AGL Gas Import Jetty Project

AGL Wholesale Gas Limited

Environmental Noise Assessment

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Client Name:	AGL Wholesale Gas Limited
Project Manager:	Shelley Ada
Author:	Johnny Zhang
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Jacobs Group (Australia) Pty Limited
ABN 37 001 024 095
Floor 11, 452 Flinders Street
Melbourne VIC 3000
PO Box 312, Flinders Lane
Melbourne VIC 8009 Australia
T +61 3 8668 3000
F +61 3 8668 3001
www.jacobs.com

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Contents

Glossary and Abbreviations

Term	Description
dB	Sound pressure levels are expressed in decibels (dB) as a ratio between the measured sound pressure level and the reference pressure. The reference pressure is $2x10^{-6}$ Pascal (Newtons per square metre). Some typical noise levels are presented below: **Sound Pressure Level, dB(A)** — **Example** 130 — Threshold of pain 120 — Jet aircraft take-off at 100 m 110 — Power tool at 1 m 100 — Nightclub 90 — Heavy trucks at 5 m 80 — Kerbside of busy street 70 — Loud radio (in typical domestic room) 60 — Office 50 — Domestic fan heater at 1m 40 — Living room 30 — Theatre 20 — Rural environment on still night 10 — Sound insulated test chamber 0 — Threshold of hearing
dB(A)	The A-weighted sound pressure level in decibels, denoted dB(A) is the unit generally used for the measurement of environmental, transportation or industrial noise. The A-weighting scale approximates the sensitivity of the human ear when it is exposed to normal levels and correlates well with subjective perception over a number of different types of sounds. An increase or decrease in sound level of approximately 10 dB corresponds to a subjective doubling or halving in loudness. A change in sound level of 3dB is considered to be just noticeable.
EPA	Environment Protection Authority Victoria
L_{Aeq}	The A weighted equivalent continuous sound level is denoted L_{Aeq}.
L_{A90}	The A weighted sound pressure level that is exceeded for 90% of the measurement period. Usually used to represent the background noise level.
L_{Max}, L_{FMax}, L_{SMax} L_{AMax}, L_{AFMax}, L_{ASMax}	The maximum measured linear (un-weighted or Z) sound pressure level. The L_{Max} variations, L_{FMax}, L_{SMax} are the L_{Max} levels using the "Fast" and "Slow" networks respectively. The A-weighted variations are also used in various guidelines and standards, L_{AMax}, L_{AFMax} and L_{ASMax}.
Frequency (Hz)	The rate of repetition of a sound wave. The unit of frequency is the Hertz (Hz), defined as one cycle per second. Human hearing ranges approximately from 20 Hz to 20,000 Hz. For design purposes, the octave bands between 63 Hz to 8 kHz are generally used. The most commonly used frequency bands are octave bands. For more detailed analysis, each octave band may be split into three one-third octave bands or in some cases, narrow frequency bands.
L_W	The sound power level of a source is a measure of the total acoustic power radiated by a source. It is a characteristic of the sound source which is not affected by the environment within which the source is located.
Background Noise Level	The lower ambient noise level, usually defined as the value of the time varying ambient noise level exceeded for 90% of the measurement time. Usually defined in the dB(A) scale - L_{A90}.
NIRV	Noise from Industry in Regional Victoria

Term	Description
SEPP N-1	Victorian State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1.
NSA	"Noise Sensitive Area" is defined under SEPP N-1 as: a) That part of the land within the apparent boundaries of any piece of land which is within a distance of 10 metres outside the external walls of any of the following buildings – i. Dwelling (except Caretaker's House) ii. Residential Building b) That part of the land within the apparent boundaries of any piece of land on which is situated any of the following buildings which is within a distance of 10 metres outside the external walls of any dormitory, ward or bedroom of such buildings: i. Caretaker's House ii. Hospital iii. Hotel iv. Institutional Home v. Motel vi. Reformative Institution vii. Tourist Establishment viii. Work Release Hotel
Day Period	07:00 to 18:00 Monday to Friday 07:00 to 13:00 Saturday
Evening Period	18:00 to 22:00 Monday to Saturday 13:00 to 22:00 Saturday 07:00 to 22:00 Sunday and Public Holidays
Night Period	22:00 to 07:00 Monday to Sunday

Executive Summary

This report presents an environmental noise impact assessment for the proposed Liquefied Natural Gas (LNG) import facility known as AGL Gas Import Jetty Project (the Project) located at Crib Point, Victoria. The Project comprises:

- The continuous mooring of a Floating Storage and Regasification Unit (FSRU) at the existing Crib Point Jetty
- The construction of ancillary topside jetty infrastructure (Jetty Infrastructure), including high pressure gas unloading arms and a high pressure gas flowline.

