I at a site in Queensland. The second package involved review and further interrogation of the RUMBLE software previously used by AECOM to determine the ability of the software to accommodate, and model a vehicle, which better represents the worst-case scenario for rocket launch from the site, recognising that the previously modelled worst case vehicle was the Space X Falcon 9 which is very significantly larger than the largest vehicle which would ever be launched from the WWOLC.

Resonate were able to generate a model of a more appropriate vehicle, being the Avio Vega with a mass of 137 tonnes, supplementing the previous models of the Blue Origin New Shephard, with a mass of 75 tonnes, and the Space X Falcon 9 with a mass of 549 tonnes.

Resonate have prepared two reports which augment the previous report prepared by AECOM:

- Southern Launch – Whalers Way Orbital Launch Complex – Environmental Noise Advice – June 2022.
- Southern Launch – Hapith I Motor Statis Test – July 2022.

The reports prepared by Resonate are contained in **Appendix C**.

Where submissions have referenced noise and vibration impacts in respect of terrestrial and marine fauna, these issues are responded to in **Section 4.0** and **Section 5.0**, rather than in this section.

3.2 Summary of Submissions

A total of 24 submissions mentioned the potential noise and vibration impacts of the proposal.

These included submissions P26, P41, P72, P74, P122, P124, P148, P150, P152, P164, P170, P186, P195, P200, P209, P211, P223, P246, P253, P254, P255, P257, P258 and P261.

The majority of the submissions that referenced noise and vibration did so in the context of the impact on terrestrial and marine fauna.

Several submissions referenced noise and vibration impacts in respect of impacts on sensitive receivers, including dwellings in the vicinity of the subject site and public spaces, such as Fishery Bay in the vicinity of the site.

Where submissions have referenced noise and vibration impacts in respect of terrestrial and marine fauna, these issues are responded to in **Section 4.0** and **Section 5.0**, rather than in this section.

This section seeks to detail the revised noise assessment work undertaken, and the noise and vibration impacts on sensitive receivers, providing context to the noise expected to be generated by the proposed facility and the updated data prepared since the exhibition of the EIS.

3.2.1 State Government Agency Responses

EPA

The EPA provided support for the following measures:

- The proposed specified mitigation measures outlined in WEIS.
- Informing residents prior to launch activities as this has proven to assist in managing community concerns associated with other activities/industries that have periodic, loud, short-duration noise impacts elsewhere in South Australia.
- Ongoing monitoring program if and when permanent operations are commenced. This data would aid decision making around noise impacts and mitigation measures for future launches and form part of a noise management plan.

Issues raised by other agencies in respect of the impact of noise on fauna are addressed in **Section 4.0** and **Section 5.0**, rather than this section.

3.3 Discussion

3.3.1 Baseline Conditions

The aim of the existing conditions assessment is to identify where sensitive receptors are located relative to the proposed Project Area and to characterise the existing acoustic environment.

It is important to establish the existing noise environment throughout the Project study area in order to:

- Verify the known contributions from existing noise and vibration sources prior to the impact assessment.
- Develop appropriate criteria and limits that would guide the impact assessment.

Following the exhibition of the EIS, review of the existing conditions has indicated that there has been no material change to the location of sensitive receivers. The relocation of Launch Site A has altered the site location of a key noise generator relative to those sensitive receivers.

The majority of the land located adjacent to the project is sparsely populated rural land. This type of land use is typically quieter than suburban areas and is usually more sensitive to the introduction of a new commercial noise source.

A study area up to 5.0 kilometres from the Project, including the nearest residential locations, was considered appropriate to assess the noise and vibration impacts in this environment. The extent of the study area has not changed as a result of changes to the proposal following exhibition of the EIS.

Baseline noise monitoring was used to quantify the existing noise environment at sensitive receptors near the proposed Project Area. Noise monitoring consisted of unattended measurements at five measurement locations.

Existing noise levels were monitored and reported with reference to the following descriptors:

- LA90 noise level: The dB(A) noise level that is exceeded for 90 per cent of a specified period. Commonly referred to as the background noise level.

- LAeq noise level: The LAeq reflects all noise occurring during the measurement period. It approximately equates to the average level for many typical environmental noise scenarios. LAeq is typically used to quantify industrial noise, and to assess environmental noise impacts.

The existing noise levels were measured with reference to Australian Standard 1055:2018 - Acoustics - Description and Measurement of Environmental Noise.

Unattended noise monitoring was undertaken at each location for up to two weeks. Equipment was set up in a free field location with the microphone at least 3.5 metres from all reflecting surfaces and away from extraneous noise sources. All noise monitoring equipment had current laboratory calibration status at the time of the measurements.

The locations of the background monitoring locations referenced to the proposed development and the nearest sensitive receivers is detailed in **Figure 3.1**.

FIGURE 3.1

TEST LAUNCH MONITORING LOCATIONS

SOURCE: AECOM

3.4 Assessment Criteria

Potential impacts to humans during the construction and operational phases of the project may be caused by a disturbance of the acoustic environment. Accordingly, a review of local regulations and international standards was undertaken to seek guidance on the suitable noise and vibration objectives for the project.

3.4.1 Construction Noise

The *Environment Protection (Noise) Policy, 2007* provides specific criteria for construction noise under Part 6 – Special Noise Control Provisions – Division 1 – Construction Noise.

Under the Policy, construction activity with an adverse impact on amenity must not occur on a Sunday or public holiday, and on any other day except between 7.00 am and 7.00 pm. The criteria are applicable at noise-affected premises for determining whether construction activities result in noise with an adverse impact on amenity. These criteria are presented in **Table 3.1**

Table 3.1: Summary of Construction Noise Criteria

TIME	NOISE CRITERIA
Monday to Saturday, 7.00 am to 7.00 pm	No specific construction noise limit. Minimise construction noise where possible.
All other times, and public holidays	LAeq, 15mins should not exceed 45 dB(A). LAmax should not exceed 60 dB(A).

Project construction works would typically occur between Mondays and Saturdays within the 7:00 am to 7:00 pm time period. Within these hours, there is no specific construction noise limit, although construction noise should be minimised where possible.

3.4.2 Operational Noise (Office and Workshop Activities)

The noise from a noise source complies with the requirements of the *Environment Protection (Noise) Policy, 2007* if:

- it does not exceed the relevant indicative noise level as measured at a noise affected premises, or
- it is not higher than 5 dB(A) above the background noise level as measured at the noise affected premises.

Residential areas in the vicinity of the project are located in the area of Sleaford within the District Council of the Lower Eyre Peninsula.

It is considered reasonable, having regard to the nature of the surrounding allotments containing dwellings and the adjacent land uses, that the land containing sensitive receivers in the locality could be categorised as Rural Living for the purpose of this assessment.

The background plus 5 dB criteria at the nearest noise affected premises have been approximated using the average background levels shown in **Section 5.2.1.2**. The levels relevant to this assessment are presented in **Table 3.2** Note that only one of the following tests needs to be met to satisfy the requirements of the *Environment Protection (Noise) Policy, 2007*.

Table 3.2: Noise Criteria Summary

DESCRIPTION	NOISE GOALS	
	Day	Night
Indicative noise factor for Rural Living	47	40
Background plus 5 dB	29	36

In accordance with the noise policy "*the predicted source noise level (continuous) for the development should not exceed the relevant indicative noise level less 5 dB(A)*".

As such, the criteria for the project would be:

- Leq(15-min) 42 dB(A) - Daytime hours (7:00 am and 10:00 pm on the same day).
- Leq(15-min) 35 dB(A) - Night-time hours (10:00 pm on one day and 7:00 am on the following day).

3.4.3 Operational Noise

The nature of the proposed operations for the launching of rockets results in activities which generate significant noise for a short duration, which occur infrequently throughout the year. The noise levels at sensitive receivers will exceed goal noise levels in the *Environment Protection (Noise) Policy, 2007* for a short duration. It is considered, however, that guidelines seeking to limit noise impacts which occur on an ongoing and continuous basis are not directly relevant to infrequent, short duration noise events.

A desktop study was undertaken of relevant scientific research that describes the impacts of rocket noise on humans. This step was considered important as there are no standards, regulations and/or guidelines available for assessing airborne noise and ground vibration from rocket launch activities in Australia.

The study found that all the noise assessments undertaken for new and modified launch facilities referenced the United States Federal Aviation Administration (FAA) Order 1050.1F. This policy specifies Day-Night Average Sound Level (DNL) as the standard metric for community noise impact analysis of rocket launch facilities.

The DNL describes the daily noise energy exposure based on annual aviation activities. The metric incorporates a 10-dB penalty for noise at night to account for increased human sensitivity to noise between 10.00 pm and 7.00 am.

FAA defines a "significant impact" due to aviation noise as a sensitive location exposed to noise greater than a DNL of 65 dB(A) (FAA, 2018). The criterion is presented in **Table 3.3**.

Table 3.3: Preliminary Operational Noise Criterion – Human Amenity

ACTIVITY	OPERATIONAL NOISE CRITERIA
Rocket launch and testing	DNL 65 dB(A)

The FAA notes that the application of this criterion should be considered carefully when determining the noise impact in areas of low existing noise levels. Accordingly, additional noise metrics have been considered to help identify the potential impacts in a quiet rural environment.

Where noise sources are in motion, for example an aircraft/rocket, the noise level changes over time. For a rocket launch, the maximum A-weighted sound pressure level (LAmax) is used to describe the maximum level that would be produced during a launch. The LAmax can be a helpful metric for describing the possible disturbance to conversation, sleep, or other common activities due to a noise event.

The Sound Exposure Level (LAE) has also been identified as another suitable metric as it represents the intensity and duration (total acoustic energy transmitted to the listener) of a single noise event. This parameter can also be used to calculate other energy-based acoustic metrics (e.g., LAeq (15min)) using a single logarithmic subtraction.

An indicative histogram for the noise metrics over the time of a launch has been shown in **Figure 3.2** The initial thrust produced by the launch vehicle is expected to produce high levels of noise starting a few milliseconds after ignition. The greatest noise produced is expected to occur when the rocket is at maximum thrust close to the ground. The levels are expected to radiate omnidirectionally away from the launch site as the rocket elevates.

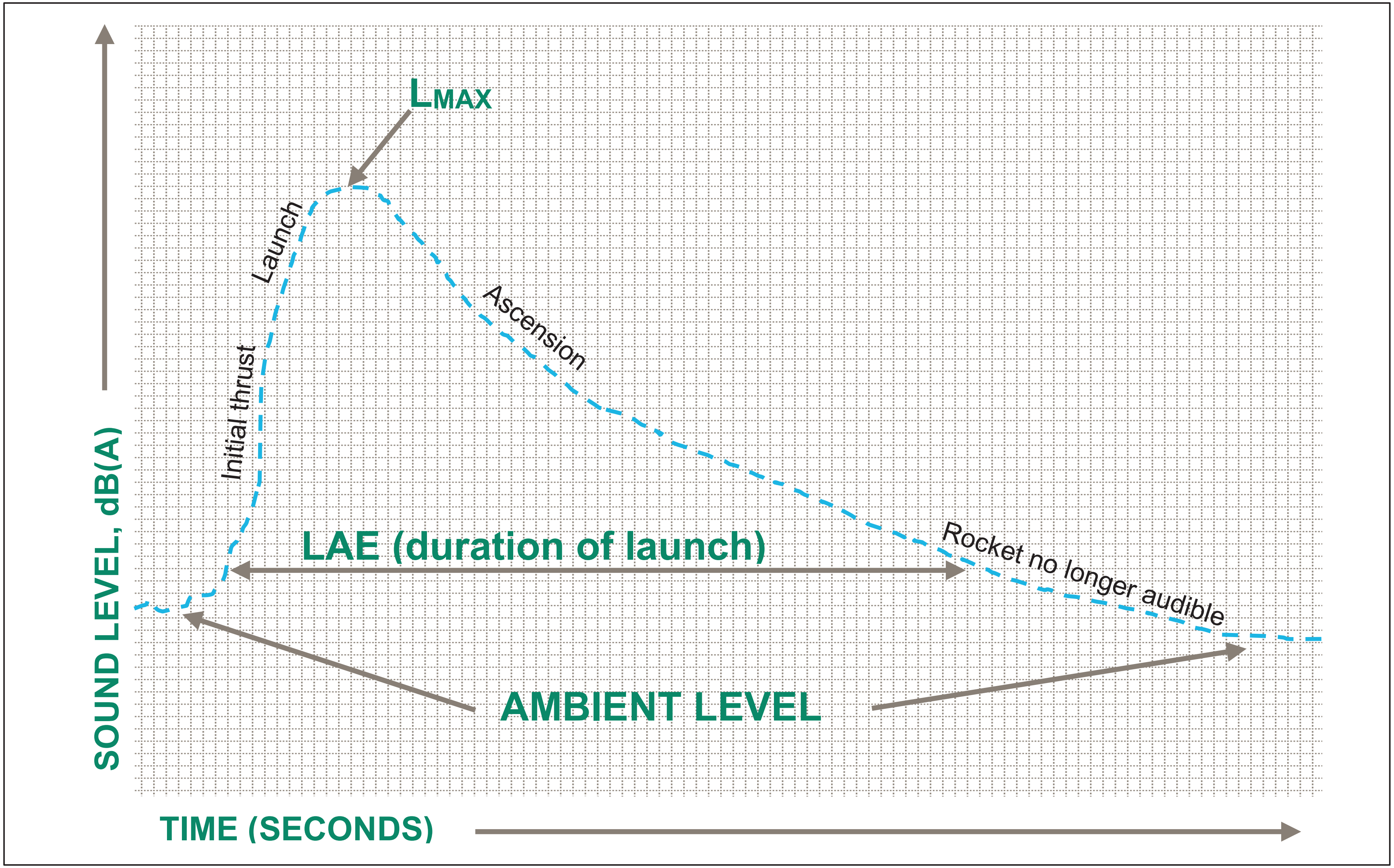


FIGURE
3.2

NOISE LEVEL FROM A NOMINAL LAUNCH OVER TIME

SOURCE: AECOM

The DNL is not shown above as it is calculated using a person's cumulative exposure to sound over a 24-hour period, expressed as the noise level for the average day of the year on the basis of annual operations.

3.4.4 Ground Vibration

AECOM have undertaken a literature review and identified DIN 4150-3 as a suitable standard which outlines 'safe limits' for ground vibration as Peak Particle Velocity (PPV) levels up to which no damage due to vibration effects have been observed for particular classes of buildings.

Damage is defined as anything from minor non-structural effects such as superficial cracking in cement render to the separation of partitions or intermediate walls from load bearing walls. Safe limits applicable to vibration levels of a short duration are summarised in **Table 3.4**.

Table 3.4: Structural damage 'safe limits' for construction induced short-term vibration on structures (DIN 4150-3)

GROUP	TYPE OF STRUCTURE	PEAK PARTICLE VELOCITY (PPV) in millimetres per second (mm/s)		
		At foundation at a frequency of:		
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100Hz
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50
2	Dwellings and buildings of similar design and/or occupancy	5	5 to 15	15 to 20
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g., heritage listed)	3	3 to 8	8 to 10

3.4.5 Air Overpressure

Structural damage to nearby buildings and human disturbance can be caused by high levels of air overpressure. High levels of air overpressure can often be perceived by humans as vibration as it can cause windows to rattle and other building elements to shake.

A literature review was undertaken to determine the most-appropriate criteria to apply to air overpressure produced by rocket launches. It was found that a maintaining a level below 133 dB (linear) peak would minimise the chance of damage to buildings and other structures.

This is consistent with the level applied to blasting activities within the Australian Standard, AS 2187.2-2006 Explosives – Storage and use Part 2: Use of explosives.

The assessment of potential damage has been based on the predicted Maximum Unweighted Sound Level (Lmax) for the largest rocket type modelled.

3.5 Methodology

Operational noise levels were assessed for the following activities:

- The operational of launch complex supporting infrastructure, including buildings, dams and workshops.
- A rocket launch or testing.

The methodology for predicting operational noise impacts is further discussed in the following sections.

3.5.1 Supporting Infrastructure - Assumptions

Noise from the operation of the launch facility would include industrial noise from the project area including generator noise, vehicle movements and other typical operational noise.

Supporting infrastructure has been modelled as operating separately for the assessment on the basis that this noise would be generated on a frequent basis through the day-to-day operation of the facility between actual launches. Noise emissions from key plant and activities were based on international standards and the AECOM noise source database.

Typical values for winching cranes and generators were obtained from British Standard BS 5228-1:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise.

Noise propagation calculations were performed assuming simple geometric spreading of sound from each noise source. Assumptions have been made where necessary in terms of estimations of the noise level, location, and expected operation of noise sources.

The following assumptions have been made to assess the typical operational noise levels of the launch complex:

- day to day operation of the facility would require generators providing power to support office buildings, dams, workshops and launch facilities;
- workshop activities would be similar to those at a mechanical workshop; and
- noise from the launch vehicle erector has been assumed to be similar to that of a large mobile crane.

The following table provides a breakdown of the proposed noise sources, the duration of each activity within a seven-day period and estimated sound power levels.

Table 3.5: Expected operation scenarios and duration

ACTIVITY	DURATION OF ACTIVITY WITHIN A 7-DAY PERIOD	ESTIMATED SOUND POWER LEVEL
General office activity and vehicle movements	5 days	LAeq 97 dB
Auto mechanic noise	Up to 2 days	LAeq 114 dB inside workshop
Launch vehicle erector (similar to a mobile crane winch)	10 minutes	LAeq 98 dB

3.5.2 Rocket Launch and Engine Testing – Assumptions

The main noise sources associated with a rocket launch or test can be attributed to the engine and exhaust. Environmental noise levels produced by these sources during rocket launch and testing events were predicted using the RUMBLE 3.0 Computer Modelling Package developed in the United States by Blue Ridge Research and Consulting (https://www.blueridgeresearch.com/).

This modelling package is used evaluate the far-field environmental noise impact associated with inflight and static operations of subsonic commercial launch vehicles. The software is approved by the United States Federal Aviation Administration and considered suitable to use during the development stage of the Project. It has been recently used for environmental assessments including the SpaceX DragonFly Vehicle at the McGregor test site in Texas.

RUMBLE 3.0 includes several updates that improve the functionality of the software over the version of the software used for modelling which was contained in the EIS (RUMBLE 2.0).

The updates include:

- an expanded database of default rockets available for modelling;
- updates to the rocket noise source levels and characteristics; and
- bug fixes and general improvements.

The software update has resulted in changes to the modelled noise level when compared to the EIS. A majority of the levels presented are slightly higher (up to 3 dB) than those previously presented for the Falcon 9 rocket. The exception being the calculated SEL that is notably higher (more than 10 dB) for the updated assessment. This has been attributed to the improvements to the software calculation module for this rocket.

The actual rockets to be launched at the facility cannot be specifically determined, with customers bringing a variety of new rocket types to the facility not available within the RUMBLE code. For the purposes of assessment, it is useful to compare rockets of the various scales which may be launched at the facility with rockets which already exist both in practice and in RUMBLE to provide appreciable context.

The assessment of noise for this project has been developing over the extended assessment timeframe time, over which familiarisation with software modelling packages has increased, updates to software have been released and additional literature has been referenced.

Initially, and due to lack of available rocket vehicle data for modelling purposes, the Space X Falcon 9 was adopted as a worst-case scenario for the assessment of noise impacts from the proposed facility. Whilst, from the perspective of impact on sensitive receivers, the modelling of the Space X Falcon 9 proved that the impacts upon the nearest sensitive receivers were seen as according with appropriate acoustic guidelines, the use of the Space X Falcon 9 was not indicative of the size of rockets to be launched from the WWOLC. In fact, the Space X Falcon 9 was over four times larger than the largest rocket expected to be launched from the WWOLC.

The next largest rocket, the Blue Origin New Shepard was slightly smaller than the largest rocket expected, so represented close to, but not, the upper bounds of the size of vehicle to be launched from the proposed facility. In order to provide a more realistic quantum of the types of rockets to be launched from Whalers Way, further work was undertaken by Resonate which enabled the software to be tailored for custom rocket vehicles based on size, thrust, tonnage and other technical metrics. This enabled the software to be tailored for custom rocket vehicles based on size, thrust, tonnage and other technical metrics.

Consequently, the 137 tonne Avio Vega orbital rocket was selected to be modelled as a realistic upper bound's vehicle. By comparison the Space X Falcon 9 which was previously used is 549 tonnes. This has provided Southern Launch with a realistic set of noise measurements which is now applied throughout this Response Document and has been used to update the Terrestrial Ecological Assessment and Marine Ecological Assessment.

For further clarification on the data, modelling and literature, please refer to the Resonate report in **Appendix C**.

To provide context of the relative scale of vehicles, six vehicles are represented in **Table 3.6** below.

Table 3.6: Comparative Rocket Types (for context and comparison only)

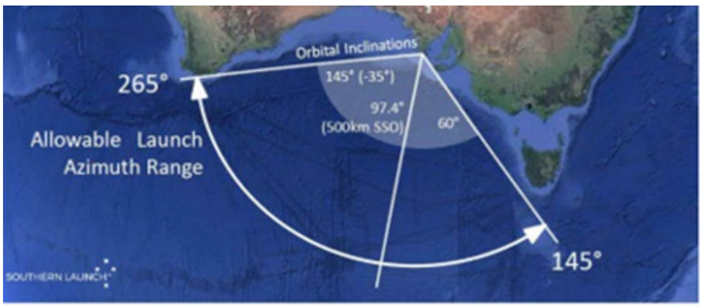
ROCKET	STATUS	MANUFACTURER	HEIGHT (M)	DIAMETER (M)	WET MASS (KG)	FIRST STAGE THRUST (KN)	LAUNCH LIKELIHOOD
SS-520	Active	JAXA	9.7	0.52	2,600	176	Regularly
Electron	Active	Rocket Lab	17	1.2	12,500	225	
Miura 5	Under Development	PLD Space	25	1.8	32,000	408	
Firefly Alpha	Active	Firefly Aerospace	29	1.82	54,000	736	

ROCKET	STATUS	MANUFACTURER	HEIGHT (M)	DIAMETER (M)	WET MASS (KG)	FIRST STAGE THRUST (KN)	LAUNCH LIKELIHOOD
New Shepard	Active	Blue Origin	18	7	75,000	1,020	Sometimes
Vega	Active	Avio	30	3	137,000	1963	Rarely
Long March 6	Active	Chinese Government	29	3.35	103,000	1,188	Rarely
Falcon 9	Active	Space X	70	3.7	549,000	7,600	Not Envisaged

As is shown in **Table 3.6**, above, where Space X Falcon 9 has been modelled, this represents a rocket s more than four times larger than the largest rockets proposed to be launched at the WWOLC, with a first stage thrust (which is relevant to the impact on the terrestrial and marine environment) also approximately five times greater than the largest rockets proposed to be launched at the WWOLC.

The modelling assumptions input into the RUMBLE 3.0 model as utilised by both AECOM and Resonate are summarised in **Table 3.7**.

Table 3.7: Noise modelling assumptions

ITEM	ASSUMPTION
Launch Sites	• -34.932804, 135.637994 (Site A) • -34.933906, 135.643307 (Site B)
Azimuth	The maximum range of azimuths that the site is likely to support is from 145 deg to 265 deg:  A single scenario of a launch with a trajectory in a southerly direction has been assumed. This is considered a reasonable approach as vertical launches have been assumed to produce a similar noise impact at ground level regardless of the azimuth.
Nominal Trajectory	**Stage** — **Trajectory and speed** Lift-off — • Notional speed: 0 km/h • Notional altitude: 0 m • Notional downrange distance: 0 m

ITEM	ASSUMPTION
	10 seconds after lift-off: • Notional speed: 106 km/h • Notional altitude: 192 m • Notional downrange distance: 0 m 30 seconds after lift-off: • Notional speed: 389 km/h • Notional altitude: 1,520 m • Notional downrange distance: 20 m 1 minute after lift-off: • Notional speed: 1,042 km/h • Notional altitude: 7,200 m • Notional downrange distance: 780 m 2 minutes after lift-off: • Notional speed: 3,800 km/h • Notional altitude: 38,000 m • Notional downrange distance: 17,600 m 2.5 minutes after lift-off: • The first stage of the launch vehicle separates
	Notes: Notional Speed: Notional velocity of launch vehicle. Notional altitude: Notional altitude of launch vehicle above initial launch height. Notional downrange distance: Notional offset distance from initial launch location within range of azimuths
Potential Rockets	• Medium size solid • Small size liquid • Small solid sounding rocket
Maximum sound power of rocket	Notional sound power level of 140 dB(A)based on Southern Launch specifications.
Launch vehicle	Maximum thrust at lift-off of launch vehicle of~1,200kN is assumed. The Avio Vega launch vehicle was selected from the RUMBLE database due to the similar levels of thrust to the maximum assumed. This is considered as the worst-case scenario as Southern Launch would typically launch much smaller rockets.
Number of launches	Maximum of one launch per week with up to 42 per year (36 orbital launches and 6 sub-orbital launches). A launch could be undertaken during day or night-time hours. Accordingly, assumed launch numbers have been assumed to be spread between day (7.00 am to 10.00 pm) and night (10.00 pm to 7.00 am), i.e., 11 launches during the day and 10 at night for each launch site. In practice, Southern Launch would not expect to undertake this many launches at night.
Launch testing (Site A)	Typically, prior to each launch of a liquid propellant rocket there would be single a "stack test" involving the first stage engine firing for approximately 10 to 15 seconds. This would take place with the rocket clamped down on the pad and the water sound suppression system operating. Solid rockets would not have any pre-launch firing tests. Controlled rocket engine testing would be undertaken up to 10 times per year between 7.00 am and 10.00 pm at Site A. Each test is expected to occur for approximately 2.5 minutes.

Predicted noise levels due to rocket launch and testing operations have been described using the following acoustic descriptors:

- Day-Night Average Sound Level (DNL);
- Maximum A-weighted Sound Level (LAmax);
- Maximum unweighted Sound Level (Lmax);
- A-weighted Sound Exposure Level (LAE); and
- Unweighted Sound Exposure Level (LE).

3.5.3 Modelled Construction Noise Levels

Table 3.8: Noise impact set back distances

ACTIVITY REFERENCE	CONSTRUCTION WORKS	SOUND PRESSURE LEVEL, LAeq, dB(A), AT DISTANCES FROM SOURCE						
		25m	50m	100m	200m	500m	1000m	2000m
C1	Site preparation	78	72	66	60	54	48	42
C2	Utility construction	83	77	71	65	59	53	47
C3	Foundations	78	72	66	60	54	48	42
C4	Structural works	75	69	63	57	51	45	39
C5	Testing and commissioning	73	67	61	55	49	43	37
C6	Roads, landscaping and reinstatement	77	71	65	59	53	47	41

3.5.4 Impact Assessment – Construction Noise

The construction works would typically occur between 7.00 am and 5.00 pm, Monday to Friday, excluding public holidays. This would be within the allowable construction hours for the *Environment Protection (Noise) Policy, 2007*, where no criteria are applied.

The construction noise level is calculated to be 53 dB(A) at the nearest residence for the worst-case construction scenario (during utility construction at Range Control Site E). This calculated worst-case level is deemed compliant with the assessment criteria as there are no specific noise criteria for construction works occurring between Monday and Saturday, 7.00 am to 7.00 pm, excluding public holidays.

Although construction noise is likely to be audible at times it is considered unlikely that construction noise would present a significant impact to the existing acoustic amenity at the closest residential locations as good practice construction methods would be adopted. Vibration impacts are also expected to be limited to within 100 metres of the work area and are considered to be unlikely to disturb humans at any stage of construction.

Accordingly, it is recommended that the good practice construction noise management measures are incorporated into the Construction Environmental Management Plan (CEMP). Southern Launch have committed to adopting these measures in the final CEMP.

Noise impacts from construction activities have not been identified as representing a significant risk. Nevertheless, all reasonable and practicable measures must be taken to minimise noise resulting from the construction in order to minimise the potential for adverse impact on the amenity of nearby residencies.

3.5.5 Impact Assessment – Operational Noise Supporting Infrastructure

Table 3.9: Setback distances and estimated noise levels from typical site facilities and supporting infrastructure

CONSTRUCTION WORKS	SOUND PRESSURE LEVEL, dB(A), AT DISTANCES FROM SOURCE						
	25m	50m	100m	200m	500m	1000m	2000m
Building generators	62	56	49	40	29	20	<20
Workshop activity	59	53	48	38	25	<20	<20
Lifting crane	61	54	47	37	26	<20	<20

In addition to these fixed operational noise events, up to 16 truck movements per week have been modelled. The maximum (LAmax) noise produced by a single truck movement would be approximately 85 dB(A) at 10 metres from a passer-by. These above truck movements are expected to typically occur throughout the day and are not expected to cause significant noise impact.

Noise generated from building generators and other supporting launch infrastructure and activities have been predicted to be less than 20 dB(A) at distances greater than 1.0 kilometre from the launch facilities.

These noise levels would likely be inaudible at the nearest residential locations at Fishery Bay, which are more than 3.5 kilometres away from any launch facility. It is considered unlikely that the typical operational activities, excluding a rocket launch or testing, would cause disturbance to the inhabitants of nearby residences.

3.5.6 Impact Assessment – Operational Noise Rocket Launches

Noise from launches and testing will temporarily alter the quiet setting of the natural environment for one to two minutes during launches and for up to 15 seconds during a stack test and for approximately 2.5 minutes for controlled rocket engine testing. These events have the potential to disturb nearby residents.

Parameters relevant to the disturbance of humans have been considered when calculating the impacts from the operational noise associated with launch vehicles. **Table 3.10** provides an overview of the parameters and assumptions for each scenario. The assumptions represent a scenario which is beyond worst case, as the largest rockets would only launch from Launch Site A, and not from Launch Site B. For the modelling, it has been assumed that rockets up to the largest size will launch from site Launch Site A and Launch Site B.

Notwithstanding that the Space X Falcon 9 has been superseded as the worst-case vehicle by the Avio Vega, it has been retained as for the purposes of assessment of impacts on sensitive receivers.

A full list of assumptions has been included within **Section 4.2.3**.

Table 3.10: Modelling scenarios

PARAMETER, dB(A)	SCENARIOS AND NOMINAL ASSUMPTIONS
LAmax and Lmax	The maximum instantaneous sound pressure level for a single launch for both Falcon 9 and New Shepard rockets from each proposed launch site.
LAE	The A-weighted Sound Exposure Level for a single Falcon 9 and New Shepard rocket launch assuming the loudest rocket would launch from each proposed launch site.
DNL	The combined future equivalent sound level for a 24-hour period assuming up to 42 launches per year and 10 tests. The following has been modelled for this assessment: • Site A launches: 11 day (7.00 am to 10.00 pm) and 10 night (10.00 pm to 7.00 am) - Falcon 9 and New Shepard launch vehicle. • Site B launches: 11 day (7.00 am to 10.00 pm) and 10 night (10.00 pm to 7.00 am) - Falcon 9 and New Shepard launch vehicle. • Site rocket testing: 10 day (7.00 am to 10.00 pm) for a duration of 2.5 minutes for each test.

This section presents the predicted noise levels associated with the launch and testing of rockets followed by a discussion outlining how these levels may impact the amenity of nearby residents. **Table 3.11** (Falcon 9),**Table 3.12** (New Shepard) and **Table 3.13** (Vega) provide an overview of the predicted levels at each residence.

The noise levels presented are considered a conservative approximation based on the information available at the time of the assessment. Furthermore, the noise reduction from the initial mitigation measures (water deluge and blast walls) captured within the design (see **Section 4.4**) have not been included within the results presented (this being due to limitations of modelling software).

Table 3.11: Sensitive receptors near launch activities (Falcon 9)

LOCATION	LAUNCH FROM SITE A			LAUNCH FROM SITE B			DAY-NIGHT AVERAGE SOUND LEVEL (DNL)
	LAmax	Lmax	LAE	LAmax	Lmax	LAE	
Residence 1	100	121	117	101	122	118	65
Residence 2							
Residence 3							

Table 3.12: Sensitive receptors near launch activities (New Shepard)

LOCATION	LAUNCH FROM SITE A			LAUNCH FROM SITE B			DAY-NIGHT AVERAGE SOUND LEVEL (DNL)
	LAmax	Lmax	LAE	LAmax	Lmax	LAE	
Residence 1	93	104	120	95	105	121	57
Residence 2							
Residence 3							

Table 3.13: Sensitive receptors near launch activities (Vega)

LOCATION	LAUNCH FROM SITE A			LAUNCH FROM SITE B			DAY-NIGHT AVERAGE SOUND LEVEL (DNL)
	LAmax	Lmax	LAE	LAmax	Lmax	LAE	
Residence 1	-	-	-	96	112	117	62
Residence 2							
Residence 3							

The LAmax levels for Launch Site A are shown for both the Space X Falcon 9 and Blue Origin New Shepard are shown on **Figure 3.3**.

The LAmax levels for Launch Site B are shown for both the Space X Falcon 9 and Blue Origin New Shepard are shown on **Figure 3.4**.

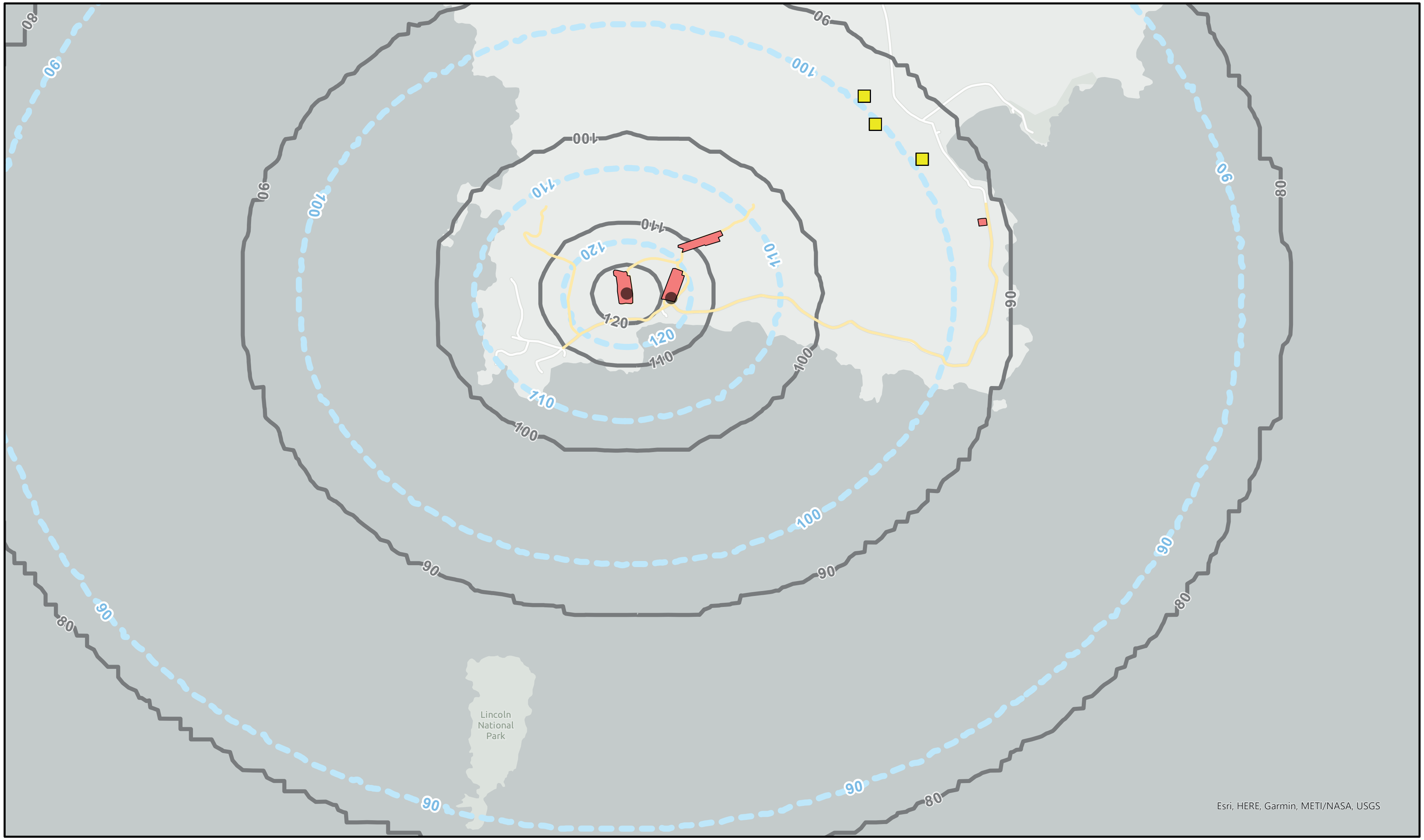
The DNL levels for combined for both Launch Site A and Launch Site B are shown are shown on **Figure 3.5**.

In respect of the modelling of the Avio Vega, undertaken by Resonate, only the impact from a rocket launch at Launch Site B has been modelled, representing the worst-case scenario in respect of the impact in the nearest sensitive receivers.

The Lmax levels for Launch Site B for the Avio Vega are shown on **Figure 3.6**.

The LAmax levels for Launch Site B the Avio Vega are shown on **Figure 3.7**.

The LAEeq,24hr levels for Launch Site B the Avio Vega are shown on **Figure 3.8**.



L_{Amax} Noise Levels (dB)

- Falcon 9 (Site A)
- New Shepard (Site A)
- Southern Launch Infrastructure
- Residential Locations
- Southern Launch Tracks
- Launch Pad

CALCULATED L_{AMAX} NOISE LEVELS FOR A ROCKET LAUNCH AT LAUNCH SITE A

Client: Southern Launch
Whalers Way Orbital Launch Complex - Environmental Assessment Report: Noise Assessment