In addition, this assessment will also include the Crib Point Pakenham Pipeline Project's (Pipeline Project) End of Line Facilities which AECOM has prepared the SoundPlan noise model and assessment report for APA Group (AECOM 2018).

This report provides an assessment of the construction and operational noise impacts associated with the Project. The noise criteria for construction and operation have been determined in accordance with Environment Protection Authority Victoria's (EPA) *Noise Control Guidelines,* Publication 1254 and *Noise from Industry in Regional Victoria*, Publication 1411 (NIRV) respectively.

It is assumed that construction work will only occur during normal working hours, i.e.: day time only. There are no applicable Guideline Noise Levels for this time period, although lowest noise work practices and equipment are expected.

A SoundPlan noise model has been created to predict the environmental noise impact at the noise sensitive areas surrounding the Project Site. The scenarios modelled include the mooring of the LNG carrier, FSRU operations as well as end of line facilities. The existing United Petroleum operation on the jetty has also been considered in the assessment.

The conclusions of the noise assessment are presented below:

- Operations of the AGL Gas Import Jetty Project and the End of Line Facilities comply with the NIRV Recommended Noise Levels at all time periods. Activities include:
  - Mooring of LNG carrier
  - FSRU operation including regasification process
  - Injection and offloading of nitrogen at end of line facilities
- There may be instances that the existing United operations on the jetty occur simultaneously with the proposed AGL operations, assuming that United are operating at the threshold limits of NIRV Recommended Noise Levels during day, evening and night period at each of the Noise Sensitive Areas (NSAs), the following can be concluded:
  - Operations of the AGL Project and End of Line Facilities will not increase the existing noise levels when United is operating simultaneously.
  - The residents surrounding the Project Site are unlikely to perceive a change in noise levels when AGL Project and End of Line Facilities commence operation.

1. Introduction

1.1 Project Overview

AGL Wholesale Gas Limited (AGL) is proposing to develop a Liquefied Natural Gas (LNG) import facility, utilising a Floating Storage and Regasification Unit (FSRU) to be located at Crib Point on Victoria's Mornington Peninsula. The project, known as the "AGL Gas Import Jetty Project" (the Project), comprises:

- The continuous mooring of a FSRU at the existing Crib Point Jetty, which will receive LNG carriers of approximately 300 m in length
- The construction of ancillary topside jetty infrastructure (Jetty Infrastructure), including high pressure gas unloading arms and a high pressure gas flowline mounted to the jetty and connecting to a flange on the landside component to allow connection to the Crib Point Pakenham Pipeline Project.

There are several other activities that are related to the Project. These include the Jetty Upgrade and the Crib Point Pakenham Pipeline Project (Pipeline Project) which are the subject of separate assessment and approval processes carried out by separate entities.

1.2 Purpose of this Report

Jacobs Group (Australia) Pty Ltd (Jacobs) was engaged by AGL to prepare this assessment of the construction and operational noise impacts associated with the Project. The noise requirements for construction and operation have been determined in accordance with Noise Control Guidelines Publication 1254 and Noise from Industry in Regional Victoria respectively. This report has been prepared to support:

- A referral under the Commonwealth *Environment Protection and Biodiversity Conservation Act (EPBC) 1999*
- A referral under the Victorian *Environment Effects Act 1978*
- Identification of requirements under the *Environment Protection Act 1970*.

1.3 Study Area

The Project Site includes the landside component known as allotment 2040 The Esplanade, Crib Point and the Crib Point Jetty. The Project Site is included in a Port Zone under the Mornington Peninsula Planning Scheme.

The study area for the purposes of this assessment is the Project Site and the surrounding Noise Sensitive Areas (NSAs) of Crib Point and French Island.

1.4 Project Description

A description of the key construction and operational activities is provided below.

The AGL Gas Import Jetty Project will utilise a FSRU, to be continuously moored at Crib Point Jetty to receive LNG cargoes from visiting LNG carriers, store the LNG and regasify it as required to meet demand for high pressure pipeline gas. The FSRU is essentially an LNG carrier with equipment on board to warm and regasify LNG. Gas from the FSRU will be received by a gas flowline positioned on the jetty and connecting with the Pipeline Project's "End of line Facilities" (or onshore infrastructure). The FSRU supplies heat to vaporise the LNG from two sources. The primary source of heat is from sea water pumped through heat exchangers on the vessel. In addition, gas fired boilers will be installed on the vessel to provide an option to supply regasification heat.