Figure A

A3 size

FIGURE 3.3

LAMAX NOISE LEVELS - SITE A

SOURCE: AECOM

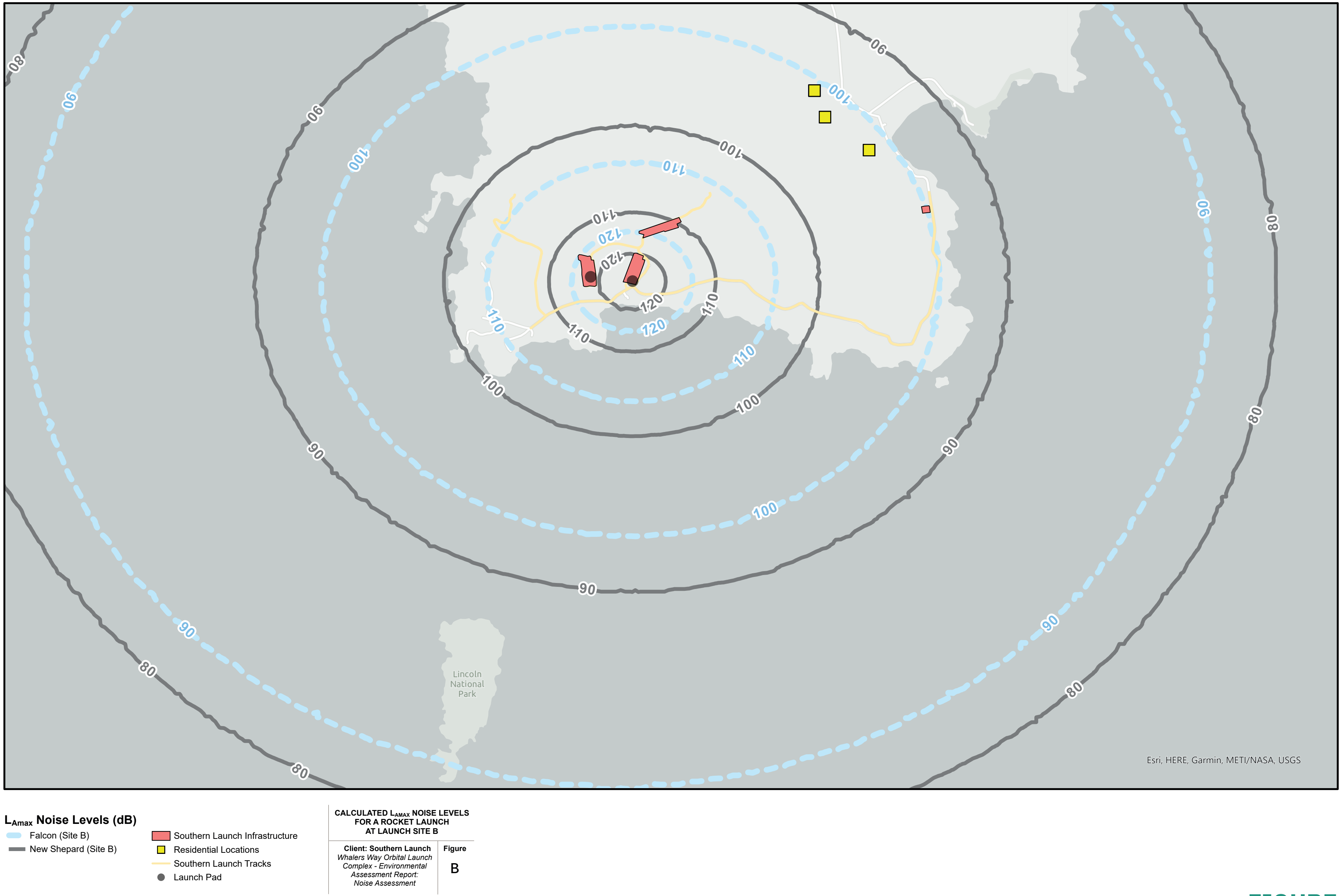


FIGURE 3.4

LAMAX NOISE LEVELS - SITE B

SOURCE: AECOM

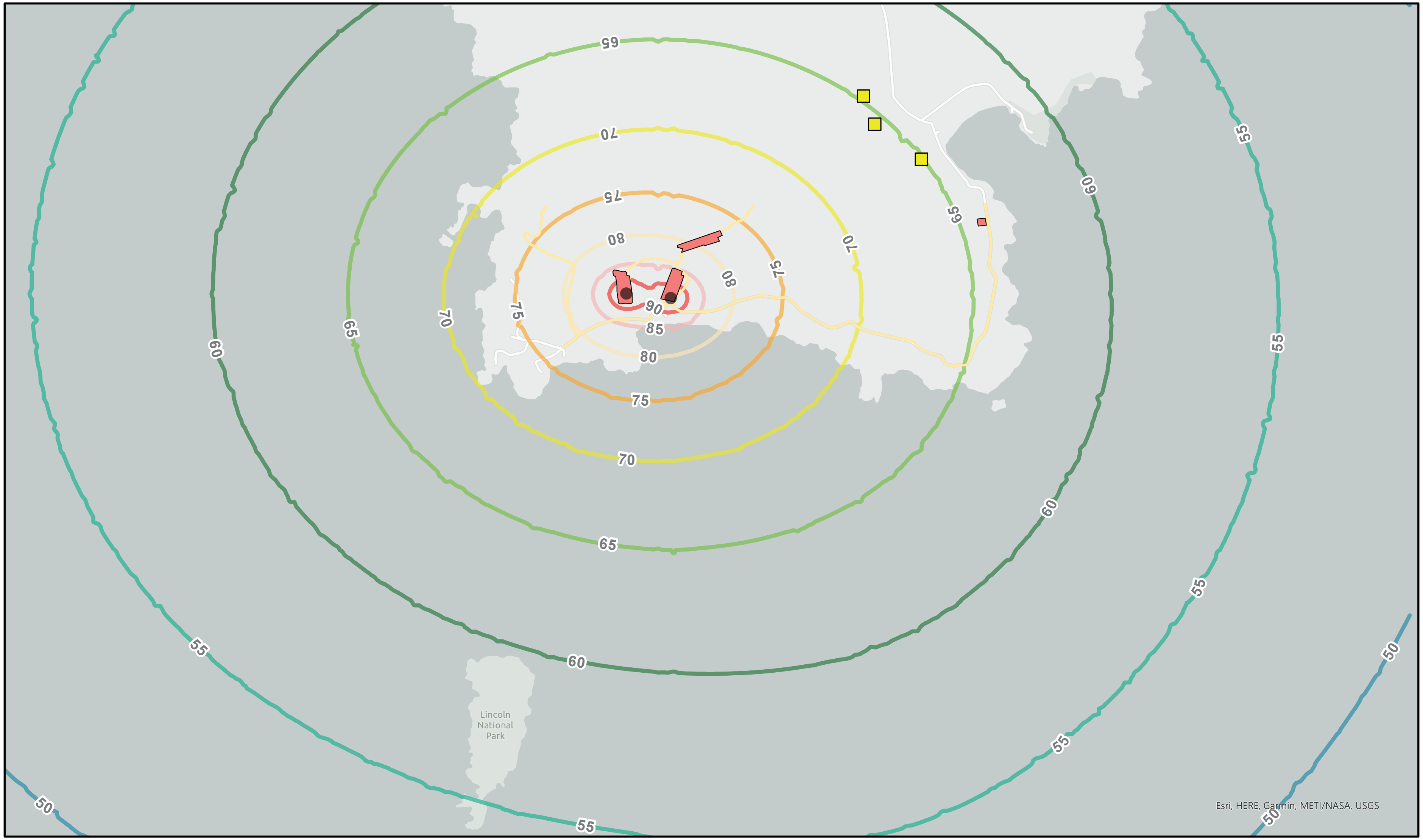


FIGURE 3.5

COMBINED DNL NOISE LEVELS - FOR SITE A & SITE B

SOURCE: AECOM

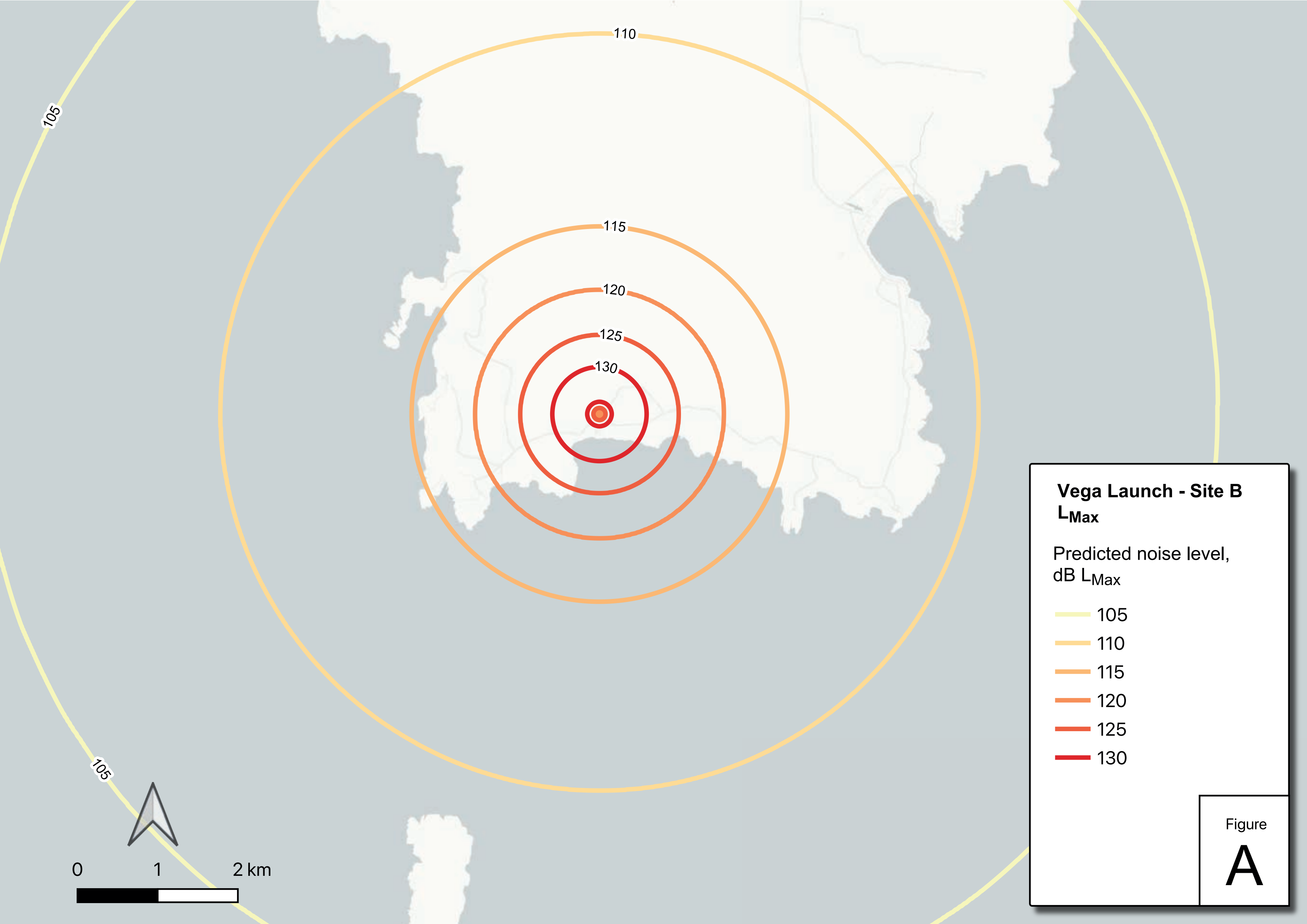


FIGURE 3.6

L_{Max} VEGA LAUNCH - SITE B

SOURCE: RESONATE

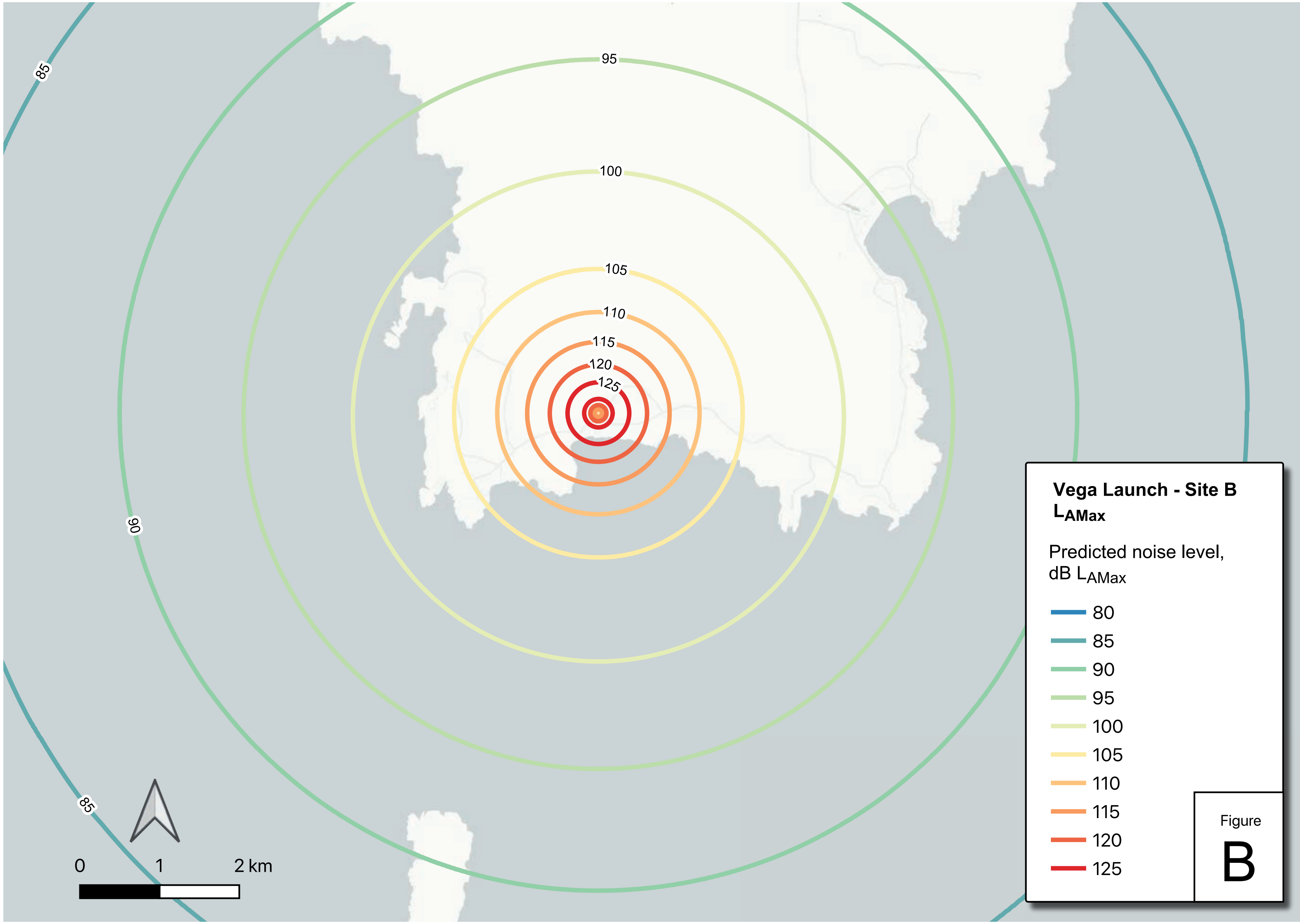


FIGURE 3.7

L_{AMax} VEGA LAUNCH - SITE B

SOURCE: RESONATE

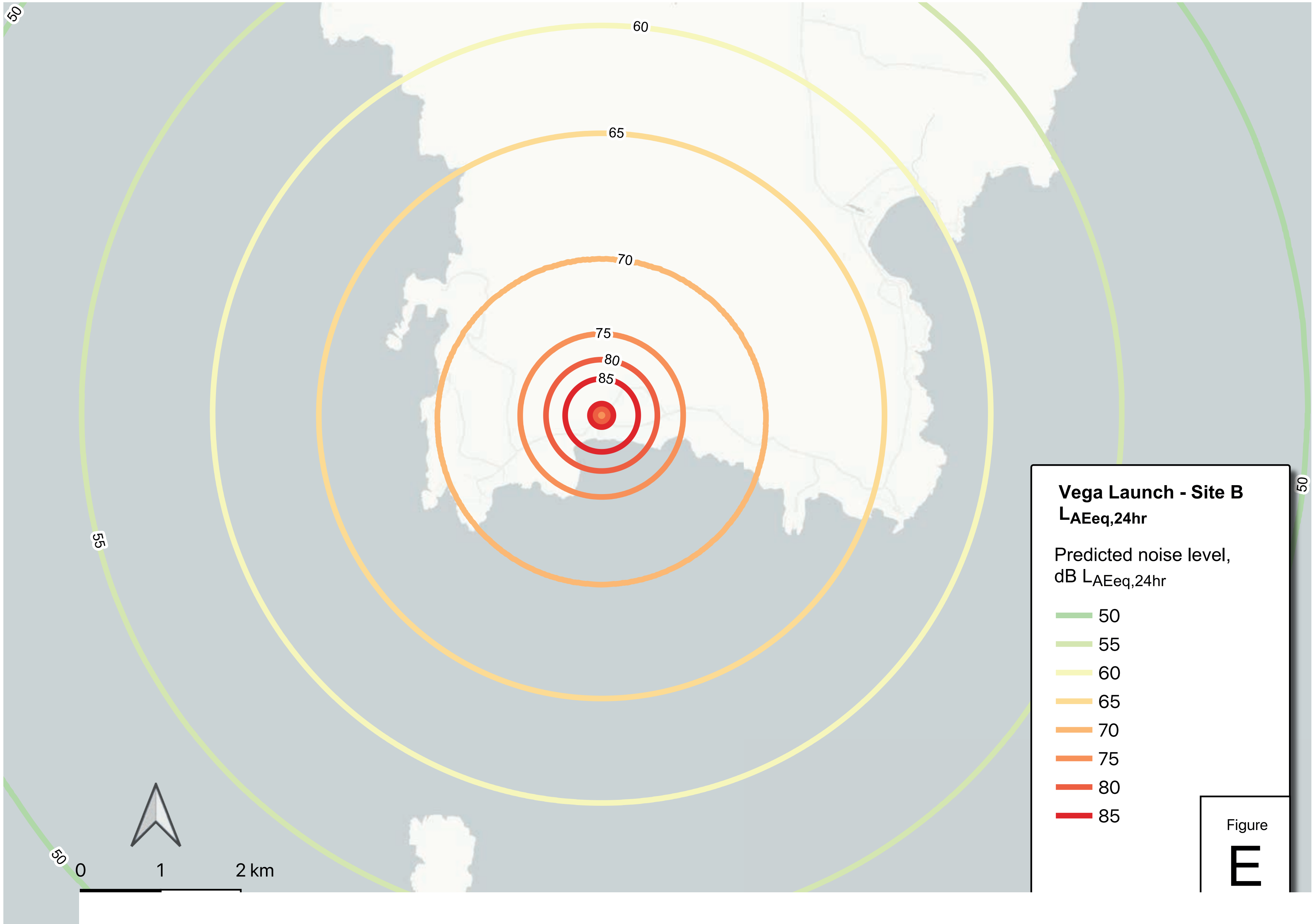


FIGURE 3.8

$L_{AEeq,24hr}$ VEGA LAUNCH - SITE B

SOURCE: RESONATE

The cumulative noise exposure (DNL) from the proposed ultimate operating scenario (42 yearly launches) is predicted to be equal to the proposed assessment criterion of DNL 65 dB(A) for the worst-case scenario where all rockets are either Falcon 9 (above the maximum thrust of the facility) or the New Shepard rocket (expected to be above the 85th percentile of all launch vehicles at Whalers Way) assumed to be operating is designed to support.

For comparison, if only New Shepard rockets were used at Whalers way, the predicted DNL value would be below 60 dB.

Achieving a DNL at or below 65 dB(A) indicates that the overall level and frequency of the planned Southern Launch activities are less likely to cause a significant community response to noise as per FAA recommendations.

This outcome does not mean that a launch would not cause annoyance or disturbance. At this stage of the project, it is assumed that a rocket could be launched at any time over a 24-hour period. Consequently, the maximum instantaneous noise produced by an individual rocket launch or static test is likely to cause disturbance at the neighbouring properties, particularly if these activities are undertaken at night.

Maximum external noise levels (LAmax) of up to 101 dB and 95 dB for each scenario were calculated outside the residential properties closest to Launch Site B. Noise at this level is likely to be of short duration (seconds) when a launch vehicle is close to the ground (beginning of a launch). This level would decline after launch due to the gradual decrease in energy output from the rocket and increase in altitude. A lower audible sound associated with the rocket engine may persist after the launch (approximately 1 – 2 minutes) under quiet conditions, such as a night time launch.

The external levels transferring to the inside of a typical residential building during a launch would likely be high enough to disturb sleep. Noise during a day launch or test may also be at an annoying outdoor level for a brief period (less than one minute) before ambient levels returned to normal. For context, AECOM have indicated that a comparable level of sound could be experienced by standing close to a train pass by or below an aircraft flyover at low altitude.

Additional mitigation at the source to reduce these levels is not considered to be feasible as the design has already incorporated a water deluge system to reduce both near and far field noise impacts and blast walls/bunds to reflect acoustic energy away from the launch vehicle and sensitive areas. In addition, as the noise source (launch vehicle) ascends the terrestrial based noise mitigation methods will provide no further mitigation.

Engagement measures proposed by Southern Launch would also include a plan to notify residents of upcoming launch activities and to restrict human presence within required launch safety areas prior to a launch. These actions may not necessarily reduce the noise level exposure, but would prepare residents for a loud acoustic event and inform them about the activities being undertaken on-site.

A noise monitoring and reporting program would also be developed to verify noise impacts of launch activity on nearby residents. AECOM have recommended that further considerations are made during detailed design regarding the scheduling of launches at night as impacts would be greatest during this time.

Southern Launch has committed to an ongoing monitoring and communication program in respect of the noise associated with launches.

3.5.7 Sonic Booms

The potential impact from sonic booms has been determined by comparing the impact of other launch facilities with a similar planned azimuth, trajectory and rocket size. The audible component of a sonic boom may sound similar to a single distant thunderclap. Exposure to this sound in a quiet environment could cause an unexpected disturbance to sensitive receivers.

Supersonic speeds are assumed to occur approximately 3.0 kilometres from the coast during vehicle ascent over the ocean. Sonic booms produced during vehicle ascent are typically directed in front of the vehicle and the entire boom footprint is usually some distance downrange of the launch site.

Furthermore, the rockets proposed for the Southern Launch facility are also relatively small which would limit the physical size of sonic boom being created. This means that the vehicle is unlikely to be big enough or located close enough to land to produce a focused boom that could reach the surface.

Impact assessments for suborbital rocket launch facilities in the United States (FAA, 2009) have concluded that sonic booms are less likely to contribute to other noise impacts associated with the launch if they occur over the ocean at a high altitude. Rocket landing events can often result in single or multiple sonic booms as vehicles return to subsonic speeds prior to landing however this type of activity is not proposed by Southern Launch at the WWOLC.

AECOM have concluded that the overpressure produced by the sonic boom is not expected to exceed the assessment criterion of 133 dB(L) on land.

3.5.8 Ground Vibration

The extent of ground and structural vibration produced by the acoustic environment near the launch vehicle is expected to be limited to the buildings and structures supporting the launch. This consideration is related to the design of the facility and is outside the scope of the assessment undertaken by AECOM.

No evidence of damage or significant disturbance caused by ground vibration during typical launch and testing operations was found when undertaking the literature review in preparation for the assessment undertaken by AECOM.

3.5.9 Air Overpressure

The potential for structural damage due to launch events is assessed by comparing the predicted Lmax values to the overpressure assessment criterion of 133 dB.

The highest predicted Lmax level is 122 dB for the worst-case rocket, being the Space X Falcon 9, launching from Launch Site B. Accordingly, AECOM assessed that damage due to air overpressure from launch events is not considered to be a significant risk.

3.5.10 Test Launch

Southern Launch sought and gained approval to undertake a test launch campaign comprising of up to three launches of the Hapith I rocket. At 4:08 pm on 16 September 2021, TiSpace attempted to launch the experimental VS01 sub orbital rocket from the temporary Pad 1 at the WWOLC.

During the launch attempt only one of the four engines completed ignition and produced 'launch' thrust. With less than full 'launch' thrust being produced by all four engines, the lift-off command was not sent to the rocket and all engines were successfully shut down.

Southern Launch's emergency response system was enacted with standard shut down, and 'safeing' procedures started with the oxidiser released from the onboard tanks. Residual heat from the rocket engines caused a fire to break out in the base of the rocket which damaged the rocket structure, causing it to fall from the rocket launcher.

The fall and fire damaged the first stage oxidiser tank resulting in a pressure-induced rupture of the tank pushing the rocket off the launch pad. Emergency services extinguished the small fire at the launch pad and the area was made safe.

An overview of the of the events at the time of the launch is presented in **Table 3.14**. This information was collected by TiSpace and provided for comparison to the measured noise levels during the noted events.

Table 3.14: Launch events 16 September 2021

EVENT	TEST LAUNCH DATE AND TIME (T)
	16/09/2021 4:08:35 PM
Automatic flight mode	T-31s
Activate launcher water deluge system	T-25s
Start S2 ignition command	T-14s
S2 main valve open *	T-2s
Flight termination system abort command	T+1s
S2 tank rupture *	T+10m31s

*** Loudest noise events as per AcousticReadingRecords-1516Sept2021.xlsx (TiSpace)**

Noise and vibration measurements were undertaken during this event to verify the levels in the surrounding environment and at residences closest to the site during launch.

A summary of the noise levels measured during the two key noise events associated with the test launch is presented in **Table 3.15**. These events were assumed to occur at approximately 4:08 pm and 4:19 pm on the day of the launch.

Weather conditions on the afternoon of the launch included a moderate north easterly breeze (20 to 28 kilometres per hour) with gusts of wind up to 44 kilometres per hour. No rain was noted within 24 hours of the test launch.

Acoustic monitors for the test launch were set up in eight locations, with vibration monitors in four locations. During the period the monitors were deployed, two were stolen. One monitor had corrupted data, which was unable to be downloaded, meaning that data was available from five of the eight acoustic monitors. Vibration data was available from two of the four vibration monitors.

The location of the monitors from which data was successfully collected is shown on **Figure 3.9**.

FIGURE 3.9

NOISE MONITORING LOCATIONS

SOURCE: AECOM

Table 3.15: Measured sound pressure level

SITE	APPROXIMATE DISTANCE FROM LAUNCH SITE	MEASURED SOUND PRESSURE LEVEL, DB			
		S2 Main Valve Open		S2 Tank Rupture	
		LAeq(1-min)	LAmax	LAeq(1-min)	LAmax
2	900 metres	65	71	69	79
4	1.7 kilometres	62	74	64	88
5	3.0 kilometres	43	49	44	54
7	2.1 kilometres	61	68	56	68
8	6.2 kilometres	62	66	65	69

A summary of vibration measurements undertaken are presented in **Table 3.16**.

Table 3.16: Measured vibration levels

LOCATION	MAXIMUM MEASURED PEAK PARTICLE VELOCITY (PPV, mm/s)
	Test launch
Site 4	0.3
Site 7	0.15

In addition to the monitoring equipment deployed by Southern Launch, monitoring equipment was also deployed by the EPA and by TiSpace.

The EPA undertook monitoring a day before the failed launch (15 September 2021) between 2.00 pm and 3:30 pm at approximately 100 metres from the launch vehicle. During the EPA monitoring, the rocket was able to reach the stage of the igniters firing before aborting before fuel was engaged (at approximately 2.14 pm on 15 September 2021).

The EPA measured 15-minute broadband and spectral levels with instantaneous sound pressure levels also being captured at 100 metre intervals.

Sound pressure levels measured during this activity were typically between 90 dBA and 105 -dBA with an LAmax of 109 dB.

TiSpace undertook noise monitoring at the launch pad and inside the vehicle during rocket firing on the 15 September 2021 and also during the test launch on the 16 September 2021. The levels recorded represent the highest level measured for each event before and after ignition.

Table 3.17: TiSpace measured levels 15 September 2021

EVENT	COUNTDOWN T-ss	ACOUSTIC VALUE INSIDE LAUNCHER (dB)	ACOUSTIC VALUE ON RIGHT SIDE OF LAUNCHER (dB)
Before	~	73	65
Automatic Flight Mode	T-31 to T-25	71	65
Activate Launcher Water Deluge System	T-24 to T-14	94	82
Start S2 Ignition Command	T-13 to T-3	108	117
S2 Main Valve Open	T-2 to T+1	108	135
FTS Abort Command	T+2 to T+6	111	137

Table 3.18: TiSpace measured levels 16 September 2021

EVENT	COUNTDOWN T-ss	ACOUSTIC VALUE INSIDE LAUNCHER (dB)	ACOUSTIC VALUE ON RIGHT SIDE OF LAUNCHER (dB)
Before	~	74	63
Automatic Flight Mode	T-31 to T-26	74	64
Activate Launcher Water Deluge System	T-25 to T-15	94	79
Start S2 Ignition Command	T-14 to T-3	89	104
S2 Main Valve Open	T-2 to T-0	109	108
FTS Abort Command	T+1 to T+10m0s	111	112
S2 Abort Command	T+10m31s	110	110
After Rupture	~	75	82

AECOM considered it likely that the external monitor was not operating correctly on the 16 September as the levels were expected to be higher than those recorded.

Noise measurements during the test launch were comparable to the ambient sound pressure levels measured before and after the event. Accordingly, the launch attempt may not have been audible at all monitoring locations and is unlikely to have caused adverse impact at the nearest residential receptors.

This conclusion was supported by anecdotal commentary from visitors located within the site approximately 3.0 kilometres from the launch. Visitors at this location reported that the test launch activities could not be heard.

Vibration measurements during the period of the launch indicated that the vibration was slightly above the measured average baseline levels. Levels at the magnitudes measured indicate that vibration-induced structural damage is unlikely to be a notable risk at residential receptors.

The estimated sound power level for the test launch was approximated by considering the following measured sound pressure levels:

- The maximum levels at Site 2 during the S2 Tank Rupture (79 dBA).
- The overall levels measured by the EPA at approximately 100 metres from the rocket ignition (90 to 105 dBA).
- The overall levels at the right side of launcher during the S2 Main Valve Open event on the 15 September 2021 (135 dB).

The octave band levels for the rocket launch have been based on the maximum predicted acoustic environment values provided within the SpaceX user guides.

This information was used to help create an acoustic model that would represent the noise produced during the test launch and allow for noise levels to be calculated for receptors outside of the monitoring locations.

The estimated sound power level and acoustic spectra for the test launch event is presented in **Table 3.19**.

Table 3.19: Estimated sound power level

ITEM	OCTAVE BAND FREQUENCY (Hz) SOUND POWER LEVELS (dB)							OVERALL SWL dBA
	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	
Rocket test launch	152	150	148	143	136	132	129	145

Note that the sound power level presented in **Table 3.19** should be considered relevant to the test launch only, as only one of the four engines were operating during the launch attempt.

3.5.11 Calculated Levels at Monitoring Locations During Test Launch

Noise emissions from the test launch were predicted using SoundPLAN version 8.2 environmental noise modelling software and the implementation of ISO 9613-2: 1996 'Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation'. ISO 9613-2 describes a method for calculating the attenuation of sound from industrial sources and is used to predict noise levels at noise-sensitive receptors.

The ISO 9613-2 methodology was considered acceptable in this instance as the launch vehicle was not airborne at any stage of the testing. Validation of noise from successful launches would utilise rocket noise modelling software such as RUMBLE 3.0.

The following inputs were included in all operational acoustic models:

- Terrain was based on elevation contour lines sourced from the Elevation and depth – Foundation Spatial Data (https://elevation.fsdf.org.au/)

Ground Absorptivity was modelled as:

- 50 per cent acoustic absorptivity within the terrestrial areas.
- Acoustically reflective in ocean areas.
- Structures were digitised from site layout files.
- Noise sources were based on the derived sound power levels using the measured levels during the test launch.

The levels presented are intended to provide a reasonable reproduction of the noise measured at each noise monitoring location. Accordingly, there may be some variation between the measured and modelled level due to complex noise environment at the launch site.

It is expected that noise predictions would continue to be refined using the additional data collected during future launches.

The calculated LAmax levels for the test launch are showing graphically on **Figure 3.10**.

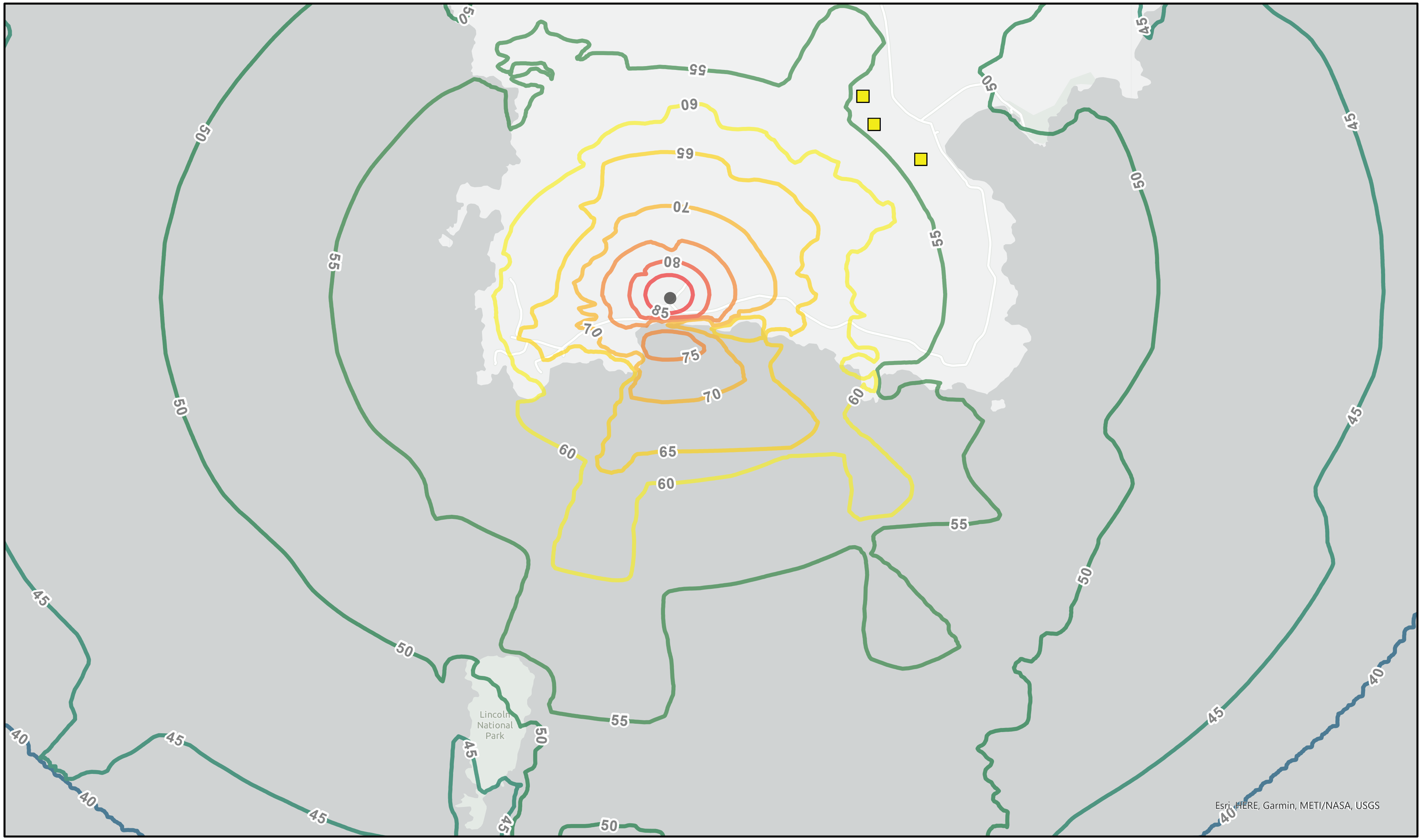


FIGURE 3.10

CALCULATED LAMAX LEVELS FOR TEST LAUNCH

SOURCE: AECOM

3.5.12 Static Motor Test (Queensland)

In addition to the VSO-1 test launch undertaken at the project site, a static motor test of a Hapith 1 rocket was undertaken at a launch site in Helidon, Queensland in June 2022. As the motor test was for the engines of the same rocket being used in the test launch campaign, this test provided an opportunity to gain further empirical data in respect of the noise generated and the propagation of that noise at various distances from the motor test stand. In a similar manner to the test launch campaign, the empirical data collected provided an opportunity to verify the computational modelling undertaken to predict the noise generated at the proposed facility.

The static test occurred at approximately 4:00 pm on 9 June 2022. Resonate staff attended the site and set up monitoring equipment prior to the motor test. Eight noise monitors were deployed at various locations from the static test to measure Unweighted and A-Weighted maximum (LMax/ LAmax) and Sound Exposure (LE / LAE) levels.

This static test provided an opportunity to:

- gather further empirical data; and
- validate the noise predictions provided by the RUMBLE software utilised in the AECOM and Resonate reports.

<u>Empirical Data</u>

There were eight measurement locations in various proximity to the static test. These locations are set out in **Table 3.20** below, with a Figure also providing these location on a map in **Figure 3.11**.

Table 3.20: Static test noise monitoring locations

LOCATION	LATITUDE	LONGITUDE	DISTANCE FROM TEST (metres)
N1	-27.5062484	152.1483161	120
N2	-27.5037974	152.1500505	461
N3	-27.4835131	152.1622109	2990
N4	-27.4630067	152.1822826	5960
S1	-27.5077046	152.1479563	62
S2	-27.5114871	152.1562125	937
S3	-27.5219526	152.1607314	2060
S4	-27.528993	152.1648989	2930

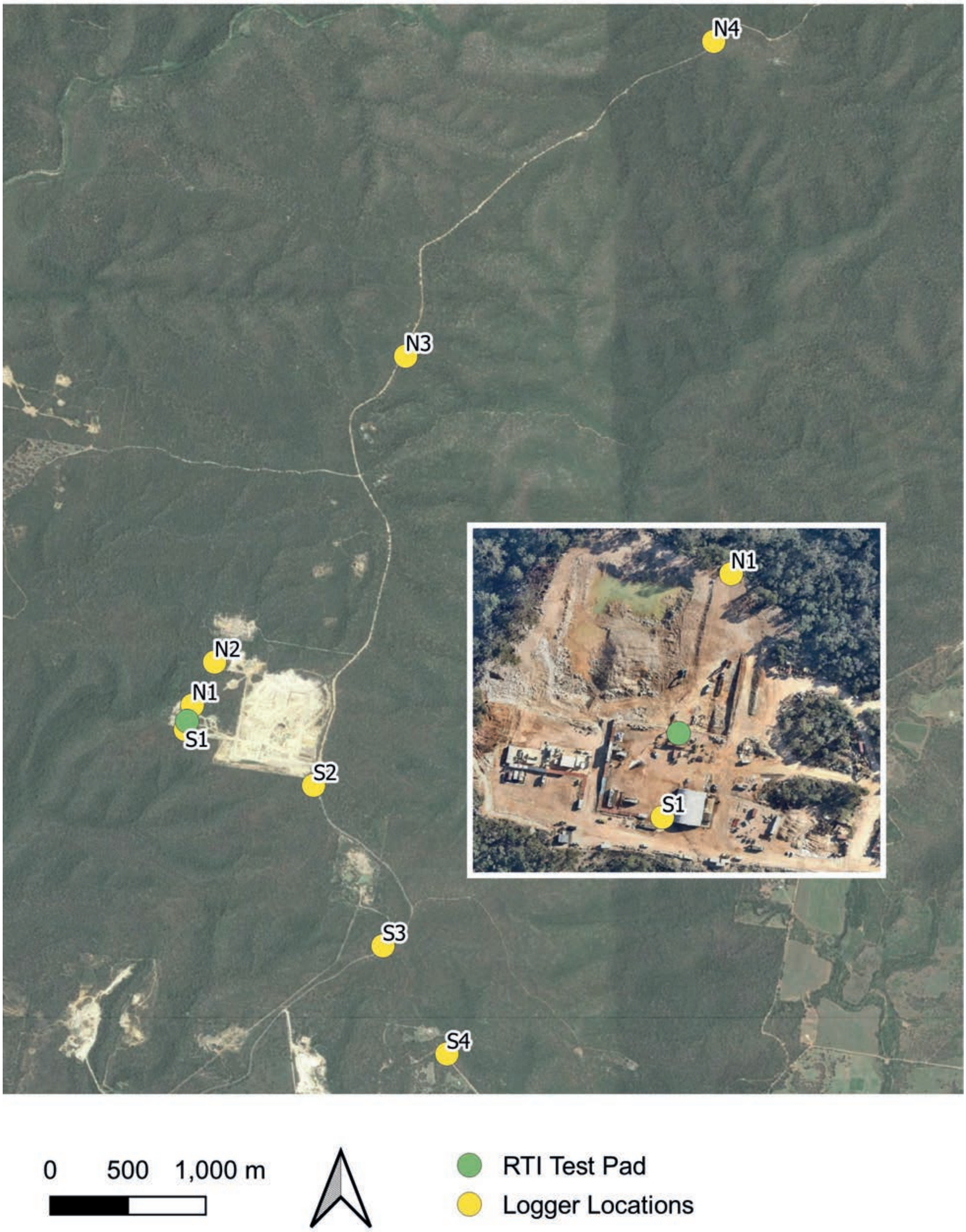


FIGURE 3.11

NOISE LOGGING LOCATIONS

Results

The rocket motor test proceeded successfully, with data being gathered from seven of the eight noise monitors. The data gathered is presented in **Table 3.21** below.

Table 3.21: Static test measured noise levels

LOCATION	UNWEIGHTED, DB		A-WEIGHTED, DB(A)		NOTES
	Lmax	LE	LAmax	LAE	
N1	120	121	112	116	
N2	104	110	97	106	
N3	73	83	65	75	
N4	67	78	52	66	
S1	115	122	107	122	
S2	90	94	82	94	Influenced by truck pass-by during test
S3	-	-	64	76	
S4	-	-	-	-	No data – equipment fault

RUMBLE Data Validation

Resonate then proceed to compare the gathered data with the predictive model from the RUMBLE software. To achieve this, the exact specifications of the Hapith 1 rocket were inputted as parameters into the RUMBLE software package, and the noise recorder distances were applied.

The outcome of this comparison, undertaken by Resonate, was that the predicted data by RUMBLE provided very similar data in terms of the LAmax measurement. The comparative results are outlined in **Table 3.22** below:

Table 3.22: Static test predicted versus measured levels

LOCATION	PREDICTED NOISE LEVEL, DB LAMAX	MEASURED NOISE LEVEL, DB LAMAX	DIFFERENCE, DB
N1	112	112	0
N2	94	97	-3
N3	71	65	6
N4	60	52	8
S1	118	107	11
S2	87	82	5
S3	77	64	13
S4	71	-	-

Measured noise levels are most consistent with modelling results at locations near to the test site where there is a line of sight between the measurement location and test pad.

At larger distances and/or where there is shielding of the line of sight from topography or noise barriers, such as shipping containers installed surrounding the motor test stand, the measurement results are consistently less than predicted. These results expected since the RUMBLE model does not account for topography and shielding.

It is noted that the measured noise level is slightly higher than the predicted noise level at location N2. Resonate have inferred that this may be due to reflection of sound off the quarry face, which is also not accounted for in the RUMBLE model.

3.5.13 Summary of Findings

Resonate have determined that based on the measurement data the rocket test had a sound power level of 158 ±3 dB(A).

Comparison with predicted levels using a RUMBLE 3.0 model showed the measured levels were less than predicted at all locations, with the exception of an under-prediction by 3 dB(A) at location N2, approximately 460m to the north of the rocket, where measured levels may have been elevated due to noise reflecting off the quarry face immediately south of the test pad.

Based on this comparison work undertaken it is concluded that the RUMBLE software provides a suitable predictive model for the noise levels of rocket launches at the Whalers Way Facility.

3.5.14 Transfer of Noise to Marine Environment

Resonate were engaged to provide technical advice on potential noise impacts on marine fauna from launch activities at the Whalers Way Orbital Launch Complex.

Sound pressures are measured with a hydrophone when underwater and a microphone when in air. The international standard unit of sound pressure is the Pascal (Pa). Sound pressures encountered underwater and in air range from levels just detectable by the mammal ear (hundreds of micro Pascals (µPa)) to much greater levels causing hearing damage (billions of Pa). Because this range is so enormous, sound pressure is normally described in a logarithmic scale in terms of a sound pressure level (SPL) with units of decibel (dB), referenced to a standard pressure of 1 µPa for underwater and 20 µPa for airborne acoustics.

Based on the launch sound level spectra, and air to water transmission loss from Bevans (2018), underwater noise levels of up to 125 dB rms and SEL24hr 137 dB re 1 µPa are predicted due to launch of a Avio Vega or equivalent rocket. The predicted underwater noise levels are less than the hearing damage thresholds for fish and turtle species.

A noise level of up to SEL24hr 135 dB(LF) SEL is predicted with application of a low frequency marine mammal (LF) weighting. This is less than the TTS criteria of SEL24hr 168 dB(LF) for impulsive noise and SELC 179 dB(LF) for continuous noise. Underwater noise levels are also less than the (significantly higher) TTS and PTS thresholds for other marine mammal species.

Due to the different reference levels, density and speed of sound in air and water media, there is a difference of approximately 62 dB for a sound with the same absolute intensity in air and water. For example, a sound level of 100 dB re 20 µPa in air is approximately equivalent to 162 dB re 1 µPa in water.

Sounds are usually characterised according to whether they are continuous or impulsive in character. Continuous sounds occur without pauses and include shipping noise and dredging. Impulsive sounds (such as hammer piling) are of short duration and can occur singularly, irregularly, or as part of a repeating pattern, over a broad range of frequencies.

Noise from launch activities would generally be characterised as continuous rather than impulsive, although it should be noted that it is of limited duration compared to many other sources of continuous underwater noise.

Based on the launch sound level spectra predicted by AECOM, and air to water transmission loss, underwater noise levels of up to 147 dB rms and SELC 164 dB re 1 µPa are predicted. As noted above, these levels are conservatively based on an overhead noise source and actual noise levels are expected to be lower. Noise levels will also decrease at greater distances from the launch pad, and with increasing water depth.

The transmission of sound to water does not relate to the impact of the facility on sensitive receivers. Consideration of the impact of underwater sound on marine fauna is further addressed in Section 5.0.

3.5.15 Mitigation Measures

The project design, construction methodology and operation strategies were progressed at the commencement of this impact assessment. Accordingly, mitigation measures that were already incorporated in the project planning have been considered within the assessment.

These initial mitigation and control measures are summarised in **Table 3.23**.

Table 3.23: Planned mitigation and management measures

DESIGN ASPECT	MITIGATION AND MANAGEMENT MEASURES
Construction noise management	If a construction activity results in noise with an adverse impact on amenity, all reasonable and practicable measures must be taken to minimise noise resulting from the activity in order to minimise the impact. This includes (but is not limited to) the following measures to the extent that is practicable: • Scheduling particularly noisy activities to commence after 9.00 am where reasonable and practicable to do so.

DESIGN ASPECT	MITIGATION AND MANAGEMENT MEASURES
	• Locating noisy equipment (such as masonry saws) or processes so that their impact on neighbouring premises is minimised (whether by maximising the distance to the premises, using structures or elevations to create barriers or otherwise). • Shutting or throttling equipment down whenever it is not in actual use. • Ensuring that noise reduction devices such as mufflers are fitted and operating effectively. • Ensuring that equipment displaying wear-induced noise characteristics is repaired or maintained prior to use. • Operating equipment and handling materials so as to minimise impact noise. • Using off-site or other alternative processes that eliminate or lessen resulting noise.
Water deluge system	Water deluge systems reduce noise impact by producing water droplets that interact with the generated sound waves. The sound energy is converted into heat energy through the water being turned to steam. This reduces emission of engine and booster noise from the launch pad. Water-based acoustic suppression systems are in common usage on launch pads, where they offer typical noise reductions of 3-5dB.
Flame trench	For larger rockets a flame trench will be used to redirect rocket exhaust and associated acoustic pressure in an upwards trajectory towards the south.
Blast deflection bunding	For smaller rockets where a flame trench would be deemed too large, blast deflection walls are to be constructed/placed to channel the rocket exhaust up and away from the pad. The blast deflection walls will be constructed or placed either side of the launch pad, providing a physical barrier between the launch pad and the areas of the site where the surrounding environment is closest to the pad itself.

3.5.16 Noise Monitoring Program

Southern Launch is committed to comprehensive noise monitoring associated with the proposed facility to provide ongoing data associated with launches, which will underpin the ongoing ecological monitoring and assessment associated with the facility. To this end Southern Launch will further develop a bespoke Noise Monitoring Program. The Noise Monitoring Program will be an evolving document that would be tailored based on evidence gathered throughout operation of the facility and on feedback from the EPA and other relevant regulatory agencies.

Initially however, the remaining two launches of the test launch campaign provide opportunity to further develop this program. In advance of the Noise Monitoring Program which will support permeant operation of the facility the remaining two test launches will involve terrestrial based noise monitoring which replicates that employed for the first test launch.

The second launch, and potentially the third launch, will also involve:

- Noise monitoring on Liguanea Island, as was attempted for the first test launch.
- The placement of hydrophones to gain additional information in respect of underwater conditions during the launch.

This is seen to add to the readiness of the Noise Monitoring Program moving into permanent operation of the facility. For ongoing operations, Southern Launch will install permanent noise monitoring equipment on the site, which is proposed to be located adjacent the launch pads at Launch Site A and Launch Site B. A minimum of two further noise monitors will be placed at distances of nominally 1.0 kilometre and 5.0 kilometres from the sites.

Southern Launch intends that the permanent noise monitoring equipment will be permanently powered and telemetered so as to provide noise data which is available in as close to real time as possible.

Southern Launch will share the raw noise data with the EPA (and other relevant regulators) and summarised data with the public on an ongoing basis to ensure clear visibility of the noise generated by permanent operations on the site.

Southern Launch further intends to retain the services of a qualified acoustic expert for a minimum period of the first three years of operations to analyse the noise data collected and provide feedback and recommendations to Southern Launch on operational and design mitigations that can be applied to the facility and updates and refinements to the Noise Monitoring Program.

3.6 Conclusion

Having regard to the submissions which raise issues associated with the acoustic performance of the facility, the majority of these relate to the impact on terrestrial and marine fauna, which is considered further in **Section 4.0** and **Section 5.0**.

In respect of the impact of noise and vibration on the nearest sensitive receivers, the updated report prepared by AECOM, following the exhibition of the EIS reaches the following conclusions:

- That the impact of construction noise on the nearest sensitive receivers is unlikely to be significant, provided that construction occurs in accordance with relevant EPA guidelines and that appropriate noise management practices and procedures detailed in the Construction Environmental Management Plan are implemented during the construction.

- That the impact of operational noise, other than of rocket launches, on the nearest sensitive receivers is unlikely to be significant, provided that appropriate noise management practices and procedures are implemented on an ongoing basis during of the operation of the proposed facility.
- That the impact of operational noise from rocket launches is likely to result in some degree of impact on the nearest sensitive receivers.

Whilst the impact of operational noise from rocket launches is anticipated to have an impact on the nearest sensitive receivers, there is no legislated regulatory standard against which to quantitatively assess the appropriateness of this impact. AECOM has assessed the cumulative impact using the DNL standard recommended by the FAA, and has confirmed that the impact of the proposed facility at the nearest sensitive receptors is equal to the guideline.

Having regard to the level of conservatism in the modelling undertaken by AECOM, particularly given that it has been based on a rocket over four times larger than the largest rocket to be utilised at the WWOLC, the actual impact on the nearest sensitive receivers is anticipated to be less than the guideline.

From a qualitative perspective, AECOM have concluded that the rocket launches will be audible from and cause some degree of impact upon the nearest sensitive receivers. However, the impact of the rocket launches on the nearest sensitive receivers needs to be appropriately balanced against the frequency and duration of the impact. Even operating at full capacity of 42 launches per year; the acoustic impact of each launch will last for only several minutes in an average period of over eight days. The occupiers of surrounding residences will have prior notification of the impact of launches, as part of a comprehensive ongoing engagement program to which South Launch has committed.

The impact of launches on sensitive receivers has some similarities to the impact of aircraft noise, however the frequency of the impact will be significantly less than that of an airport or significant flight path. The proposed facility is located in an area where the number of sensitive receivers is small. This was a key selection criterion in the site search and selection process. Whilst there will be a degree of impact from the launches, the impact will be consistent with the applicable guideline identified by AECOM and will be very limited in duration. Appropriate management measures will further mitigate the impact.

The assessment of AECOM is that vibration, air overpressure and sonic boom impacts on sensitive receivers are unlikely to be material.

Resonate have compared the noise levels predicted by the RUMBLE software, which has formed the basis of the predictive modelling undertaken by AECOM, with empirical noise data collected from an engine test undertaken in Queensland in June 2022. This comparison has provided validation of the predictive noise monitoring, confirming it as a suitable basis for the assessment of expected noise impacts from the proposed WWOLC.

On balance, have regard to the research and reporting undertaken by AECOM and RESONATE it is considered that the noise and vibration impacts on sensitive receivers of the proposed facility have been adequately modelled using appropriate computational predictive modelling software. It is further considered that the predicted noise and vibration impacts on sensitive receivers, in respect of construction, ordinary operations and rocket launches proposed to occur at the WWOLC are acceptable.

4 TERRESTRIAL ECOLOGY

4.0 TERRESTRIAL ECOLOGY

4.1 Background

The proposal involves the establishment of built infrastructure in a location where at the present time limited built form exists. The construction will involve the development of four discrete areas of the site, together with the upgrade of exiting access tracks and the establishment of new access tracks to connect the development areas to the existing access tracks.

To site the proposed infrastructure, clearance of vegetation will be required to site the four sites, new access roadways and upgrades to existing access roadways.

The Terrestrial Biodiversity Technical Report, prepared by AECOM, undertaken for the project and referenced in the EIS, acknowledged that there will be ecological impacts in the Whalers Way site, emanating from the project. These effects will result from the clearance of vegetation, construction and operational impacts of the proposal.

Following the exhibition of the EIS, the project has been refined to relocate Site A. The primary purpose of the Site A relocation was to reduce the terrestrial ecological impact of the proposal.

Contemporaneously with and subsequently to exhibition of the EIS, AECOM was engaged to undertake significant further investigations including surveys associated with the approved test launch campaign and further surveys to investigate alternative siting and design options to reduce the impact of the proposal on the Whalers Way site and surrounding area.

Additionally, further acoustic investigations undertaken by Resonate have provided further information in respect of the impact of noise from the proposed operations of the WWOLC, most particularly rocket launches. This additional review and information has provided further data in respect of the potential for threshold shifts in terrestrial avian species found on the site, resulting in a significant reduction in the level of uncertainty in respect of these issues.

These investigations, together with review of the submissions received during exhibition, culminated in the relocation of Site A as the best option to reduce the impact of the proposed development, whilst still allowing the proposal to achieve its operational requirements.

The extent of terrestrial ecology survey work now undertaken by AECOM includes:

- a detailed desktop assessment, undertaken to inform the initial baseline survey (February 2020);
- a baseline field survey (March 2020);
- a targeted fauna survey (June 2020);

- a targeted flora survey (October 2020);
- test launch campaign survey;
  - site selection survey (June 2021);
  - test launch 1 pre-launch survey (August 2021);
  - test launch 1 post-launch survey (September 2021);
- Site A relocation survey (December 2021).

The methodology for these investigations and their findings are described in further detail in **Section 4.4**.

AECOM have presented their findings in an updated of the Terrestrial Biodiversity Technical Report which details the additional investigations and updated findings, contained in **Appendix D**.

In respect of terrestrial ecological impacts, it is noted that since exhibition of the EIS, the proposed has been determined to be a controlled Action pursuant to the *Environment Protection and Biodiversity Conservation Act, 1999* (Cth). In respect of terrestrial species, this relates specifically to the impact on the Southern Emu-Wren and Mallee Whipbird. Specific assessment of the proposal on these two species will be undertaken pursuant to the requirements of the EPBC Act, including the preparation of management plans and the provision of appropriate offsets in respect of these species.

As noted above, one of the potential ecological impacts relates to noise impacts on terrestrial fauna. Separate reporting has been prepared which considers the acoustic performance of the facility, which is addressed in **Section 3.0**. The acoustic reporting focuses on an empirical analysis of the noise which is forecast to be generated by the proposal. The impacts on that noise on terrestrial fauna are considered in the Terrestrial Biodiversity Technical Report and detailed in this section.

4.2 Summary of Submissions

Impacts on the terrestrial ecology of the site was frequently mentioned in the submissions received during the exhibition of the EIS. Representations raised issues related to terrestrial ecology in a broad range of contexts, which have been grouped into different issues.

The issues grouping have been developed as follows:

- Habitat loss — 35 mentions.
- Endangered species — 26 mentions.
- Southern Emu-wren (Eyre Peninsula) — 26 mentions.
- Noise and Vibration — 24 mentions.

- Mallee Whipbird 19 mentions.
- Native Vegetation Impacts 17 mentions.
- Coastal Erosion 17 mentions.
- Other Fauna Species Impacts 13 mentions.
- Hearing loss – animals 10 mentions.
- Roadkill 4 mentions.
- Biodiversity loss 1 mention.
- Environmental damage 1 mention.

The submissions refencing these issues included P26, P28, P30, P32, P41, P42, P43, P45,47, P51, P59, P61, P62, P66, P67, P68, P69, P71, P72, P73, P74, P106, P107, P109, P113, P122, P123, P124, P126, P127, P131, P139, P140, P148, P150, P152, P153, P155, P157, P158, P161, P163, P164, P165, P167, P170, P172, P182, P183, P185, P186, P191, P192, P194, P195, P198, P199, P200, P203, P206, P207, P209, P, 211, P215, P219, P223, P226, P227, P228, P231, P232, P238, P239, P244, P246, P249, P253, P254, P255, P256, P257, P258, P261.

4.2.1 State Government Agency Responses

In relation to the Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird DEW have provided comment in respect of the in which they state:

Operational noise through the launching of rockets at a frequency of once every three (3) weeks for a duration of 75 seconds will generate noise at a level that will likely impact the species up to a distance of 4.0 to 5.0 kilometres from the launch site. The species is sensitive to discrete, unpredictable disturbances such as sudden loud noises that can cause physiological effects, such as stress, avoidance and fright-flight responses, nest abandonment, damage to hearing from acoustic over-exposure, and masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects.

In addition, and in relation to the Osprey and White-bellied Sea-eagles. DEW state that:

Should the proposal proceed, a comprehensive survey by a suitably qualified coastal raptor expert should be undertaken and mitigation and monitoring measures identified and implemented.

There is an interrelationship between the issues raised in the representations and the terrestrial ecological impacts of the proposal relating to the clearance required to establish the proposed development, the construction impacts and the impacts from operation of the facility. Where representations relate to specific flora or fauna species, they typically reference the impacts emanating from the proposed development.

4.3 Discussion

The proposed development has adopted a broad range of techniques to minimise the impact on terrestrial ecology. These are categorised under responses in respect of:

- Site selection for the facility.
- Design of the facility, including internal site selection processes.
- Construction techniques and management.
- Operational techniques and management.

The proposed development will have an impact on the terrestrial ecology of the subject site.

The potential impacts of the proposal have been assessed in detail in the AECOM Terrestrial Biodiversity Technical Report under the following headings:

- Habitat Loss and Degradation from Vegetation Clearing.
- Fauna Species Injury or Mortality.
- Disturbance to Breeding and Foraging Habitat.
- Edge Effects.
- Habitat Fragmentation.
- Barrier Effects.
- Dust and Light Impacts.
- Noise and Vibration Impacts.
- Dam and Detention Basins.
- Irrigation.
- Increased Fire Risk.
- Indirect Impacts.

In responding to the representations, we do so with reference to the potential impacts. The discussion following is structured as follows:

- An outline of the survey methodology.
- Discussion of why alternative sites for the project are not feasible.

- Habitat loss and vegetation clearance.
- The methodology for the internal relocation of Site A.
- Fauna species injury or mortality.
- Disturbance to breading and foraging habitat.
- Edge effects.
- Habitat fragmentation.
- Barrier effects.
- Dust and light impacts.
- Noise and vibration impacts.
- Dam and detention basins.
- Irrigation.
- Increased fire risk.
- Indirect impacts.
- Coastal and Dune erosion and hazards.

4.4 Survey Methodology

The terrestrial biodiversity assessment has been expanded with significant additional survey work since the exhibition of the EIS. Ecologists have now undertaken surveys on the terrestrial site on seven (7) occasions from February 2020 to December 2021. The field survey work has resulted in the acquisition of a significant set of data pertaining to the ecological conditions of the subject site.

The survey methodology and investigations undertaken represents a significant level of investigation of the terrestrial biodiversity values of the site, which has provided an enhanced understanding of the likely impacts of the proposal and the mitigation options which are available. Having regard to the requirements outlined in the Assessment Guidelines, the methodology adopted both prior to the preparation of the EIS and subsequently up to the completion of this Response Document is considered to be comprehensive and have appropriately identified and categorised the potential impacts of the proposed development.

A brief description of each element of the survey work is set out below.

4.4.1 Desktop Assessment (February 2020)

A detailed desktop assessment was conducted to inform the baseline field survey, which described the existing environment and determined the potential environmental values present within the project area. The desktop assessment considered the following resources:

- The EPBC Act Protected Matters Search Tool (PMST) administered by DAWE was searched for an area encompassing an additional 10 kilometre buffer on the project Area (DAWE 2020a);
- The Department for Environment and Water (DEW) Biological Databases of SA (BDBSA) via NatureMaps was used to identify flora and fauna records and vegetation mapping (DEW 2020a);
- SA Resources Information Gateway (SARIG, 2020); and
- Eyre Peninsula fauna surveys 2004 and 2009 as published on NatureMaps (DEW 2020b) and in Brandle (2010).

A broad range of additional reports were utilised, as detailed in the AECOM Terrestrial Biodiversity Technical Report.

4.4.2 Baseline Survey (March 2020)

A baseline field survey was undertaken between 16 - 19 March 2020 by a NVC Accredited ecologist. This included a vegetation survey which was undertaken in accordance with the NVC Bushland Assessment Method.

Fauna habitats were assessed for specific habitat components including consideration of structural diversity and refuge opportunities for fauna, in order to determine the potential for these habitats to support threatened species. The survey focussed on searching for habitat that would be utilised by threatened species identified in the desktop assessment as having the potential to occur in the area.

4.4.3 Targeted Fauna Survey (June 2020)

Targeted fauna surveys were commissioned following the baseline survey to determine the presence and extent of particular threatened fauna species utilising the native vegetation at Whalers Way. Two (2) fauna species of conservation significance including the Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird were subject to additional targeted field surveys between 22 - 24 June 2020.

4.4.4 Targeted Flora Survey (October 2020)

A targeted flora spring survey was commissioned following the baseline survey to determine the presence and extent of EPBC Act and NPW Act listed flora species utilising the project area at Whalers Way. The targeted flora spring survey was undertaken by NVC Accredited ecologists between 13 - 15 October 2020.

4.4.5 Site Selection Survey (June 2021)

The Site Selection Survey was conducted by experienced fauna ecologists with specific knowledge of the two focal species between 15 to 18 June 2021. The field survey was conducted under the following research and ethics permits/licenses:

- Scientific Research Permit No. E27057-1 (Department for Environment and Water);
- Wildlife Ethics Committee (WEC) Approval No. 6/2021, (Wildlife Ethics Committee); and
- Scientific Licence No. 370 (Animal Welfare, National Parks and Wildlife SA).

The focus of the Site Selection Survey was to establish Impact and Control Sites, with the aim to find individuals and record individual song of each of the target species. Known locations within Whalers Way (Impact Sites) were surveyed and previous locations of Southern Emu-wren (Eyre Peninsula) and the Mallee Whipbird records in Lincoln NP were surveyed to establish Control Sites, away from potential impacts of the Test Launch Campaign.

4.4.6 Pre-Test Launch 1 Surveys (August 2021)

The Pre-Launch survey was undertaken from 18 – 21 August 2021 by two teams of two ecologists with specific knowledge of the two focal bird species. Test Launch 1 was undertaken by Southern Launch on 16 September 2021.

4.4.7 Post Test Launch 1 Survey (September 2021)

The Post-Launch survey was undertaken from 21 – 24 September 2021 by the same two teams of two ecologists.

4.4.8 Site A Relocation Survey (December 2021)

The results from the Site Selection Survey and Test Launch 1 of the Test Launch Campaign identified the original location of the Launch Site A contains high density of records of the Southern Emu-wren (Eyre Peninsula) and it was inferred that habitat in within the original location for Launch Site A is critical habitat for the species. Considering the data collected during the Test Launch Campaign and the EIS submissions from both the public and State Government agencies a further targeted bird survey for both the Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird at multiple site options for Launch Site A was undertaken to locate a more suitable site with less potential impact to both species, with consideration of ecology, heritage and launch trajectories constraints.

This additional targeted field survey was conducted between 16 -17 December 2021 using the same methodology as detailed above.

4.5 Alternative Sites

A significant number of the public submissions on the EIS frame the authors position on the proposal as supporting the proposed use generally, however not supporting the proposal on the subject site, and suggesting that an alternative site should have been selected. Some of the public submissions make specific suggestions as to the alternative site, including Woomera or Southern Launch's Koonibba Test Range, located to the north-west of Ceduna.

The position advanced in the submissions in this regard is that the terrestrial impacts on the subject site could be mitigated effectively by undertaking the development on an alternative site. Whilst potentially such an assertion has some basis , it has been demonstrated that relocating the facility to an alternative site is not a viable option, and would result in the project not proceeding. This outcome has been covered in detail the EIS in consideration of the site selection process and the consequences of the project not proceeding. It is noted that typically where representors have suggested other sites, they have either not identified a specific site or have done so in very broad terms. In many cases where more specific suggestions are made, they are locations that have either been specifically ruled out in the EIS (such as Woomera or Koonibba) or locations that would be immediately ruled out if investigated for reasons such as not being able to meet launch trajectories or not being able to meet launch safety requirements.

As was detailed in the EIS, the locations available for launch sites meeting operations requirements are very highly constrained. Additionally, the requirement for launch sites to allow for polar and sun synchronous launches to be located on or immediately adjacent the southern coastline of Australia means that alternative launch sites have a high likelihood of being in locations that are vegetated, subject to coastal processes, which provide habitat for various species or are located in zones which do not envisage the proposed use.

The site selection process undertaken by Southern Launch, outlined in the EIS, detailed the specific operational criteria for locating and site, and the challenges that this presents in locating a suitable site. As is made clear in the EIS, no alternative options presented to Southern Launch met operational and launch safety requirements for launches. This includes the potential option put forward by some representors for a northward relocation within the locality of Whalers Way onto land which has previously been cleared.

4.6 Habitat Loss

Habitat loss is the issue raised most frequently in the submissions which refer to terrestrial biodiversity issues. The habitat loss that will occur as result of the proposed development is frequently referenced in submissions as a primary reason for the proposal being inappropriate. Submissions which are not supportive of the proposal variously refer to mitigations such as not undertaking the project, undertaking the project on an alternative site or undertaking the project in an alternative manner on the subject site which would result in a reduction in the amount of habitat loss which will occur. It is not possible to avoid habitat loss through clearance of vegetation in order to site the proposed facility on the subject site.

Since the inception of the proposal, the design process has sought to minimise the direct habitat loss which will occur through the clearance of native vegetation on the subject site. This process has been ongoing through the design process and has sought to optimise the design to ensure that space requirements are managed as efficiently as possible. Whilst the site design process has been subject to a large number of constraints, including operational and safety constraints, the requirement to minimise the site footprint to minimise the requirement for clearance of habitat has been a high priority and fundamental constraint throughout the design process.

The proposed development has been amended following the exhibition of the EIS and will result in the clearance of 23.4 hectares of vegetation from the site. The area proposed to be cleared was significantly reduced from the original 70 hectares proposed to be cleared to 23.7 hectares during the concept design phase of the project, prior to the exhibition of the EIS. Further consideration was given to the ability to further reduce the project footprint following the exhibition of the EIS; however, it was determined that a further material reduction could not be undertaken without adversely impacting upon the operational and economic viability of the project.

The focus of minimising habitat loss and indirect impacts arising from habitat loss through clearance was therefore focussed on the configuration of the development and siting of project elements, rather than a reduction in footprint. The process led to the relocation of Site A, discussed in further detail in **Section 2.0**.

A small further reduction in the total project footprint resulted from the reconfiguration, resulting in the project footprint reducing from 23.7 hectares to 23.4 hectares, representing a reduction in clearance of a further 3,000 square metres.

With the proposed lease area being approximately 1,590 hectares, the 23.4 hectare area of vegetation to be cleared represents 1.47 per cent of the lease area. The areas of the site proposed to be cleared to accommodate the proposed development are not contiguous and represent separated, isolated areas within the site.

Further reductions in the project footprint may be able to be achieved during the detailed design of the project; however, these are uncertain until detailed design takes place, so have therefore not been factored into the assessment process to ensure that the assessment represents an appropriately conservative assessment of maximum area required to be cleared.

AECOM have assessed that the removal of vegetation resulting in habitat loss is likely to pose the largest risk of adverse impacts for terrestrial biodiversity arising from the project. The impact may be direct, in the form of vegetation and habitat clearance, or indirect, such as a reduction in flora and fauna diversity due to shortages in available habitat resources or habitat degradation in areas adjacent to direct impacts.

Vegetation clearing and habitat loss that cannot be avoided, particularly in high constraint areas, is considered likely to result in permanent impacts to threatened biodiversity. This includes a reduction of feed availability for habitat-specialist fauna species which are dependent on native vegetation for food sources, such as Mallee Whipbird and Southern Emu-wren (Eyre Peninsula) that forage actively, hopping through dense vegetation and taking food from reeds, foliage, twigs and other surfaces of shrubs. The potential effects associated with this impact include direct loss of breeding habitat and loss of foraging habitat which will in turn lead to greater pressure on remaining available habitat outside of the project area. The resulting increase in pressure on resource availability is likely to increase individual animal stress levels which may result in reduced breeding success, genetic isolation and population decline over time.

The project will clear 23.4 hectares of native vegetation in four discreet locations (Launch Site A, Launch Site B, Infrastructure Site D and Range Control Site E) and several new and upgraded access tracks. No threatened flora species listed under the EPBC Act and NPW Act are considered likely to occur within the project area or within close proximity.

AECOM have assessed that the vegetation on the subject site could provide suitable habitat for the following threatened fauna species protected under the EPBC Act and NPW Act:

- Australian Fairy Tern;
- Black Falcon;
- Cape Barron Goose;
- Diamond Firetail;
- Eastern Osprey;
- Elegant Parrot;
- Painted Buttonquail;
- Peregrine Falcon;
- Purple-gaped Honeyeater;
- Rock Parrot (known to occur);
- Southern Emu-wren (Eyre Peninsula);
- Mallee Whipbird;
- White-bellied Sea-eagle; and
- Yellow-tailed Black Cockatoo.

Not all of these species have been identified on-site during the extensive surveys undertaken.

Native vegetation extends further inland on the Whalers Way Peninsula estimated at 2,600 hectares of which 95 per cent is mapped as native vegetation. Vegetation and fauna habitat during the field surveys was observed as homogenous in the area. It is likely that the Whalers Way Peninsula and conservation reserves contain suitable habitat for the threatened species listed above.

Specifically, there is a risk that some of the proposed clearing may pose a direct threat to the local viability of the ecosystems and potentially heavily impact upon individual threatened species.

All vegetation within the project area has had an additional 5.0 metre clearance buffer applied for fire safety. The buildings and infrastructure are all located greater than 5.0 metres from the project boundary, meaning the 10-metre clearance buffer proposed around the exterior fencing of all sites, is greater than the 5.0 metre buffer proposed for fire safety.

All roads have a 3.0 metre clearance buffer applied to each side of the access roadways, however, this may be utilised as 6.0 metres on one side of the road as part of upgrades or alternatively as the buffer is stated. The extent of the buffer required to construct access roadway upgrades is dependent on the bends in roads and terrain encountered. This 3.0 metre buffer on each side of the road is also provided to allow for the addition of power and water easements, the construction method and infrastructure type, which have not been finalised at this stage. It is considered that the provision of the buffer for access roadway upgrades represents a highly conservative assessment, with the extent of upgrades of existing access roadways being localised and limited in extent.

A full assessment of native vegetation clearance has been undertaken against the Principles of Clearance under the NV Act. The clearance of 23.4 hectares of native vegetation is considered Level 4 clearance and is seriously at variance with Principle 1a and 1b and at variance with Principle 1e of the Principles of Clearance under the NV Act.

Whilst the clearance is a key noted impact, the transition of the site to a more controlled access regime associated with the proposed development, where less unsupervised access by members of the public occurs offers the potential to limit the impact of the existing use on habitat. At the present time, the edges of the access roadways and areas of the site used by the public are poorly defined, with evidence of vehicles regularly interacting with intact vegetation and resulting in damage and degradation. The proposal will result in those areas of the site where access and use occur being considerably better defined than at the present time, limiting the potential for unauthorised access into vegetated areas of the site to impact of habitat.

Whilst the extent of clearance required is acknowledged as a material direct impact of the proposal, it is considered that the design of the proposal has been optimised to minimise the extent of clearance as much as a reasonable and practical, whilst allowing the project to proceed on the subject site.

4.6.1 Mitigation Hierarchy

When exercising a power or making a decision under Division 5 of the *Native Vegetation Regulations 2017*, the NVC must have regard to the mitigation hierarchy. The mitigation hierarchy seeks to ensure that where clearance cannot be avoided, it occurs in a manner which minimises and offsets that clearance to the extent which is practically possible.

AECOM summarised the application of the mitigation hierarchy in the design of the proposed development as set out in **Table 4.1** below:

Table 4.1: Mitigation Hierarchy

CRITERIA	ASSESSMENT
a) **Avoidance – outline measures taken to avoid clearance of native vegetation such as making adjustments to the location, design, size or scale of the activity in order to reduce the impact.**	The Whalers Way area provides a number of benefits to operating an orbital launch complex at this location. The availability of suitable sites is extremely constrained: • Southern Launch undertook an extensive site selection process; • The process was underpinned by a weighted multi-criteria analysis; and • The process ultimately led to the selection of Whalers Way. Critical criteria included: • Latitude – between -30 and -40 degrees; • Launch Trajectories – support launches from 60 to 180-degree with respect to the equator; • Coastal Access – site to be on the coast with open ocean due south; • Weather – support year-round launches with no temperature extremes; • Land Size – min 500 hectare to support two launch pads and buffer zones; • Critical National Infrastructure – no critical national infrastructure in buffer zones or on trajectory; • Population – Need to be capable of exclusion from buffer zones; and • Environment – Impact on environmental values. Whilst existing cleared land exists several kilometres to the north of Whalers Way, this land is not suitable for the proposal due to constraints on achieving launch safety areas under national legislative requirements. Internal site selection within Whalers Way was based on criteria including: • Existing degraded areas; • Existing cleared areas; • Topography; • Blast radius; • Existing road access; • Proximity to coast; • Proximity to residential dwelling; and • Security requirements.

CRITERIA		ASSESSMENT
		Avoidance of vegetation wherever possible has occurred within the engineering constraints of a highly technical project. Reduction of the footprint as far as practicable to avoid clearing native vegetation with the size of the project area reduced in size from 70.58 hectares to 23.4 hectares from concept design. As a result of the comments received from the SA Government, public submissions provided, and further analysis undertaken by Southern Launch's ecology and cultural heritage advisors an alteration to proposed Launch Site A has been made following the exhibition of the EIS. Launch Site A will be moved 700 metres to the north-east to Site Option 2 as detailed in **Section 6.3**. Launch Site A was originally located closer to the coast. Assessment of the original site suggested the disturbance to this vegetation would negatively impact upon listed species such as the Mallee Whipbird and Southern Emu-wren (Eyre Peninsula) found in the Whalers Way Area due to their presence in the vicinity of the original Launch Site A location. Further analysis was therefore undertaken to identify a more suitable location from an ecological and from a cultural heritage perspective. Further targeted surveys were undertaken in December 2021 to assess the alterative options for Launch Site A for the presence of Mallee Whipbird and Southern Emu-wren (Eyre Peninsula). Several launch option sites were identified and subsequently ruled out, based on ecological constraints. The ultimately selected preferred option is more suitable from an ecological and cultural heritage standpoint. Physical limitations associated to launch trajectories exist around the placement of sites further to the north within the project area, in areas of slightly poorer vegetation. The majority of the existing access track, commonly known as Whalers Way Drive, will be retained in its current condition, with localised grading and re-sheeting, not affecting the existing road alignment, and not requiring an expansion of the existing footprint, as required to maintain all weather access.
b)	**Minimisation – if clearance cannot be avoided, outline measures taken to minimize the extent, duration and intensity of impacts of the clearance on biodiversity to the fullest possible extent.**	The clearance footprints have been minimised to the minimum area possible and located adjacent to existing access roadways where possible. Existing access roadways are being utilised to ensure minimum disturbance and implementing a CEMP and OEMP to manage direct and indirect impacts during the construction and operation phases of the project. Each launch site will have a clearance footprint which is larger than the site to accommodate batter slopes and enable suitable external access to the fencing and a nominal 10 metre width buffer beyond this for fire protection, access and maintenance requirements. It is on this basis, including the 10 metre external buffer, that the clearance envelopes for the site have been calculated. Notwithstanding the calculated clearance envelopes, these are conservative figures as the clearance required for each site will be minimised through the design and construction process, and it is likely that the final clearance envelopes can be reduced further from those indicated on the proposal plans in the Response Document and the supporting technical reporting.

CRITERIA		ASSESSMENT
c)	**Rehabilitation or restoration – outline measures taken to rehabilitate ecosystems that have been degraded, and to restore ecosystems that have been degraded, or destroyed by the impact of clearance that cannot be avoided or further minimized, such as allowing for the re-establishment of the vegetation.**	Southern Launch are enthusiastic about incorporating the restoration and conservation of the Whalers Way area as a critical part of the project lifecycle. Avoiding and mitigating impacts is at the forefront of the company ethos. Some measures that are in planning phases include: • Predator proof fencing and eradication of predators including cats and foxes from the Whalers Way heritage agreement area; • Firebreaks incorporated along fences where appropriate to protect and mitigate one of the primary threats to EPBC listed species present; • Weed and pest control; and • Ongoing studies into risks associated with the project such as funding PhD studies in association with universities and further research into terrestrial threatened species. Former access tracks that are remnants of previously utilised but now closed or unnecessary are proposed to be rehabilitated as a stage approach utilising clearance material from clearance areas. The tracks proposed include (east to west); the closed track to the southern tip of Whalers Way; a former track aligned south of the existing main track which has partially self-regenerated; the old track alignment previously used prior to formation of the sinkhole; and the small loop track to Blue Whale Bay which is significantly degraded due to wind erosion and ongoing off-road vehicle damage. Rehabilitation will consist of ripping of the existing base material where present, spreading of topsoil from other clearance areas which will provide the seedbank, and placement of organic material on top to stabilise and prevent erosion until natural regeneration occurs. These rehabilitation areas will act in reducing fragmentation of vegetation within the primary Southern Emu-wren (Eyre Peninsula) habitat.
d)	**Offset – any adverse impact on native vegetation that cannot be avoided or further minimized should be offset by the achievement of a significant environmental benefit that outweighs that impact.**	Southern Launch intends to provide a SEB in the form of an inground offset provided by SEB credit providers within the region. This is currently subject to ongoing negotiations and pending final footprints and offsetting requirements. SEB offsets will be like-for-like with habitat cleared. Southern Launch is currently investigating a number of sites which will be suitable for offsets and anticipates completing the identification and selection of suitable offset land in the near future.

4.7 Revised Site A Location

Following the exhibition of the EIS, Southern Launch has sought to better understand the potential terrestrial ecological impacts and further develop the proposal to ensure the impacts are mitigated to the extent possible.

A number of submissions received focussed on the original location of Site A as being particularly problematic in respect of the proposed development due to the identified habitat and density of records of the Southern Emu-wren (Eyre Peninsula). Southern Launch committed to undertake a comprehensive investigation process to determine whether there was an opportunity to relocate Launch Site A within the subject site to reduce the impacts of the proposal.

Southern Launch gained approval from the South Australian Government to undertake up to three test launches using the Hapith I rocket in order to gather empirical data to be used to validate modelled data and to determine the impact of launches on the environment through specific observation before, during and after the three test launches. At the time of preparing this response document there had been one Test Launch undertaken.

The results from the Site Selection Survey and Test Launch 1 of the test launch campaign identified the original location of the proposed Launch Site A contains higher density of records of the Southern Emu-wren (Eyre Peninsula). It was inferred that habitat within the original location for Launch Site A is critical habitat for the species.

The degree of interaction with critical habitat for Commonwealth threatened terrestrial avian species at the original Launch Site A was strengthened by ongoing survey work associated with pre-launch and post-launch surveys established within Whalers Way and the Lincoln National Park.

As the survey processes proceeded, it became increasingly clear that Launch Site A was situated within an extensive area of significant habitat for Southern Emu-wren (Eyre Peninsula) populations within Whalers Way. Repeat observations of Southern Emu-wren (Eyre Peninsula) at numerous sites within Whalers Way and the Lincoln National Park has resulted in the modelling of qualitative habitat conditions where Southern Emu-wren (Eyre Peninsula) are most likely to be utilising that structure.

With relative confidence, if the following qualitative habitat preferences are met within Whalers Way, there is a high likelihood that Southern Emu-wren (Eyre Peninsula) will be present:

- Low coastal heath with average height of 300 - 400 millimetres with shrubs connected or spacings of less than 300 millimetres on average; and
- Eucalyptus diversifolia low mallee individuals of up to 1.0 metre in height with a density of at least one to two trees per hectare.

Habitats identified as less preferable occur where either:

- Heath shrub spacings exceed 500 millimetres on average; and
- E. diversifolia is not present or is substituted by E. angulosa; or

- E. diversifolia becomes the dominant overall cover (>50 per cent); or
- E. diversifolia dominant cover is greater than 1.2 metres in height on average.

The original Launch Site A location was located where preferred habitat conditions exist, and subsequently alternative site location options were sought where habitat was less preferable but conformed with other project limitations. Five options were presented where ecological assessments were made based on avian species diversity and presence/absence of Commonwealth threatened terrestrial avian species.

AECOM has undertaken an analysis of the five options for the relocation of Launch Site A from an ecology perspective.

The five locations of the five options selected for assessment are shown in **Table 4.5**.

A risk assessment to threatened species is based on likelihood of direct impact based on presence/absence and severity of impact. The likelihood of impact assessment is based on ecological data compiled during the baseline survey undertaken in 2020 and targeted surveys completed in 2020 and 2021 for the Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird where opportunistic observations for other species were also recorded.

Severity of impacts are included based on the extent of critical habitat within the launch footprints and new and existing access tracks based on site surveys, qualitative observations and site photographs. AECOM has assessed the likelihood, severity and risk rating in a scored matrix.

Table 4.2 (likelihood) and **Table 4.3** (severity) detail the criteria, which is presented as a risk rating matrix in Table 4.4. The likelihood and severity of impact is identified as 1, 2 or 3, with 1 representing the lowest and 3 representing the highest likelihood and/or severity.

Table 4.2: Likelihood of impact to threatened terrestrial species

LIKELIHOOD OF IMPACT TO NUMBER OF THREATENED SPECIES	DESCRIPTION
3	Likely to directly impact 2 Commonwealth listed threatened species and 2 State listed threatened terrestrial species.
2	Likely to directly impact at least one Commonwealth listed threatened terrestrial species or one or two State listed threatened terrestrial species.
1	Likely to directly impact at least one or two State listed threatened terrestrial species, with no impacts expected to Commonwealth species.

Table 4.3: Severity of direct impact to number of threatened species

SEVERITY OF DIRECT IMPACT TO NUMBER OF THREATENED SPECIES	DESCRIPTION
3	Site footprint and new access roads to site likely to directly impact 100% of critical habitat for Commonwealth and State listed species.
2	Site footprint and new access roads to site likely to directly impact >50% of critical habitat for Commonwealth and State listed species.
1	Site footprint and new access roads to site likely to directly impact <50% of critical habitat for Commonwealth and State listed species.

Table 4.4: Risk Rating

		SEVERITY		
		1	**2**	**3**
LIKELIHOOD	**1**	LOW	LOW	MEDIUM
	2	LOW	MEDIUM	HIGH
	3	MEDIUM	HIGH	HIGH

The AECOM assessment of the site candidates is set out at in **Table 4.5**, below:

Table 4.5: Ecological Constraints of Launch Site A Options

SITE A OPTIONS	IMPACT ASSESSMENT	LIKELIHOOD	SEVERITY	RISK
Original Location	• Known habitat for two Southern Emu-wren (Eyre Peninsula); • Largest extent of critical habitat for Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird within Whalers Way surrounds this area with numerous observations of both species within the immediate vicinity of original site footprint; • Based on extensive site surveys and photographs of vegetation within the site, 100% of site considered suitable habitat for both Commonwealth listed species and State listed Rock Parrot and Diamond Firetail; and • Existing access to location from Launch Site B located entirely within area of intact habitat for listed commonwealth species.	3	3	High

SITE A OPTIONS	IMPACT ASSESSMENT	LIKELIHOOD	SEVERITY	RISK
1	• Known Southern Emu-wren (Eyre Peninsula) records in close proximity to site, no further studies undertaken due to cultural heritage constraints identified prior to targeted survey; and • Based on extensive site surveys and photographs of vegetation within the site, 100% of site considered suitable habitat for listed species.	N/A	3	N/A
2	• Known habitat for three Southern Emu-wren (Eyre Peninsula) and two Mallee Whipbird in southern extent of site option; • Approximately half the northern extent of the site has marginal habitat for State listed terrestrial species Diamond Firetail and Rock Parrot; • Approximately half the northern extent of the site option has marginal habitat for Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird; resulting in impacts to edge of species ranges; • Able to access the site option through less valuable vegetation and habitat from northern end associated with the degraded Infrastructure Site D area; and • Based on extensive site surveys and photographs of vegetation within the site, 50% of site option considered suitable habitat for listed species.	3	1	Medium
3	• Known habitat for three Southern Emu-wren (Eyre Peninsula) and three Mallee Whipbird within the entire site option; • Known habitat for Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird likely to remove entire home range of family groups; • Close to coastal edge so this meaning area is surrounded by suitable habitat for Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird potentially reducing ability to maintain connectivity to neighbouring territories;	3	3	High

SITE A OPTIONS	IMPACT ASSESSMENT	LIKELIHOOD	SEVERITY	RISK
	• High quality habitat for State listed terrestrial species Diamond Firetail and Rock Parrot; and • Based on extensive site surveys and photographs of vegetation within the site option, 100% of site considered suitable habitat for listed species.			
4	• Known habitat for four Southern Emu-wren (Eyre Peninsula) and no known recordings of the Mallee Whipbird within the entire site option. • Known habitat for numerous Southern Emu-wren (Eyre Peninsula) and likely habitat for Mallee Whipbird. • High quality habitat for State listed terrestrial species Rock Parrot. • Based on extensive site surveys and photographs of vegetation within the site option, 100% of site considered suitable habitat for listed species.	3	3	High
5	• Known habitat for one Southern Emu-wren (Eyre Peninsula) family groups and no known recordings of the Mallee Whipbird. Likely to impact more than one home range of Southern Emu-wren (Eyre Peninsula) and displace numerous individuals of Mallee Whipbird. • Close to coastal edge so this meaning area is surrounded by suitable habitat for Southern Emu-wren (Eyre Peninsula) and Rock Parrot. • Based on extensive site surveys and photographs of vegetation within the site, 100% of site option considered suitable habitat for listed species.	2	3	High

During the targeted avian survey in December 2021, Southern Emu-wren (Eyre Peninsula) were detected at Launch Site Options 2, 3, and 4. No Southern Emu-wren (Eyre Peninsula) were detected at Site Option 5, however, previous surveys undertaken in 2020 detected Southern Emu-wren (Eyre Peninsula) in the southern end of this location.

During the targeted avian survey in December 2021, Mallee Whipbird were detected at Launch Site Options 2 and 3, and not at Launch Site Options 4 and 5 (refer to **Table 4.5**).

Launch Site Options 4 and 5 have dense and low coastal vegetation that could be considered less suitable (e.g., too low/sparse) for Mallee Whipbird to occupy/utilize frequently.

Option 1 was not surveyed due to cultural heritage constraints identified prior to targeted surveys omitting that site as a potential opportunity for the relocation of Launch Site A. The remainder of the options were considered to be appropriate from an operational perspective, and therefore suitable for further ecological assessment. Site selection was then based largely on presence and extent of preferable habitat both within the site footprint and within existing access roadway options.

Based on the likelihood of presence of avian species and using the severity based on habitat extent and quality, Site Option 2 was identified as being the most suitable option available. This was due to the northern extent of Site Option 2 not having coastal heath as the dominant cover and the non-preferred density and height of E. diversifolia.

Site Option 2 also has the added benefit of not requiring an access route to be developed through preferred habitats.

Design work identified that Site Option 2 could reasonably be developed for a geotechnical and engineering perspective, that suitable access could be provided, and that adequate separation would be provided from the existing location of Launch Site B to enable the independent operation of a launch site at Site Option 2. It was determined that the engineering and construction would present some additional challenges and costs having regard to the topography, however these were determined to be acceptable by Southern Launch, having regard to the assessed reduction in ecological impacts.

With Site Option 2 having emerged as the prime candidate from the ecological perspective, further cultural heritage assessment was undertaken which resulted in the site being cleared for the proposed development. Further assessment was also undertaken in respect of visual amenity, surface and groundwater impacts, air quality impacts and access impacts. The acoustic impacts were also remodelled based on Site Option 2.

With all of the assessment criteria having been investigated Site Option 2 was selected as the revised location for Launch Site A and the revised proposal has subsequently proceeded on this basis.

4.8 Fauna Species Injury or Mortality

Fauna injury and death is a direct impact that may lead to a decline in population size and extent of fauna species. This potential impact is most likely to occur during vegetation clearing, earthworks, trenching and increased labour force in the fields (through the movement of vehicles) during construction, and from vehicle collision during operation.

Earthworks and clearing of native vegetation may lead to interaction of machinery with fauna species. This includes clearing vegetation that includes a nesting site, crushing or otherwise harming a fauna species with machinery.

The project will result in increased vehicle movements that have the potential to cause injury or death to fauna by vehicle strike. Mammals, reptiles, and birds are all at risk of vehicle strike, particularly species that utilise roads for movement pathways.

Entrapment of wildlife in utility diversions or other excavations associated with the project may cause physical trauma to individual fauna. Open trenches for underground utilities, or other pits are known to be effective at trapping a wide variety of wildlife and often result in mortality.

The Threatened bird species known to occur in the project area are mobile species that are likely to be able to fly out of any trench or excavation. As such, it is considered unlikely that the risk of wildlife entrapment would have a significant impact on these species.

Construction and operational management should substantially mitigate the potential for injury or death of fauna species. This will include the imposition of speed limits, identification of key risk areas and the majority of activity occurring within the fenced project sites where fauna species will be excluded.

A draft Construction Environmental Management Plan (CEMP) has been developed for the project. This will be further updated prior to any construction taking place to incorporate specific management measures for the species anticipated to be encountered during the construction process. Southern Launch is committed to retaining the expertise of experts during the construction phase of the project to ensure that appropriate mitigation measures are put in place and observed during the entirety of the construction process.

In respect of operation, the nature of the proposed facility will allow improved mitigations to minimise the potential for injury or death of fauna species through an Operational Environmental Management Plan (OEMP) and specific management plans for identified species. Whilst the proposal will result in additional traffic movements on the site, when compared to the largely unmanaged movement of private vehicles over the site at the present time, the implementation of the proposal will result in improved management and mitigation measures, which will assist in the reduction of the risk to fauna from the proposed levels of activity.

4.9 Disturbance to Breeding and Foraging Habitat

Many fauna species have specific requirements for breeding and foraging. The two key Threatened bird species recorded during field surveys (Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird) build nests out of twigs, barks and grass that is placed close to the ground in dense vegetation. Both species breed during September and October (spring).

Works associated with the project will have both direct and indirect effects on specialist habitat. Direct impacts will include the clearance of 23.4 hectares of suitable breeding and foraging habitat for fauna species while indirect impacts such as noise during construction works and rocket launch operations may affect where these species choose to nest and feed.

AECOM assessed species which may be impacted due to the disturbance of these habitat features include the following EPBC Act and NPW Act listed species with known breeding or foraging habitat within the project area:

- Australian Fairy Tern;
- Black Falcon;
- Cape Barron Goose;
- Diamond Firetail;
- Eastern Osprey;
- Elegant Parrot;
- Painted Buttonquail;
- Peregrine Falcon;
- Purple-gaped Honeyeater;
- Rock Parrot (known to occur);
- Southern Emu-wren (Eyre Peninsula);
- Mallee Whipbird;
- White-bellied Sea-eagle; and
- Yellow-tailed Black Cockatoo.

Not all of these species have been identified on-site during the extensive surveys undertaken.

These impacts are likely to be long term in relation to the removal of suitable habitat and may be short or long term in relation to operational noise depending upon individual species resilience.

Southern Launch is committed to ongoing monitoring and management of the site to gain time-series data on the impact on fauna species from the implementation of the development. This will allow for the continued enhancement of mitigation options over time to further reduce the impacts of the proposal.

4.10 Displacement of Flora and Fauna from Invasion of Weed and Pest Species

Weed and pest species have the potential to impact on terrestrial biodiversity as native species can become displaced through predation and competition with exotic biota. Pest fauna species can also damage native vegetation by grazing and trampling.

Nine non-native species have been recorded within the project area, consisting of five weeds and four pest species. Of these, one weed species (Bridal Creeper) is a listed WONS and a Declared Weed under the LSA Act, and the four pest species are listed as Declared Pests under the LSA Act. Without appropriate management strategies, the project activities have the potential to disperse weeds into areas of remnant vegetation where weed species are currently limited or occur in low densities.

Project activities also have the potential to introduce new weed species into the project area and surrounding area. The most likely causes of weed dispersal and introduction associated with the project include earthworks, movement and disturbance of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases. Weed dispersal by vehicles along access tracks and roads is a key source of weed invasion. Weed invasion is an indirect impact that may degrade the quality of habitats, potentially resulting in habitat loss.

Soil disturbance during construction may increase the risk of invasion from weed and/or pest species, which can further reduce habitat quality and compromise the integrity of adjacent areas of native vegetation.

Exotic flora species were observed as sparsely present during the baseline survey. As the vegetation condition of the project area is of a relatively high quality with low weed invasion it is important to ensure exotic weed species are not spread and brought onto site during all phases of the project. The potential for habitat modification from weed invasion resulting from the project is highest where project activities take place in areas of high-quality vegetation condition, such as those identified as containing intact remnant vegetation that currently have low weed diversity and abundance.

Unmitigated project activities have the potential to disperse pest (animal) species from the project area into the surrounding landscape, due to habitat removal, noise disturbance, and human presence during the construction and operation phases of the project. Construction of access tracks and the rocket launch pad facilities infrastructure through large patches of intact native vegetation may result in the introduction of pest species (particularly predators such as foxes and cats) into these areas. Unmitigated potential impacts of the displacement of native species through the invasion of non-natives may be temporary or permanent.

These potential impacts are proposed to be mitigated through detailed construction and operational management practices and will include ongoing, active management and control of pest plant and animal species.

At the present time, there are very limited management controls enforced upon visitors to the site, significantly increasing the potential for pest species to be brought into the site on vehicles. The current use of the site involves members of the public accessing the site, typically in private vehicles, on a largely unsupervised basis. This existing use carries with it a lack of awareness of the sensitivity of the site by a proportion of visitors, allowing for pest plant and animal species to be brought onto the site.

Following the implementation of the project, access to the site will be subject to significantly greater levels of control, limiting the opportunity for pest species to be brought onto the site through the implementation of standard hygiene practices, vehicle inspections and controlled access to the site.

4.11 Edge Effects

Edge effects refer to the changes in environmental conditions such as altered light levels, temperature, and wind speed that occur along the edges of habitats. These new environmental conditions along habitat edges can promote the growth of different vegetation types (including weed species), promote invasion by pest animals specialising in edge habitats, or change the behaviour of resident native animals. Edge zones can be subject to higher levels of predation by introduced mammalian and native avian predators.

Within the project area, the vegetated areas are large and have generally not been disturbed from previous clearance or edge effects. There are some areas that have had minor disturbance through the construction of access tracks for tourist activity in the Whalers Way. It is likely that the project may create edge effects resulting in habitat degradation and a reduction of the habitat available for a range of species through the expansion of access tracks and clearance for the launch pads.

No Threatened flora species listed under the EPBC Act and NPW Act are considered likely to occur within the project area of within close proximity.

Whilst noting that not all of the listed species have been identified on-site during the extensive surveys undertaken, AECOM have assessed that edge effects have the potential to adversely impact the following Threatened fauna species known to be or identified as potentially occurring in the project area:

- Australian Fairy Tern;
- Black Falcon;
- Cape Barron Goose;
- Diamond Firetail;
- Eastern Osprey;

- Elegant Parrot;
- Painted Buttonquail;
- Peregrine Falcon;
- Purple-gaped Honeyeater;
- Rock Parrot;
- Southern Emu-wren (Eyre Peninsula);
- Mallee Whipbird;
- White-bellied Sea-eagle; and
- Yellow-tailed Black Cockatoo.

The potential impact of edge effects has been mitigated through the design process. This has included location Launch Site B and Infrastructure Site D in portions of the site which have been previously disturbed and more likely to already the subject to such affects. Further, the reuse of existing roads, with some alteration and upgrade, where possible will minimise the need for additional clearance for road connection. The relocation of Launch Site A, resulting in an agglomeration of the project sites in the central portion of the site will consolidate and limit the proportion of the lease area subject to potential edge effects.

All of the project sites are buffered externally and will be fenced. This will serve to minimise potential edge effected through limiting the extent to which effects such as light spill, thermal effects and acoustic effects impact upon the surrounding vegetated areas.

The design of the sites has been carefully considered to minimise the potential edge effects through the clear definition of the boundaries of the site through fencing. Ongoing operational management techniques such as pest plant and vermin control will further limit impacts.

4.12 Habitat Fragmentation

Habitat fragmentation relates to the physical division of a continuous habitat into separate smaller fragments. The habitat situated between fragments is often artificial and less suitable to the species remaining within these fragments.

The landscape in which the project is situated is relatively undisturbed with significant vegetation cover, with the only fragmentation in fauna habitat occurring through access tracks that have been constructed for tourist access to Whalers Way. The project activities will contribute to fragmentation of fauna habitat by increasing the number and width of access tracks and by clearing four discreet areas of the subject site. Habitat fragmentation may impact threatened species, regionally significant vegetation, bioregional corridors and wildlife refugia.