The Crib Point Jetty is currently utilised by United Petroleum (United) for the import of fuel which is delivered by ship and transferred by pipeline to their terminal in Hastings.

Four reciprocating gas engines, located on the FSRU, will be used to provide all the power required on board, i.e. for driving the compressors, pumps, ventilation fans, general utility, etc. The engines will also provide electric power for propulsion of the FSRU. A review of ship engine and emissions data from two candidate FSRUs was undertaken, and the larger of the two FSRUs selected as a conservative measure in the assessment.

The engines are modern high efficiency 4-stroke, non-reversible engines with indirect injection of gas fuel. Natural gas will fuel each of the gas engines. When no gas is exported, one engine will operate at reduced capacity to support all utility power needs on the FSRU. The other three engines will not be operational. During gas send out, all four engines will operate at varying capacities to support the gas vaporisation, pressurisation and export processes. The operating capacities will depend on the gas export rate.

There will also be an emergency diesel generator to be used for back-up power requirements.

The LNG once pressurised and vaporised on board the FSRU will be delivered as high pressure gas vapour to the gas flowline on the jetty via gas unloading arms (these components are all part of the AGL Gas Import Jetty Project). The gas flowline will connect to the Pipeline Project's "End of line Facilities" situated on approximately 1.5Ha of area adjacent to the Crib Point Jetty. The "End of line Facilities" include metering, pressure let down, pig traps, and odourisation, quality analysis, nitrogen injection and emergency shut down facilities.

The noise model incorporates the anticipated noise emissions from the operation of the Pipeline Project's End of line Facilities. The model for the End of Line Facilities has been prepared by AECOM for APA Group. Noise emissions from these facilities are considered cumulatively with the noise emissions from the AGL Gas Import Jetty Project.

Construction of Jetty Infrastructure is anticipated to commence in 2019 with an estimated construction timeframe of approximately six months. Operation is expected to commence in 2020.

The key construction phase activities with a potential for noise emissions will be:

- Installation of high pressure unloading arms
- Installation of new high pressure gas flowline along the jetty to transport natural gas to the onshore infrastructure.

1.5 Limitations

For the purposes of assessing the potential noise impacts for the Project, Jacobs relied upon information provided by AGL regarding their proposed activities at the site. A conservative approach to assessment was undertaken.

The environmental noise assessment was limited by, primarily, the FSRU equipment specifications and operational data provided by AGL. The details of the FSRU will not be known until procurement tenders are complete. For the purpose of this assessment Jacobs have reviewed ship engine and emissions data from two candidate FSRUs and picked the larger of the two.

Dimensions of the FSRU and LNG carrier (length and width) were assumed based on the common appearance of other vessels with similar use and size.

Noise impact from both the FSRU and LNG carrier present at the site was assessed as the worst-case-scenario.

Specific assumptions applicable to the acoustic model are detailed in Section 3.2 of this report.

2. Criteria

Relevant criteria have been determined for construction and operational noise at each of the surrounding Noise Sensitive Areas (NSAs).

2.1 Construction Noise

Construction noise at each of the residential locations surrounding the site has been assessed under the Victorian EPA *Noise Control Guidelines* (Publication 1254, October 2008) and *Environmental Guidelines for Major Construction Sites* (Publication 480, February 1996). The purpose of EPA 1254 is to protect nearby residences from unreasonable noise from construction activities. EPA 1254 states *that commercial and other premises affected by noise should be considered and reasonable measures implemented to reduce impact on these premises*.

EPA 1254 states (for Construction and Demolition Site Noise) that the following measures apply to this site:

- Where work is conducted in a residential area or other noise-sensitive location, use the lowest-noise work practices and equipment that meet the requirements of the job
- Site buildings, access roads and plant should be positioned to minimise disturbance to the locality. Barriers such as hoardings or temporary enclosures should be used. The site should be planned to minimise the need for reversing of vehicles
- All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair
- Fit all pneumatic tools operated near a residential area with an effective silencer on their air exhaust port
- Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems must be followed
- Turn off plant when not being used
- All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the relevant authority
- Where possible, no truck associated with the work should be left standing with its ending operating in a street adjacent to a residential area
- Special assessment of vibration risks may be needed, such as for pile-driving or work structurally connected to sensitive premises
- Noise from the site needs to comply with the Guideline Noise Levels, except for:
    - Unavoidable works
    - Night period low-noise or managed-impact works approved by the local authority.