This is due to the importance of connectivity, dispersal opportunities and habitat quality for species at a local scale.

Habitat fragmentation as a result of vegetation clearing for the project is considered to be localised. The habitat in the local area is contiguous and provides ample connectivity across Whalers Way. It is considered unlikely that vegetation clearing will result in the inability of any species to become genetically isolated and lead to sub-populations in the local area.

The widening of tracks and the construction of the launch pads may lead to local fragmentation, however the majority of species at Whalers Way are mobile and are able to traverse the distance a track represents. It is noted that tracks existing on the site at the present time, and as part of the implementation of the project, a number of existing tracks will be closed and rehabilitated. The potential effect of habitat fragmentation is therefore considered limited and unlikely to be considered significant.

4.13 Barrier Effects

Barrier effects occur where particular species are either unable or are unwilling to move between suitable areas of habitat due to the imposition of a barrier. This can include a habitat type that has become unsuitable or a physical barrier such as a fence. Species most vulnerable to barrier effects include those with limited dispersal abilities.

Various project activities may create barrier effects, particularly those that may create a hard barrier that restricts fauna movement. The project includes exclusion fencing to prevent unauthorised entry to the launch pad facilities. The fences will also prevent the movement of fauna species, in particular large fauna species such as kangaroos or emus. AECOM consider it is unlikely that fencing required for the project will prevent movement of the threatened birds that are known to occur in the project area. Human activity and infrastructure are likely to create a barrier as many species are known to avoid areas of human activity resulting in indirect habitat loss. Human presence may affect species in different ways with some species displaying avoidance behaviour while others may habituate and become attracted to areas of human activity. Predators and prey may respond differentially to human activity, causing a disruption of community interaction and potentially disrupting ecological processes.

The impact of human presence resulting from the proposal needs to be weighed against the existing use of the site for largely unmanaged tourism and recreational uses by members of the public in their own private vehicles. The proposal will allow for better management of such activities, in addition to the high levels of management of the proposed activities on the site. Whilst the proposal will result in increased levels of human activity on the project site, it should also result in a reduction in unmanaged activities and vehicle access to the remainder of the site.

Barrier effects may be also experienced by native fauna in the form of increased patrolling and predation by pest animals along barriers, such as a cleared corridor. Foxes and wild cats target these barrier areas as prey becomes more exposed and easier to detect and catch. The project proposes appropriate and ongoing management of pest plant and animal species to reduce the potential for such impacts.

The project sites are consolidated in the central portion of the site, however, remain separated by a minimum of 250 metres (Launch Site B and Infrastructure Site D) and 320 metres (Launch Site A and Launch Site B). The area enclosed by the project sites represents less than 1.5 per cent of the proposed lease area. The 98.5 per cent of the site which will remain undisturbed by the implementation of the project will remain contiguous.

4.14 Dust and Light Impacts

Dust and light are direct impacts that have the potential to occur as a result of the project during all phases and may potentially have cumulative effects. The likelihood of potential impacts is anticipated to be greatest where the project activities take place near vegetated areas and known habitat, particularly during the construction and rehabilitation phases.

Dust will result primarily from the movement of vehicles on unsealed roads. The number of vehicle movements associated with the development will be relatively low, and the nature of the facility means that strict operational criteria can be placed on the movement of vehicles around the site, such as the imposition of speed limits to manage the generation of dust.

On the project sites, dust will be limited through the use of sealed access roadways where vehicle movements are to occur and active dust suppression where localised sources of fugitive dust are identified. Open areas of the project site will be planted with suitable indigenous species to provide ground cover which should effectively reduce the potential for dust generation. On the access roadways connecting the sites, speed limits and active dust suppression will be utilised to mitigate to the potential generation of fugitive dust.

When compared to the current operation of the site, where there is limited operational control on members of the public accessing the site in private vehicles, it is considered that the operational management controls resulting from the implementation of the project may reduce the potential for fugitive dust generation when compared to that which presently occurs.

The project will result in impact from light spill into adjacent receiving environments due to the operation of plant and equipment throughout the construction phase of the proposal and installation of lighting on infrastructure required for the operational phases of the project. Impacts associated with light spill may include direct impacts such as increased susceptibility to predation from increased light or indirect impacts related to altered foraging and habituation in areas exposed to increased lighting. Light impacts associated with construction will be temporary in nature, however operational lighting impacts will be long term and will be typically localised or transient in nature.

Whilst the potential exists for launches to occur at night, this is expected to occur for only a small proportion of overall launches. Across the entire year, night-time operations resulting in a need for the sites to be illuminated will be limited. Where lighting of the sites is not required to support operations, only minimal security lighting in the immediate vicinity of the buildings will be required.

Lighting will be designed and sited to minimise the effects beyond the project sites. This will include the appropriate selection and location of lighting to achieve high levels of cut-off of the illumination, limiting spill beyond the boundary of the project sites. When combined with the 10 metres wide external buffers around the edge of the project sites, it is considered that this will effectively mitigate the potential impacts outlined above.

Ecological receptors affected by these potential impacts include all threatened fauna species listed under the provisions of the EPBC Act and/or NPW Act. AECOM have assessed that these types of impacts are likely to be short in duration and localised.

4.15 Acoustic Impacts on Terrestrial Fauna

Noise and vibration have the potential to adversely impact sensitive wildlife populations and habitat located near construction and operational activities. Noise impacts may include changes in behaviour and physical harm.

Bird species have been identified as the primary noise-sensitive receptors for this project, however, mammal and reptile species have also been noted within the project area.

AECOM have identified through a review of literature that the potential of anthropogenic noise on birds are commonly identified as follows:

- physiological effects, such as stress, avoidance and fright-flight responses;
- damage to hearing from acoustic over-exposure; and
- masking of important bioacoustics and communication signals, such as the ability to hear each other or predators, which may also lead to dynamic behavioural and population effects.

Hearing acuity is an important sense for avian species. The noise from a rocket launch and associated activities could elicit a startle response in birds located in the immediate area of the launch or have the potential to cause disturbance. High levels of disturbance, such as from aircraft operations, can cause sudden nest abandonment, which can lead to a potential loss of eggs or chicks through breakage, trampling, chilling and predation.

The four categories that describe the effects of noise relative to noise level, distance and potential effects are presented as an example as it's applied to a range of bird species. These dynamic behavioural and population effects are described in increasing severity of effect (**Figure 4.1**):

- Behavioural and physiological disturbance: these are short-term responses, such as avoidance, flipper-flapping and increased heart rate.
- Masking: No change in the ability of an animal to perceive sound, but biologically meaningful sounds are "drowned out" (masked) by anthropogenic noise.
- Temporary Threshold Shift (TTS): A temporary reduction in the ability of an animal to perceive sound. Recovery to pre-exposure levels is expected to occur.
- Acoustic Injury and Permanent Threshold Shift (PTS): Acoustic trauma may result in mortality or injury (namely, PTS). A PTS is a permanent reduction in the ability of an animal to perceive sound. Recovery is not expected to occur.

Noise criteria have been established for PTS, TTS and behavioural responses to noise for the general faunal groups.

Noise metrics, such as Leq and Lmax are used to describe the noise based on the characteristics of the noise source. Noise metrics account for the differences in duration and loudness of sounds. Generally, continuous noise sources are described in terms of time-averaged descriptors, such as Leq. Construction noise for example, is usually a continuous and is described in terms of Leq noise descriptors.

Where noise sources are in motion for example, aircraft/ rocket, the noise level changes over time. For a rocket launch, the maximum noise level (Lmax) is used to describe the maximum level that would be produced during a launch.

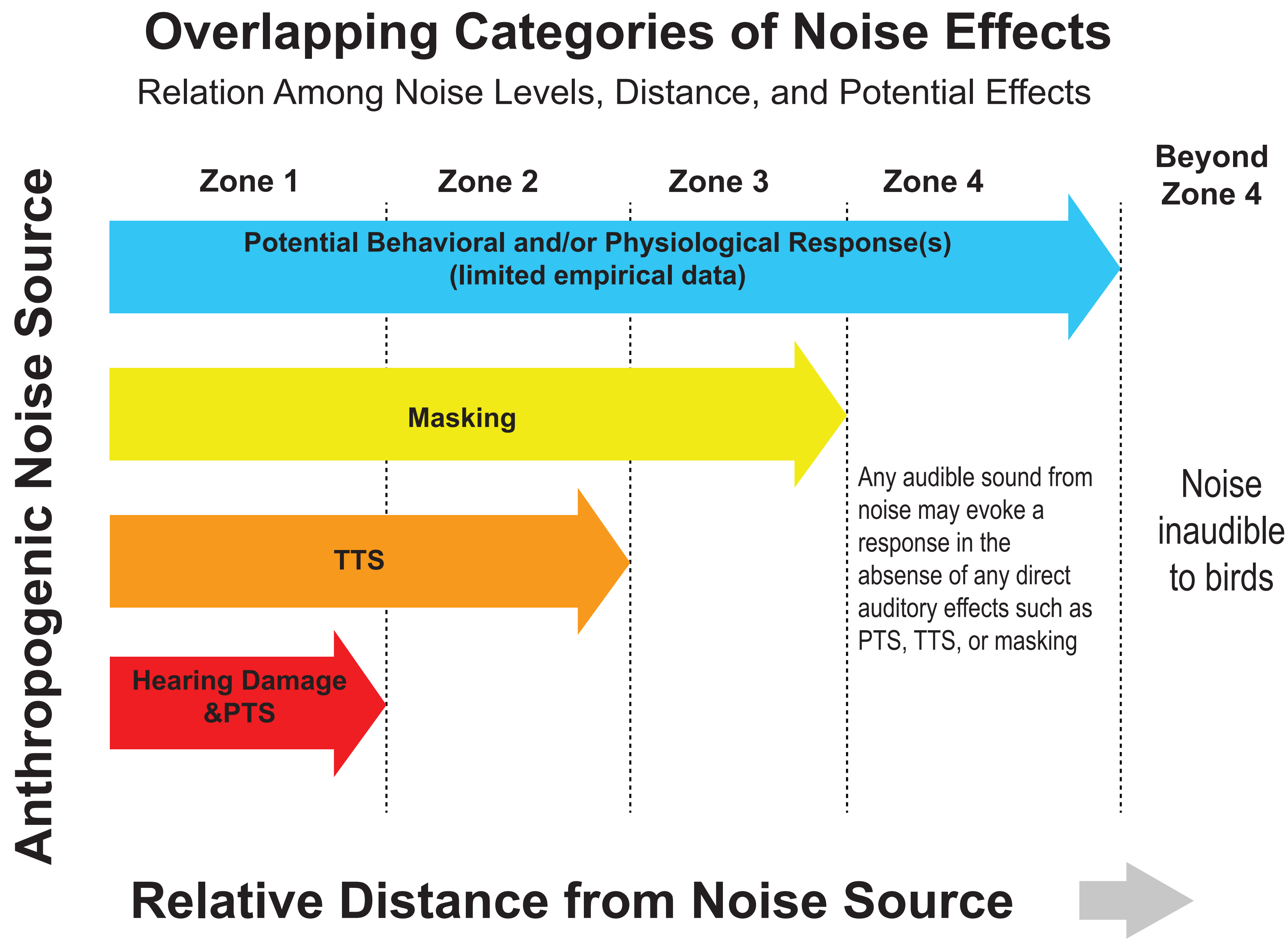


FIGURE 4.1

CONCEPTUAL RELATIONSHIP BETWEEN THE DISTANCES FROM A NOISE SOURCE AND THE OVERLAPPING EFFECTS ON HEARING AND BEHAVIOUR AS APPLIED TO A RANGE OF BIRD SPECIES

SOURCE: DOOLING & POPPER 2007

4.15.1 Assessment Criteria

A desktop study was undertaken of relevant scientific research that describes the impacts of noise on wildlife receptors. This step was considered important as there are limited standards, regulation and guidelines available for assessing airborne noise and ground vibration impacts on wildlife. As such, information on the hearing sensitivity and acoustic thresholds for the specific birds within the subject site could not be established. Accordingly, it has been assumed that responses of birds within the subject site are like those of birds in general.

AECOM cite the California Department of Transportation's Technical Guidance for the Assessment and Mitigation of the Effects of Traffic Noise and Road Construction Noise on Birds (Dooling & Popper, 2016) which provides a comprehensive summary of the studied effects of noise on birds from the construction and operation of roads. The Technical Guidance recommended interim guidelines for potential effects to birds from different noise sources are presented in **Table 4.6**.

Table 4.6: Recommended interim guidelines for potential effects from different noise sources (Dooling & Popper 2016)

NOISE SOURCE TYPE	NOISE EFFECT			
	PTS onset L_{Amax}, dB(A)	TTS onset L_{Aeq}, dB(A)	Masking L_{Aeq}, dB(A)	Potential behavioural effects
Single impulse (for example, starter's pistol 6" from the ear)	140[1]	Not available[3]	Not applicable[5]	Any audible component of traffic and construction noise has the potential of causing behavioural and/or physiological effects. These are independent of any direct auditory effects on the auditory system of PTS, TTS or masking.
Multiple impulse (for example, jackhammer and pile driver)	125[1]	Not available[3]	50-60[6]	
Non-strike continuous (for example, construction noise)	Not applicable[2]	93[4]	50-60[6]	
Traffic and construction noise	Not applicable[2]	93[4]	50-60[6]	
Alarms (97 dB/ 100 ft)	Not applicable[2]	Not applicable[2]	Not applicable[7]	

1. Estimates based on bird data from Hashino et al. (1988) and other impulse noise exposure studies in small mammals.
2. Noise levels from these sources do not reach levels capable of causing auditory damage and/or permanent threshold shift based on empirical data on hearing loss in birds from the laboratory.
3. No data available on TTS onset in birds caused by impulsive sounds.
4. Estimates based on study of TTS onset by continuous noise in the budgerigar and similar studies in small mammals.
5. Cannot have masking from a single impulse.
6. Conservative estimate based on addition of two uncorrelated noises. Above ambient noise levels, critical ratio data from 14 bird species, well documented short-term behavioural adaption strategies and a background of ambient noise of a quiet suburban area would suggest noise guidelines in the range of 50-60 dB(A).
7. Alarms are non-continuous; therefore, they are unlikely to cause masking effects.

Following the exhibition of the EIS, Resonate were engaged by Southern Launch to undertake further assessment of noise impacts of the proposed development. Resonate have undertaken a further detailed review of the literature, in particular the work by Dooling & Popper (2016) and based on this review have provided further guidance on the approach to assessment of the likelihood of PTS and TTS in the context of the proposed development.

In their further review of literature, Resonate have highlighted that Dooling & Popper (2016) note that the recommended guideline level of 93 dB(A) for TTS in birds is based partly on a study by Dooling (1980) in which budgerigars were exposed to continuous noise for 72 hours.

While Dooling & Popper (2016) do not specify an acoustic metric for PTS and TTS thresholds, Resonate consider that it is generally appropriate to use a maximum or peak level for impulsive noise, and an equivalent noise level (i.e. Leq,T) for continuous noise where the potential for hearing damage depends on both the level and duration of noise exposure, being the total sound energy received in a given period.

An equivalent noise level (Leq,T) is defined as the steady sound pressure level which, over a given period of time (T), has the same total sound energy as a fluctuating or non-steady noise. This allows a direct comparison of hearing loss potential of different noise levels and exposure times. For example, exposure to a steady noise of 107 dB(A) for one hour is equivalent to continuous exposure to 93 dB(A) for 24 hours (i.e. 93 dB Laeq,24hr), as both result in the same total sound energy and therefore same expected potential for hearing injury.

Resonate consider that averaging time of 24 hours (i.e. LAeq,24hr) is considered suitable for assessment of TTS in birds on the basis that this time window is consistent with the cumulative noise assessment period for many other species including marine mammals and fishes, and is conservative since it is less than the 72 hour continuous exposure in the Dooling & Popper (2016) study that the criteria is derived from.

For a bird (based on the median data from masking studies on 14 bird species), Dooling & Popper (2016) suggest an interim guideline threshold of 50 dB(A) to assess where noise may begin to interfere with acoustic communication in birds.

The A-weighting, designed for the response of the human ear to sound is considered acceptable for birds, as humans hear just as well or better than birds over a much wider range of frequencies (Dooling & Popper, 2007). Accounting for variations in ambient noise environments, and variation in hearing sensitivity between individual birds and species, a precautionary threshold of 50 dB(A) has been adopted to identify where birds may be at risk of masking effects.

Noise Modelling

Whalers Way Orbital Launch Complex - Environmental Assessment Report: Noise and Vibration provides predicted noise level contours for launch of Space X Falcon 9 (549 tonnes) and Blue Origin New Shepard (75 tonne) rockets from Launch Site A and Launch Site B.

The Space X Falcon 9 is considerably heavier than the largest vehicle that is proposed to be launched from Whalers Way Orbital Launch Complex (approximately 110 tonnes), while the suborbital Blue Origin New Shepard rocket is smaller (75 tonnes). Acoustic power is proportional to rocket exhaust mechanical power (thrust), meaning that larger rockets typically generate higher noise levels. Predicted noise levels from a hypothetical Space X Falcon 9 launch are therefore likely to be higher than actual worst-case noise levels, while predicted noise levels from a Blue Origin New Shepard launch may be lower.

As design has progressed and greater data on rockets to be used for the project has become available, Southern Launch has been able to undertake more realistic and targeted noise modelling for the project to quantify expected noise levels from a realistic launch expected to take place at the facility. Subsequent to the exhibition of the EIS Resonate have undertaken additional modelling of noise emissions from launch of a 137 tonne Avio Vega rocket at Launch Site A and Launch Site B. This is slightly larger than the nominal largest launch vehicle and therefore expected to provide a conservative representation of worst-case noise emissions.

Noise levels from this rocket were predicted using the RUMBLE 3.0 computer modelling package, which has also been used in AECOM's Whalers Way Orbital Launch Complex – Environmental Assessment Report: Noise and Vibration. RUMBLE 3.0 implements a modified version of the 'SP8072' rocket noise prediction algorithm developed by NASA (Eldred, 1971), and has been approved by the United States Federal Aviation Administration (FAA) as suitable for predicting noise from rocket launch activities.

4.15.2 Wildlife Impacts During Construction

Utility construction activities are expected to be the noisiest stage of the project construction, with ground compaction expected to produce the highest level of noise from the site. Noise levels more than those that have been established to protect birds from temporary hearing damage (LAeq 93 dB) are predicted to be achieved at distances approximately 10 – 20 metres from the works.

Behavioural effects and masking of communication signals may be impacted temporarily during construction. Ambient sound measured throughout the study area was as low as 38 dBA during the day and 30 dBA at night, meaning that construction noise could be up to 20 dB above the ambient level at approximately one kilometre from the proposed construction areas.

Continuous noise levels that are 20 dB above background (50 – 60 dB(A)) in the frequency region of bird hearing and communication can have a detrimental effect on the detection and discrimination of vocal signals by birds (Dooling & Popper, The Effects of Highway Noise on Birds, 2007).

Potential behavioural and/or physiological effects are noted as possible in any case where construction noise is audible. This includes both construction activities that produce short bursts of impulsive noise and the continuous noise produced by mobile and fixed machinery.

It would be impossible to reduce construction noise to an inaudible level, particularly for areas located within 2.0 kilometres of the works; however, construction noise could be minimised by limiting intensity and duration of high impact activities near sensitive wildlife areas where possible.

Construction of the project will be managed in accordance with a Construction Environmental Management Plan to ensure that all impacts are reduced as far as practicable utilising the management measures outlined.

4.15.3 Wildlife Impacts During Operation

Supporting Infrastructure

The predicted noise level of 62 dB(A) at 25 metres from the project area is below the continuous noise level threshold of 93 dB(A) for causing temporary threshold shift in birds. It is considered that the risk of operational noise impacts from general site facilities would be limited to the masking of communication signals and brief behavioural response.

Rocket Launches

Noise from launches would temporarily alter the quiet setting of the natural environment for one to two minutes during launches and for up to 15 seconds during testing. These events have the potential to disturb nearby residents and have an adverse physiological or behavioural impact on the wildlife located in the local habitat.

Noise from launches and stationary rocket testing are predicted to temporarily alter the quiet setting of the natural environment with noise briefly above the measured ambient level at distances further than 5.0 kilometres from the launch.

The Southern Emu-wren (Eyre Peninsula), Mallee Whipbird and other protected species that inhabit the areas close to the launch site are at greatest risk increased stress, adverse behaviour reactions and physiological impacts. Coastal species are predicted to generally be exposed to low levels of noise however a brief adverse behavioural response is likely.

The exposure to unmitigated noise levels above the permanent hearing damage threshold of 140 dB(A) is predicted to be limited to between 50 metres – 150 metres from the launch pad based on the range of launch vehicles modelled. Accordingly, a PTS is expected to be limited to areas within a launch site only and the immediate surrounds.

The maximum instantaneous sound pressure level (LAmax) for the subsonic (velocities below the speed of sound) launch activities assuming the loudest rocket (Space X Falcon 9 (549 tonnes)) in each location has been shown in the noise contour maps. As shown in AECOM (2022), predicted noise levels from launch of a Space X Falcon 9 (549 tonnes) are at the recommended PTS guideline criteria of 140 dB at the direct site for Launch Site A and Launch Site B and then reduces quickly from each Launch Site.

The exposure to unmitigated noise levels above the permanent hearing damage threshold of 140 dB(A) is predicted to be limited to 50 – 150 m from the Launch Sites based on the Space X Falcon 9 modelling.

As shown the additional modelling undertaken by Resonate, predicted noise levels from launch of a Avio Vega rocket are less than the recommended PTS and TTS guideline criteria of 140 dB LAmax and 93 dB LAeq,24hr respectively, even in immediate proximity of the launch sites. On this basis AECOM considers that there is low risk of hearing injury to birds as a result of a nominal worst case rocket launch. Dooling & Popper (2016) note that any audible noise has the potential of causing behavioural effects in birds, independent of any direct TTS or PTS effects on the auditory system. Predicted noise levels from launch of a Avio Vega rocket (137 tonne) at launch Site A and Launch Site B have been shown in J Diversity noise contour maps Figure 11 and Figure 12.

Information from the studies reviewed could not confirm whether long term behavioural changes would be caused by launch vehicles or if the birds in this area would habituate to the sound of launches and testing. Some birds have demonstrated the ability to habituate to repeated, regular, and predictable flights, such as king penguin studies in Hughes et al. (2008). While it has been studied that some birds can become accustomed to aircraft, others may become sensitised to aircraft noise and become more easily disturbed (Hoang, 2013).

As noted for human impacts resulting from the acoustic effects of the proposal, it is unlikely that there are feasible source controls available in addition to those already incorporated in the Southern Launch design. As the long-term impacts are unknown, AECOM have recommended that a plan to monitor the behaviour of protected wildlife in response to noise be included within the targeted species management plans for the Southern Emu-wren (Eyre Peninsula) and Mallee Whipbird that will be prepared for the project. Southern Launch has committed to the implementation of such a monitoring program, including retaining expert advice for a minimum period of three years from the commencement of operations.

A test launch campaign to further assess the potential noise impacts on bird species has been commissioned for the project, with one launch at Whalers Way and a second static test at Helidon, Queensland having taken place. Refer to **Section 6.2** and **Section 6.3** for further details and assessment of impacts.

<u>Exposure to Shockwaves</u>

The potential impact from sonic booms has been determined by comparing the impact of other launch facilities with a similar planned azimuth, trajectory and rocket size.

Supersonic speeds are assumed to occur approximately 3.0 kilometres from the coast during vehicle ascent over the ocean. Sonic booms produced during vehicle ascent are typically directed in front of the vehicle and the entire boom footprint is usually some distance downrange of the launch site (SpaceX, 2020). The smaller rockets proposed for the Southern Launch facility are also relatively small which would limit the size of sonic boom being created.

Furthermore, impact assessments for suborbital rocket launch facilities in the United States (FAA, 2009) have concluded that sonic booms are less likely to contribute to other noise impacts associated with the launch if they occur over the ocean at a high altitude. Rocket landing events can often result in single or multiple sonic booms as vehicles return to subsonic speeds, however, this type of activity is not proposed by Southern Launch.

Hence, the overpressure produced by the sonic boom is not expected to exceed the assessment criteria of 133 dBL on land. The audible component of a sonic boom may sound similar to a single distant thunderclap that could result in a short-duration startle response.

Ground Vibration

The extent of ground and structural vibration produced by the acoustic environment near the launch vehicle is expected to be limited to the buildings supporting the launch in the immediate vicinity of the launch pad. Having regard to the design of Launch Site A and Launch Site B, and the separation of the launch pad from the fenced edge of the launch sites, ground vibration is not expected to impact on flora or fauna surrounding the launch pads, elsewhere on the subject site or beyond the boundaries of the subject site.

4.16 Dam and Detention Basins

Retention basins will be located at Launch Site A and Launch Site B to capture and retain stormwater and deluge water generated on the two launch sites. A 30 megalitre capacity dam is proposed to be located at Infrastructure Site D to provide for storage of water associated with uses across the whole of the project.

If not properly designed and managed, there is the potential that these open water bodies will attract pest species such as cats, foxes, and native species, including birds, reptiles and mammals, and increase the presence of weeds. The design process has specifically considered these issues and developed a set of design responses to mitigate potential impacts.

The retention basins and the dam will be lined with a geotextile liner and will incorporate appropriate collection and leak detection systems. In addition to being lined, the basin and the dam will feature an impermeable cover to prevent access to the stored water by fauna, including avian species. The liners and cover will effectively make the retention basins and dam sealed 'tank' structures and remove the potential for interaction between fauna species, both native and pest, and the stored water.

The retention basins and the dam will be surrounded by 1.8 metre high chain mesh fence with three strands of barbed wire, for a total height of 2.4 metres, including fencing separating the retention basins and dam from the remainder the sites on which they are located. Fencing will be designed in such a manner as to also limit the potential for burrowing species to gain access.

Pest plant and animal control will be a regular mitigation measure during the construction and operational phase of the project.

These mitigations should ensure pest species and native ground dwelling fauna species and avian species are prevented from entering the open water bodies.

A testing regime for water in the retention basins will be employed as part of the irrigation management plan as detailed in **Section 4.17**.

4.17 Irrigation

The major threat irrigation poses to the environment is increased salt content in the soil which leads to decline in nutrient in soils and loss of habitat for native flora and fauna species. Irrigation also modifies vegetation structure and composition, likely to facilitate weed invasion and may increase local herbivory.

Irrigation of the project footprints is subject to the detailed design phase and the development of an irrigation management plan and water quality monitoring program to manage irrigation for the project.

All irrigation will occur within the project footprints. Irrigated areas will be surrounded by gravel areas with a minimum buffer zone of 23 metres from native vegetation at the closest point with most irrigation having a gravel/asphalt buffer zone of greater than 30 metres from native vegetation. The project sites will be physically separated from the surrounding surface water and groundwater environments as detailed in **Section 12.3**.

The project will limit the landscaping from a plant perspective using species growing in-situ only where possible. Any disturbed topsoil from top 200 millimetres during construction should be stockpiled in low windrows until construction complete and then used to recover areas post hard landscaping to promote natural regeneration including sticks, litter and detritus. This material carries necessary seedbank, fungal and mycorrhizal material to allow for natural germination of indigenous species.

Through the implementation of these design considerations and the mitigation measures proposed it is considered that the risks irrigation pose can be managed adequately.

4.18 Increased Fire Risk

The fire risk associated with the project was raised frequently in the submissions received during the exhibition of the EIS. Many of the comments in submissions raise a binary comparison of the fire risk of the proposal versus a perception that there are no fire risks emanating from the current use of the site. It is considered that this is not an accurate characterisation of the fire risks emanating from the proposal.

The implementation of the project will result in activities which carry a degree of fire risk; however, these are substantially mitigated through the design of the proposal and operational management practices proposed to be put in place.

Whilst there is no record of fire affecting the subject site in recent decades, the unmanaged nature of tourism and recreational uses of the site at the present time carries with it a significant degree of fire risk. These risks include inappropriate vehicle use, such as reversing or driving into vegetation, accumulation of rubbish and the setting of campfires for cooking or heating purposes.

Southern Launch has, since the exhibition of the EIS, engaged SA Bushfire Solutions to review and report on bushfire risk, mitigation of bushfire risk and fire response and management plans.

The fire risk and mitigation measures are assessed extensively in **Section 10.2**.

4.19 Indirect Impacts

The project footprint has been defined in the concept design process to minimise the potential for indirect impacts.

The exterior of Launch Site A, Launch Site B, Infrastructure Site D and Range Control Site E will be fenced within chain mesh fence to a minimum height of 1.8 metres, topped with three stands of barbed wire for a total height of 2.4 metres. This definition of the edge of the site will have the effect of providing a clear and distinct barrier between the developed sites and the surrounding environment. The fencing will serve to restrict encroachment from operations on the surrounding areas, reducing the potential for edge and indirect effects.

Access roadways will have a clearly defined edge, and access over the site will be limited at all times to the defined access roadways.

Both construction and operational management practices will have a strong focus on ensuring that the boundaries of the project area are clearly identified and rigidly enforced to ensure that inappropriate access to areas of the site which are vegetated and have a high biodiversity value is prevented. This will include staff and contractor training and inductions, signage, physical access restrictions and ongoing monitoring and supervision.

4.20 Coastal and Dune Erosion and Hazards

DEW has identified that the EIS has not included any measures for the remediation of erosion or sand drift should it occur within the clifftop dune system as a result of the development.

Having regard to the proposal, as amended following the exhibition of the EIS, the potential for the remediation of erosion and sand drift to be exacerbated by the proposal is considered to be low. The project sites are located, with the exception of several areas of access roadway which already exist, a considerable distance from the coastal interface, which is predominantly coastal cliffs rather than dune environments.

Additionally, through improved management of tourism and recreational uses, the implementation of the proposal will reduce unmanaged access to coastal areas of the site which should reduce the potential for physical impacts on the coastal interface and also reduce the potential for impacts on fauna resulting from such activity.

As part of Southern Launch's commitment to the rehabilitation of the site, the remediation of existing areas of coastal erosion or sand draft will be considered.

The CEMP and SEDMP, to which Southern launch has committed prior to the commencement of construction, will appropriately address the coastal interface, dune areas and the management of hazards during the construction phase.

Ongoing recognition and management of coastal hazards would also be included in the OEMP to ensure appropriate management of these issues during the operations phases of the project. Whilst the risk of such impacts has been assessed as low, Southern Launch is committed to ongoing monitoring and management of the coastal interface. This is anticipated to include ongoing monitoring of the condition and change of the coastal environment, the identification of hazards and the development, in consultation with relevant regulatory authorities, of mitigation and rehabilitation of locations where impacts requiring management are identified.

4.21 Offset

A Significant Environmental Benefit is required for approval to clear under Division 5 of the *Native Vegetation Regulations 2017*. The Native Vegetation Council must be satisfied that as a result of the loss of vegetation from the clearance that a SEB will result in a positive impact on the environment that is over and above the negative impact of the clearance.

The SEB obligation is quantified by multiplying the geographical area in hectares by the Unit Biodiversity Score.

The total maximum area of clearance is 23.4 hectares.

The individual hectares represented by each vegetation association is multiplied by the Universal Biodiversity Score, resulting in subsequent points of loss and overall hectare requirement. The outcome of the bushland assessment sheets and resulting calculation for the proposal shows a Significant Environmental Benefit offset amount of 2606.94 SEB points in total.

The overall SEB requirement for this Project, as calculated, currently stands at $1,816,951.65 plus an administration fee of $99,932.34. The total payment as calculated is $1,916,884.01.

Southern Launch seeks to provide a Significant Environmental Benefit in the form of an inground offset provided by credit providers within the region. Significant Environmental Benefit offsets will be like-for-like with habitat cleared.

4.22 Further Research and Investigation

Southern Launch is committed to further research and investigation to gather further information where current gaps in knowledge exist. This information will be developed and utilised on a continuous basis to refine the project, guide operational management and impose additional mitigation measures.

In particular, Southern Launch has funded two PhD students undertaking investigations into the impact of the proposal on specific environmental values.

A PhD student has commenced studies via Flinders University in respect of the Southern Emu-Wren (Eyre Peninsula). Their research, which will be undertaken over the next three years will seek to understand behavioural mechanisms driving differentiation among populations of the same species is important both from a conservation management point of view and to comprehend evolutionary processes.

With the Southern Emu-wren (Eyre Peninsula) being a small, poor flying passerine with limited dispersal ability, making them highly vulnerable to habitat loss, fragmentation, introduced predators and fire events. Being a shy and cryptic species, the Southern Emu-wren (Eyre Peninsula)'s behaviours are also likely to be highly impacted by increased human encroachment and habitat changes; however, little is known about their responses to these threats.

In South Australia, the emu wrens are listed as "Endangered" and divided into four of subspecies. However, there are no current records of population indices for any of the South Australian subspecies. Assessment is therefore required for the Southern Emu-wren (Eyre Peninsula) to determine if the populations have significantly decreased, what the major threats are and how different populations respond to these, and if the South Australian sub-species are part of one large population or four distinct isolated populations, all of which can have important implications to conservation management.

The Emu-wren PhD project therefore aims to answer these questions by assessing element diversity at a landscape scale and determining behavioural response differences across populations to local and non-local song playback to highlight the value of conserving individual populations:

- updating the sub-species abundance and distributions;
- assessing their behavioural response to human disturbance to highlight the potential need to mitigate disturbance, and
- monitoring nesting behaviour and success in the Southern Emu-wren (Eyre Peninsula) populations based on habitat quality and human disturbance to determine current breeding trends and risks to population growth.

Overall, the thesis hopes to recognise and address new and emerging threats to the focus species, enhance knowledge on their ecology, update statuses, and highlight the urgency for its conservation.

4.23 Summary of Mitigations of Terrestrial Ecological Impacts

Southern Launch it committed to extensive mitigations of the potential terrestrial ecological impacts of the proposal. These areas are described in detail in the EIS, this Response Document and the supporting technical reports.

The commitments to ongoing management and monitoring are summarised in **Section 4.15**.

In respect of specific mitigations of the potential terrestrial ecological impacts, will be implemented throughout the following implementation stages of the project as follows:

- Detailed Design.
- Pre Construction.
- Construction.
- Post Construction.
- Operation.

4.24 Conclusion

Whilst the proposal will have impacts on the terrestrial biodiversity values of the site that cannot be avoided, Southern Launch is committed to a comprehensive process to minimise, mitigate and offset these impacts to the extent that is reasonably possible. Where gaps exist in existing data, Southern Launch has expressed and demonstrated a substantial commitment to obtaining the information and data required to provide a better understanding and allow for long-term improvements and aid in the recovery of threatened species.

The project presents an opportunity to study the impacts of the project on the site and surrounding locality over an extended period, allowing an improved understanding of the impacts and mitigations. In respect of Threatened species such as the Mallee Whipbird and Southern Emu-wren (Eyre Peninsula), the project provides the potential to gain data, particularly in respect of the acoustic impact on these species that does not currently exist in literature.

Having regard to the proposal on the subject site, it is considered that all reasonable and practical measures have been include and will be implemented to reduce the impact of the proposal on terrestrial ecological values. This includes the minimisation of the direct impact through clearance of vegetation to the extent which is practically possible whilst preserving the operational and safety requirements of the project.

The relocation of Launch Site A has resulted in this project element being located away from an area of the site where there is suitable habitat for and recorded abundance of Threatened species.

Ongoing management and mitigation measures through construction and operational management will reduce the potential impacts through these phases of the project.

In respect of the proposal, Southern Launch has sought to achieve the minimisation of impacts to the absolute extent possible whilst retaining the feasibility and viability of the project on the subject site.

It is considered that the implementation of the project should also result in significant improvements to the current operational management of the site. This will include the rehabilitation of existing impacted areas, the removal of large quantities of rubbish from the site, a comprehensive program to limit the prevalence of pest plant and animal species on the site and the significantly improved management of tourism and recreational uses on the site through limitation of unaccompanied access, most particularly to sensitive areas of the site.

The impact through clearance that cannot be mitigated will be offset through inground offset of like-for-like vegetation, resulting in a net expansion of the area of vegetation on the Southern Eyre Peninsula which is under protection.

It is considered that opportunity for further reduction in impacts beyond those proposed would only be available through not undertaking the project on the subject site. As it detailed both in the EIS and this Response Document, the availability of sites operationally suitable for polar and sub-synchronous launch is severely constrained, and if the project does not proceed on the subject site there is a very high likelihood that the project will not proceed at all.

5 MARINE ECOLOGY

5.0 MARINE ECOLOGY

5.1 Background

The potential for the proposed development to impact on the marine environment involves direct and indirect impacts resulting from the construction and operation of the facility on the subject site.

The potential for impacts on the marine environment resulting from the facility includes the following:

- acoustic impacts on marine fauna;
- risk to the marine environment and fauna from failed launches; and
- risk to the marine environment and fauna from spent launch vehicles entering the marine environment.

The proposed development does not involve the construction of any marine structures on or adjacent the terrestrial site, with all built form elements of the proposal being located away from the coastal interface. The closest interaction of the construction and operation of the proposed facility with the coastal interface is in respect of the access roadways within the site. The access roadways to be utilised in association with the proposed development and located in proximity to the coast within the subject site are all presently existing and will require limited upgrade to support the proposed operations.

As has been set out in the EIS, the proposal is considered likely to result in negligible impact on the coastal interface adjacent the subject site. Suitable separations to proposed buildings, structures and infrastructure have been proposed to ensure that the proposed development is adequately protected from anticipated coastal hazards. The facility, particularly the stormwater management and wastewater management has been designed to ensure that stormwater runoff and wastewater from the proposed development does not enter the marine environment.

Accordingly, the marine ecological impacts associated with the project have been focused on the indirect impacts rather than the direct impacts.

The Marine Ecological Assessment, prepared by J-Diversity Pty Ltd, undertaken for the project and referenced in the EIS, considered the potential marine ecological impacts of the proposal.

Following the exhibition of the EIS, the project has been refined to relocate Launch Site A. The primary purpose of the Launch Site A relocation was to reduce the terrestrial ecological impact of the proposal. A review of the effect of the relocation of Launch Site A on the marine ecological impact was undertaken as part of the internal site selection process, and it was determined that no material change would occur as a result of the relocation of launch sites within the subject site.

Contemporaneously with the investigations that resulted in the relocation of Launch Site A and subsequent to exhibition of the EIS significant further investigations associated with the approved test launch campaign were undertaken. These investigations involved the installation of acoustic monitoring equipment and video recording equipment on Liguanea Island during the test launches.

These investigations, together with review of the submissions received during exhibition, culminated the relocation of Launch Site A as the best option to reduce the ecological impact of the proposed development, whilst still allowing the proposal to achieve its operational requirements.

J-Diversity have presented their findings in an updated version of the Marine Ecological Assessment which details the additional investigations and updated findings, as contained in **Appendix E**.

The main changes are in relation to southern right whales, with additional information about their presence in the area, and a shift in focus to assessment of underwater rather than airborne noise impacts based on further consultation with noise experts and additional noise modelling. There have also been minor updates to the assessment of noise impacts on pinnipeds and birds as the result of additional noise modelling undertaken by AECOM and Resonate.

The potential marine impact zone is also narrower than that considered in the EIS as a result of being more accurately mapped in the intervening period.

Other changes include additional information about:

- sharks near Liguanea Island;
- commercially important invertebrate species;
- Australian Sea Lion breeding behaviour; and
- seal haul-out sites

In respect of marine ecological impacts, it is noted that since exhibition of the EIS, the proposal has been determined to be a controlled Action pursuant to the *Environment Protection and Biodiversity Conservation Act, 1999* (Cth). In respect of marine species, this relates specifically to the impact on the Australian Sea Lion, Long Nosed Fur Seal, Southern Right Whale and Short-tailed Shearwater. Specific assessment of the proposal on these species will be undertaken including, where required, the preparation of management plans and the provision of appropriate offsets in respect of these species.

One of the potential ecological impacts relates to noise impacts on marine fauna. Separate reporting has been prepared by AECOM and Resonate which considers the acoustic performance of the facility, which is addressed in **Section 3.0**.

The acoustic reporting focuses on an empirical analysis of the noise which is forecast to be generated by the proposal. The impacts on that noise on marine fauna are considered in the Marine Ecological Assessment and detailed in this section.

5.2 Summary of Submissions

Impacts on the marine ecology of the areas surrounding the subject site and areas further downrange was frequently mentioned in the submissions received during the exhibition of the EIS. Representations raised issues related to marine ecology in a broad range of contexts, which have been grouped into different issues:

- Southern Right Whale 38 mentions.
- Endangered Species 26 mentions.
- Noise and Vibration 24 mentions.
- Australian Sea Lion 19 mentions.
- Coastal Erosion 17 mentions.
- Other Fauna Species Impacts 13 mentions.
- Ocean Dumping 12 mentions.
- Hearing Loss – Animals 10 mentions.
- Long Nose Fur Seal 9 mentions.
- Biodiversity Loss 1 mention.
- Marine Park Concerns 1 mention.
- Pointy Nose Seals 1 mention.
- Space Junk Management 1 mention.
- Environmental Damage 1 mention.

The submissions referencing these issues included P5, P26, P28, P32, P42, P43, P45, P47, P48, P49, P59, P64, P65, P66, P68, P70, P71, P72, P74, P101, P106, P107, P112, P113, P122, P123, P124, P125, P128, P139, P140, P144, P148, P150, P152, P153, P155, P158, P159, P164, P165, P167, P170, P173, P177, P179, P182, P183, P184, P186, P191, P192, P194, P195, P198, P200, P201, P203, P205, P206, P207, P209, P211, P213, P223, P226, P227, P228, P231, P232, P238, P246, P249, P253, P254, P255, P256 ,P257, P258, P261.

In distilling the key issues raised, there is a focus on the impacts resulting from noise and vibration caused by launches, the impact of spent vehicles entering the marine environment and the impact of the proposal on the coastal interface.

5.2.1 State Government Agency Responses

Nil on this matter.

5.3 Discussion

The trajectory of rockets launched from the WWOLC is over the Southern Ocean, within an arc between bearings 145 degrees and 265 degrees, with the Potential Marine Impact Zone (PMIZ) extending for 1,000 kilometres from the subject site. Two thirds of launches are expected to have Polar or Sun Synchronous trajectories, corresponding to bearings of approximately 185 degrees and 195 degrees, respectively.

The South Australian waters component of the PMIZ overlaps the south-eastern corner of the Thorny Passage Marine Park, which includes a Habitat Protection Zone containing Liguanea Island, located between approximately 5.0 and 8.0 kilometres south of the WWOLC.

J-Diversity has detailed that most of the important values of the park within the PMIZ are concentrated on this island, including:

- A breeding colony of the Australian sea lion (ASL) Neophoca cinerea listed as Endangered under the *EPBC Act, 1999*. Liguanea Island is the fifth-largest of 11 breeding colonies within the 'Spencer Gulf' metapopulation, with estimated pup counts of 25 to 43, corresponding to an estimated total Liguanea Island population size of 100–165. Liguanea Island accounts for about three per cent and one per cent of the Spencer Gulf and Australian pup production of ASL, respectively. The interval between its breeding seasons is 17 to 18 months.

- A breeding colony of the long-nosed fur seal (LNFS) Arctocephalus forsteri. The pup population of LNFS on Liguanea Island has been estimated at about 1,800, corresponding to a total Liguanea Island population of about 8,700. Liguanea Island accounts for about nine per cent of the LNFS pup production in South Australia. Breeding occurs between December and March.

- A breeding colony of Short-tailed Shearwater (Mutton Bird) Ardenna tenuirostris, listed as Migratory under the *EPBC Act 1999*. The breeding colony spans about a quarter of the island's area, with more than 10,000 burrows, accounting for about one per cent of South Australia's breeding population. Breeding occurs in late November, and fledglings leave the colony in late April (migrating to north of Japan).

- A breeding population of Crested Tern Thalasseus bergii, listed as Migratory under the *EPBC Act 1999*, with 'several thousand' birds (of an estimated South Australian population of 13,000 to 25,000) recorded.

Sleaford Bay, approximately 10 kilometres east of the subject site, has been identified as a site where small, but increasing, numbers of Southern Right Whale (SRW) Eubalaena australis regularly aggregate briefly, and there are museum records from waters adjacent to the subject site.

5.3.1 Collision Impacts

No impacts on Liguanea Island are expected from debris during successful launches, because the first stage of orbital rockets would not fall to earth within 500 kilometres from the subject site, and suborbital rockets (for which the booster would fall to earth within a range of 3.0 to 8.0 kilometres from the subject site) would not be launched with a trajectory over Liguanea Island. Debris from failed launches with polar and sun synchronous trajectories has the potential to impact Liguanea Island, however, the risk has been assessed as remote. Flight safety risk analysis using processes set out by the United States Federal Aviation Authority and Flight Safety Code shows that:

- An air burst, which results in the launch vehicle breaking up into a number of pieces and landing over a large area, would have an average frequency of LNFS and ASL casualties of between one every 3,375 and 194,470 launches, respectively, for small rockets. For mini or micro rockets, expected to collectively account for 95 per cent of launches from the proposed facility, the frequency would be 30 or 100 times lower, respectively.
- A ground burst, which results in a largely intact launch vehicle impacting the ground, would occur every three million launches, with an average frequency of LNFS and ASL casualties of one every 7,700 and 445,000 launches, respectively, for small rockets and almost half as often for mini or micro rockets.

An air burst over Liguanea Island would be a very rare event that could result in mortalities, however, there would be negligible impact at subpopulation level. Ground bursts on Liguanea Island would be a rarer event than an air burst (provided that a flight termination system is used in the launch vehicle) but could impact more individuals. Although such an outcome may result in reductions in ASL pup production, no long-term impact is expected at subpopulation level.