For Unavoidable Works, works that cannot practicably meet the schedule requirements because the work involves continuous work (such as a concrete pour) or potentially commissioning requirements, EPA 1254 imposes no specific Guideline Noise Levels.

For avoidable works, EPA 1254 provides recommended hours of operation of a construction work site and Guideline Noise Levels for works undertaken outside of Normal Working Hours. There are no specific Guideline Noise Levels that apply for Normal Working Hours; however, there are operational requirements placed on a construction site to be in compliance with EPA 1254 during these hours. Time periods and Guideline Noise Levels are presented in Table 2.1.

Table 2.1 : Time periods and guideline noise levels

Time period	Applicable hours	Guideline noise levels	
		Up to 18 months after project commencement	18 months or more after project commencement
Normal Working Hours	7am to 6pm Monday to Friday 7am to 1pm Saturday	No specified Guideline Noise Level - noise reduction measures apply	
Weekend / Evening work	6pm to 10pm Monday to Friday 1pm to 10pm Saturday 7am to 10pm Sunday and Public Holiday	Noise level at any residential premises not to exceed background noise by 10 (dBA) or more	Noise level at any residential premises not to exceed background noise by 5 (dBA) or more
Night	10pm to 7am Monday to Sunday	Noise is to be inaudible within a habitable room of any residential premises	

*Note: The construction noise levels the equivalent continuous noise level, $L_{Aeq,}$ measured over a representative period of time and not less than five minutes.

2.2 Operational Noise

State Environment Protection Policy (Control of Noise from Commerce Industry and Trade) No. N-1 (SEPP N-1) and the *Noise from Industry in Regional Victoria* (NIRV), Publication 1411, October 2011 (NIRV) manage the impact of noise from commercial, industrial and trade premises on residential and other noise sensitive uses.

The NIRV is a non-statutory guideline which provides guidance on Recommended Noise Levels for regulators. These Recommended Noise Levels are only legally binding when applied through statutory instruments, such as a planning permit or notice. The NIRV envisages that proponents will use the policy to self-assess, and that regulators will use the policy to apply noise controls to a premises. SEPP N-1 applies to the Melbourne metropolitan region (within the SEPP N-1 boundary), and NIRV applies to all areas in Victoria outside this boundary. The NIRV has two approaches to determine Recommended Noise Levels, depending on the area where the facility or noise sensitive area is located. For areas within the Urban Growth Boundary, the NIRV requires that the SEPP N-1 methodology be used. For areas outside the Urban Growth Boundary, NIRV has a separate procedure for setting recommended levels.

Properties located to the west of the Project Site (i.e. Crib Point) are located in the Urban Growth Boundary, therefore the Recommended Noise Levels are determined following the SEPP N-1 methodology. The residential locations to the east of the Project Site on French Island are assessed using the NIRV methodology, given that these locations and the Port Zone are both outside the Urban Growth Boundary.

Both the NIRV and the SEPP N-1 apply to noise from industrial premises, and this assessment has assumed that they apply to the operation of the FSRU and the mooring of the LNG carrier beside the FSRU.

2.2.1 SEPP N-1

The SEPP N-1 methodology requires the following:

- Determination of the Effective Noise Level based upon the noise level measured at the NSA with adjustments for noise character, duration and measurement position
- Determination of the Recommended Noise Level, based on the measured background noise level and land use zoning of the area around the NSA
- A comparison between the Effective Noise Level and the Recommended Noise Level. For compliance, the Effective Noise Level is not to exceed the Recommended Noise Level.

The Recommended Noise Levels are determined following the methodology in Schedule B of SEPP N-1 and are dependent on the specific time periods, as defined by SEPP N-1 and shown in Table 2.2.

Table 2.2 : SEPP N-1 Time periods

Time Period	Time
Day	7am to 6pm Monday to Friday 7am to 1pm Saturday
Evening	6pm to 10pm Monday to Friday 1pm to 10pm Saturday 7am to 10pm Sunday and Public Holiday
Night	10pm to 7am All days

The Recommended Noise Levels determined using this methodology should not be less than the SEPP N-1 Base Noise Limits, which are provided in Table 2.3. If the Recommended Noise Levels determined are lower than the Base Noise Limit, then the Base Noise Limit becomes the Recommended Noise Levels.

Table 2.3: SEPP N-1 Base noise limits

Time Period	Base noise limits (dBA)
Day	45
Evening	40
Night	35

The Noise Limits are applicable to the combination of all noise associated with commerce, industry and trade. Therefore, noise from each facility may need to be less than the given Recommended Noise Levels.