For the entire PMIZ, four sharks, four turtles, 17 marine mammals, 42 marine birds and six shorebirds protected under the *EPBC Act, 1999* and/or the *National Parks and Wildlife Act, 1972* have been identified as known to occur or possibly occurring. The likelihood of debris colliding with individuals of these species is considered to be remote and would not occur when animals are submerged. Within the Southern Ocean, including the waters of the Thorny Passage Marine Park surrounding Liguanea Island, there may be occasional debris strike impacts on individual animals on the sea surface but no impact at population level is expected.

Having regard to the consideration of collision impacts, as assessed by J-Diversity, the overall level of the risk resulting from the project, as mitigated by the operational proposals, are considered to be acceptable. Whilst the potential for collision impacts affecting Liguanea Island, in particular, is not zero, the probability of occurrence is low when compared to the number of rocket launches proposed to take place at the facility. Even if such a collision was to occur, J-Diversity have assessed that the impact would not be significant at a sub-population level.

Collision impacts within the entire PMIZ, whilst again not zero, are not expected to have an impact at a population level. Similar risks within a PMIZ would attach to a similar facility, no matter where it was located, given the requirement for vehicles to be launched over the ocean towards to the south.

5.3.2 Noise Impacts - Operational

Sound transmission from air into water is limited, with most noise reflected off the sea surface unless the angle of incidence is less than 13 degrees from the vertical. For a typical, near-vertical rocket trajectory, this would mean that the rocket would be at about 2.0 kilometres in altitude before significant noise were able to transmit from the air into the marine environment. Resonate found that sound attenuation through air and across the air/sea barrier would reduce noise to levels well below the thresholds for hearing damage for marine mammals, including whales and seals, and no higher than noise that can frequently arise from wind and waves. Behavioural impacts on marine mammals resulting from such noise are considered possible only within 750 metres of the shoreline for the largest few rockets, and such impacts would be short-term in nature and impact.

Southern Launch propose to mitigate these potential impacts through undertaking observations for whales in the vicinity of the site prior to launches occurring, with the presence of whales in a location where they could be subject to acoustic impacts being a NO-GO criteria which would result in a delay to the launch until the whales were no longer present in the critical location.

It is noted that an assessment of the impact of ricket launch noise on whales near the Kodiak Island launch facility in Alaska found that whales would only hear the launch if it flew directly overhead, and it would be unlikely that the noise would be at levels that would be sufficient to affected behaviour or cause injury (FAA 2009).

Noise from debris falling into the ocean has the potential to generate acoustic impact through the initial 'slap' at the water entry, vibrations of the impacting object, and pulsations of an air cavity created byt eh impact. In general, high impact energy is required to generate underwater noise levels above typical background noise levels. Resonate concluded that rocket debris is likely to have similar impact energy to waves breaking at the coast or on the bow of a ship, and is not expected to generate underwater noise levels above typical background noise levels beyond a distance of a few metres.

J-Diversity noted that an ecological risk assessment of underwater noise impacts from rocket launches in New Zealand found that the consequences were negligible for most fauna but for air-breathing fauna (and some other fauna in shallow environments) were assessed as minor with measurable, localised, short-term effects at a population or community scale.

Whales are more likely to be subjected to noise through water than air because their ears remain underwater while they are on the surface, except for rare occasions where breaching occurs.

J-Diversity has assessed that airborne noise would be below hearing loss thresholds within ASL or LNFS breeding colonies on Liguanea Island and haul-out sites at Cape Wiles or elsewhere along the Whalers Way coastline. Impacts on seal behaviour are the primary concern with regard to rocket launches. There may be some behavioural impacts on seals on Liguanea Island for the largest few rockets launched from the WWOLC, or the Whalers Way coastline for most rockets, including movement on land or into the water. Trampling injuries are considered unlikely due to the low density of seals and the robustness of pups after their first month, and seals entering the water are expected to return within two hours.

On review of similar facilities in other locations, J-Diversity noted that approvals have been routinely granted for activities resulting in behavioural impacts on seals at the Kodiak Launch Complex (KLC) in Alaska and Vandenberg Air Force Base (VAFB) in California, including movement both on land and into the water, but the latter has occurred only rarely with seals hauling out again within minutes to two hours of each launch. Seal populations near the VAFB have increased at an annual rate of 12.6 per cent over a decade despite five to seven space vehicle launches per year.

Comparisons of the estimated sound propagated underwater against noise impact criteria for sharks, fish and turtles undertaken by Resonate show that there would be no organ damage to these groups as a result of rocket noise.

In the absence of quantitative criteria for temporary hearing loss and behaviour change, Resonate applied the risk assessment approach of Popper et al. (2014), finding a low risk of temporary hearing loss except within tens of metres of the source and a low risk of behavioural impacts except within hundreds of metres of the source. Behavioural changes are likely to be a short term result of movement away from the source. These potential impacts would be further mitigated by the observations proposed to be undertaken by Southern Launch, as outlined above.

In respect of sea birds J Diversity have assessed that the equivalent noise levels (LAeq,24hr) on Liguanea Island are predicted to be less than 60 dBA for all rockets modelled, well below the hearing loss thresholds, and therefore no impacts are expected on the hearing of Short-tailed Shearwater, Crested Tern, Cape Barren Goose or other seabirds inhabiting Liguanea Island.

There may be behavioural impacts on seabirds on Liguanea Island, but these are expected to me minor and short-term in nature. Masking of acoustic signals is not expected to have any significant impact on bird communication due to the infrequency and short duration of the rocket noise.

5.3.3 Noise Impacts – Construction

As close as 25 metres from source, sound pressure levels associated with various sources of construction noise are all predicted by AECOM to be below the thresholds associated with acoustic trauma or behavioural change for birds and marine mammals, and underwater species would not be impacted by construction noise.

J-Diversity concluded, therefore, having regard to the distance between the project site and the marine environment that no impacts on marine species are expected from noise associated with construction activities.

5.3.4 Other Debris Impacts

The impacts of debris following contact with the sea surface depend on the nature of the rocket components of which the debris is comprised. Southern Launch has provided details of these components in the EIS.

Key points in respect of these components which are expected to enter the marine environment include:

- all component materials are inert and harmless to the marine environment except lithium (within batteries) and copper (within electrical wiring);
- fuels would be expended before contact with the sea floor, or alternatively would burn, remain inert (rubber-based solid fuel) or vaporise (liquid fuels);
- most materials would sink, except rubber-based solid fuels (and liquid fuels prior to vaporisation) and some small pressure vessels which have not been punctured; and
- casings that have not already broken up during re-entry would generally shatter into thousands of pieces on impact with sea surface, with the possible exception of some thick carbon fibre components.

Other debris impacts assessed by J-Diversity include:

- ingestion by marine fauna;
- crushing or smothering of biota;
- emission of toxic contaminants;
- noise from debris striking the sea surface; and
- provision of habitat.

J-Diversity has assessed that these impacts would be highly localised, the area impacted would be insignificant in comparison to the extent of the receiving environment and population level effects would be negligible.

These impacts would attach to a similar facility, no matter where it was located, given the requirement for rockets to be launched over the ocean towards to the south.

5.3.5 Monitoring, Management and Mitigation

Monitoring of seal behaviour and noise on Liguanea Island and underwater noise in the nearshore area near the launch sites will be undertaken before, during and after launches for at least the first three years of operation, including of future test launches.

Mitigation measures designed to reduce noise impacts on terrestrial species during rocket take-off such as earth bunds and site structures for acoustic screening, may also benefit seals and seabirds on Liguanea Island.

Other mitigation measures specific to marine fauna include:

- Avoiding trajectories over Liguanea Island for suborbital launches.
- Searches for whale presence, by appropriate methods, within areas of possible impact for launches where there is some risk to whales, with the launch delayed if whales are found in the relevant areas.
- Using a flight termination system, which would substantially reduce the risk of a ground burst on Liguanea Island.
- Consideration, for some launches such as for the largest rockets, of avoiding critical periods (e.g., breeding times) for species.

A review of risks to the marine environment from debris (once fallen) would be undertaken after the first three years of operation, with recommendations made for further mitigations as appropriate.

J-Diversity has assessed that the conclusions of this assessment are consistent with the findings of a risk assessment undertaken for comparable rocket launches in New Zealand.

6 MIGRATORY AVAIN SPECIES ECOLOGY

6.0 MIGRATORY AVAIN SPECIES ECOLOGY

6.1 Background

A specific investigation was undertaken for the EIS by Jacobs in relation to effects on Coastal Raptor bird species specifically the Eastern Osprey (Pandion haliaetus cristatus) and White-bellied Sea-eagle (Haliaeetus leucogaster). In summary the investigation identified the following.

White-bellied Sea-eagles occupy a territory and nest on the offshore Liguanea Island greater than 5.0 kilometres from the launch sites. An inactive nest is present along the Whalers Way coastline. Current disturbance at Whalers Way from interactions with amateur photographers and drone users is suspected to a have caused nest to be inactive.

Two known inactive Eastern Osprey nests are located at Cape Wiles and another between Cape Wiles and Cape Carnot. Due to human disturbance from recreational activities, including hiking, car parking, and lookouts, the two nests are highly likely to be inactive. It has been determined that there is potential for the territory of an Eastern Osprey pair to overlap the project footprint; however, it is unlikely that the area forms a breeding habitat for the pair.

It was summarised the following would be likely as a result of the operations on the site:

<u>Eastern Osprey</u>

Noise impacts would be most significant to an individual nesting pair (if located within 2.0 kilometres of the launch sites) during the critical breeding period. The proposed locations of Launch Site A, Launch Site B and Infrastructure Site D are not within the line of site of a known nesting pair. Based on this, it is considered that project is unlikely to seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the Eastern Osprey.

<u>White-bellied Sea-eagle</u>

Due to the better managed public accessibility to the area as a result of the proposal proceeding, it is highly likely that potential disturbance to nests by human activity will decrease. As such, the proposal may enhance the protection to both onshore and offshore nests in the area, rather than increase their risks. Certain mitigation strategies will need to be employed to ensure that construction activities in proximity avoid important breeding times and minimise the potential for disturbance.

It is considered highly unlikely that proposed launch activities over 5.0 kilometres away from the onshore cliff top nest would cause disturbance or a startle response as the nest is below any visual sight line and background noise from surf and or wind would be likely to limit the impact of noise generated at launch.

6.2 Summary of Submissions

A total of 21 submissions mentioned impacts upon raptors specifically the Eastern Osprey and White-bellied Sea-eagle.

These included submissions P26, P28, P44, P59, P66, P68, P69, P74, P107, P123, P126, P152, P161, P167, P170, P183, P192, P211, P223, P226, and P228.

The issues raised in relation to coastal raptors included:

- The effect of noise (particularly from rocket launches) – 12 submissions.
- Coastal raptor nests near the project area may be reused – 6 submissions.
- Impact assessment adequacy of survey duration and search for new active nests deficient – 5 submissions.
- A coastal raptor expert was not consulted – 3 submissions.
- Inappropriate local bird enthusiast referenced – 4 submissions.
- Timing of construction and operations – not avoiding the breeding seasons – 4 submissions.
- Noise mitigation measure proposed – scare gun inappropriate – 3 submissions.
- An independent review is required – 1 submission.
- The impact of rocket test launches – 1 submission.
- The impact of toxic fallout – 1 submission.

6.2.1 State Government Agency Responses

DEW provided the following in response to discussion provided in the EIS:

Both Osprey and White-bellied Sea-eagles are known to occur in this area. Both of these species have undergone a significant decline in SA and are now listed as Endangered under the NPW Act. While the Coastal Raptor Assessment (**Appendix R**) states that there are no known nests near the site, the assessment only checked the known vacant sites, and did not include a comprehensive survey of the area by a suitably qualified raptor expert, as previously recommended by DEW. Therefore, there is a reasonable potential that there is breeding Osprey and/or White-bellied Sea-eagles' territories within the area likely to be impacted by the proposal and that these have not been identified and appropriate mitigation and monitoring measures have not been incorporated into the proposal. This is a potentially significant impact on a small and declining population. Should the proposal proceed, a comprehensive survey by a suitably qualified coastal raptor expert should be undertaken and mitigation and monitoring measures identified and implemented.

6.3 Discussion

An action plan for the management of the Eastern Osprey and White-bellied Sea-eagle in the areas surrounding the facility is proposed. It is largely considered that the implementation of this action plan in the form of a coastal raptor monitoring program would provide appropriate mitigation measures to manage and foster coastal raptors at Whalers Way.

The EBS Ecology (2022) Whaler's Way Coastal Raptor Memorandum can be found in **Appendix F**.

6.3.1 Coastal Raptor Monitoring Program

As is detailed in the EBS Ecology (2022) Whaler's Way Coastal Raptor Memorandum, indirect impacts to the Eastern Osprey and White-bellied Sea-eagle managed and monitored through a Coastal Raptor Monitoring Program involving surveys and monitoring as follows:

- A systematic Eastern Osprey and White-bellied Sea-eagle nest survey is to be carried out prior to the commencement of construction of WWOLC (Survey 1) with the aim of identifying the status of any Eastern Osprey or White-bellied Sea-eagle nest within a 6.0 kilometre radius of the proposed Project. The parameters for this survey include:
  - Inspect all coastline within 6.0 kilometres of the project area. The 6.0 kilometre radius will incorporate the closest active nests to the project area and the extent of the predicted 93 dBA noise contour within which birds may experience temporary hearing loss (threshold shift) from rocket launches (AECOM 2020; Dooling & Popper 2007). The nest survey is to include nearby islands that occur within the 6.0 kilometre radius (such as Liguanea Island). The survey is to include assessment of all known nests as well as searches for additional nesting locations.
  - Surveys are to be undertaken by suitably qualified and experienced ecologist.
  - Surveys are to be undertaken from the water (i.e., by boat) as this reduces disturbance to birds and will not require land access.
  - Undertake surveys in September / October providing critical breeding stages (nest building, egg laying and incubation) have finished. At this time, chicks should be present on the nest if it is being actively used. In the case of an attempted nesting event, evidence should be present that the nest was recently utilised (e.g., fresh nesting material, white wash).
  - Determine the status of each nest and whether it is being actively used by either species. Observations should include presence of chicks or any other indicators to justify recorded status of the nest.
  - Record specific observations in relation to presence / activity of both species near any identified nest locations.
  - Whilst nest surveys are being undertaken, record all sightings of coastal raptor species, including species, location and activity. If any birds are banded, record band colour and leg.

- Repeat the systematic Eastern Osprey and White-bellied Sea-eagle nest survey (as detailed in Action 1) for the first two years of facility operation (post-construction) (Surveys 2 and 3).
- If an active nest, of either species, is recorded within the survey area prior to construction (Survey 1), a detailed construction management plan for coastal raptors will be required. The management plan will include adaptive management measures to ensure impacts during construction are minimised. The management measures will be dependent on the construction program, timing of works and the proximity of the active nest to the construction areas. Management measures may include times when certain construction activities are not permitted to reduce potential impacts to breeding birds. This management plan will need to be submitted to DEW.
- If an active nest, of either species, is recorded within the survey area prior to construction (Survey 1), a detailed operational management plan for coastal raptors will be required. Specific adaptive management measures for the operation of the launch facility will need to be included in the plan. Management measures will be based on the proximity of the nest to the launch sites and the time of year of planned activities. This management plan will need to be submitted to DEW.
- If an inactive nest becomes active after the commencement of the operation phase of the project or a new nest is constructed after the commencement of the operation phase of the project, there is no requirement for the development of an Operational Management Plan.
- At the completion of the second post construction survey (Survey 3), the results need to be collated, analysed and presented to DEW. The results of the post construction surveys will assist in determining if the project has had a negative impact on the breeding success of either species. If the results suggest that this has occurred, a detailed review of the operations and management of the project will be required. In addition to any changes to operational management measures, further monitoring will be required to determine if the changes to the operations have alleviated the negative impacts on the nesting success of the project.

6.3.2 Additional Survey Post Public Consultation

Following the public consultation and the initial advice provided by EBS Ecology, a baseline survey has been undertaken post public consultation. On 13 February 2022 a Coastal Raptor Boat Survey was conducted from Jussieu Peninsula to NW D'Anville Bay Eyre Peninsula by Larry Bebbington.

A distance of 170 nautical miles were travelled which is indicated on **Figure 6.1**.

The Coastal Raptor Boat Survey conducted by Larry Bebbington can be found in **Appendix G**.

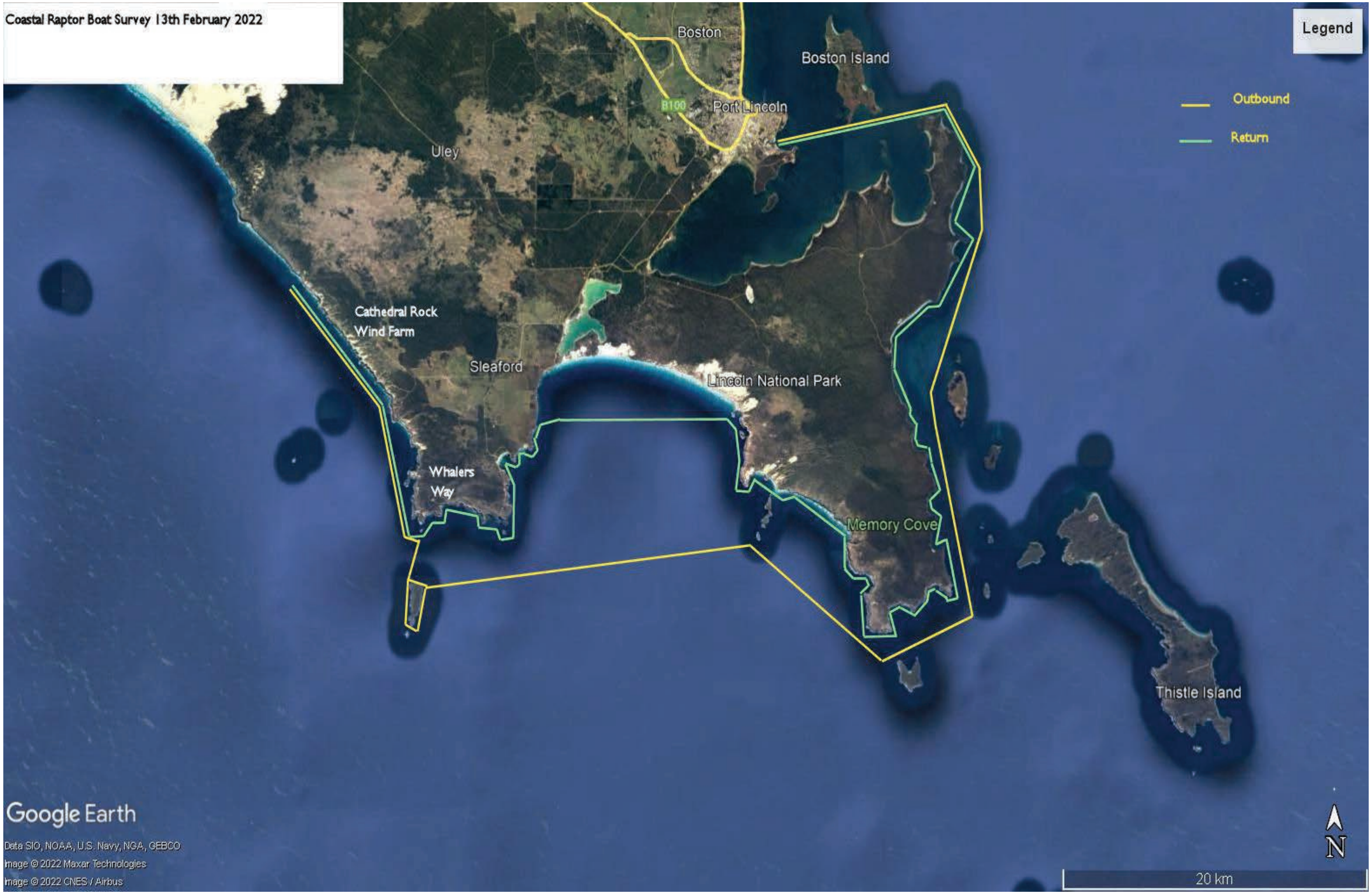


FIGURE 6.1

COASTAL RAPTOR SURVEY ROUTE – APRIL 2022

A 7.5 metre open deck aluminium work boat was selected for the survey work, operated by a local cray fisherman with over 30 years' experience fishing the waters within the study area. Sightings of each species were recorded and mapped, shown in **Figure 6.2**.

The analysis of the survey has confirmed the presence of a breeding pair of White-bellied Sea-eagles successfully raising an offspring to fledgling maturity 4.0 kilometres from Launch Site A and 1.0 kilometre from the swimming hole and a cliff top car park. Both the swimming hole and car park are frequently visited by members of the public for tourism activities and photography. Many recreational fishermen launch their boats from Fishery Bay launch point, located approximately 2.0 kilometres from the nest and then fish along the coast including in locations within a few hundred metres from the nest. Additionally, surfers are almost daily present within 1.3 kilometres of the nest site. This pair of Sea-eagles have therefore, conclusively demonstrated, that despite all the potential human interference have successfully habituated in this locality.

Analysis also provides that that one of the two unoccupied nest sites located at Cape Wiles is once again the object of intense Osprey attention. Upon observation, a pair of Osprey were engaged in potential nesting activities. One bird sighted was carrying what appeared to be nesting material and they eventually both occupied the lowest of the two nests (where a member of the public recently posted a picture of the bird sitting). Whilst all this was happening a number of tourists were present at the Cape Wiles observation point directly above them. It is considered that this is a firm signal of acceptance of human activity and presence proximal to a favoured nest site.

FIGURE 6.2

COASTAL RAPTOR SURVEY - RAPTOR SIGHTINGS – APRIL 2022

6.3.3 Raptor PhD

Southern Launch has committed to funding a student undertaking a PhD through Flinders University in respect of raptor species.

The study will investigate the ecology of a widespread and common raptor, the Nankeen Kestrel, across an urban/rural gradient in South Australia to better understand how raptors in general respond to human disturbances in their environment.

Raptors are powerful ecological indicators found in biodiverse and productive ecosystems around the world. Subject to much persecution, raptor numbers are declining globally due to loss of suitable foraging and breeding habitat, climate change, poisoning and intentional killing. Consequently, it is critically important to determine key foraging and breeding habitats and conduct detailed monitoring of populations to ensure the survival of these keystone predator species.

The project will address these questions by quantifying kestrel abundance, habitat use, foraging behaviour, individual health and nesting success across the gradient and factors or disturbances that may affect these behaviours. By using a common and widespread species as a bio-indicator for other rarer raptor species, such as the Osprey and Sea-eagle, this project will ensure a robust sample size to draw meaningful conclusions about how raptors adapt to changing environments.

6.4 Conclusion

Previous studies have shown that it would be unlikely that the either raptor species would be significantly impacted by the proposed development. The most recent study also found that raptors were found to be occupying and nesting in areas where human disturbance in the form of tourism and other recreational and commercial pursuits are being undertaken. It is noted that this has not been formally understood until the most recent survey undertaken by Larry Bebbington.

This ongoing survey and monitoring operations seeks to foster the species in the area and given that Southern Launch seek to increase biodiversity in this region is advantageous.

It is anticipated that the operation of the development and the associated Coastal Raptor Monitoring Program would provide long-term and ongoing significant survey data for both species in the area.

Southern Launch wish to continue this survey and monitoring work cooperatively with the relevant Government stakeholders in respect of monitoring and mitigating the potential impact of the project on coastal raptor species.

7 HERITAGE AGREEMENT

7.0 HERITAGE AGREEMENT

7.1 Background

The Heritage Agreement covering the subject Allotment was put in place in 1988 and established under the former *SA Heritage Act 1978* (now replaced by the *Heritage Places Act 1993*). The Agreement is registered as dealing number 6456268 listed on the Certificate of Title for the purposes of a Native Vegetation Heritage Agreement HA 148. The Agreement is now operating under the *Native Vegetation Act 1991*.

7.2 Summary of Submissions

A number of responses referenced the Heritage Agreement. In total there were 19 responses which included P26, P28, P45, P68, P69, P71, P153, P165, P191, P199, P203, P226, P253, P254, P255, P256, P257, P258 and P261.

The responses can be distilled to the following matters:

- The existing Heritage Agreement protections should be enough to discount this site as a rocket launch facility.
- Alteration of the Heritage Agreement and its impact upon flora and fauna.
- Operational applicability of the Heritage Agreement.

7.3 Discussion

The Major Development process for the clearance of vegetation under the *Native Vegetation Act, 1991* does not apply to land that is subject to a Heritage Agreement. Therefore, should the proposal receive development approval, the clearance would not be able to occur on land to which Heritage Agreement applies. In order to enable the clearance to proceed, the Heritage Agreement would need to be varied in order to remove the land that will be impacted by the development from the agreement. Under Section 23 of the *Native Vegetation Act*, the Minister for the Environment and Water can, with the agreement of the owner of the land, vary the Heritage Agreement.

On 4 November 2020 the Native Vegetation Council met with representatives from Southern Launch to explore the proposal and how the Heritage Agreement would be altered as a result.

During the session the NVC acknowledged that whilst the subject land has been protected by a Heritage Agreement since 1988, there are some parts of the site, which are protected by the Heritage Agreement, that have been degraded through past clearance and recreational related activities.

Additionally, and confirmed by the NVC, the Heritage Agreement itself contains a number of exclusion areas, being areas that are not subject to the agreement, that are scattered through areas to the allotment to which the Heritage Agreement applies. Whilst the historical basis for the excluded areas has not been able to be definitively determined, it is likely that a level of development was anticipated to occur within the site when the Heritage Agreement was first established, and that such development could potentially still occur.

Should the major development proposal be approved, Southern Launch will, through the owner of the land (with whom they have negotiated the lease), request to have the Heritage Agreement varied by moving and consolidating the existing exclusion areas to match the locations of the proposed development which has been approved. This approach would leave the overall size the Heritage Agreement largely unchanged. Southern Launch is also committed to using the existing vehicle tracks on-site for access and placing elements of the development in the more degraded areas of vegetation where possible. Southern Launch will also investigate degraded areas that remain within the Heritage Agreement. These areas will be identified, managed and improved, through ecological restoration activities on an ongoing basis over the life of the project.

The NVC agreed in principle that should the proposed development receive the approval under the
Major Development Process, the NVC will vary the Heritage Agreement to accommodate the development, subject to the following considerations:

- the overall size of the Heritage Agreement remaining largely the same;
- the layout and design of the proposed development and the likely impacts on native vegetation, as presented to the NVC on 4 November 2020, remaining largely unchanged;
- the varied Heritage Agreement is to include a clause requiring the development and implementation of a plan to actively manage the Heritage Agreement area for improved ecological outcomes;
- sufficient actions being committed to as part of the development application to manage and mitigate the impacts of both construction and operation of the rocket launching facility on native fauna.

Southern Launch is accepting of all of these considerations and is proceeding with the project in a manner which allows them to be accommodated in the final design and implementation of the project.

Several submissions have asserted that Southern Launch, not being the owner of the land, cannot seek to vary the Heritage Agreement. Southern Launch is not the owner of the allotments of the land to which the Heritage Agreement applies, however does have a registered interest in the land by way of a lease. Pursuant to the terms of agreements between the parties to the land, Southern Launch will work with the owner on the future variation of the Heritage Agreement. Southern Launch are engaged in ongoing dialogue with the owner of the land in respect of the project and has made them aware of the process by which the Heritage Agreement would need to be varied in future.

7.4 Conclusion

Southern Launch acknowledges the protection of the majority of the subject site by the current Heritage Agreement. The process for a future variation of the Heritage Agreement is accepted, and should the proposal be granted approval, Southern Launch will, through the owner of the land, proceed with this process.

Engagement with the NVC has been undertaken to discuss varying the Heritage Agreement to allow the facility to be built. A firm decision by the NVC was made that should the development receive the approval under the Major Development Process, the NVC will conditionally vary the Heritage Agreement to accommodate the development.

8 PEST SPECIES MANAGEMENT

8.0 PEST SPECIES MANAGEMENT

8.1 Background

Weed and pest species have the potential to impact on terrestrial biodiversity as native species can become displaced through predation and competition with exotic biota. Pest fauna species can also damage native vegetation by grazing and trampling.

Nine non-native species have been recorded within the project area during the surveys undertaken of the site, consisting of five weeds and four pest species. Of these, one weed species (Bridal Creeper) is a listed WONS and a Declared Weed under the LSA Act, and the four pest species are listed as Declared Pests under the LSA Act. Without appropriate management strategies, the project activities have the potential to disperse weeds into areas of remnant vegetation where weed species are currently limited or occur in low densities.

Project activities also have the potential to introduce new weed species into the project area and surrounding area. The most likely causes of weed dispersal and introduction associated with the project include earthworks, movement and disturbance of soil, and attachment of seed (and other propagules) to vehicles and machinery during all phases. Weed dispersal by vehicles along access tracks and roads is a key source of weed invasion. Weed invasion is an indirect impact that may degrade the quality of habitats, potentially resulting in habitat loss.

Soil disturbance during construction may increase the risk of invasion from weed and/or pest species, which can further reduce habitat quality and compromise the integrity of adjacent areas of native vegetation.

Exotic flora species were observed as sparsely present during the baseline field survey. As the vegetation condition of the project area is of a relatively high quality with low weed invasion it is important to ensure exotic weed species are not spread and brought onto site during all phases of the project. The potential for habitat modification from weed invasion resulting from the project is highest where project activities take place in areas of high-quality vegetation condition, such as those identified as containing intact remnant vegetation that currently has low weed diversity and abundance.

In respect to exotic fauna, four exotic species listed as Declared Pests under the LSA Act have been confirmed as being present on the site during the surveys undertaken, being the:

- Domestic Cat;
- European Rabbit;
- Red Fox; and
- Common Starling (bird).

Unmitigated project activities have the potential to disperse these pest (animal) species from the project area into the surrounding landscape, due to habitat removal, noise disturbance, and human presence during the construction and operation phases of the project. Construction of access tracks and the rocket launch pad facilities infrastructure through large patches of intact native vegetation may result in the introduction of these pest species (particularly predators such as foxes and cats) into these areas. Unmitigated potential impacts of the displacement of native species through the invasion of non-natives may be temporary or permanent.

At the present time, there are very limited management controls enforced upon visitors to the site, significantly increasing the potential for pest species to be brought into the site on vehicles. The current use of the site involves members of the public accessing the site, typically in private vehicles, on an unsupervised basis. This existing use carries with it a lack of awareness of the sensitivity of the site, allowing for pest plant and animal species to be brought onto the site. Following the implementation of the project, access to the site will be subject to significantly greater levels of control, limiting the opportunity for pest species to be brought onto the site through the implementation of standard hygiene practices, vehicle inspections and controlled access to the site.

8.2 Summary of Submissions

A number of responses were concerned at how pest species both plant and animal were to be managed onsite. In total there were 3 responses which included P26, P163 and P256.

8.3 Discussion

As previously outlined in Section 10 of the EIS, during the detailed design phase of the development a Weeds and Pests sub-plan will be developed as a component of both the CEMP and the OEMP for the project.

To summarise EIS Section 10, the Weeds and Pests sub-plan will ensure weed control methods for threatened species will be done in accordance with the relevant Recovery Plan for the species (i.e., the Mallee Whipbird National Recovery Plan).

This sub-plan will include procedures and policies in relation to the construction and operational phase of the development and include the following components:

8.3.1 Pre-construction/Construction Phase Pest Mitigation Strategies

A series of mitigation measures, as described below, will be included in both the construction and the operational management of the site to reduce the potential for the introduction and spread of pest flora and fauna.

Mitigation measures during pre-construction/construction phases of the project are summarised as follows:

- During construction, training and induction addressing biosecurity risks will be required for all staff and contractors operating on-site.
- Induction and training will include identification of risks, mitigation of risks through operational procedures and ongoing review and monitoring to ensure that all requirements are being met on a consistent basis.
- Construction sites will be clearly delineated, and personnel will not be permitted to move beyond the boundaries of designated construction sites, particularly into areas of remnant vegetation.
- To the extent possible, construction machinery will be based on the site for the duration of construction, and not removed from the site to other locations or brought to the site from other locations.
- Construction compounds are kept neat and tidy at all times, to prevent pest animals from being attracted to and inhabiting the area.
- Ensure food waste is placed in enclosed/covered bins, to prevent pest animals from accessing it.
- Recording and reporting rabbit/hare/fox/feral cat and other pest fauna sightings.
- Undertake a weed survey within and immediately adjacent to the construction impact zone prior to construction commencing, to understand existing weed conditions and potential impacts (e.g., spread) during construction.
- Remove or destroy all WONS and Declared and/or environmental weeds located within the construction impact zone, prior to construction commencing.
- Undertake weed control such as (but not limited to) slashing, spraying, or physical removal, prior to the weeds setting seed. Weed control methods within threatened species habitat areas will be in accordance with the relevant National Recovery Plan for the species.
- Display a fact sheet on declared and environmental weeds known to occur within the construction impact zone, on-site notice boards and in staff areas.
- Ensuring all vehicles and construction equipment are clean and free of soil material containing weed seed or propagules, prior to arriving on-site. If vegetative material or earth is present, ensure that the equipment is taken away and washed down at an appropriate facility to prevent vegetative material or earth potentially containing weed seeds being brought into the site.

- Install a designated wash-down bay to clean vehicles and construction equipment during construction works and prior to leaving site.
- Ensure all earthmoving equipment is clean and free of soil material prior to commencing earthworks within known threatened species habitat.
- Ensure all fill materials such as sand and aggregate imported to site are sourced from weed and pathogen free sites.
- Locate stockpiles of clean, weed free soil or fill material away from areas of weed infestation.
- If stockpiling of weed infested material is required, ensure it is stored on a constructed hardstand and separated from clean, weed free materials.
- If soil or fill material stockpiles become infested with weeds, undertake weed control as soon as practicable and at least 10 to14 days prior to moving material.
- Store construction vehicles and equipment on constructed hardstands, away from areas of weed infestation.

8.3.2 Operation Phase Pest Mitigation Strategies

Mitigation measures to be adopted during the operational phase of the project are summarised as follows:

- During operation, training and induction addressing biosecurity risks will be required for all staff and contractors operating on-site.
- Induction and training will include identification of risks, mitigation of risks through operational procedures and ongoing review and monitoring to ensure that all requirements are being met on a consistent basis.
- Sites will be clearly delineated through boundary fencing, and personnel will not be permitted to move beyond the boundaries of designated sites, particularly into areas of remnant vegetation.
- Improved management of persons accessing the areas of the site covered by remnant vegetation will occur.
- Vehicles and equipment being brought to the site will be required to be in clean condition before entering the site, with regular inspections being carried out to ensure that all requirements are being met on a consistent basis.

- Annual surveys of the site will seek to identify if any pest flora or fauna have become established, allowing management programs to be implemented or modified in suitable timeframe to reduce or avoid impacts on the existing terrestrial and/or marine environments.

- Improved management of the areas of the site covered by remnant vegetation will be implemented.

- Prevent establishment of new weed species and/or infestations during the operational phase by implementing standard hygiene practices when bringing equipment, vehicles and other materials which have the potential to harbour weed seed or propagules, onto the site (e.g., for maintenance purposes) and by practicing minimal disturbance methods.

- Conduct an annual survey to identify and monitor the location, extent, and abundance of weed species, particularly WONS and Declared weed species.

- Control pest animal species (especially rabbits, foxes, and feral cats) that may proliferate as a result of site activities. Ensure rabbit control is in accordance with the threat abatement plan for competition and land degradation by rabbits.

- Ensure waste stored at the facility prior to disposal off site is not able to be accessed by pest animals.

8.4 Conclusion

At the present time the site presents opportunities for members of the public to visit the site. This occurs on a largely unsupervised basis, including members of the public bringing their own vehicles onto the site. Through the implementation of security at the entrance to the site, and a reduction in the unfettered and unaccompanied use of the site for tourism and recreation purposes, the proposed development provides for the implementation of a management regime which should result in a reduction in the potential risk of pest flora and fauna being transported to and/or dispersed within the site.

Mitigation measures will be further developed in operational documentation developed prior to the commencement of construction and the commencement of operations. Whilst the proposed use of the site does carry risks in respect impacts resulting from pest plant and animal species, these risks can be substantively mitigated through appropriate management and control measures. When compared to the risks of pest plant and animal infestation at the present time, it is considered that the level of risk should reduce as a result of the implementation of the proposed development.

9 INFRASTRUCTURE

9.0 INFRASTRUCTURE

9.1 Traffic and Access

9.1.1 Background

The traffic and access impacts resulting from the proposal relate to the manner which vehicles accessing the proposed facility will impact upon the public road network, the movement of vehicles on the access roadways within the site and construction traffic impacts.

The Transport and Access Impact Assessment, prepared by WGA, undertaken for the project and referenced in the EIS, sought to quantify the traffic impacts of the proposal during both the construction and operational stages. The report concluded that the traffic impacts of the proposal were relatively limited with an assumed 56 vehicles per day accessing the facility, of which eight per cent would be commercial vehicles.

The WGA Transport and Access Impact Assessment concluded that the existing road network could accommodate the forecast demand of the proposed facility, with some additional maintenance being required to accommodate the forecast traffic.

The WGA Transport and Access Impact Assessment also reviewed the suitability of the access roadways within the site, identifying upgrades and operational requirements to ensure that safe and convenient access is provided to the project elements.

Following the exhibition of the EIS, WGA were engaged to review the submissions which referenced traffic and access issues and provide input into the response document. This included providing input in respect of the impact of the relocation of Site A on the internal access roadway network.

In response to these matters, WGA have provided a detailed response which is contained in Appendix H.

9.1.2 Summary of Submissions

Numerous responses were received in relation to traffic and access matters in particular:

- General Impacts (Caused by industrial traffic), Road Maintenance, Road Safety (Vehicles)
  - 29 Responses (P25, P26, P41, P49, P51, P62, P64, P101, P107, P122, P124, P125, P127, P128, P139, P144, P152, P165, P173, P177, P179, P194, P213, P223, P226, P231, P239, P249, P256).
- Slope Instability and rock fall issues created by heavy traffic (included in coastal erosion)
  - 17 Responses (P32, P42, P43, P47, P68, P71, P107, P124, P195, P226, P231, P253, P254, P255, P257, P258, P261).

- Road Safety (Cyclists)
  - 4 Responses (P57, P60, P72, P107).

The District Council of Lower Eyre Peninsula also provided commentary on the road upgrades and potential costs for the proposal (L1).

In summary and in relation to the abovementioned impacts the following response is provided.

9.1.3 General Impacts (Caused by Industrial Traffic)

The design vehicle, being a 19 metre semi-trailer, is a general access vehicle and does not require a notice or permit to access any public road network (including Fishery Bay Road and Right Whale Road). It is quite likely that 19 metre semi-trailer vehciles are currently operating on an infrequent basis between Sleaford and Port Lincoln, servicing the primary production activities in the area including livestock and cropping activities. Furthermore, the general area has seen activity from over dimensional vehicles (under permit) to traverse much of this network during construction of the Cathedral Rocks Wind Farm in the mid-2000's.

The WGA Transport and Access Impact Assessment, Section 5.1 "Impacts on the arterial and local road network" goes into some detail regarding the existing "external" (i.e., between Port Lincoln and Whalers Way) road network and the vehicles that currently access this network under gazetted route access.

The northern section of road (Pine Freezer Road, Investigator Road) sees moderate volumes of traffic with high commercial content (2,200 vehicles per day with 22 per cent Commercial Content). Therefore, these roads should not experience perceptible increases in commercial traffic due to the proposed development.

Moving southerly onto Proper Bay Road (currently 560 vehicles per day) and Fishery Bay Road (currently 160 vehicles per day) the development operational traffic may become perceptible to road users familiar with the current traffic mix and volume, however the volumes are only in the order of 12 heavy vehicles per day during the intensive construction period for a predicted six months, reducing to eight heavy vehicles per day during "peak" launch operations, with heavy vehicle volumes reducing significantly during normal operations outside of launch events.

At the height of operations (by year five) 36 orbital launches per year are envisaged, consequently the pre-launch and demobilisation activity is still only constrained to approximately half the year. Approximations indicate that on average the launch operations will involve 460 heavy vehicle trips per annum (based on an average of 23 launches per year involving 20 heavy vehicle trips per launch).

As outlined in the TIA (Section 5.2 "Traffic and Access Requirements Within the Site"), the "internal" network of access roadways within Whalers Way will require some upgrades to make it suitable for more frequent heavy vehicle usage. With regard to the transport of hazardous goods (with respect to the route being shared with a school bus), Section 8.3 "Dangerous Goods Transport" of the TIA explains that the transport of "dangerous goods" is regulated by the *Dangerous Substances Act 1979* (SA) and *Dangerous Substances Regulations 2008* (SA) and goes into some detail about how these risks are managed, including specific licencing and route assessment requirements.

9.1.4 Road Safety (Vehicles)

The sealed road network as assessed in the TIA was considered to be generally fit for purpose and the intersections were safe in that they had good sight lines, delineation and signage. Whilst it is acknowledged that additional traffic increases exposure to road safety risks, provided that these roads are maintained appropriately, the proposed increase in traffic is not expected to create additional road safety issues.

The unsealed road network (Fishery Bay Road, Right Whale Road) carries a lower traffic volume (160 vehicles per day) and are also considered to be of a reasonable standard for this magnitude of traffic, provided that the unsealed surface is maintained in an acceptable condition.

It is recommended that traffic management planning is considered during the "construction" phase of the launch facility, which should also provide some level of consultation with relevant stakeholders to increase their awareness of increased construction activity and associated traffic impacts, for the duration of works. DCLEP correspondence indicates that an Event Management Plan should be prepared for each launch event (including a Traffic Management Plan). Southern Launch is accepting of these requirements.

9.1.5 Road Safety (Cyclists)

For the region under consideration, cycling is generally a recreational activity that currently occurs within the local road network/routes associated with the development, and "sharing the road" is a consideration for the existing traffic and proposed traffic generated by the development. Whilst there may be some overlap between peak traffic and cycling activity, generally cycling coincides with non-peak traffic times, reducing cycling exposure to higher volume traffic periods somewhat.

WGA obtained information from the cycling social network site Strava, which provides Heat Map data showing use of the road network by cyclists. This data indicates the most popular cycling route in the area is along Proper Bay Road, with cycling activities diminishing from the point where Proper Bay Road intersects with Donington Road (Lincoln National Park entrance). Cyclist activity is relatively low along Fishery Bay Road and beyond to Whalers Way. Therefore, the main exposure for cyclists is considered to be along Proper Bay Road (particularly Port Lincoln to Donington Road).

Proper Bay Road is currently approximately 6.5 metres wide with 1.5 metre unsealed shoulders and is generally flat and straight but with sections that have undulating, winding geometry (e.g. at the tramline crossing which has a reverse curve and reduced sight lines to oncoming traffic).The relatively small proportional increase in traffic proposed by the development (estimated at 56 vehicles per day with 8 commercial vehicles at peak times of operation) on Proper Bay Road is only expected to slightly increase cyclist exposure to additional traffic.

On the sections of unsealed road, including Fishery Bay Road and Right Whale Road and on the access roadways within the subject site, cycling activity is considered to be very low and therefore cyclists' potential exposure to increased traffic is also considered to be very low.

Southern Launch is committed to safety as their highest priority, and will ensure that all staff, contractors and visitors to the site are aware of the risks on the public road network whilst accessing the site, including the presence of cyclists. Such risks will be integrated into the WHS management system for the facility.

9.1.6 Road Maintenance

The concerns raised by respondents are understood to be related to the unsealed road network, namely Fishery Bay Road, which would be used more regularly by locals.

The TIA addresses this in Section 5.1. The additional 50 vehicles per day on Fishery Bay Road may result in the need for slightly more frequent grading operations (typically undertaken by the District Council of Lower Eyre Peninsula) to maintain its existing shape and ride/roughness (condition). This is assuming the road is not sealed in the future. If additional maintenance is not implemented, it is likely that issues such as corrugations may develop more frequently.

DCLEP has responded directly to the above commentary from the TIA, stating that Fishery Bay Road will require re-sheeting and possibly may require sealing, rather than more frequent grading.

DCLEP has also requested dilapidation reports be developed, so that road condition can be monitored during the construction period (of the launch facility) and are returned to their pre-construction condition.

The lower order roads (Right Whale Road and Whalers Way) are very low volume and only service a few local properties and provide tourist access to the area. The TIA indicates that these roads may require some upgrades to cater for additional traffic volumes and traffic types.

Proper Bay Road and Fishery Bay Road are deemed to be Category 2 roads. Fishery Bay Road is indicated to be patrol graded 2.5 times per annum on average and re-sheeted every 15 to 25 years on average. Council correspondence has indicated that the increase in traffic on Fishery Bay Road will increase the frequency of re-sheeting to a 10 to 17 year occurrence. The DCLEP assessment, however, assumes a conservative traffic assumption which requires further refinement with DCLEP.

Southern Launch considers it reasonable and appropriate for DCLEP to seek a contribution towards the maintenance and upkeep of roads which is attributable to the development. Southern Launch is comfortable with the requests of Council for dilapidation reports to be prepared around the construction period and to establish an Infrastructure Agreement which relates to both construction and operational impacts. Southern Launch has had preliminary negotiations with DCLEP for an agreed maintenance contribution toward the sections of road network that may experience accelerated deterioration.

9.1.7 Cliff Instability, Land Slip and Rock Falls Caused by Heavy Vehicles

The issue of cliff instability was raised by a number of submissions, which particular reference to the length of Fishery Bay Road to the north of the entrance to the subject site.

Based on these geotechnical conditions and a set-back distance of typically 6.0 metres to 10.0 metres from the existing road to the top of the cliff at the closest points, the loads imposed by the 10 to 12 heavy vehicles per day, on average, are not expected to materially affect the stability of the coastal cliffs. The vehicle speeds are expected to be relatively slow and hence no significant dynamic effects are anticipated. The heavy vehicles will cause deterioration of the road surface, which will require maintenance, which is typical for any unsealed road. As outlined above, Southern Launch will enter an infrastructure agreement with Council to address the issue of ongoing road maintenance.

The cliffs are subject to natural erosional and weathering processes and are expected to continue to undergo a gradual degradation over geological time, including during the life span of the proposed development. Such natural degradation may involve local rock falls or slumping, which may pose a hazard to persons on the foreshore. This natural process would not be materially affected by the passage of heavy vehicles along the road.

An on-going monitoring program would be incorporated as part of the dilapidation report sought by Council to record the condition of the adjacent cliff top during the construction works and subsequently during the operation of the proposed development.

9.1.8 Conclusion

The issues raised in the submissions in respect of traffic and access are not considered to be significant in the overall assessment of the project. The proposed facility will result in a relatively low number of vehicles, including commercial vehicles, accessing the facility, when compared to many industrial developments.

WGA consider the existing public road network has the capacity to accommodate the additional movements.

As the number of existing traffic movements on the road network reduces in the vicinity of the subject site, the proposed facility will result in a larger proportional increase in the number of traffic movements. Notwithstanding this, the impact of the traffic movements on the surrounding locality is considered to be reasonable.

Southern Launch accepts that the proposed facility will result in impact on the condition of the public road network. Southern Launch accepts the need for dilapidation reports to be prepared and also for it to enter into a road maintenance agreement with DCLEP.

Within the subject site, limited upgrades are required to the existing access roadway network the support the proposed development. These upgrades are typically localised and have been designed to minimise the spatial extent of their impact and requirement for the removal of vegetation.

On balance, it is considered that the traffic and access impacts of the proposed development are reasonable and appropriate and are capable of being managed through the measures outlined.

9.2 Water Supply

9.2.1 Background

The proposed facility has limited requirements for water during its construction and operational stages.

Following the exhibition of the EIS, further work has been undertaken to quantify the water demand for the facility. Engagement has occurred with SA Water to determine the ability to meet that demand from the SA Water network in the locality.

9.2.2 Summary of Submissions

A total of 37 submissions were received in relation to water supply use and water contamination (town water used for the facility).

These included P25, P26, P30, P32, P42, P43, P46, P47, P49, P51, P64, P65, P68, P71, P72, P123, P127, P128, P139, P150, P155, P178, P183, P184, P186, P192, P195, P198, P201, P206, P209, P211, P223, P227, P231, P246, P256.

9.2.3 Discussion

SA Water have investigated several options for the launch facility; however, the facility is located a significant distance from existing SA Water infrastructure providing potable water. To this end, SA Water recommended a servicing solution.

Based on a system's planning investigation, SA Water have indicated that the network has sufficient capacity to support a proposed mains extension. This would involve the construction of approximately 6.4 kilometres of new DN150 main along Proper Bay Road from the existing 150 PVC main in Proper Bay Road.

This would be a significant infrastructure upgrade, that would have significant cost implications. However, it would have the likely benefit of providing potable water to the existing dwellings at Sleaford and the facilities at Fishery Bay beach.

Given that the demands seem relatively modest and that there is no existing SA Water infrastructure within the immediate area, SA Water also recommended that it may be worthy to consider alternative options such as:

- Bore supply from within the parcel of land that is being developed to enable the rocket launches; or
- Localised rainwater harvesting and or/bore supply from adjoining properties.

Southern Launch have undertaken preliminary investigations as to the availability of bore water on the site as a suitable option for supply. As an alternative option, Southern Launch has investigated the potential to extend the existing SA Water network some distance through the construction of a standpipe, bringing the supply point closer to the site and reducing the travel distance required for the transportation of water via vehicles.

Southern Launch proposes that the ultimate solution for water supply to the site will involve a variety of uses, including transportation of water to the site, groundwater and surface water capture.

In respect of the potential for contamination of the potable water supply, it is noted that the subject allotment is located a considerable distance from the areas where groundwater is extracted for potable water supplies. Groundwater in the area typically moves towards the south, meaning that groundwater on the site would be moving from north to south in the opposite direction to the areas where groundwater is extracted for potable supply.

The design of the proposed facility seeks to isolate the sites from the surrounding ground and surface water, retaining all water which contacts the sites for reuse. An ongoing water testing regime will be implemented to ensure that the operation does not result in contamination of surface, ground or marine waters.

Accordingly, the potential for the operation of the facility to result in contamination of water resources, particularly potable water supplies, is considered to be low.

9.2.4 Conclusion

The facility has a limited demand for potable water during the operational phases of the development. Water utilised for launch operations will be captured on-site and stored in covered storage facilities, supplemented by additional water either transported to the site or obtained from ground or surface water sources.

SA Water have outlined that water can be provided and that the network has sufficient capacity to service the site.

Southern Launch proposes to undertake further investigations into the potential for groundwater supply to provide long term supply to the site. Detailed design for the facility will incorporate Water Sensitive Urban Design (WSUD) techniques which will seek to capture stormwater for reuse.

9.3 Other (Power, Communications, etc)

Other infrastructure such as power and communications would be progressively installed from commencement of project as each launch site is developed.

It is envisaged that in relation to communication systems, fibre optic and satellite systems would be progressively installed based on necessity.

Power requirements for the proposed development are low. Initially, all power needs for the site will be provided by generators located adjacent the fuel storage area of each launch site.

Ultimately as the entire site is developed, it is anticipated that the site will either have access to mains electricity or centralised on-site power generation with a system including solar and battery storage. Such infrastructure does not form a part of this proposal and would be subject to future assessment and approval as necessary at the time it is proposed.

10 HAZARDS

10.0 HAZARDS

10.1 Emergency Management

Southern Launch has prepared an Emergency Management Plan, and associated Risk Register in consultation with SA Police, the South Australian Country Fire Service, and the SA Ambulance Service with the latest update being Version 2 dated 3 February 2022. This plan was included with the EIS, however, was redacted from public viewing. A copy of the latest version of the Emergency Management Plan is attached in **Appendix X**.

The EMP is a document that is continually being updated and considered a 'living document'. A large update and was made in response to findings from the first test launch.

The plan identifies the potential risks associated with the establishment and operation of the proposed launch complex and forms the basis of the discussion and analysis set out below. The aim of the Whalers Way Emergency Management Plan (WWEMP) is to develop a timely and coordinated response and recovery strategy for emergencies at, or in the vicinity of the project Site. The Emergency Management documentation will be periodically reviewed and updated to remain contemporary to relevant management strategies.

The WWEMP details the arrangements for control, command and coordination of the response to emergency situations.

The following have been considered in preparation of the WWEMP:

- AS/NZS ISO 31000:2018 Risk Management.
- National Emergency Risk Assessment Guidelines 2014.
(Australian Emergency Management Handbook Series book 10).
- National Emergency Risk Assessment Guidelines 2015.
(Australian Emergency Management Handbook Series book 11).
- Civil Aviation Safety Authority, Safety Risk Management, SMS 3, 2014.

This WWEMP provides the base document for conducting a Risk Assessment of all operations associated with the proposed development. It adapts the most appropriate interpretations of risk management for use by Southern Launch when planning for the launch of rockets from the WWOLC. The main aim of the risk assessment process is to maintain staff and public safety throughout the core functions of the proposed operations, including during the lead up, assembly, refuelling, launch, post launch activity and recovery stages.

Southern Launch will operate a generic risk assessment list. As the nature of launches vary (from type of rocket, fuel and launch type), modifications to the risk list may occur to meet the requirements of individual launches.

The risk assessment process will be constantly overviewed with analysis of the generic list of risks; identification of new or different risks and potential treatment and mitigation actions; and further analysis of the residual risk level. The following summary outlines the steps of the Risk Assessment process.

For each risk identified the Emergency Management Plan provides the following steps to manage and mitigate the risk:

- Definition of the Risk – Defining the nature of the risk.
- Control Agency – Defining who is responsible for management of the risk.
- Support Agencies – Defining who is to provide support in the event of an emergency.
- Activation of processes – Tasks and measures assigned to control and support agencies to manage the risk in the event of an emergency.
- Exclusion of dangerous areas – In the event where there are areas of danger, this is excluded from access based on relevant investigations.
- Stand-down – When risk has been managed, an order to stand down is issued.

The scope of this assessment relates to both the construction and the operational phases of the WWOLC facility.

10.2 Bushfire

10.2.1 Background

Whilst there is no recorded fire history (bushfire or prescribed burn) for the area proposed as the launch sites or within the leased area generally, it is likely that there have been fires within adjacent farmland that have not been recorded on government or agency databases.

However, there have been some significant bushfires in similar vegetation types throughout the lower Eyre Peninsula, the bushfire history of the Eyre Peninsula is well known and is captured within **Figure 10.1** below.

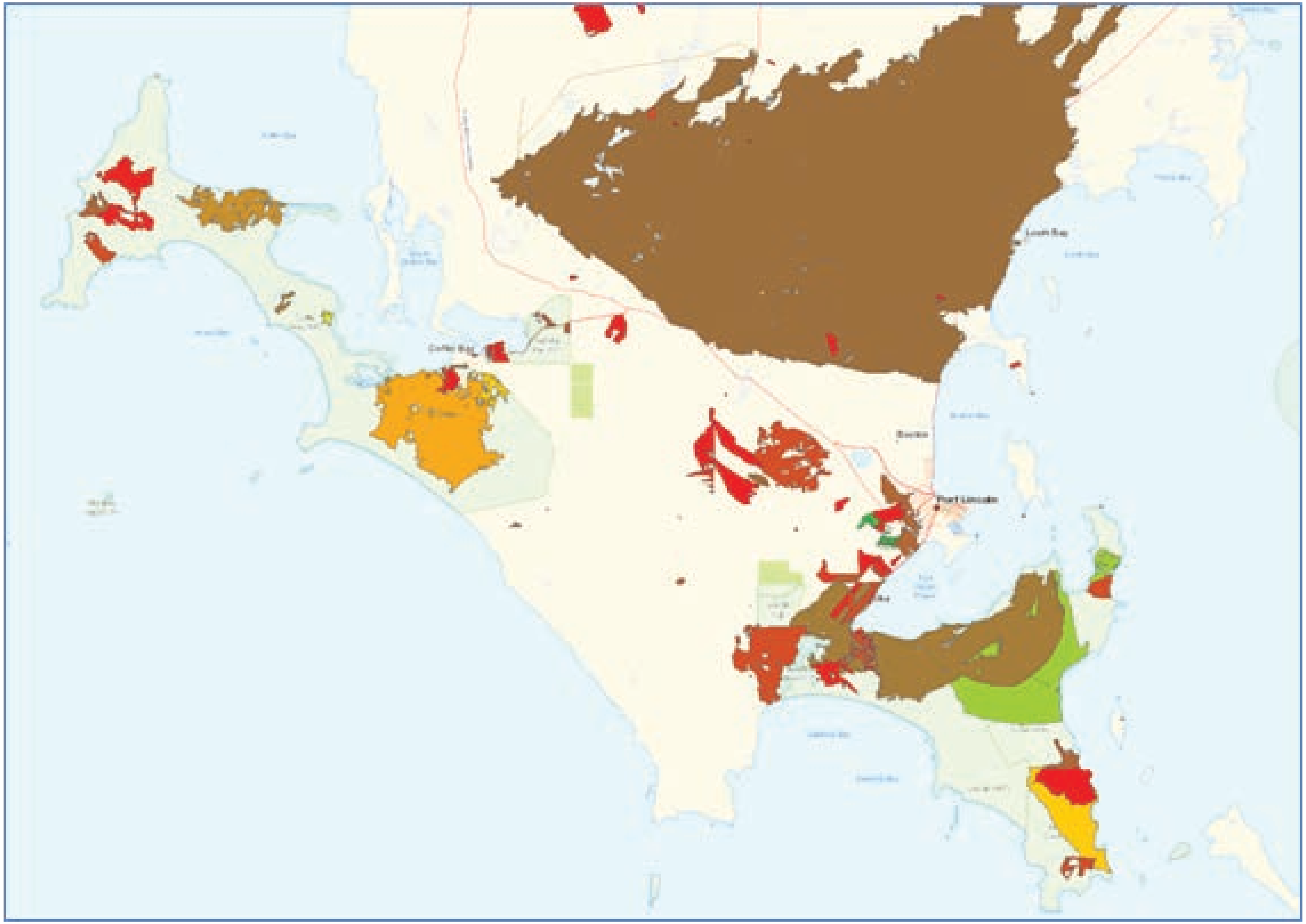


FIGURE 10.1

HISTORIC BUSHFIRE DETAIL

SOURCE: : NATURE MAPS HOME

Within the EIS Section 20.4.2.11, the general details for a Bushfire Management Plan were outlined.

It was noted initially that:

- The site is situated in a bushfire risk area.
- The site is within the Country Fire Service (CFS) Fire Ban District "Eyre Peninsula & West Coast".
- The site is not classed as a Bushfire Safe Place by the CFS.
- This area is covered by CFS Region 6.
- The current Fire Danger Season for this site is from 1 November through to 30 April.

Draft detail on the Bushfire Management Plan was included within the appendices to the Emergency Management Plan. Due to the sensitivity of the contents of the Emergency Management Plan, the document was not included in the package of information released to the public.

Following the exhibition of the EIS, Southern Launch determined that further investigations were required in respect of bushfire risk assessment, mitigation and emergency management.

Southern Launch engaged SA Bushfire Solutions to provide further advice and develop a Bushfire Emergency Management Plan for the proposed facility.

The full bushfire management plan can be found in **Appendix I**.

10.2.2 Summary of Submissions

The most common matter mentioned in submissions received during the exhibition of the EIS was the risk of bushfire in the region. 67 representations mentioned the management and mitigation of bushfire as a major concern.

These included submissions P29, P30, P32, P42, P43, P45, P47, P49, P58, P62, P65, P68, P71, P72, P74, P106, P122, P124, P125, P128, P139, P143, P144, P148, P152, P153, P155, P158, P159, P161, P163, P167, P170, P173, P177, P179, P183, P184, P185, P186, P191, P194, P195, P196, P198, P199, P200, P201, P203, P205, P206, P209, P211, P213, P223, P227, P231, P239, P244, P246, P249, P253, P254, P255, P256, P257 and P26.

<u>State Government Agency Responses</u>

DEW also provided comment in relation to the establishment and maintenance of fixed fire breaks for the proposal. This is discussed in Section 6.2.7 Protection of Buildings and Infrastructure.

The following matters were specifically raised in the submissions:

- The developer's bushfire mitigation strategies are inadequate and not fit for purpose, and do not address the severity of this issue nor the extent of the risks posed.
- The conditions under which operations are suspended because of fire risk for both the construction and operational phases of the facility.
- How the risk of ignition from launches will be minimised.
- How will the facility be managed over the Bushfire Season from November 1 to April 15.
- Potential bushfire risk to surrounding vegetation and wildlife.
- Fire risk related to transport, access/egress/evacuation.
- Mitigating the risk of fuel storage.
- The reliance on the CFS as a firefighting presence during launches.
- The creation and implementation of a Bushfire Hazard Management Plan.
- How the development will be protected in the event of a fire, independent of any launching activity.
- Detailed descriptions of all the situations that could potentially lead to a fire breaking out.
- Details of the actions that will be taken to minimise the risks of such fires breaking out.
- Details of all fire hazard monitoring to be carried out at the site as well as fire response training and procedures.
- Details of the equipment and human resources that will be available should a fire break out.
- The timeframes within which these resources can be brought to bear.

10.2.3 Discussion

The overwhelming desire of Southern Launch is to implement proactive preventative actions to mitigate the potential bushfire risk from a fire starting on the land and impacting the subject site, adjacent landowners and communities. Southern Launch acknowledge their responsibility to reduce the likelihood and impact of bushfires within and escaping the development and are committed to implementing preventative measures and complying with any fire prevention and management recommendations.

In response to these matters raised in the public consultation Southern Launch engaged SA Bushfire Solutions to prepare a detailed Bushfire Emergency Plan (BEP) to ensure Southern Launch proactively manages and mitigates the risk of bushfire during the construction and operation of the facility.

10.2.4 Launch Management

The risk of fire from launches has been raised as a concern. In response to this concern, it is appropriate to refer to the *Space (Launches and Returns) Act 2018* and *Space (Launches and Returns) (General) Rules 2019* which provides strict requirements for launch be met prior to a launch permit being granted[1].

Whilst this major development process assesses the suitability of this use for the site and surrounds, the Commonwealth Space legislation specifically assesses the suitability of each individual vehicle launch from the site. This rigorous process involves the production (for approval of the ASA) of a Launch Management Plan and a Risk Hazard Analysis. These plans are produced/updated for every launch.

10.2.5 Launch Management Plan

The launch management plan is a comprehensive document which outlines the entire process including the inherent risks and mitigations. The plan must include the applicant's arrangements and procedures for conducting each launch and any connected return, including:

- arrangements to ensure the safety of associated ground operations;
- procedures for making any changes to the conduct of the flight;
- procedures to confirm that the launch vehicle is ready for assembly;
- procedures for assembly of the launch vehicle;
- procedures for the integration of payloads;
- procedures for identifying and responding to adverse weather conditions for launch;
- procedures for launch countdown;
- procedures to recover from any anomalies or failures during the launch;
- for a connected return—the procedures for recovery of each returned space object and for its removal from the place that it lands.
- arrangements for reporting to the Minister on a launch and any connected return;

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1 Space (Launches and Returns) Act 2018 (legislation.gov.au)
Space (Launches and Returns) (General) Rules 2019 (legislation.gov.au)

- arrangements to ensure that personnel who have duties or functions in connection with a launch or launches and any connected return are properly prepared;
- arrangements for responding to any problem encountered in conducting a launch or connected return and for taking action to resolve it;
- a statement identifying all hazardous ground operations associated with a launch or connected return, and a description of the procedures to manage those operations;
- communications arrangements for a launch and any connected return, including the following;
  - launch area communications;
  - communications from drop zones to the launch area;
  - telemetry communications (including the radio frequencies to be used); and
  - emergency communications;
- procedures for managing any change to a payload, including addressing the effect of the change on the performance and stability of the launch vehicle;
- the system to be used for:
  - making and keeping records in relation to the operation of the launch vehicle; and
  - maintaining documentation (such as manuals and procedures) relating to the operation of the launch vehicle;
- arrangements for maintaining the launch vehicle, including the system for recording scheduled and unscheduled maintenance;
- the plan must include a timeline for the launch and flight that identifies all safety-critical events.

10.2.6 Risk Hazard Analysis

The Risk Hazard Analysis provides a comprehensive analysis and calculations of the risks associated with the launch. This is informed by the Flight Safety Code which provides the methodology to complete this analysis.

The analysis undertaken must:

- be performed by a suitably qualified expert who is approved by the Minister and is not a related party of the applicant; and
- fall within the launch safety standards set out in the Flight Safety Code.
- the application must describe the methodology, assumptions and data used in the analysis.

- the methodology must apply the launch vehicle probability of failure set out in the risk hazard analysis methodology in the Flight Safety Code.
- if the methodology used differs from the risk hazard analysis methodology in the Flight Safety Code in any other respect, the application must:
  - describe the methodology used in a form that can conveniently be assessed against the methodology in the Flight Safety Code; and
  - set out each difference between the methodology used and the methodology in the Flight Safety Code; and
  - demonstrate, having regard to those differences, that the methodology is technically sound.
- the application must describe any software used to carry out the analysis, including:
  - a description of the system for:
    - making and keeping records and data relating to the operation of the software; and
    - maintaining documentation (such as manuals) relating to the operation of the software; and
  - for software that is not a generally available commercial product[2]:
    - who developed the software; and
    - how the software operates to implement the methodology used; and
    - how the software was tested and the results of testing; and
    - who validated the software and how it was validated.

It is therefore confirmed that through the assessment for a launch permit a strict and comprehensive plan and analysis is undertaken to manage the very complex launch process. This would include 'hazards' which is defined in the Flight Safety Code as "*a potential source of casualty or loss*" which would, by default, include the risk of fire as a result of a launch.

This process in combination with the proposed Emergency Management Plan and BEM provides significant and suitable mitigation and management measures in the event a hazard that may result from a launch.

10.2.7 Findings of BEP

The BEP includes a full assessment of the bushfire risk within the Southern Launch lease site, from both external and internal fire ignitions.

[2] Flight Safety Code | Department of Industry, Science, Energy and Resources

The four key elements of the Plan include:

1. An assessment of bushfire risk across the site comprising
   a. Current site risk analysis (e.g. no development, current conditions)
   b. Construction and Operational risk analysis – no mitigation measures
   c. Construction and Operational risk analysis – mitigation measures applied.
2. Recommendations regarding preparing for bushfire and the implementation of bushfire risk reduction activities.
3. Detailed information and guidance on bushfire readiness and bushfire emergency management procedures
4. Specific actions to guide Southern Launch staff, contractors and visitors on the actions should a bushfire occur.

Bushfire Risk Assessment

To gain a full understanding of how the proposal would impact upon the risk of bushfire on the site, The Bushfire Management Plan analysed three scenarios. The first, the current risk experienced as it exists now with the Heritage Agreement and tourism uses on the site. Secondly an analysis on how the risk changes without bushfire mitigation measures applied to the construction and operation of the development. Thirdly, an analysis of the development with mitigation measures applied. This has been summarised in **Table 10.1** below:

Table 10.1: Summarised Bushfire Risk Assessment

RISK TO LIFE AND PROPERTY			
	Likelihood	Consequence	Risk Rating
Current Risk Rating	Likely	Catastrophic	Extreme
Construction & Operation (no mitigation)	Likely	Catastrophic	Extreme
Construction & Operation (mitigation)	Unlikely	Major	High
RISK TO THE ENVIRONMENT			
	Likelihood	Consequence	Risk Rating
Current Risk Rating	Likely	Major	Extreme
Construction & Operation (no mitigation)	Likely	Moderate	High
Construction & Operation (mitigation)	Unlikely	Moderate	Medium

As shown in the table, the existing and current bushfire rating ranges between major and catastrophic, indicating that as it stands the risk of bushfire on this site is likely. As the site is progressively developed and mitigation measures applied; the risk of bushfire gradually reduces. This is mainly due to the significant bushfire mitigation measures that will be applied as part of the Bushfire Management Plan. These measures are ongoing and seek to provide pre-emptive measures to reduce the risk of bushfire on the site with the resulting risk rating with mitigation measures ranging from medium to high.

<u>Fire Danger Rating</u>

Data that has been collated by the Bureau of Meteorology (BOM) from weather stations closest to lease area over the past 30 years highlight the average number of days per year with the Fire Danger Rating (FDR) and Very High Fire Danger Index (FDI). This is provided in **Table 10.2** and shows that there is a potential of 22 days very high FDI and a combined 6 from Severe and extreme. It is noted that on average there are zero catastrophic days forecasted in a year.

Table 10.2: Average number of FDR days per year

AVERAGE NUMBER OF FDA DAYS PER YEAR				
High	Very High	Severe	Extreme	Catastrophic
34	22	5	1	0

Table 10.3: FDR/FDI Action Plan

FORECAST FIRE WEATHER CONDITIONS (FDR) AND (FDI)	ACTION REQUIRED BY THE CHIEF BUSHFIRE WARDEN FOR FORECAST FDR FOR THE WHALERS WAY SITE NEXT WORKING DAY		DISTANCE OF REPORTED FIRE (NORTH OR WEST OF SITE, SHELTER IN PLACE BUILDING, OR EGRESS/EVACUATION ROUTE)		
			<10 km	10 – 20 km	>20 km
Catastrophic FDI 100+	ACTION	Act to close site, notify CFS of closure	Site Closed	Site Closed	Site Closed
Extreme FDI 75-99		Act to close site, notify CFS of closure	Site Closed	Site Closed	Site Closed
Severe FDI 50-74		Site open to essential operations only. Possible Evacuation in the event of a fire may be required – prepare now and inspect Shelter in Place Building	Shelter in Place	Immediate Full Evacuation	Possible Evacuation
Very High 25-49		Site Open Possible Evacuation in the event of a fire may be required – prepare now and inspect Shelter in Place Building	Possible Evacuation	Possible Evacuation	Possible Evacuation

10.2.8 Protection of Buildings and Infrastructure

Bushfire does not adhere to property boundaries, and it is evident that a similar bushfire risk exists on land managed outside of the Southern Launch site.

Bushfire mitigation works undertaken on the site such as implementing asset protection zones around key infrastructure, improved vehicle access, vegetation management, dedicated fire resources and training will help to reduce the overall bushfire risk, the subsequent impact on surrounding communities and the environment.

The Southern Launch Whalers Way site is being constructed in an environment that is well known and understood for being bushfire prone. This risk assessment has dealt with bushfire risk holistically. This includes the risk of fire occurring on-site as part of the proposed operations and the risk of fire entering the area from the surrounding landscape.

The single greatest threat to the buildings/infrastructure on-site and the surrounding private and public land, particularly on the northern side of the Southern Launch site is the amount, configuration and arrangement of bushfire fuel present and its ability to spread fire rapidly across the site under adverse fire weather conditions.

Significant resources are being applied to the development of mitigation actions to reduce bushfire risk, and this includes the recognition of dedicated Southern Launch fire resources during launch activities occurring in the Fire Danger season.

The reduction of the overall fuel hazard on the site and maintaining sterile areas and asset protection zones around critical infrastructure, assets and access tracks is proposed in line with the recommendations listed in the BEP.

Both launch sites, other built operational buildings and the range control will have vegetation management zones around them to manage the potential bushfire risk. This will consist of a fuel reduced area to prevent direct flame contact on the assets, minimise radiant heat, possible ignitions from ember attack and operational failure.

The minimum vegetation management zone (Asset Protection zone) around the launch sites will be 60 metres. These areas will primarily be located within the fenced sites and also include the buffer areas on the outside of the fenced area.

10.2.9 Recommendations to be Adopted by Southern Launch

As discussed above, a number of mitigation measures will be applied to the development to reduce the bushfire risk rating. These 25 recommendations are outlined in the Bushfire Emergency Plan to be fully adopted by Southern Launch.

The recommendations are:

1. All staff and contractors must carry basic firefighting equipment (including fire extinguisher) along with communications devices in all vehicles.
2. Invest in 4-wheel drive fire suppression capability to support bushfire risk mitigation during launch operations.
3. All staff that will be at the site during the fire danger period should be provided with basic wildfire awareness (BWA) training.
4. All staff involved in any initial attack bushfire suppression operations to be provided with the appropriate nationally accredited training.
5. Develop policies and procedures to appropriately manage bushfire risk to visitors, staff and contractors. Including site induction, bushfire response, actions on forecast high fire weather days, reported bushfire emergencies, visitor management and site closure.
6. Site induction to include site specific bushfire risk information.
7. Maintain a database of assets and a maintenance register.
8. Record the annual mitigation and preparedness actions through the implementation of the annual Bushfire Mitigation Operational Schedule (BMOS).
9. Review their legal liabilities regarding lease agreements, bushfire prevention requirements, suppression responsibilities and access to the lease area.
10. Southern Launch facilitate the opportunity for local CFS Brigades to undertake annual visits to become familiar with access and egress, access difficulties for larger appliances and areas restricted to smaller fire appliances.
11. Consider reducing the overall fuel hazard on the site, maintain sterile areas and asset protection zones around critical infrastructure, assets and access tracks.
12. Annually review and update the Bushfire Emergency Plan (BEP).
13. Provide a bushfire shelter in place location on the property for staff, contractors and visitors to shelter if threatened by a bushfire.
14. Implement a communication system that ensures that all staff, contractors and visitors can always be contacted and be notified of any emergency warnings and alerts.
15. Appoint a dedicated Chief Bushfire Warden and deputies as part of the Emergency Control Organisation (ECO) requirements.

16. Ensure a hot works management system (including permits) is implemented and includes consideration of the bushfire risk on the given day.

17. Consider the installation of surveillance cameras to assist with bushfire detection and site security.

18. Install dedicated static firefighting water supplies at appropriate locations across the site.

19. Advise the Bushfire Management Area Committee (BMAC) of bushfire mitigation actions being carried out on the lease area and update the Bushfire Management Area Plan (BMAP) as required.

20. Ensure all roads and access tracks through the site meet the current SA Government fire access track guidelines.

21. Continue to liaise with all stakeholders across the southern peninsula and apply a tenure blind approach to bushfire mitigation and response.

22. Work with fire agencies, all surrounding land managers and private properties to ensure landscape risk is being appropriately managed.

23. Ensure that any future revegetation projects do not contribute to an increased bushfire risk to assets, infrastructure, or access.

24. Develop sound environmental management practices for future fire management, including post bushfire recovery actions.

25. Improve emergency vehicle access around the perimeter boundary of the lease area.

The implementation of these recommendations by Southern Launch will assist in mitigating the likelihood and consequence of bushfire, guide response actions and provide strategic direction for future investment and planning with specific focus on the protection of life and property as it relates to bushfire.

Having regard to submissions which highlighted reliance on the CFS and other emergency agencies during launches, it is noted that Southern Launch, as expressed in the EMP and BMP will have its own capability for emergency response, including fire management. Existing protocols exist for funding of emergency agencies for their scheduled attendance at activities undertaken by private companies. This extends to many events where the public attend, such as sporting events, festivals, concerts, and also to activities which do not involve the public but where prior attendance by emergency services is appropriate.

The requirement for attendance at launches by the CFS and other emergency agencies will be assessed as part of the planning for each individual launch, as the risk will vary based on the size of the rocket being launched, the fuel type, the time of year and various other factors.

10.2.10 Conclusion

In summary, the BEP provides for a holistic preparedness plan to ensure fire management and mitigation is an ongoing proactive process. The recommendations included within the BEP will be implemented over time and the BEP strictly followed. This will reduce the risk of bushfire as it is implemented over time.

The BEP, to be incorporated into the EMP, provides suitable justification from a fire management and mitigation perspective and meets with the concerns and matters raised as a result of the public consultation.

Southern Launch welcomes a condition to ensure the BEP is specifically referenced as a management document for the facility including the implementation of the 25 recommendations.

The proposal is considered to have developed appropriate plans for mitigation and management of the risk of bushfire. Whilst the activity proposed carries an inherent degree of the risk, regulation of the operation of the facility under Commonwealth space legislation requires detailed assessment, planning and mitigation of risks, including of bushfire. These mitigations will include comprehensive and ongoing assessment of prevailing conditions, which will result in launches not being undertaken in conditions where the risk of a fire starting, or being unable to be controlled, is excessive.

Whilst the submissions raising this issue have a reasonable concern, the extent to which the potential risk exists is frequently overstated, generally without reference to the extent to which the risk is capable of being managed and mitigated. The proposal includes multiple layers of risk management through the design of the proposal, operational planning and management and response plans in the event of a contingency.

Ongoing liaison will occur with emergency services during the detailed design, construction and operational planning phases of the development, including further revisions to the BMP and EMP.

10.3 Coastal Processes

10.3.1 Background

The proposed development is occurring on an allotment which is adjacent the coast. Whilst the majority of the coastal interface itself is located in a parcel of Crown Land which is located between the subject allotment and the ocean, there is no fence or distance boundary between the subject allotment and the coastal interface, and the coastal areas are not accessible other than through the subject allotment.

The proposed development, including Launch Sites A and B, Infrastructure Site D and Range Control Site E are all set back from the coast. The proposal will require localised upgrades to existing access roadways which are in closer proximity to the coast, however, no new access roadways will be constructed which are closer to the coast than those which presently exists.

10.3.2 Summary of Submissions

A total of 17 submissions received during the exhibition of the EIS referenced the issues of coastal erosion.

These submissions included P32, P42, P43, P47, P68, P71, P107, P124, P195, P226, P231, P253, P254, P255, P257, P258 and P261.

DEW has identified that the EIS has not included any measures for the remediation of erosion or sand drift should it occur within the clifftop dune system as a result of the development.

10.3.3 Discussion

Having regard to the proposal, as amended following the exhibition of the EIS, the potential for erosion and sand drift to be exacerbated by the proposal is considered to be low. The project sites are located, with the exception portions of existing roadway, a considerable distance from the coastal interface.

Additionally, through improved management of tourism and recreational uses, the implementation of the proposal will reduce unmanaged access to coastal areas of the site which should reduce the potential for physical impacts on the coastal interface as a result of these activities and also reduce the potential for impacts on fauna resulting from such activity.

Cliff instability as a result of heavy vehicles traffic on roads adjacent the coastal interface is discussed in **Section 9.1.7**. As noted, the traversal of 10 to 12 heavy vehicles per day, on average, travelling at slow speeds is not expected to materially affect the stability of the coastal cliffs or result in any significant dynamic effects. An on-going monitoring program will be incorporated as part of the dilapidation report sought by Council to record the condition of the adjacent cliff top during the construction works and subsequently during the operation of the proposed development.

As part of Southern Launch’s commitment to the rehabilitation of the site, the remediation of existing areas of coastal erosion or sand draft will be considered.

A Soil Erosion and Drainage Management Plan (SEDMP) will be developed and incorporated into a CEMP for the management of the matter. Southern Launch has committed to the implementation of a SEDMP as a component of the final CEMP.

10.3.4 Conclusion

The primary manner in which the stability of the coastal interface will be protected is through the design of the proposed development locating the sites and infrastructure a suitable distance away from the coast. The only locations where this is unable to be avoided is where existing access roadways are located in proximity to the coast.

The proposal will result in improved monitoring and management of the coastal interface within the site, with rehabilitation being able to be undertaken where issues such as erosion or sand drift occur.

The proposal is considered to have been designed in such a way that it minimises the potential for the development to be impacted by coastal hazards or to impact on the coastal interface through effects such as sand drift or erosion.

11 VISUAL AMENITY

11.0 VISUAL AMENITY

11.1 Background

The proposal involves the establishment of built infrastructure in a location where at the present time limited built form exists. The construction will involve the development of four discrete areas of the site, together with the upgrade of exiting access tracks and the establishment of new access tracks.

The majority of the construction involves civil works and structures of relatively low height. Several elements of the proposal, including the assembly and maintenance buildings and the elevated water towers are higher structures, and will have greater levels of visibility.

The Landscape Character and Probable Visual Effect Assessment (LCPVEA), prepared by WAX, referenced in the EIS acknowledged that there will be visual effects on the character of the locality as a result of the project.

Following the exhibition of the EIS, the project has been refined to relocate Site A. The primary purpose of the Site A relocation was to reduce the terrestrial ecological impact of the proposal. It is acknowledged that the relocation of Site A will alter the visual impact of the proposal. Whilst the configuration of the relocated Site A remains the same as previously proposed, it is located in a different position, and will therefore alter the visibility of this element.

Following the exhibition of the EIS, WAX were engaged to review the submissions which referenced visual amenity and provide input into the process of selecting a revised location for Site A.

WAX have prepared a technical memo responding to the representations, which includes updated Zone of Theoretical Visual Influence ('ZVTI') mapping for the revised position of Site A.

The technical memo prepared by WAX following the exhibition of the EIS is contained in **Appendix J**.

11.2 Summary of Submissions

Seven submissions received during the exhibition of the EIS referenced the issues of visual amenity.

These submissions included P3, P42, P68, P128, P153, P159 and P168.

All seven submissions expressed the need to protect and preserve the natural landscape and referenced what they perceived as potentially unacceptable impacts of the proposal.

The impacts were perceived to be derived from the visibility of the proposed built form and infrastructure, combined with the perceived high quality of the existing landscape character. Reference was made to protecting views available from publicly accessible areas to the east of the site and views available from sites such as Cape Wiles and Theakstone Crevasse.

Several of the submissions referring to visual amenity issues suggested amendments to the proposal, most notably the relocation of Site A and Site B further inland.

11.3 Discussion

11.3.1 Revised Zone of Theoretical Visual Influence Mapping

An updated Landscape Character Map showing the revised location of Site A in the context of the maps charter of the site is shown in **Figure 11.1**.

ZVTI mapping of the revised location of Site A with a 30 metre mast is shown in **Figure 11.2**. This represents the worst case scenario of the proposal as only the elevated water tanks and the launch vehicles themselves will reach this height.

ZVTI mapping of the revised location of Site A with a 10 metre mast is shown in **Figure 11.3**. This represents the remainder of the site infrastructure.

ZVTI mapping of the combined effect of the revised location of Site A, together with the location of Site B and Site D is contained in **Figure 11.4**.

ZVTI mapping of the combined effect of the original location of site A, together with the location of Site B and Site D is contained in **Figure 11.5**.

The revised mapping shows the visual impact moving towards the central portion of the site, with the impact over the sea also moving eastwards.

11.3.2 Protection and Preservations of the Natural Landscape

Whilst the proposal will present a certain level of visual impact, the separation of the various sites will fragment the visual effect of the overall development. Combined with the low raised built form and the existing screening provided by local ridgelines, the visual effect of the WWOLC is described by WAX as slight to moderate.

The scale of the built form and the specific siting reduces the potential visual impacts. Each site has been selected to offer increased levels of screening and visual mitigation. The original siting of Site A was situated on an inclined plateau facing north away from the coastal edge towards the modified rural landscapes. The revised location of Site A will position the launch facility further to the north, away from the south-facing coastal edge of the locality. While the revised position for Site A has a slightly higher elevation than the original position, it is surrounded by local ridgelines that provide screening to the west and fragmented screening to the north, south and east, mitigating the overall visual effect of the launch site, particularly to the south.

The position of Site B is surrounded by the local landforms that restrict views to the broader landscape. In addition, a local ridgeline to the south restricts visual impacts on the coastal cliffs.

Site D is set well back from the coastline and is located in a low-lying basin, visually separating it from the broader locality.

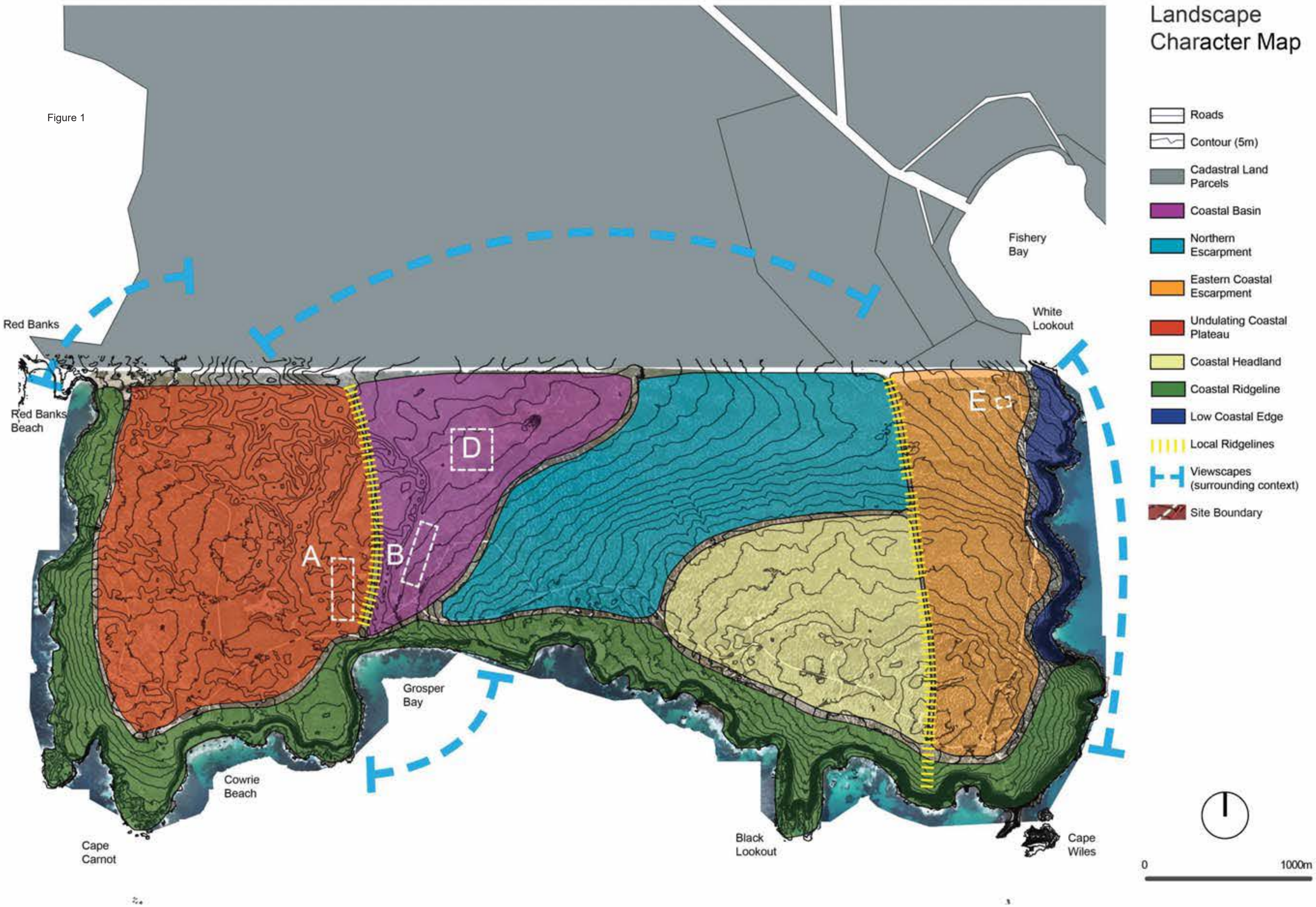

FIGURE 11.1

UPDATED LANDSCAPE CHARACTER MAP

SOURCE: WAX

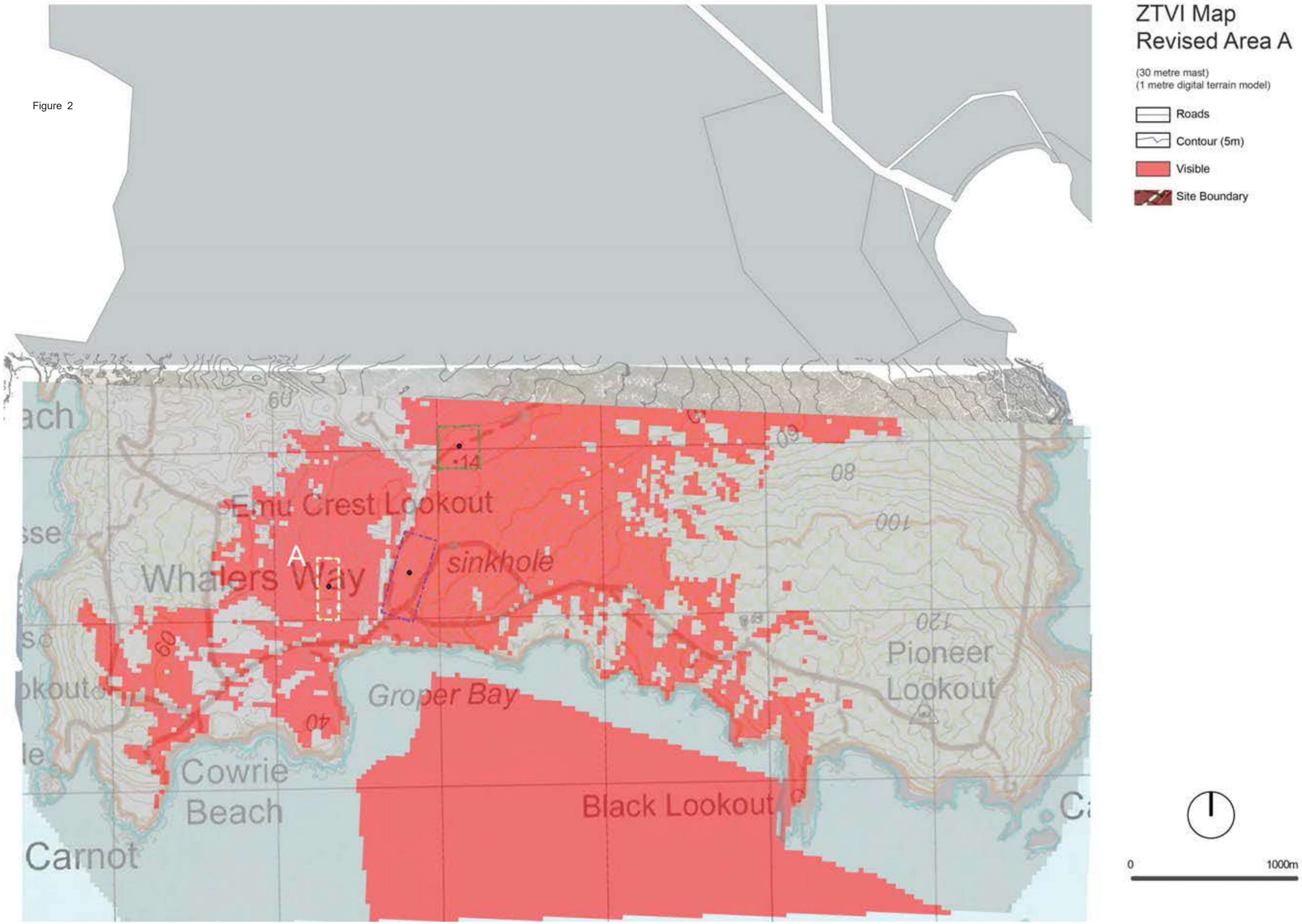

FIGURE 11.2

ZVTI MAPPING – REVISED SITE A – 30M MAST

SOURCE: WAX

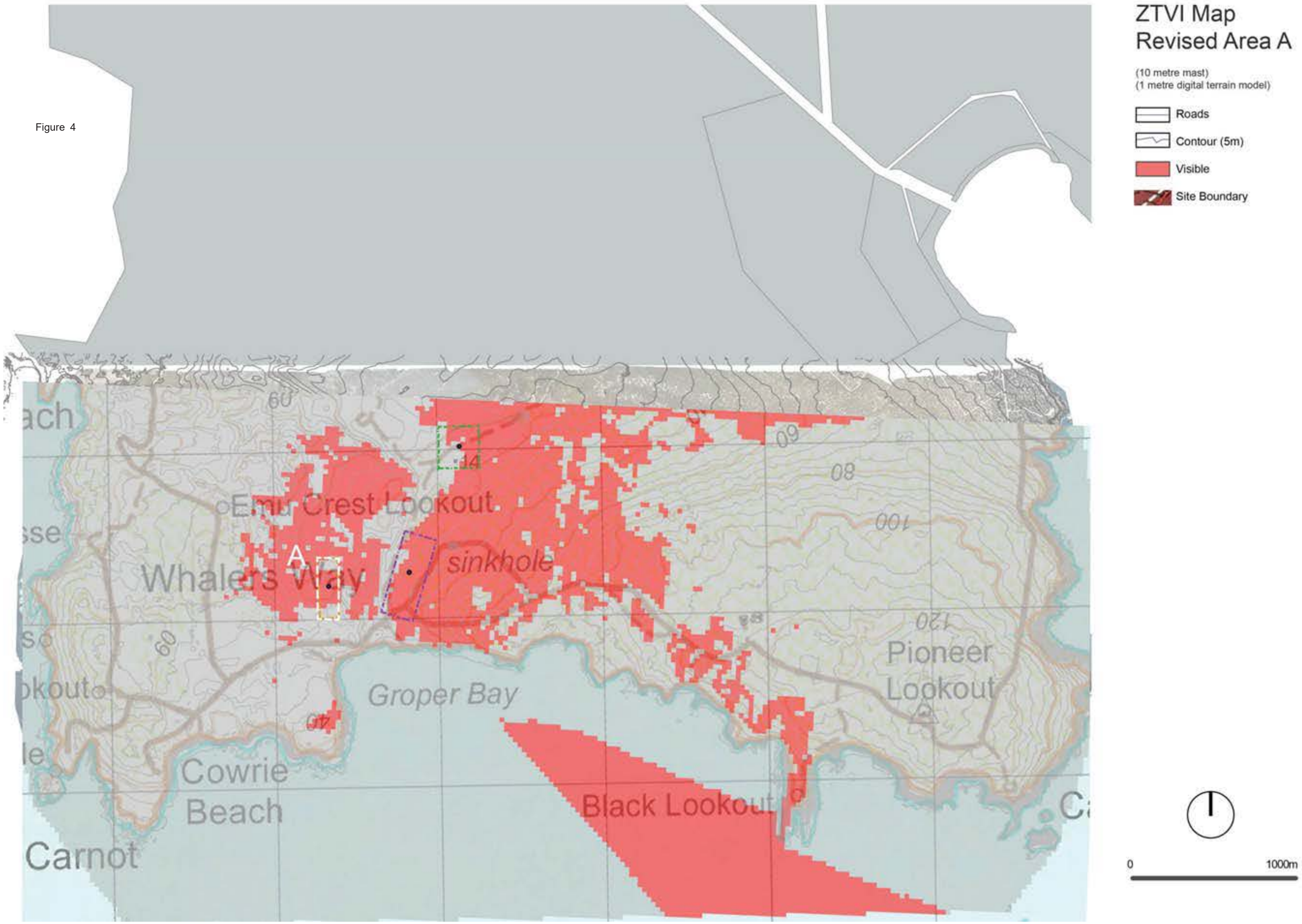

FIGURE 11.3

ZVTI MAPPING – REVISED SITE A – 10M MAST

SOURCE: WAX

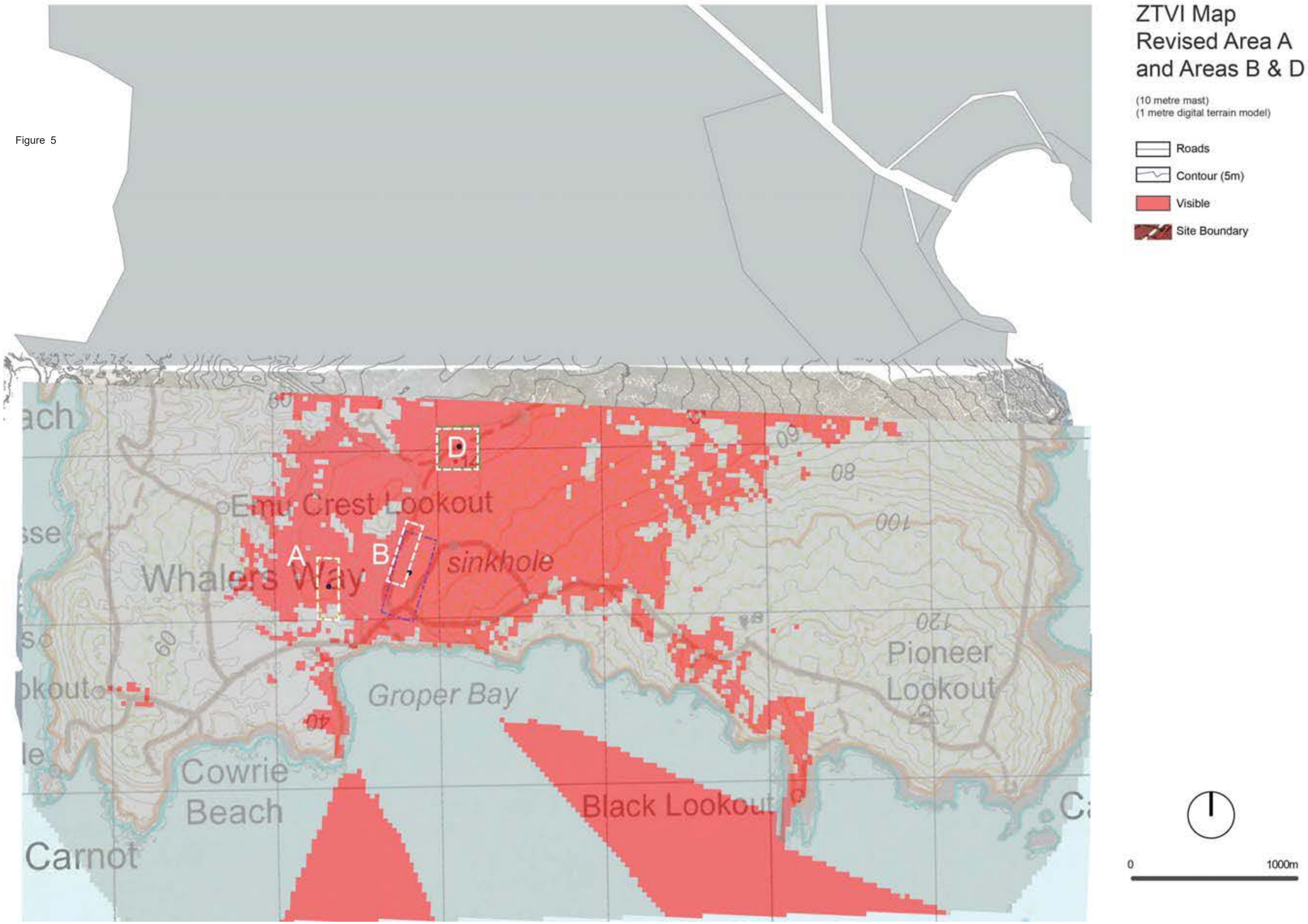

FIGURE 11.4

ZVTI MAPPING – REVISED SITE A – SHOWING SITES B & D

SOURCE: WAX

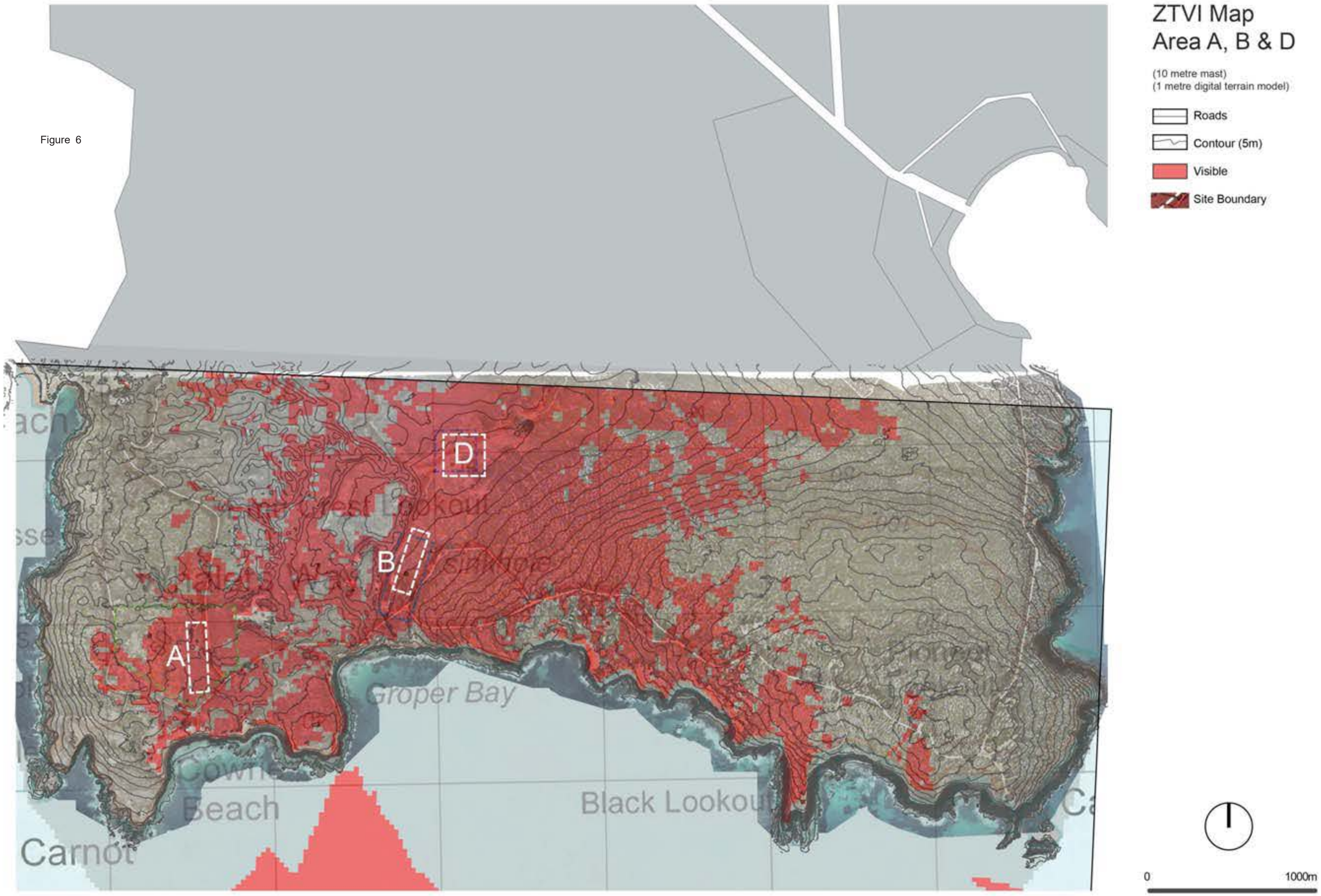

FIGURE 11.5

ZVTI MAPPING – ORIGINAL SITE A – SHOWING SITES B & D

SOURCE: WAX

While there will be specific changes to the existing landscape character, the overall natural character of the locality will remain. Notably, there will be limited impacts on the visually sensitive and scenic coastal edge. The contained visibility of the proposed development is illustrated by the Zone of Theoretical Visual Influence (ZTVI) mapping referenced above, which has been updated to reflect the revised Site A.

While the visual impacts of the proposed development will increase during launch periods, the duration and temporary nature of the visual effect does not alter the slight to moderate visual effect determined by WAX.

In respect of impacts on existing features and locales within the site, the ZTVI mapping illustrates that there will be no impacts on Theakstone Crevasse due to the relative position of the crevasses, the landform screening to the west of the revised position of Site A. The visual impacts on Wanna Cliff Lookout and Winter Hill Lookout will be negligible given the separation distances and landform screening between the development sites and these locations. The eastern escarpment of the Whalers Way locality already contains several buildings and infrastructure elements, which create visual impacts across the natural landscape character of the area.

11.3.3 High Quality of the Existing Landscape of Whalers Way

While the Coastal Viewscapes of South Australia report, undertaken by Dr Andrew Lothian, rates the coastline as having a value of 8.25, this value relates to the coastline and coastal edge. The landscape assessment considered the broader locality, including the landscape character of inland areas. This results in a lower landscape value and lower impact of the corresponding visual effects.

Given the contained ZTVI, the screening provided by local ridgelines and the fragment development form associated with the proposed development, it remains the opinion of WAX that the probable visual effect will be slight to moderate.

11.3.4 Consistency with Development Plan Objectives

The LCPVEA provided a review of the Lower Eyre Peninsula Council Development Plan (consolidated 12 July 2018) concerning potential visual impacts.

Several public submissions highlighted the Zone requirements, with specific reference to potential visual impacts. As discussed in the assessment report, the objectives for the Zone aim to facilitate development that contributes to the desired character of the zone while enhancing and conserving the natural features of the coast, including visual amenity and landforms.

The desired character statement indicates certain development may occur within the zone but must be undertaken in a way that does not dominate the area's natural elements. As previously stated, the fragmented development form and ridgeline screening mitigate the impact effect of the Whalers Way Orbital Launch Complex.

The revised Site A location and the location of Site B will consist of buildings with a maximum height of 10-metres and water towers with lattice towers up to 22.5-metres above the surrounding ground level. These buildings and associated infrastructures will be constructed with colours and materials to mitigate some of the visual impacts on the surrounding landscape.

The bunding and potential revegetation across the sites will further reduce the potential impacts of the buildings. In addition, the retention of existing vegetation where possible will provide additional screening and mitigate the visual impact of the water towers over greater distances.

The 30-metre launch towers will be visible from surrounding areas. When these structures are raised for launches, they will be visible within two defined view corridors: from offshore waters to the south and north towards the agricultural land of the peninsula. However, the temporary nature of these infrastructure elements assists in minimising potential visual effects.

Given the scale of the development and the visibility demonstrated by the revised ZTVI mapping, the impact on the landscape of the locality is not dominant, and the potential visual and landscape impacts of the WWOLC in the coastal landscape will be minimised.

An assessment of revised Site A, and the ZTVI mapping illustrates a compact visual effect is produced across the central coastal basin of the locality. The adjacent ridgelines and vegetation cover provide distinct viewsheds to the east and west. The revised location in combination with the underlying topography mitigates the potential visual effects of the proposed development. This is especially so when compared with the original Area A proposal.

11.4 Conclusion

In considering the visual impact of the proposal, the extent to which people are actually present in the locations from which views can be obtained is a relevant consideration. The most significant views of the proposed infrastructure will be obtained from on the site itself, which will be accessed either by staff and visitors of the facility or by persons accessing the site for tourism and recreation purposes.

Views of the proposed development will be visible from the sea to the south of the site, however, will only be obtained by the small number of vessels and aircraft which transit the vicinity. Views from the north are largely obtained from private property, which has limited accessibility to the public. Views of the proposed development from publicly accessible areas to the east of the site are assessed to be negligible.

The revised location of Site A is assessed to reduce visibility of the proposed development in the area of Theakstone Crevasse.

WAX have concluded that the proposed development is likely to create a range of slight to moderate visual impacts within a contained landscape context. Coupled with other mitigation measures, the degree of visual effect on the existing landscape will be minimised and is considered to be acceptable.

12 ENVIRONMENTAL EXTERNALITIES

12.0 ENVIRONMENTAL EXTERNALITIES

12.1 Air Quality

12.1.1 Background

Impacts on air quality from the proposal principally relate to the impacts of rocket launches, where exhaust from the combustion process enters the atmosphere.

The impacts on air quality have been separated into two sections, those relating to direct air quality impacts and those relating to the greenhouse gas impacts resulting from the proposed development.

The Air Quality Impact Assessment, prepared by SLR Consulting Australia, undertaken for the project and referenced in the EIS, undertook modelling of the air quality impacts of the proposed facility.

In the Air Quality Impact Assessment, the dispersion modelling was based on launch test emissions from Launch Site B, which is the closest launch site to the nearest sensitive receptors, which are residences approximately 3.5 kilometres to the north-east of the operations. This captured worst case conditions for the launch operations.

The air quality assessment also modelled emissions from engine tests at Launch Site A, which is now proposed to be relocated within the site.

The distance to the nearest receptor from Launch Site A (as first proposed) was approximately 4.7 kilometres. The distance to the nearest receptor from the new location of Site A is approximately 3.8 kilometres.

Following the exhibition of the EIS, and the decision to relocate Launch Site A, SLR was engaged to review the submissions which referenced air quality impacts and provide input into this response document.

SLR have undertaken further modelling of the proposed facility in having regard to the revised Site A position, and its location closer to the nearest sensitive receivers.

The updated report prepared by SLR following the exhibition of the EIS in contained in **Appendix K**.

12.1.2 Summary of Submissions

A total of 29 submissions received during the exhibition of the EIS raised issued which related to or were directed at air quality.

These included responses from P26, P46, P49, P51, P65, P74, P123, P128, P131, P139, P143, P149, P150, P152, P165, P166, P167, P173, P177, P178, P179, P194, P203, P209, P219, P223, P231, P244 and P246:

- Chemical toxic fallout from launch – 21 mentions.
- Air Pollution – 6 mentions.
- Contribution to South Australia's greenhouse gas emissions - 6 mentions.

<u>State Government Agency Responses</u>

The EPA have assessed the EIS specifically in relation to the Air Quality Impact, and provide the following commentary:

> *The air quality impact assessment was performed as a highly conservative assessment, particularly with regards to the level of activity at the site. The expectation is for 36 launches per year, lasting 30 seconds per launch, and a few engine tests per year for up to 2.5 minutes per test. The modelling assumed a launch and test for every second hour for the whole year, equating to 4,380 launches and engine tests. Even with this significant level of conservatism, the modelling predictions show compliance to the maximum ground level air pollutant concentrations contained in Schedule 2 of the Environment Protection (Air Quality) Policy 2016, aided by the significant distances to sensitive receivers.*

Given this, it is apparent that the proposed level of operations will be extremely likely to comply with Schedule 2 of the *Environment Protection (Air Quality) Policy 2016*.

12.1.3 Discussion

12.1.3.1 Air Quality Impact

As detailed above, SLR have been engaged throughout the process to provide modelling to assess the potential impacts of the facility upon air quality.

The Air Quality Impact Assessment undertook a thorough literature review to determine the potential air quality impacts resulting from rocket launch facilities. It is noted that in many cases the separation between such facilities and sensitive receivers had resulted in quantitative air quality analysis not being undertaken. Considering the level of detail available for both rocket engine exhaust emissions in general, and the rockets that may be launched from the proposed orbital launch complex, the emissions estimation was focused on potential worst-case emissions of each pollutant.

From a review of rocket engine exhaust emissions data. the following pollutants were identified as relevant to include in the assessment to cover both liquid and solid fuel emissions:

- Carbon monoxide (CO) – combustion product from liquid RP1 (kerosene) fuel.

- Nitrogen oxides as nitrogen dioxide (NO_2) – combustion product from liquid RP1 (kerosene) fuel.
- Hydrogen chloride (HCl) – emitted from certain solid fuel engines.
- Particulate matter (PM) as for combustion emissions assumed to be fine particulate matter ($PM_{2.5}$) – emitted as part of all combustion however worst-case emissions are from solid fuels.

Due to operational circumstances, a rocket could be launched at any time of day. As such, it was conservatively assumed that emissions would occur all times of day.

However, considering that the emissions only occur for a very short duration, that there will be no consecutive launches within short time periods, and that the emission rates are very high (compared to standard dispersion modelling applications), variable emissions files were set up including a rocket launch/engine test every second hour of the year for each scenario. As such the modelling includes assessment of a total of 4,380 launch events and 4,380 engine tests within a year. The annual total of proposed launches is 42 (36 orbital launches and six sub-orbital launches) and the number of engine tests will be very few and mostly much smaller scale than assumed for the purpose of the modelling.

The Air Quality Impact Assessment also considered other emission sources from the site, such as generators for electricity generation, however considered these not of large scale and not significant for the purposes of the assessment.

In the 2020 Air Quality Impact Assessment, the dispersion modelling was based on launch test emissions from Launch Site B. This was the closest launch site to the nearest sensitive receptors, with residences approximately 3.5 kilometres to the north-east of the operations. This captured worst case conditions for the launch operations.

Given this conservative approach was already incorporated in the modelling, there was no requirement to update the modelling to reflect the relocation of Launch Site A, as it has been assumed that all launches would be occurring closer to the sensitive receivers than either the original or relocated positions of Launch Site A.

The air quality assessment also modelled emissions from engine tests at Launch Site A, which is now proposed to be relocated. The distance to the nearest receptor from Launch Site A (as first proposed) was approximately 4.7 kilometres. The distance to the nearest receptor from the new location is approximately 3.8 kilometres.

In consideration of the reduced separation distance to the nearest sensitive receptors for the engine test operations, the dispersion modelling has been updated with the engine test emissions (as previously estimated and modelled) occurring at the new Launch Site A location.

As previously modelled, the engine tests were assumed to occur every second hour of the year (total of 4,380 engine tests assessed). The requirement to model this frequency of testing was based on limitations of the modelling software in respect of the frequency of the emission sources. With capacity planned for only a small number of engine tests (compared to the planned 36 orbital and 6 sub-orbital launches per year), the assessment can be considered as conservative assessment of ground level concentration impacts.

The dispersion modelling of engine tests at the new Launch Site A location shows marginal exceedances for the modelled emissions of CO, NO2 and PM as PM2.5. The modelling assumed engine tests occurring every second hour of the assessment year with total of 4,380 engine tests. At this stage it is only envisaged that a smaller number of engine tests (compared to the planned 36 launches per year) may be performed each year.

In consideration of the smaller number of engine tests proposed, the results can be regarded as conservative. The likelihood of an engine test occurring in worst dispersion conditions with wind direction towards the nearest sensitive receptors is considered low and hence the risk of air quality exposure is also low. Nevertheless, air quality management actions that can be considered to reduce the exposure potential include:

- Performing engine tests in daytime conditions only (avoiding overnight conditions).
- Avoiding performing engine tests in wind directions towards the nearest receptors (south westerly wind direction) in light wind conditions.

Southern Launch is accepting of these limitations on engine testing, to ensure that compliance is achieved at all times.

12.1.3.2 *Greenhouse Gas Emissions*

Greenhouse Gas Emissions have also been investigated by SLR as a component of the overall assessment. The relocation of Launch Site A has not material impact on the greenhouse gas emissions of the project as a whole as the scale and intensity of the proposed facility, which result in the generation of greenhouse gas emissions has not changed.

A number of submissions received during the exhibition of the EIS referenced the greenhouse gas emissions of the project, in respect of the proportion of all emissions from South Australia that the project would comprise.

Greenhouse Gas Emissions were estimated for both construction and operation activities associated with the project. Construction and operational phase emission sources were identified by review of the project description.

The emissions associated with the construction and operational phases that were considered include:

- Construction.
- Land clearing.
- Construction.
- Vehicle movements:
  - Power generation;
  - Production and supply; and
  - Haulage of materials.
- Operations:
  - Launches;
  - Vehicle movements;
  - Production and supply; and
  - Haulage of materials.

The Greenhouse Gas (GHG) assessment estimated emissions during construction and operations and compared these to the State and National GHF emission inventories to assess the potential significance of the project in the context of Australia's annual GHG emissions.

The contributions of the predicted annual GHG emissions resulting from the project are detailed in Table 12.1. As can be seen, the emissions are a relatively small proportion of both the Australian and South Australia total emissions.

It should be noted, that should the project not proceed, the demand for the launches which would have occurred at the WWOLC will most likely be met through launches on other locations. As such, it is considered that the small amount of GHG emissions generated by the project will have a minor effect on global climate change.

Table 12.1: Southern Launch GHG Emissions Contribution to State and National Annual Emission Totals (SLR 2020, p.25)

TOTAL EMISSIONS - 2018			
Southern Launch		Australia	South Australia
Construction and Operations (tCO_2-e)	395,819	537,446,390	24,241,070
Percentage of National/ State Inventory	-	0.07% (0.002%PA)	1.6% (0.06%PA)

For clarification the 1.6 per cent is estimated on the entire 29-year lifespan of the development, not a per annum figure. When calculated in this regard the emissions per annum would be 0.002 per cent for Australia and 0.06 per cent for South Australia. Where some of the submissions suggest the proposal makes up 1.6 per cent of South Australian emissions per annum, this is simply not the case. This figure was included to provide a realistic comparison of the performance of the facility over its calculated lifetime.

As noted above, on an annual basis, the proposal has been calculated to be responsible for 6/1000ths of South Australia's emissions.

This has been clarified by SLR with this detail provided in **Appendix K**.

12.1.4 Conclusion

Considering the relatively small number of launch and engine test events compared to the number of events assessed in all dispersion conditions it is unlikely that a launch or engine test would co-occur with the worst dispersion conditions and result in ground level concentrations as modelled. The emissions from the operations are expected to mostly occur in average dispersion conditions producing lower ground level concentrations than what was presented in the highly conservative testing.

The Air Quality Impact Assessment as updated for the revised location of Launch Site A demonstrates that there is a low risk associated with air quality impacts from the proposed orbital launch complex as assessed and would meet with Schedule 2 of the Environment Protection (Air Quality) Policy 2016.

Having regard to the greenhouse gas emissions from the proposed development, SLR have clarified that the proposal has been calculated to be responsible for 6/1000ths of South Australia's emissions.

The air quality impacts of the proposal are considered to be reasonable and will be able to comply with relevant policies and guidelines relating to the protection of air quality.

In respect of greenhouse gas emissions, the proposed development will make up only a very small proportion of South Australia's emissions. Further. It is noted that these emissions would occur irrespective of the location of the proposed facility.

12.2 Water (Surface and Ground)

12.2.1 Background

The EIS outlined methods for the control and mitigation of pollutants entering the Environment. As stated in the EIS detailed surface and ground water management plans would be included in the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP).

12.2.2 Summary of Submissions

A total of 37 submissions received during the exhibition of the EIS raised issued which related to or were directed at the potential for water impacts on or around the site.

These included responses from P25, P26, P30, P32, P42, P43, P46, P47, P49, P51, P64, P65, P68, P71, P72, P123, P127, P128, P139, P150, P155, P178, P183, P184, P186, P192, P195, P198, P201, P206, P209, P211, P223, P227, P231, P246 and P256.

12.2.3 Discussion

To provide further context and analysis, the aim of this plan was to estimate the potential types and levels of contamination which may occur in the deluge water and provide recommendations for monitoring of potential impacts to water at and near the site.

A review of existing literature indicated that the key chemicals of environmental concern were:

- hydrogen chloride (HCl) which forms hydrochloric acid when dissolved in water;
- unburnt hydrocarbons and carbon black, which may contain traces of polycyclic aromatic hydrocarbons (PAH), and
- aluminium oxide (Al2O3).

Some solid aluminium oxide and soot produced may be suspended with HCL and some exhaust gasses being dissolved and at launch a heated "ground cloud" of atomised and vaporised deluge water that rises from the launch site to fall/rain out at some distance from the launch site. The action of the water deluge and ground cloud is expected to diminish the size of the plume (for water soluble chemicals) from those estimated by puff dispersion modelling.

Other chemicals of concern present at lower concentrations with the potential to impact the deluge water include metals, which may be present in propellants; organic compounds, which may form in the rocket exhaust; and oxides of nitrogen, which may form in the rocket exhaust and by 'after burning' in air. Chemicals of concern were identified and conservative estimates of deluge water concentration for key contaminants (HCl, PAH and Al) were made.

Surface water monitoring programs were recommended. These are to be detailed in the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP). A desktop review of regional geology and hydrogeology was undertaken, and an initial Hydrogeological Conceptual Site Model (CSM) was developed.

Installation of groundwater monitoring wells and groundwater monitoring is not recommended at this stage since risks to groundwater are considered to be low subject to implementation of surface water management measures which will mitigate the risk of water borne contaminants migrating from the launch site(s). This has been confirmed by the EPA who state:

As it is proposed to capture all site runoff up to the 1% AEP, the risks to the environment from stormwater are considered low.

Measures proposed will be detailed in control plans to be included in the CEMP and OEMP, and in accordance with the EPA Guideline – Wastewater Lagoon Construction and Bunding and spill management (where appropriate), which may include but need not be limited to:

1. Perimeter earthen bunding of launch site(s).
2. Bitumen and concrete hardstands in operational areas of the lunch site.
3. Concrete bunding of above storage vessels.
4. Installation of "SPEL Puraceptor" to capture water from within concrete bunded areas (See WGA 2020b).
5. Capture of deluge water in flame trench(s).
6. Testing water in flame before pumping out on trench to launch site dam after launch of each new rocket type.
7. Polymer liner of launch site dam(s) (to be specified).
8. Routine (e.g., quarterly) sampling of water in the launch site dam(s).
9. Placement of lower permeability compacted fill over entire launch site including areas to be subsequently covered in top soil and covered with irrigated lawns.
10. Monitoring of irrigated areas to verify that water applied does not saturate underlying engineered fill.

12.2.4 Conclusion

Subject to appropriate mitigation measures the estimated contaminant levels of HCl, PAH and Al during operation of the proposed facility are considered to pose a low risk to human health and nearby receiving (marine) waters.

12.3 Ocean Dumping

12.3.1 Background

The proposal will result in components from launch vehicles landing in the sea under two (2) flight scenarios, being:

- successful launches; and
- unsuccessful launches.

In the normal event of a successful launch, as the fuel and oxidiser are expended, each stage is ejected from the launch vehicle in sequence at varying distances down range. The ejected stage falls to earth and lands in the ocean.

In the event of an unsuccessful launch the launch vehicle fails during flight resulting in the vehicle exploding or falling to earth in an unpowered and uncontrolled manner. In the event of an explosion, fuel and oxidiser would likely burn up during decent and pieces of the vehicle would fall to the ocean over a large area. In the event of an uncontrolled descent, the vehicle would strike the ocean as a single unit.

The nature of the vehicles proposed to be launched from the facility means that recovery of spent vehicles from the ocean is not practical or viable, and does not, therefore comprise part of the proposal. Whilst recovery of components of space vehicles has occurred for many decades (such as recovery of solid rocket boosters from the space shuttle from the ocean and, more recently, automated recovery of components of SpaceX vehicles, such recovery is only viable for very expensive components of heavy launch systems.

The spent vehicles will therefore strike the ocean, and the debris will remain in the marine environment. This has been the approach for space launches since the inception of the space industry and well-established international law and protocols exist for dealing with spent space launch materials.

12.3.2 Summary of Submissions

A total of 12 submissions mentioned that there would be negative environmental impacts as a result of spent launch vehicles falling into the ocean.

This matter was raised in submissions P59, P68, P70, P74, P113, P152, P164, P170, P186, P223, P227 and P231.

The submissions in respect of this issue typically did not provide detailed justification of the mechanisms by which impact would be caused, however identified issues including:

- waste materials;
- pollution;
- toxic materials; and
- debris impacts.

Many of these issues have been addressed in **Section 5.0** relating to marine ecological impacts. Further detail in respect of these issues is provided below.

12.3.3 Discussion

The rockets proposed to be launched from the WWOLC will be largely comprised of inert components with some components which have minimal impact on the environment.

The rockets will be made up of:

- Carbon Fibre Reinforced Plastic (CFRP).
- Plastic.
- Plastic (Bakelite).
- Aluminium.
- Stainless Steel.
- Titanium.
- Glass.
- Copper wire.
- Li-Ion Batteries.
- Computer chips.
- Fuel/Oxidiser.
- Other gases.

Further description of these components is provided as follows.

12.3.4 Component Descriptions

<u>Carbon Fibre Reinforced Plastic (CFRP)</u>:

Carbon Fibre Reinforced Plastic (CFRP) has been used for many years for aerospace products. The material is light, very strong and workable into complex aerodynamic shapes. Launch vehicles use CFRP for the majority of the structure including the skin that forms the external shape of the rocket, as well as the structure that forms the rocket motors and fuel tanks. Many modern rockets are constructed using this material such as Rocket Lab's Electron vehicle, flown out of their launch site in New Zealand. CFRP is inert and does not leach any harmful chemicals into the environment.

Plastic:

Plastic is used within the launch vehicle to form a protective outer cover for electrical wiring. Plastic is non-reactive and does not leach any harmful chemicals into the environment.

Plastic (Bakelite):

Plastic (Bakelite) is a common plastic used extensively for common household goods. It is used within the launch vehicle to form a protective outer cover of critical components given Bakelite's resistance to heat, electricity, and non-reactivity. Bakelite does not leach any harmful chemicals into the environment.

Aluminium:

Aluminium is used within the aerospace industry to create light metallic structures. Aluminium is used within launch vehicles for structural elements, holding key components within the rocket in place. Aluminium is a natural element and does not leach any harmful chemicals into the environment.

Stainless Steel:

Stainless steel is used within the aerospace industry to create temperature resistant metallic structures or structures that can be subjected to large aerodynamic loads. The Stage 1 uses stainless steel in critical components of the rocket motors as well as forming components of the rocket motor actuator system. Stainless steel is does not leach any harmful chemicals into the environment.

Titanium:

Titanium is used within the aerospace industry to create temperature resistant metallic structures or structures that can be subjected to large aerodynamic loads. The launch vehicle uses titanium in critical components of the rocket motors as well as forming components of the rocket motor actuator system. Titanium does not leach any harmful chemicals into the environment.

Lithium-Ion Battery:

Rupture of the batteries on connection with the ocean surface or with the seabed could release highly reactive Lithium (Li) to the seawater – which would produce highly alkaline seawater conditions in the region surrounding the battery and dissolution of the Li into the seawater.

This effect would be transient and localised and assessed as being low risk to sea life due to the small size of the batteries and the vast area of potential drop zones.

Glass:

There is the potential for glass to be used in payload items. Glass is inert and does not leach any harmful chemicals into the environment.

Copper Wire:

Copper wire is used for electrical wiring in the launch vehicle and the payload. Copper can have negative effects on sea life, but due to the tiny mass of copper in the vast area of the drop zone, this is considered a negligible impact.

Liquid Natural Gas (Liquid Fuelled):

Any unburnt liquid natural gas is expected to vaporise on contact with the ocean and not form part of any emission.

Rocket Propellant-1 (Liquid Fuelled):

Rocket Propellant – 1 is a highly refined form of kerosene. The liquid is expected to be burnt up prior to the stage striking the ocean

Styrene Butadiene Rubber:

Styrene Butadiene Rubber (SBR), a synthetic rubber used for many household goods such as shoe heels, rubber gaskets and pneumatic tyres, is the fuel used within Stage 1 and should be completely expended prior to Stage 1 entering the ocean. SBR is inert in its solid form and non-reactive with the natural environment. Should any unburnt SBR remain in Stage 1 when it enters the ocean, the SBR will not leach any dangerous chemicals.

Liquid Methane (Liquid Fuelled):

Liquid Methane is expected to be expended before the vehicle component enters the ocean. Any unburnt liquid methane is expected to vaporise on contact with the ocean and not form part of any emission.

Paraffin Wax (Hybrid Fuelled, Solid Fuelled):

Paraffin wax is mostly found as a white, odourless, tasteless, waxy solid, with a typical melting point between about 46 and 68 degrees Celsius. The wax is expected to be expended prior to the vehicle stage striking the water.

Oxygen:

Any remaining liquid oxygen is expected to vaporise on contact with the ocean.

Nitrous Oxide:

Nitrous Oxide, also known a NOS or laughing gas is used as an oxidiser. Any unburnt nitrous oxide is expected to vaporise on contact with the ocean and not form part of any emission.

Hydrogen:

Any unburnt hydrogen is expected to vaporise on contact with the ocean and not form part of any emission.

12.3.5 Types of Fuel, Oxidiser and Other Gases

Past launch vehicle types have caused environmental concern due to the use of highly toxic fuels such as hypergolic UDMH-nitric acid fuel.

These highly toxic fuels will never be used on launch vehicles operating from the WWOLC. Modern micro, mini and small rockets use fuels such as methane gas, RP-1 (a pure form of kerosene) or forms of rubber in solid fuelled motors. These fuels and their associated oxidisers cause lower levels of harm, particularly when consideration is given to the very small number of spent launch vehicles and components over vast areas of sea. Additionally, it should be noted that in successful launches, there will only be minimal amounts of fuels and oxidisers remaining in the vehicle when it contacts the water.

The launch vehicles can be powered in three (3) configurations – Liquid Fuelled, Hybrid Fuelled and Solid Fuelled. Other gases are used for cooling and other functions. Fuels, oxidisers and other gases used include:

Fuels:

- Liquid Natural Gas (Liquid Fuelled);
- Rocket Propellant-1 (Liquid Fuelled);
- Styrene Butadiene Rubber (SBR) (Hybrid/Solid Fuelled);
- Liquid Methane (Liquid Fuelled); and
- Paraffin Wax (Hybrid Fuelled, Solid Fuelled).

Oxidisers (Liquid and Hybrid Fuelled):

- Liquid Oxygen;
- Nitrous Oxide; and
- High Test Peroxide (HTP).

Other Gases (Liquid Fuelled, Hybrid Fuelled and Solid Fuelled):

- Oxygen; and
- Hydrogen.

12.3.6 Procedure to Dump Rocket Components at Sea

Legislative requirements in relation to rocket components depend on whether the item lands in international waters or Australian territorial waters.

12.3.6.1 International Waters

The Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 – the "London Protocol" is an international convention to protect the marine environment from human activities. The objective of the London Protocol is to control all sources of marine pollution and to take practical steps to prevent pollution of the sea from waste.

The United Nations Convention on the Law of the Sea "Law of the Sea" sets out the regime of law governing the uses of all oceans and their resources. It concerns the territorial sea, exclusive economic zones and addresses the issue of pollution.

Nation-states environmental legislation are informed by the London Protocol and the Law of the Sea.

Southern Launch is compliant with the United Nations Convention on the Law of the Sea. The dumping that will occur in international waters is incidental to the rocket launch from Whalers Way. As this dumping is incidental to the rocket launch and it is not a deliberate act for the purpose of dumping, it does not contravene the convention.

Any debris falling into international waters will be of the same size and materiality as that falling in both the State and Federal Exclusive Economic Zone. International waters extend out to 250NM.

There is no adoption of the London Protocol or Law of the Sea to international waters from Australia's standpoint; however, the material being disposed of in national waters is compliant with national legislation that is governed by both conventions. Southern Launch respects the conventions as the rocket components being dumped in state and federal waters are the same material to be dumped in international waters. The rocket components will be inert, therefore causing minimal environmental impact to international waters.

12.3.6.2 Australian Waters

Australian Waters consists of state waters (out to 12 NM) and the EEZ (greater than 12 NM and less than 200 NM downrange). Waters surrounding Australia's coastlines are increasingly threatened by wastes and pollution that are dumped at sea.

Australia regulates the loading and dumping of waste at sea under the *Environment Protection (Sea Dumping) Act 1981* (the Sea Dumping Act). This Act also fulfils Australia's international obligations to prevent marine pollution by controlling dumping of wastes and other matter.

Under the Sea Dumping Act, the Commonwealth aims to minimise pollution threats by:

- prohibiting ocean disposal of waste considered too harmful to be released in the marine environment, and
- regulating permitted waste disposal to ensure environmental impacts are minimised.

The Sea Dumping Act applies to all vessels, aircraft and platforms in Australian waters and to all Australian vessels and aircrafts in any part of the sea.

Permits are required for all sea dumping operations. Permits are most commonly issued for dredging operations and the creation of artificial reefs. Permits have also been issued for dumping of vessels, platforms or other man-made structures and for burials at sea.

The Act does not apply to operational discharges from ships, such as sewage and galley scraps. These are regulated under legislation administered by the Australian Maritime Safety Authority.

12.3.6.3 South Australian Waters

Southern Launch will be required to make applications pursuant to Section 38 of the *Environment Protection Act 1993* (SA) for the EPA to grant an exemption pursuant to Section 37 of the Act in respect of all launches. Each application will be specific to each launch, each launch vehicle and the components of that vehicle.

The purpose of these exemptions is to authorise Southern Launch to carry out the specified activity (rocket launches) which involve spent launch vehicle hardware landing in State waters.

Southern Launch will take all reasonable and practicable measures to ensure that any environmental harm is minimised both in terms of risk and in terms of impact. The materials intended to land in state waters will not cause any environmental harm and do not pose a risk of potential harm. However, Southern Launch commits to taking all reasonable and practical actions to retrieve any aerospace debris that washes up on the South Australian coastline following any type of rocket launch at Whalers Way.

12.3.6.4 Areas of Dumping

The potential landing zone of a stage for a particular launch vehicle is shown on the Marine Exclusion Zone (**Figure 12.1**). This is an example for one particular vehicle only, and the zone will be calculated individually for each launch, as it will vary both based on the vehicle, payload and mission requirements.

It should be noted that the potential stage drop zone for this vehicle is approximately 13,500 square kilometres.

Each different launch vehicle will have its stage drop zones calculated on a case-by-case basis. Drop zones for the final stage could be over 1,000 kilometres down range and the zone of potential Impact Zone could be as much as 1,000 kilometres long by 400 kilometres wide (400,000 square kilometres).

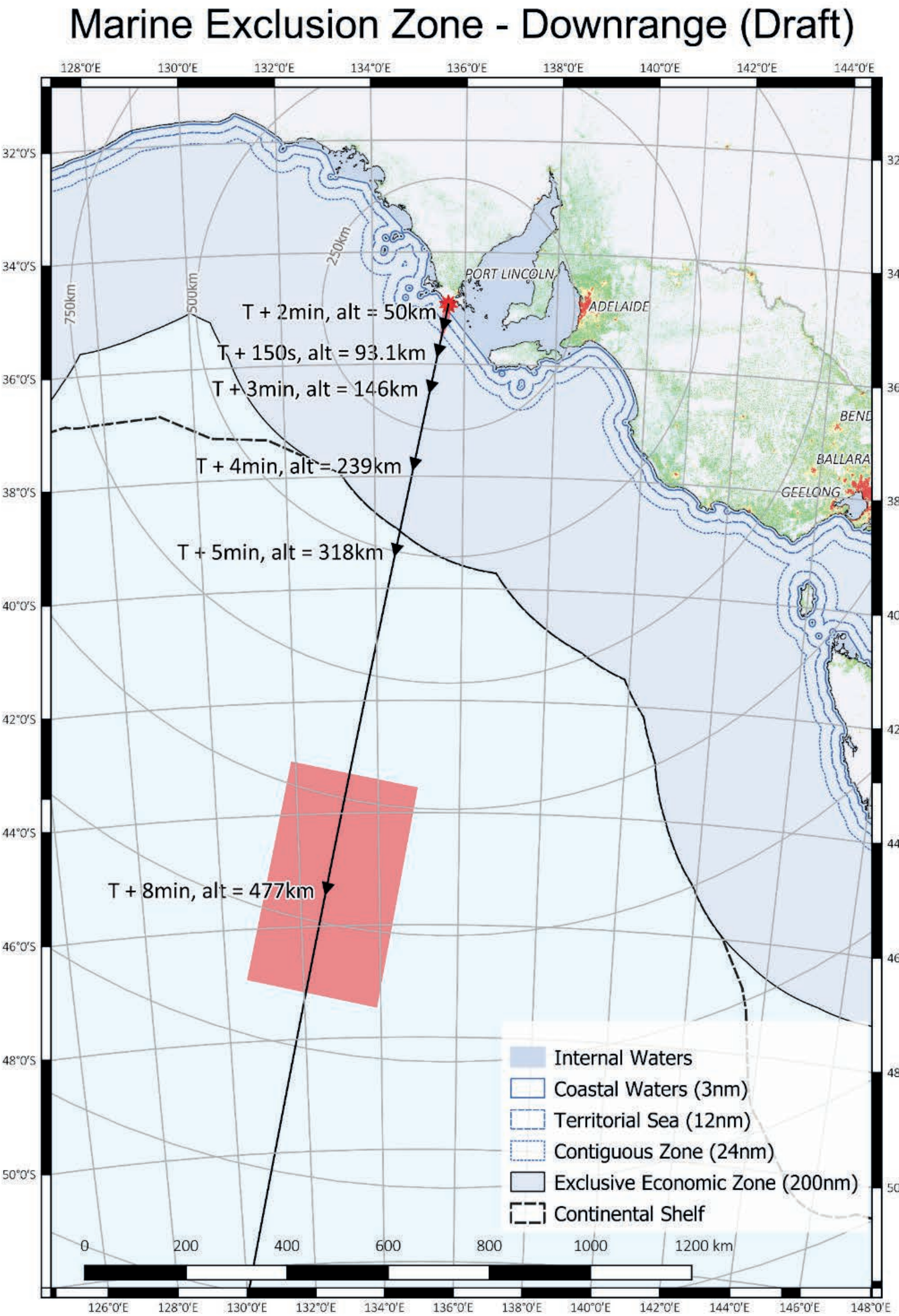

FIGURE 12.1

MARINE EXCLUSION ZONE - DOWNRANGE

12.3.6.5 Impact of Spent Rocket Components on the Marine Environment

As highlighted above, typically rocket stages that fall into the sea are generally not recovered.

The impact of spent rocket components on the marine environment has been assessed in **Section 5**.

The assessment concluded that:

> *Debris from successful launches would not impact on Liguanea Island fauna (provided that suborbital launches avoid trajectories over the Island). An air burst over Liguanea Island would be a very rare event that could result in mortalities but there would be negligible impact at subpopulation level. Ground bursts on Liguanea Island would be a rarer event than an air burst (provided a flight termination system is used) but could impact more individuals. Although this may result in temporary reductions in ASL pup production, no long-term impact is expected at subpopulation level;*
>
> *Within the Southern Ocean, including the waters of the Thorny Passage Marine Park surrounding Liguanea Island, there may be rare debris strike impacts on individual animals on the sea surface but no impact at population level; and*
>
> *Other debris impacts, including ingestion by marine fauna, crushing or smothering of biota, emission of toxic contaminants, noise from debris striking the sea surface and provision of habitat, would be highly localised, the area impacted would be insignificant in comparison to the extent of the receiving environment and population level effects would be negligible.*

12.3.7 Conclusion

As was outlined in detail in the EIS, and the above discussion, the impact of spent rockets and rocket debris entering the ocean is considered reasonable and appropriate. It is noted that the policies and procedures which govern the manner in which this occurs have be established on an international basis and apply to rocket launches around the world.

The impacts on the marine environment, particularly those occurring in international waters as a result of spent rocket stages entering the ocean will occur irrespective of the location of the launch site. The potential impacts closer to the proposed WWOLC have been considered in detail, with suitable mitigation measures to manage risk, as set out in **Section 5**.

13 ECONOMIC IMPACTS

13.0 ECONOMIC IMPACTS

13.1 Economic Impact

13.1.1 Background

To understand the potential impacts of the proposed launch activities, Southern Launch commissioned the SA Centre for Economic Studies ("SACES") to undertake an Economic Impact Analysis, which was provided in 2019. The data and key assumptions made around the potential activities associated with the launches, and associated visitor numbers were provided to SACES by Southern Launch.

This assessment provided the basis for the data and analysis provided in the EIS document. This document was included in the suite of attachments included in the EIS document and was available for review and comment by the public.

Following the exhibition of the EIS and having regard to the time elapsed since the original economic modelling was prepared, SACES were engaged to prepare an updated economic analysis of the proposal.

The updated SACES report is attached in **Appendix M**.

Since the exhibition of the EIS, the first test launch has been undertaken. Following the completion of the first test launch, an analysis of the economic impact of the first test launch was undertaken by Regional Development Australia Eyre Peninsula (RDAEP).

A copy of the report from RDAEP is attached in **Appendix N**.

Additionally, Southern Launch also engaged Malcom Davis, and industry expert on space and defence issues to prepare a paper which describes the importance of the positioning of the proposed WWOLC in the context of the space industry in South Australia and Australia.

A copy of the paper from Malcolm Davis is attached as **Appendix O**.

The economic impact of the proposed WWOLC is modelled to be significant in the context of the Eyre Peninsula, South Australia and Australia. This will be through both the direct impact of the proposal and the indirect impacts which can be realised by the agglomeration of industries in the space sector in South Australia.

13.1.2 Summary of Submissions

As a result of the exhibition of the EIS economic generation concern was raised by two submissions being P26 and P143.

Largely there was a concern that the figures provided were not accurate and quotes from the responses include:

> *"Projects of this type have a habit of not delivering on the proposed outcomes in terms particularly of employment, so I just don't believe the figures."*
>
> *"There will not be enough jobs generated too* (sic) *benefit the local community."*

It is noted that the economic impact of the proposal was highlighted by a significant number of the submissions which were identified as being in support of the proposal. For consistency with other issues in this response document, we have not individually identified the submissions in support of the proposal.

13.1.3 Discussion

13.1.3.1 Broad Impact of the Orbital Launch Facility

The importance of sovereign launch in Australia is seen as extremely advantageous. A discussion piece has been written by Malcolm Davis on the importance of sovereign launch in South Australia, and the many benefits that are attained as a result. An excerpt from the paper, attached in Appendix 13.3, is provided for this broader context:

A vital requirement of establishing the Whalers Way Orbital Space Launch Complex is to deepen opportunities for growing Australia's commercial space sector, through stimulating the growth of upstream activities. The geographic proximity of the launch site to Port Lincoln, with access to rapid air links to Adelaide, means that even if the two locations are geographically separated, they can be seen to be part of a wider 'southern space coast' concept.

However, it's not just about geographic proximity. Whalers Way Orbital Launch Complex needs to become a central focus for upstream industries including rocket and satellite manufacture, whilst being developed in a manner that reduces supply chain lengths and opens potential for future development of the Whalers Way site to establish supporting services close to the launch site. The establishment of a space coast approach would also provide greater opportunity and support to downstream industries, such as those which are developing new ways to fully utilise space support, not just for defence and national security, but also for commercial and civil applications. An agile and rapid innovation cycle is of key importance, and geographic proximity for commercial space companies in Adelaide to a dedicated launch site dramatically enhances their flexibility to develop new capabilities, whilst reducing cost, complexity and most importantly, project timelines.

The benefits of satellite development and manufacture being co-located with the Whalers Way Orbital Launch would see commercial growth stimulated in related areas such as payload checkout and integration, range safety and tracking, as well as satellite operations in the downstream context.

In a submission to the House of Representatives Standing Committee on Industry, Innovation, Science and Resources, leaders of Australia's launch providers stated in a submission that:

> *"Ultimately, the launch industry attracts and enables investment in, and development of, satellite manufacture, satellite mission control and other space related downstream industries. This is due to modern satellite companies wanting to reduce their supply chain lengths and position their manufacturing hubs as close to the launch infrastructure as practical, to reduce overall logistics costs and transportation timelines"*

13.1.3.2 Specific Analysis of Economic Benefits of the Orbital Launch Facility

Since the previous economic impact assessment conducted in 2019 by SACES, Southern Launch has provided a more forward-looking projection of future launch activity which envisions a much more aggressive ramp up in launch activity than was assumed in the earlier report. As a consequence, expected revenues and associated economic impacts over future years are much higher than was previously assumed.

13.1.3.3 Methodology

The gross economic impact of the impact of Southern Launch's proposed activities on the South Australian economy has been assessed using an input-output (IO) model.

The methodology employed involves estimating the total direct and indirect employment and gross state product (GSP) arising from the production operations, investment activities and additional visitor expenditure. GSP is the state equivalent to gross domestic product.

13.1.3.4 Outcomes

<u>Direct Impacts of the Development</u>

Considering the direct and additional downstream production activity generated within the South Australian economy, then the overall 'production impacts' of Southern Launch's own operations would be to support an average of 56 full-time equivalent (FTE) jobs over the ten-year analysis period from 2022 to 2031/32. Generation of employment indirectly through supply chain effects peaks at 15 FTE jobs in the first year of the analysis and falls thereafter as a consequence of Southern Launch reducing its purchases from intermediate suppliers as it shifts from temporary to permanent launch activities. In subsequent years direct employment accounts for around four-fifths of the total employment impact.

There are also one-off employment impacts over the period 2022/23 to 2026/27 as a result of the construction of the permanent orbital launch complex. The average gross impact on employment over this period is estimated to be 33 FTEs, with a peak employment impact of almost 53 FTEs in 2026/27.

On-going employment impacts from 2021/22 onwards associated with the spending by visitors associated with the launches (i.e., employees of launch firms) are expected to rise from 5.1 FTE jobs in 2022/23 to a peak of 30 FTE jobs in 2026/27. The average gross impact on employment over the analysis period is estimated to be 25 FTEs.

The average gross impact on employment over the ten-year analysis period due to all Southern Launch activities (including one-off impacts from construction and increased business visitors) is expected to be almost 98 FTE positions.

The estimated gross impact of Southern Launch's on-going operations on economic activity would be to contribute $9.2 million in real Gross State Product (GSP) in 2022/23. With the number of launches expected to rapidly increase over subsequent years, the gross impact on GSP from Southern Launch's on-going operations is expected to rise significantly over this period, reaching a peak of approximately $26 million from 2026/27 and onwards. The impact of Southern Launch's operations on GSP are quite large by normal industry standards. Such a large GSP impact is attributed to Southern Launch earning relatively large gross operating surplus amounts in future years as it benefits from efficiencies associated with establishing permanent facilities, and associated with this, being a South Australian headquartered company, which implies that returns to capital accrue to the state. Moreover, as the estimates are forward looking, they exclude previous losses incurred by Southern Launch in establishing the business.

There are also impacts over the first five years of the analysis period to 2026/27 as a result of the capital expenditures associated with establishing the launch facilities at Whalers Way.

Finally, there will be on-going impacts associated with increased business visitor nights associated with staff of launch vehicle manufacturers both prior to and associated with the launches. The expected annual contribution to GSP is estimated to rise from $0.7 million in 2022/23 to a peak of $3.8 million in 2026/27.

Assessed over the full ten-year analysis period using South Australia Treasury's recommended real post-tax discount rate of seven per cent, the gross impact on GSP (including the impact of capital works) resulting from Southern Launch's operations, capital investments, and induced visitor activity has a present value of $209 million in 2021/22 values.

If consumption impacts from workers at Southern Launch and its supply chain are included, then the average employment impact would be 169 FTE positions, with the present value of the impact on GSP being $312 million in 2021/22 values

<u>Spin-Off Benefits as a result of the Development</u>

There is also the potential for the existence of a permanent launch facility to:

- preserve the continued presence of the launch vehicle manufacturer in South Australia;

- attract a separate launch vehicle manufacturer to establish a 'final assembly and testing' facility, and
- attract a satellite manufacturer to establish manufacturing operations in South Australia. If these scenarios do eventuate – particularly the final two which involve establishing new activities – they will significantly increase the benefits for the state from the launch facility.

Continued operation and growth of a launch vehicle manufacturer

The estimated gross production impact of the existing launch vehicle manufacturer maintaining and growing manufacturing and testing operations in South Australia would be to support 570 FTE positions once the manufacturing facility reaches full operation (assumed to be 2025/26). The average gross impact over the 10-year analysis period is 485 FTE positions.

The modelled employment numbers are detailed in **Table 13.1**.

The estimated gross on-going impact on economic activity of the launch vehicle manufacturer maintaining and growing manufacturing and testing operations in South Australia would be to contribute $79 million in real GSP once full production activity is reached in 2025/26. Assessed over the full ten-year analysis period using SA Treasury's recommended real post-tax discount rate of seven per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $450 million in 2021/22 values.

Table 13.1: Estimated gross employment impact of continued presence of a launch vehicle manufacturer in South Australia, full time equivalent (FTE) employees

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
On-going Operations										
Direct employment (FTE)	100.0	200.0	300.0	400.0	400.0	400.0	400.0	400.0	400.0	400.0
Indirect effect (FTE)	42.5	85.0	127.6	170.3	174.2	170.6	170.7	170.8	171.0	171.1
Total	142.5	285.0	427.6	570.3	574.2	570.6	570.7	580.8	571.0	571.1
Average employment impact over period (FTE)	485.4									

Separate Launch Vehicle Manufacturer Undertaking Final Assembly in South Australia

The estimated gross production impact of a separate launch vehicle manufacturer undertaking final assembly in South Australia would be to support approximately 143 FTE positions from 2024/25 onwards, which is the first year in which the manufacturer is assumed to commence operations. The average gross impact over the 10-year analysis period is 114 FTE positions.

The modelled employment numbers are detailed in **Table 13.2**.

The estimated gross impact on economic activity of a separate launch vehicle manufacturer undertaking final assembly and testing operations in South Australia would be to contribute $20 million in real GSP from 2024/25 onwards. Assessed over the full ten-year analysis period using SA Treasury's recommended real post-tax discount rate of seven per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $103.2 million in 2021/22 values.

Table 13.2: Estimated gross employment impact of a separate launch vehicle manufacturer undertaking final assembly in South Australia, full time equivalent (FTE) employees

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
On-going Operations										
Direct employment (FTE)	0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Indirect effect (FTE)	0.0	0.0	42.5	42.6	43.5	42.6	42.7	42.7	42.7	42.8
Sub-Total, ongoing operations	0.0	0.0	142.5	142.6	143.5	142.6	142.7	142.7	142.7	142.8
Capital Expenditures										
Direct and indirect effects (FTE)	np	np	np							
Total gross impact on employment (FTE)	0.0	0.0	142.5	142.6	143.5	142.6	142.7	142.7	142.7	142.8
Average employment impact over period (FTE)	114.2									

Note: np = estimates not published due to data constraints.

Satellite manufacturer undertaking manufacturing in SA

The estimated gross production impact of a satellite manufacturer establishing in South Australia would be larger, with on-going employment in the satellite manufacturer and its South Australian supply chain expected to support 325 FTE positions once the manufacturing facility reaches full operation (assumed to be 2025/26). The average gross impact over the 10-year analysis period is 257 FTE positions.

The modelled employment numbers are detailed in **Table 13.3**.

The estimated gross impact on economic activity of a satellite manufacturer establishing operations in South Australia would be to contribute $84 million in real GSP per year once it is fully operational. Assessed over the full ten-year analysis period using SA Treasury's recommended real post-tax discount rate of seven per cent, the gross impact on GSP (assuming no change in the scale of the R&D operation) has a present value of $430 million in 2021/22 values.

Table 13.3: Estimated gross employment impact of a satellite manufacturer in South Australia, full time equivalent (FTE) employees

	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31	31/32
On-going Operations										
Direct employment (FTE)	25.0	50.0	100.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0
Indirect effect (FTE)	15.6	31.2	62.5	125.1	128.4	125.3	125.5	125.6	125.7	125.8
Sub-Total, ongoing operations	40.6	81.2	162.5	325.1	328.4	325.3	325.5	325.6	325.7	325.8
Capital Expenditures										
Direct and indirect effects (FTE)	np	np	np							
Total gross impact on employment (FTE)	40.6	81.2	162.5	325.1	328.4	325.3	325.5	325.6	325.7	325.8
Average employment impact over period (FTE)	256.6									

Overall Benefit

The overall economic benefit modelled by SACES is seen to be significant and it outlined in **Table 13.4** for both Full-time equivalent jobs and Gross State Product.

Table 13.4: Estimated gross economic impact of Southern Launch activities and spin-off benefits average or total impact over period from 2022/23 to 2031/32[(a)]

	FULL-TIME EQUIVALENT JOBS (AVERAGE OVER PERIOD)	GROSS STATE PRODUCT ($M) (PRESENT VALUE OVER PERIOD)
Southern Launch Operations		
Ongoing operations	56.2	156.0
Capital spending	32.6	30.9
Launch vehicle staff spending	25.1	22.0
Total	**97.5**	**209.0**
Spin-off Benefits		
Continued operation and growth of a launch vehicle manufacturer	485.4	449.6
Separate launch vehicle manufacturer undertaking assembly in SA	114.2	103.2
Satellite manufacturer undertaking manufacturing in SA	256.6	429.6

Note: [(a)] **Impacts for capital spending relate to the five-year period from 2022/23 to 2026/27.**

Economic Impact of the First Test Launch

An additional advantage of undertaking the first test launch in September 2021 was to measure the economic impact on the region as a result. Regional Development Australia – Eyre Peninsula Region has provided an economic impact model of the benefits to the communities' economy as a result of the test launch.

In it the RDA provide that $1.08 million was spent in the Eyre Peninsula region and consisted of:

- Travel
- Meals and Entertainment
- Freight and Courier
- Operations
- Minor Plant & Equipment
- Repairs and Maintenance

- Labour
- Consulting expenses
- Hardware sundries
- Equipment Hire
- Services
- Hire vehicles and transport
- Accommodation
- Fuel
- Development Approvals

This increase in local spending has a flow on effect. The combination of all direct, industrial and consumption effects would result in total estimated rise in Output of $1.58m in the RDA Eyre Peninsula Region economy, representing a Type 2 Output multiplier of 1.46.

These impacts would not be limited to the local economy. Industrial and consumption effects would flow outside the region to the wider Australian economy to the tune of $0.95m in Output.

The combined effect of economic multipliers in the RDA Eyre Peninsula Region and the wider Australian economy is estimated to be $2.53m added to Australia's Output.

Impact of Proposal not Proceeding

Given the growing demand for facilities of this nature and the economic opportunities presented, it is a rational assumption that, should this facility not proceed at Whalers Way, the opportunity will be realised elsewhere, be that elsewhere within South Australia or interstate. As outlined previously, other potential location options with reasonable potential are available.

Given that the low orbit satellite industry is still in its relative infancy, many innovations and opportunities arising out of this industry are yet to be matured, industrialised, or commercialised, but likely will be in time.

It is considered, therefore, that there is presently a short-term gap in the global launch industry, to which Australia is strategically positioned to respond to. South Australia in particular is ideally located to satisfy a number of critical locational criteria for a launch facility of this nature in respect to its latitude, coastal location, launch trajectory options, and lack of intervening land masses and human populations to the south.

13.1.4 Conclusion

The proposed development of the WWOLC has been modelled to have significant direct and indirect economic benefits to the Eyre Peninsula region and to South Australia as a whole.

The proposal will provide sovereign launch capability for polar and sun synchronous orbits and support greater opportunity for the development of downstream industries, such as those which are developing new ways to fully utilise space support, not just for defence and national security, but also for commercial and civil applications.

The EIS provided a thorough analysis of the economic impact of the proposal based on the SACES Report. This has been further updated by SACES in May 2022 to provide the most contemporary predicted jobs and GSP as a result of the Orbital Launch facility and associated spin-off opportunities, which as shown are significant. Whilst the modelled economic benefits of the proposal are substantial and will accrue to the Eyre Peninsula and South Australia over an extended period, the recent test launch, undertaken since the exhibition of the EIS, has demonstrated the significance of a single launch on the economy of the local area. An injection of $1.08 million into the local economy was achieved for just one launch which was of significant benefit to the Eyre Peninsula economic eco-system and provides a practical demonstration of the extent of the impact of the ongoing operation of the facility.

The proposed facility represents a very significant economic opportunity for South Australia by providing a key component of space infrastructure that is accessible both spatially and economically, supporting the growth of the space industry and surrounding and downstream industries.

13.2 Tourism Impact / Access

13.2.1 Background

The proposed development will occur on a site that is currently used for tourism and recreational purposes. The current tourism use of the site is principally for self-guided usage where persons pay a daily fee to access the site via vehicle. This use of the site is provided by the landowner; however, it is important to recognise that public access to the site exists at the pleasure of the landowner. The site is not a national park, conservation park, public reserve or community land.

The South Australian Tourism Commission provide a Regional Profile of the Eyre Peninsula which outlines the specifics for tourism in the region. As stated in the regional panel the entirety of the Eyre Peninsula has contributed a total of $349 million to the year end March 2021 South Australian expenditure of $4.4 billion.

By December 2025 a target of $397 million is proposed, and by December 2030 a $500 million target is proposed to be contributed from the tourism industry.

The most popular activity when coming to the Eyre Peninsula is eating out at a restaurant or cafe. Other popular activities include going to the beach, visiting national parks, sight-seeing, fishing, bush walking, visiting friends and relatives and visiting wineries[3].

13.2.2 Summary of Submissions

There were 34 submissions which stated the potential negative impact upon tourism as a result of this proposal.

These submissions included P42, P48, P49, P51, P68, P70, P74, P123, P125, P126, P128, P143, P148, P150, P152, P157, P167, P170, P183, P184, P186, P199, P209, P211, P215, P223, P226, P227, P231, P253, P254, P255, P257 and P261.

In addition, 21 submissions mentioned impacts upon accessibility for the general public to the site.

These submissions included P26, P65, P101, P107, P121, P124, P127, P139, P147, P153, P165, P186, P192, P199, P201, P211, P215, P226, P239, P246 and P257.

13.2.2.1 State Government Responses

DEW also reference the possibility of providing tourism opportunities around the viewing of launches, which may in turn add to the vegetation clearance footprint.

13.2.3 Discussion

13.2.3.1 Tourism Impact

Whilst a large number of submissions mention a potential negative impact on tourism, the majority of these do not provide any substantial detail of why this would be the case. Having regard to the number of tourists that currently visit the Eyre Peninsula, only a tiny proportion of those visit Whalers Way, and there is no evidence to suggest that Whalers Way is a primary draw for a material proportion of visitors to Eyre Peninsula.

A number of submissions assert that the nature of the proposed use and the perceived impact on the environmental values of the site will turn tourists away from the Eyre Peninsula as a whole. Southern Launch does not consider this to be the case. The proposal will leave approximately 98.5 per cent of the subject site vegetated in its current condition. Whilst the proposal will result in additional structures being constructed on the site, the visual impact of these has been managed through careful siting and design.

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3 https://tourism.sa.gov.au/media/n5kohwph/eyre-peninsula-regional-tourism-profile-march-2021.pdf

There will be an impact on tourism as a result of the Whalers Way Orbital Launch Facility. Overall, from the perspective of Southern Launch, the impact is seen to be a positive one. The project would have a positive economic impact for the tourism and recreation sector in terms of spin-off activities from workers and tourists attracted to the area primarily to visit the facility and/or observe launch events. This would include additional visitor nights for accommodation, increased activity for shopping and hospitality sectors, and potential increased patronage of existing and future tourist operations. This would expand the activity base within the Eyre Peninsula and provide additional tourist spending. This spending would in turn aid the region in meeting its $500 million target proposed by December 2030.

Current tourism and recreational activities on the subject land will be altered on commencement of the project. There will be less opportunity for unaccompanied access to the site, and visitor access to the site will not occur at all when launches are taking place. Notwithstanding this change, it is considered that similar opportunities for camping and recreation are available extensively throughout the region and would be able to be accommodated without any substantive loss to the overall level of economic activity currently generated in the region.

The changes to the nature of access to the site will not mean that visitor access is completely precluded. The opportunity for managed and accompanied access to the site will remain and will include both the existing values of the site and the proposed development, both of which will have considerable attraction.

Whilst there will be changes to the existing tourism operations of the site, it is considered that the introduction of the proposed activity will result in a significant diversification of the tourism attraction of the region through the introduction of an activity that occurs only in a small number of locations globally.

Whilst not forming part of this current application process, Southern Launch are working with the local community to understand and implement options for these potential tourism opportunities and associated Event Management Plans (where required) including, but not limited to:

- Bus/car/4WD/boat tours.
- Camping/Glamping opportunities.
- Launch viewing.
- Walking tours.
- Environmental/Ecological appreciation tours.
- Cultural awareness and appreciation tours.
- Space information centre.
- Space merchandise.

- Virtual tourism opportunities.
- VIP tours.
- Children's interpretive centre.

No clearance of any vegetation is proposed for these components as any facilities mentioned in this section are for consideration in the future, outside of the Major Development process.

Further exploration of these components will be undertaken upon operation of the facility.

13.2.4 Access to the Site

As outlined above, for safety during construction and operation it is likely some restrictions on access would result. It should be noted however that this allotment which covers Whalers Way is currently privately owned freehold land. At any time, the current owner of the land could deny access to the general public.

As is outlined above, Southern Launch sees a future for tourism and recreational uses of the subject site, however, they will occur in a better managed way that has less potential to adversely impact on the environmental values of the site than the current arrangements.

13.2.5 Conclusion

In summary, the construction of a development as unique as a rocket launch facility provides significant opportunity to expand the tourism base and economic output of the Eyre Peninsula. Southern Launch seeks to work with the community to leverage and realise this opportunity to contribute to the December 2030 target of $500 million tourism spend.

Southern Launch will work collaboratively with the landowner, stakeholders and the community to ensure that the tourism potential emanating from the proposed development is maximised.

13.3 Air/Shipping lanes

13.3.1 Background

The procedures for addressing the interaction between the proposed facility and air/shipping lanes was addressed in detail in the EIS.

Southern Launch will develop a detailed set of operational plans to address these interactions, which will form a key component of the planning for each launch.

13.3.2 Summary of Submissions

A submission was received which mentioned potential impact to shipping lanes (P65). As previously mentioned, shipping lanes both air and sea were discussed in the EIS, with the summary below.

13.3.3 Discussion

The appropriate notice to airmen and notice to mariners provide appropriate notification to ensure both understand when to be clear of the area.

Exclusion Zones will only be in effect when they are needed, and aviation, commercial shipping, commercial fishing (as discussed in Section 13.4) and the public will be given ample notice before they are put in place through Notices to Airmen (NOTAM) and Notices to Mariners (NOTMAR). Additional notification of launches via media channels will be undertaken to inform the public. The exact size and location of an exclusion zone will vary for each launch and will be based on the size of the rocket being launched at the time and the orbit the rocket will go into.

13.3.4 Conclusion

Having regard to the frequency of launches proposed at the facility, it is considered that the interaction between the proposed operations and air and shipping in the vicinity of the subject site and the downrange areas can be suitably managed.

Through defined management processes in operational planning, the scheduling of launches and the extensive process of notification, the impact of the facility on aviation and navigation is considered to be limited and reasonable.

13.4 Fisheries

13.4.1 Background

The proposed development will involve the launching of rockets over areas which are utilised by commercial fishing operations. The operation of the facility will require operational practices associated with launches which impose some limitations on how the areas downrange of the facility can be utilised. This is the case for all rocket launch facilities around the world, many of which are located in the vicinity of areas used for commercial fishing operations. Appropriate management and coordination will be between Southern Launch, regulatory agencies and the commercial fishing industry will be required to ensure that the operation of the facility and the commercial fishing operations can occur without undue impediment.

13.4.2 Summary of Submissions

There were 11 responses which mentioned the potential impact upon the fishing/seafood industry. Generally, there is a concern that the operations of the proposed facility would detrimentally impact the commercial fishing and seafood industry leading up to and during launches.

Submissions which mentioned this matter include: P42, P65, P101, P139, P150, P164, P199, P203, P209, P210 and P213.

SA Government Response

PIRSA have raised communication and exclusion zone analysis requirements as part of their response. They have highlighted that further quantitative analysis of the economic impact of the exclusion zones should be undertaken to support the proposal.

The following discussion provides an overview of the communication plan and operational arrangements.

13.4.3 Discussion

The commercial fishing and seafood industry forms a large economic base for the Eyre Peninsula. The local industry has a large and mobile fleet of ocean vessels, spotting aircraft and associated industry infrastructure. It is clear that upon operation of the orbital launch facility that there will be impacts upon the industry in terms of launch safety zones and risk mitigation practices.

In response to the matters raised as a result of public consultation and comments received by the South Australian Government agencies, Southern Launch has prepared a draft communications protocol plan. This will be incorporated in an operational plan, with the protocol seeking to communicate with and fully apprise AMSA and Tumby Bay VMR, all sectors of the Port Lincoln based fishing industry and both SARDI Research and Aquatic Services of proposed upcoming launch activity.

This information will include the date and duration of the proposed launch window, the nominal flight trajectory of the rocket and the areas of greatest marine risk as calculated through the application of the *Space (Launches and Returns) Act 2018*. The marine risk areas are calculated on a launch-by-launch basis and are primarily associated with the location where the rocket stages return, or the areas of highest risk should an inflight failure occur. Southern Launch's application to the relevant regulators for any launch precedes that actual launch attempt by many months with the final marine exclusion areas only being approved when the launch is permitted, which is currently 30 days prior to launch. It will therefore be possible for Southern Launch to furnish the various Executive Officers of the fishing sectors with the coordinates of the marine risk areas so that these can be superimposed on their respective nautical charts.

The proposal facility will cater for a maximum of 42 launches per year, although it is expected to take a number of years for the intensity of operation to reach this point.

A review of the operational practices employed at the Rocket Lab launch facility in New Zealand indicates that operational practices have been refined during the course of the more than 25 launches undertaken from the facility to date. Currently a launch is defined over a range of dates, with a variety of time limited windows (typically up to five hours in length) on days where a launch could occur.

A marine safety zone is active in a defined area downrange of the site (based on the specific launch trajectory) from two hours before a launch window until 30 minutes following the launch window. The marine safety zone will only be active on a day when a launch is actually being attempted. Vessels are not permitted to remain in the marine safety area when active. Vessels seeking to cross the marine safety area are asked to contact Rocket Lab launch control to arrange coordination.

A review of the marine safety areas for a variety of launches at the Rocket Lab facility has shown an area typically 25 kilometres in width and 40-80 kilometres in length.

A precis of a typical launch notification process is outlined below:

Southern Launch will engage with the Australian Maritime Safety Authority (AMSA) and the Australian Hydrographic Office (AHO) to ensure an appropriate Notice to Mariners (NOTMAR) or other maritime navigational warning is promulgated for each launch activity which could potentially affect or pose risk to marine personnel or activities in maritime areas. In practice this means that every launch activity where the rocket leaves the launch pad requires such a notification.

An Aquatics Activity License (AAL) through the South Australian Government may also be required to safeguard the shoreline and provide an easily discernible safety exclusion area.

Both the NOTMAR and AAL would be designed with the relevant regulators such that they are:

- Broad enough to notify all maritime uses of any areas that are subject to a launch related risk regardless of the level.
- As small as practicable to minimise the effect the launch activity could have on existing ongoing operations by the commercial fishing industry.

Each launch manufacturers launch vehicle are unique and require a bespoke assessment to determine the location of risk areas. Each launch will be planned and designed through the application of the relevant regulations with the goal of containing the maritime risk areas to be adjacent to lands controlled by Southern Launch and in doing so ensure recreational use of existing boating facilities and surfing at Fisheries Beach is unaffected.

Within the area bounded by the NOTMAR and AAL would be the launch day specific wind related maritime hazard area that is not knowable prior. This maritime hazard area forms the safety critical area within which a launch does not proceed should a marine vessel be present within it.

In advance of launch activity from the WWOLC Southern Launch will communicate to the fishing industry:

- the boundary of one or more areas subject to a Notice to Mariners or other navigational warning or exclusion; and
- the estimated bounds of one or more maritime hazard areas.

Three days prior to a launch attempt Southern Launch receives Bureau of Meteorology (BoM) generated meteorological reports that confirm/deny the likelihood of the launch attempt succeeding. This information is used to refine the predicted maritime hazard areas for the expected wind conditions. The updated maritime hazard area would be communicated to the fishing industry.

On the day of a launch attempt, Southern Launch receives further BoM data and refines the maritime hazard area.

It is Southern Launch's intention that marine operators:

- Are provided with the latest maritime hazard area updates; and
- Can continue to operate within the boundary of the Notice to Mariners; and
- Will be requested to remain outside the maritime hazard areas located within the Notice to Mariners area in the near lead up to, and while, launch activities are underway.

Should a maritime operator be within, or calculated to be within, a maritime hazard area during a planned launch activity, Southern Launch will pause launch activity until the operator is clear of the maritime hazard area.

Because the majority of commercial maritime operations occur in the coastal waters, the captains of the vessels can be communicated with on VHF channel 16 and 81, as well as on mobile phone. It is envisaged that for any operator within the maritime hazard area, they would only have to exit the hazard are when the rocket is ready for launch and could re-enter the zone once the launch area is safe.

Southern Launch will continue to work closely with the maritime operators and all relevant marine and space regulators to identify methods of safely integrating rocket launch activities alongside existing industries.

Southern Launch proposes that ongoing coordination will occur on a regular and continuous basis and will be a process of two-way communication and information sharing, which allows all parties to clearly express their needs and requirements.

The program for launches will be known well in advance, and this will allow for coordination with the annual activities of the commercial fishing sector. As individual launches approach, more detailed information pertaining to that specific launch will be able to be shared allowing all parties to plan their activities in a manner which minimises disruption.

Upon review of this initial protocol Letters of Support have been (see **Appendix P**) provided by the:

- South Australian Research and Development Institute (SARDI);
- Spencer Gulf and West Coast Prawn Fishermen's Association (SGWCPFA);
- Australian Southern Bluefin Tuna Industry Association (ASBTIA); and
- South Australian Sardine Industry Association (SASIA).

Upon review of this initial protocol correspondence has also been received from the Abalone Industry Association of South Australia (AIASA) who have acknowledged the need for clear communication protocols, however, have expressed a more significant level of concern as to the limitations on access to areas which will likely be within marine hazard zones. The AIASA correspondence acknowledges that vessels are launched from Fishery Bay beach 20-30 days per year for the harvesting of abalone in the area of the subject site.

Southern Launch notes that NOTMAR will be the primary, and statutory method, of communicating the marine hazard area to the commercial fishing industry and other maritime operators. The obligation of maritime operators to inform themselves of relevant information, including NOTMARS is noted. Notwithstanding, Southern Launch will also seek to ensure that all relevant launch safety information is conveyed to stakeholders and the community generally through multiple channels including website, social media and local media (radio and print).

The marine hazard areas will be temporary for periods of time that do not generally exceed six hours. Even whilst a marine hazard area is operational, vessels may be able to transit the area, subject to coordination with Southern Launch range operations. For the majority of the time, there will be no impediments to commercial fishing operations occurring downrange of the proposed WWOLC as they do at the present time.

The temporary existence of marine hazard areas and the operation of the proposed facility should have no impact on the resource available to the commercial fisheries operations in the affected areas. The operations and the existence of marine hazard areas will just result in a limitation on the availability of access to the resource. It is noted that all of the industry groups consulted have expressed their support for the proposed communications protocol and ongoing engagement as the key method of coordination and management of constraints. It is noted that the majority of the industry groups have expressed a level of support for the proposed facility.

13.4.4 Conclusion

Southern Launch forecast that there will be limited impact upon the commercial fishing industry as a result of the operation of the facility. The proposal is not anticipated to have an impact on the resource available, however the imposition of appropriate risk mitigation through marine hazard areas during launch events will impose an additional degree of limitation on when that resource can be accessed.

A thorough communication plan to directly engage with the industry has been prepared with a number of fishing associations providing their support for the proposal. Successful implementation of the communication plan and ongoing engagement with the industry will be important to ensuring there is minimal disruption for the commercial fishing industry and for the proposed operations by Southern Launch. The maximum operation of the proposed facility will involve 42 launches per year, representing a launch every eight days. The window for the marine hazard area would typically be approximately six hours on the day a launch takes place, meaning that the marine hazard zones would only be in effect for less than one per cent of year when the facility is operating at maximum capacity.

Having regard to the responses received from the commercial fishing industry, both during the exhibition of the EIS and through subsequent direct communications, Southern Launch considers that the potential economic impact on the industry will be limited, and subject to the imposition of appropriate operational management and communications protocols, subject to mitigation.

14 ABORIGINAL CULTURAL HERITAGE

14.0 ABORIGINAL CULTURAL HERITAGE

14.1 Background

The project is located within the traditional lands of the Nauo people. During the production of the EIS A Cultural Heritage Investigation was undertaken to inform this project, this investigation was in-turn informed by a field survey of Whalers Way and the specific Project Footprint locations within that area.

The field survey was conducted by four Nauo representatives. An anthropologist also participated, and assistance was provided by two representatives of Southern Launch.

14.2 Summary of Submissions

Seven responses were received which referenced cultural heritage matters.

These included submissions P123, P167, P184, P192, P198, P201 and P246.

Largely the main concern expressed in the submissions was the lack of consultation with the local Aboriginal communities.

14.3 Discussion

Significant and ongoing engagement with Nauo representatives have been undertaken throughout the development of the project. Further consultation was undertaken post public consultation to investigate two alternate site locations for Site A.

The survey was undertaken by Scott Cane and representatives from the Nauo people between 28 November 2021 and 2 December 2021. The purpose of this report was to assess the cultural heritage of these two optional rocket-launching locations. The report should be read in conjunction with the earlier report (Cane 2020) to grasp the full extent of the cultural heritage investigations already conducted and the information contained within that report.

14.4 Conclusion

The investigations concluded that the site chosen for Site A is culturally acceptable. Other site locations had previously been cleared and have not been modified following the exhibition of the EIS.

15 PLANNING ASSESSMENT

15.0 PLANNING ASSESSMENT

15.1 Background

In relation to alignment with planning policy and as outlined in the EIS a full and thorough assessment of the relevant planning policies was undertaken. This included consideration of the following strategy and policy documents:

- South Australian Planning Strategy.
- Relevant Policies of the Lower Eyre Peninsula Council Development Plan.
- Relevant Policies of the Planning and Design Code.

The analysis drew on all aspects of the project and examined them in terms of their environmental, social, and economic affects as detailed in the respective sections of the EIS.

It is noted that when a proposal is assessed as a major development, the policies contained in the Development Plan and the Planning and Design Code take on a lower level of importance compared to a standard development application. The Assessment Guidelines form the basis for the assessment of the proposal, offering a highly customised set of policy directed specifically at the project. The regular policy documents, in the form the Development Plan and Planning and Design Code are one component of the overall assessment, rather than the primary policy basis.

15.2 Summary of Submissions

Four responses were received which referenced the proposal was inconsistent with the relevant planning policies.

These included P152, P153, P170 and P191.

15.3 Discussion

15.3.1 South Australian Planning Strategy

The strategy does not specifically foresee the establishment of an aerospace facility in the region. Notwithstanding, the concept of such a facility is consistent with the general economic development aspirations of the plan.

Having regard to the investigations, analyses, mitigation, and management strategies outlined in this document, it is considered that the proposal will positively contribute to the attainment of the planning strategy for the region as follows:

- Supports the economic objectives for the region:
  - through the development of a significant new industry supporting State objectives, local and regional employment, technological innovation, education, and tourism;

- by attracting new skilled workforce to the region;
- by providing no negative impact on existing industry and primary production in the locality and region; and
- by supporting existing infrastructure in the region.

- Can be developed with minimal impact on the environment, flora and fauna, coastal areas and vulnerable ecosystems.

- Will not unduly impact the aesthetic and coastal and rural landscapes in the region.

- Will not impact on settlements or residential amenity in the region.

- Will not impact on cultural values of the region.

Potential negative impacts due to short-term sporadic interruption to commercial fishing, recreational boating and fishing, and airspace activity are specifically addressed through the management strategies outlined in the EIS and this Response Document (including exclusion zones and prior notification procedures). Such arrangements are considered appropriate in providing a reasonable balance between the benefits of a new industry and the ability of existing industries to continue to be unaffected.

15.3.2 Relevant Policies of the Development Plan

The project site is contained with the Coastal Conservation Zone as illustrated on Zone Maps LEP/1 and LEP/18 respectively. It is not located within any specific Policy Area or Precinct of the Coastal Conservation Zone.

The Council-wide policies of the Development Plan are also relevant. They apply across the whole Council area and relate to a range of social, environmental, and economic development issues and establish the development standards that apply to all forms of development. In addition, the Plan contains an overlay policy in relation to Bushfire Risk which is relevant to the assessment of the proposal.

In summary, the Coastal Conservation Zone policies allow for low intensity recreation uses and to maintain farming outside of areas of native vegetation, coastal dunes, and wetlands of national importance. The relevant principles of development control focus on the conservation and enhancement of the coastal environment and scenic beauty of the zone.

Land division is proposed in the form of a lease greater than six years. Whilst this technically meets the definition of land division, it does not result in the creation or issue of a separate title of land in the zone. The proposal therefore complies with the land division policies for the zone as it does not create an allotment for an existing tourist facility, nor does it create an additional allotment with access to the coast.

The policies do not envisage the development of an aerospace facility, nor is it a defined use in any Development Plan in the State. The policies therefore provide a context and framework for development within the zone to which the proposal must have due regard. In particular the proposal should avoid or minimise to an acceptable degree any detrimental impact on the desired character of the zone, the nature and form of land uses envisaged in the zone and should not unreasonably detract from the ability for other desired development from occurring in the zone.

In summary, the proposal:

- Does not directly impact on the natural features or landscape of the coast, any conservation park or area, wetland, samphire flats, beaches, sand dunes, or cliff tops.
- Seeks to protect the scenically attractive coastal location through the use of low building forms and associated infrastructure. Taller elements within the proposal will only be utilised during specific launch days, limiting the visual impact these elements will have on the surrounding area.
- Is located a substantial distance from surrounding towns and dwellings, which further helps to limit the impact on the visual character.
- Is sited such as to avoid being subject to any coastal hazards.
- Will be of limited visibility from the coast and surrounding areas such as to minimise any unreasonable intrusion into the scenic qualities of the area.

15.3.3 Relevant Policies of the Planning and Design Code

The Code sets out policies affecting and adjoining the site in relation to zones, sub-zones, and overlays (policies that can apply spatially over parts of the State and/or in relation to certain kinds of development identified in the Code regardless of its spatial location).

As a result of a review of the assessment provisions they were found to be generally and materially the same as those applying under the Development Act and provide no substantive additional policy affecting the proposed development.

15.4 Other Legislative Discussion

15.4.1 EPA Licensable Activities

The EPA has identified a range of activities associated with construction and operation of the project that are likely to require a licence to operate under the *Environment Protection Act, 1993*. The specific activities requiring licencing will be subject to further consideration based on detailed design documentation and proposed operational practice if the project is approved.

Ultimately, where any component of the project requires licensing, Southern Launch will apply for and obtain such a licence before the project proceed.

Having regard to the nature of the facility, the EPA may consider legislative of regulatory reform to enable the facility to be a holistically licensable facility in the event the proposal is granted development approval.

In their response EPA do seek clarification on the following matters:

Clause 1(1) Chemical Storage and Warehousing Facilities

The storage or warehousing of chemicals that are, or are to be, stored or kept in bulk or in containers having a capacity exceeding 200 litres at facilities with a total storage capacity exceeding 1,000 cubic metres to have an EP Act licence.

It is likely that safe storage of chemicals would occur on the site sporadically and would be dependent on when launches occur. It is likely that chemicals required for the launch vehicle operations would be present on the site during this time. It is not envisaged however that chemicals would be stored in bulk quantities for long periods outside of specified launch windows, apart from small quantities, required for ongoing operation and management of the site.

If in the future it becomes advantageous to store bulk chemicals onsite, Southern Launch commit to consulting the EPA to discuss licence requirements.

Clause 1(5) Hydrocarbon Storage or production works

Any storage of hydrocarbon or hydrocarbon products with a storage capacity of more than 2,000 cubic metres.

Similar to Chemical Storage, fuels for launch vehicles would be onsite during launch vehicle operations. The required fuels would be transported onto the site with the launch vehicle and remain safely stored onsite until the end of the launch cycle where it is anticipated the fuel supply would be exhausted from launch operations. The quantity of fuel largely depends on the demands of the launch vehicle which can significantly vary based on the fuel type used, design and fuel consumption of the specific launch vehicle. Outside of this and whilst diesel power generation is proposed it is not anticipated that quantities of hydrocarbons stored onsite would exceed 2,000 cubic metres.

If in the future it becomes advantageous to store more than 2000 cubic metres of hydrocarbons onsite for longer periods, Southern Launch commit to consulting the EPA to discuss licence requirements.

Clause 5(5) Concrete batching works

Any onsite concrete batching facility required during construction which has a total capacity for production of such products exceeding 0.5 cubic metres per production cycle

During construction it is proposed to locate a temporary concrete batching plant onsite. It is likely due to the build requirements that the plant would exceed production capacity of 0.5 cubic metres per production cycle. Upon detailed design of the development, Southern Launch will consult with the EPA on obtaining an EPA licence to operate this temporary concrete batching plant.

Clause 8(2) Fuel burning

> (2) *Fuel Burning - the conduct of works or facilities involving the use of fuel burning equipment, including flaring (other than flaring at petroleum production, storage or processing works or facilities that do not have a total storage capacity or total production rate exceeding the levels respectively specified in clause 1(5)) or incineration, where the equipment alone or in aggregate is capable of burning combustible matter—*
>
> (a) *at a rate of heat release exceeding 5 megawatts; or*
>
> (b) *at a rate of heat release exceeding 500 kilowatts and the products of combustion are used—*
>
> (i) *to stove enamel; or*
>
> (ii) *to bake or dry any substance that on heating releases dust or air impurities.*

EPA Licensable activities are not considered to include Fuel Burning. Whilst launch vehicles would be tested and launched at the facility, and exceed five megawatts of heat, the launch vehicle would not be considered part of the facility. This is similar to an airport where jet aircraft burning hydrocarbon fuels (which significantly exceed 5 megawatts of heat for larger planes) would not be considered to comprise a part of the airport facility.

The flare stack will allow for the disposal of surplus fuels by burning off; however, the fuel and oxidiser requirements for launches can be accurately predicted, meaning the surplus quantities for disposal will be limited. Given the limited amount of surplus fuel it is unlikely that the rate of fuel burning will exceed the heat release threshold requirements set out above.

Clause 8(3) Helicopter Landing Facilities

Helicopter Facilities

> (3) *Helicopter Landing Facilities the conduct of facilities designed for the arrival and departure of helicopters, but excluding—*
>
> …
>
> (c) *facilities that are situated more than 1 kilometre from residential premises not associated with the facilities*

The Helicopter landing pad would not be considered an EPA licensable operation as the landing pad is greater than 1.0 kilometre from residential premises not associated with the facilities, as outlined in Schedule 1 Clause 8(3)(c) of the *Environment Protection Act 1993*. The helicopter land facilities proposed are primarily for emergency use and will not involve frequent use associated with the normal operations of the facility.

15.5 Conclusion

In summary it is concluded the project:

- Achieves an appropriate degree of compliance with related land use and development controls governing the use of the land (primarily the *Development Act 1993* and *Development Regulations 2008*).
- Substantially complies with the relevant policy for development, land use and land division established under the Development Act.
- Substantially complies with the new Planning and Design Code commenced on 31 July 2020 under the new *Planning Development and Infrastructure Act 2016* which replaces the Development Plan policies.

16 OUT OF SCOPE MATTERS

16.0 OUT OF SCOPE MATTERS

16.1 Security of Region

16.1.1 Summary of Submissions

As a result of the public consultation six responses were received which perceived the development would increase the interest of this site as a target of significance. Specifically raising this matter included P49, P65, P106, P152, P153, P186.

16.1.2 Reason for Out of Scope

Generally, this is not a matter which is ever realistically considered in respect of development applications. Therefore, this matter is out of scope in relation to the assessment of the suitability of the proposed development on this site. Furthermore, it would be unrealistic to opine in this document on the potential threats, and their appetite to react to a development of this nature on this site.