As the SEPP N-1 procedure for determining the Recommended Noise Levels is determined by the land use surrounding the NSA, the ocean is included for several properties in the area. For this assessment, the ocean is treated as a Type 1 location (the most conservative approach).

In regards to pumps for firefighting equipment, SEPP N-1 states that the noise limit for this noise source shall be increased by 10 dB for a day period and by 5 dB for all other periods. This is an increase on top of the determined Recommended Noise Levels.

2.2.2 NIRV

For the French Island properties, the NIRV procedure was used to determine the Recommended Noise Levels, using the following steps:

- Determine Zone Levels based on “noise generating” and “noise receiving” zones (by reference to planning zones)
- Adjust levels by distance between generating zone and noise receiver location
- Compare to the Base Noise Levels
- Background Noise Level check and adjustment
- Adopt highest noise levels using the above steps.

As the residential locations on French Island are within a Rural Conservation Zone under the French Island and Sandstone Planning Scheme, the calculation of the distance-adjusted levels (over 900 m away) are below that of the Base Noise Levels, which are shown in Table 2.4. It should be stated that a Port Zone is not strictly defined in NIRV, however, it was found that regardless of the Generating Zone type, the Base Noise Levels will always be “higher”.

Table 2.4: NIRV Base noise levels

Time Period	Base noise levels (dBA)
Day	45
Evening	37
Night	32

If background noise levels have been measured, then the greater of the following levels should be adopted as the Recommended Noise Levels:

Day

- Distance-adjusted level or base noise level
- The day background noise level plus 8 dB.

Evening

- Distance-adjusted level or base noise level
- The evening background noise level plus 5 dB.

Night

- Distance-adjusted level or base noise level
- The night background noise level plus 5 dB.

2.3 Background Noise Measurements

Noise loggers were placed at various NSAs in the area surrounding the Project Site to determine the current background noise levels while the Crib Point Jetty is not in use. The logger locations to the west of the Project Site (mainland) are shown in Figure 2.1 and the logger locations to the east of the Project Site (French Island) are shown in Figure 2.2. Noise loggers were in place for a minimum of one week, to increase the dataset from which background levels are determined. These locations were selected based on availability, and are considered to be representative of surrounding areas. These logger locations do not mean that the assessment was only restricted to these particular properties.

Time traces of noise levels recorded by the noise loggers are provided in Appendix B, and a summary of background noise results are provided below in Table 2.5.

Table 2.5: Background noise levels for each time period

Measurement location	Date (dd/mm/yy – dd/mm/yy)	Measured background noise levels dBL_{A90}		
		Day	Evening	Night
32 Lorimer Street, Crib Point Note 1	06/09/17 – 14/09/17	39	32	31
43 Disney Street, Crib Point	06/09/17 – 14/09/17	43	36	35
103 The Esplanade, Crib Point	06/09/17 – 14/09/17	42	33	40 Note 2
123 The Esplanade, Crib Point Note 3	26/10/17 – 02/11/17	37	36	32
4 Point Road, Crib Point Note 4	20/02/18 – 27/02/18	39	41	37
350 Stony Point Road, Crib Point Note 4	20/02/18 – 27/02/18	45	45	36
387 Stony Point Road, Crib Point Note 5	27/02/18 – 06/03/18	46	43	29
French Island Logger Location 1 Note 6,7	20/11/17 – 29/11/17	34	33	30
French Island Logger Location 2 Note 6,7	20/11/17 – 29/11/17	34	32	29
French Island Logger Location 3 Note 6,7	20/11/17 – 29/11/17	34	32	29

Notes:

1. 2.5 dB was removed from the measured data as the logger was within 2 m of a façade.
2. At 103 The Esplanade, there was a significant noise source occurring every evening from approximately 6:15 pm which then decayed until approximately 2 am. The nature of this noise leads us to believe that it is due to fauna, such as bats, which could be seasonal. For this reason, data between 6:15 pm and 2 am has been removed from the assessment. This data is highlighted in Appendix B, Figure B.4.
3. At 123 The Esplanade, noise data was removed from the assessment due to wind, rain and industrial noise sources. This data is highlighted in Appendix B, Figure B.5.
4. At 4 Point Road and 350 Stony Point Road noise data was removed from the assessment due to excessive road noise and industrial noise sources.
5. At 387 Stony Point Road noise data was removed from the assessment due to excessive road noise and localised residential noise.
6. There are no residential addresses on French Island, therefore these locations are in reference to the locations shown in Figure 2.2.
7. At the French Island locations, noise data was removed from the assessment due to wildlife, outboard motors and weather (rain and thunder). This data is highlighted in Appendix B, Figure B.9.

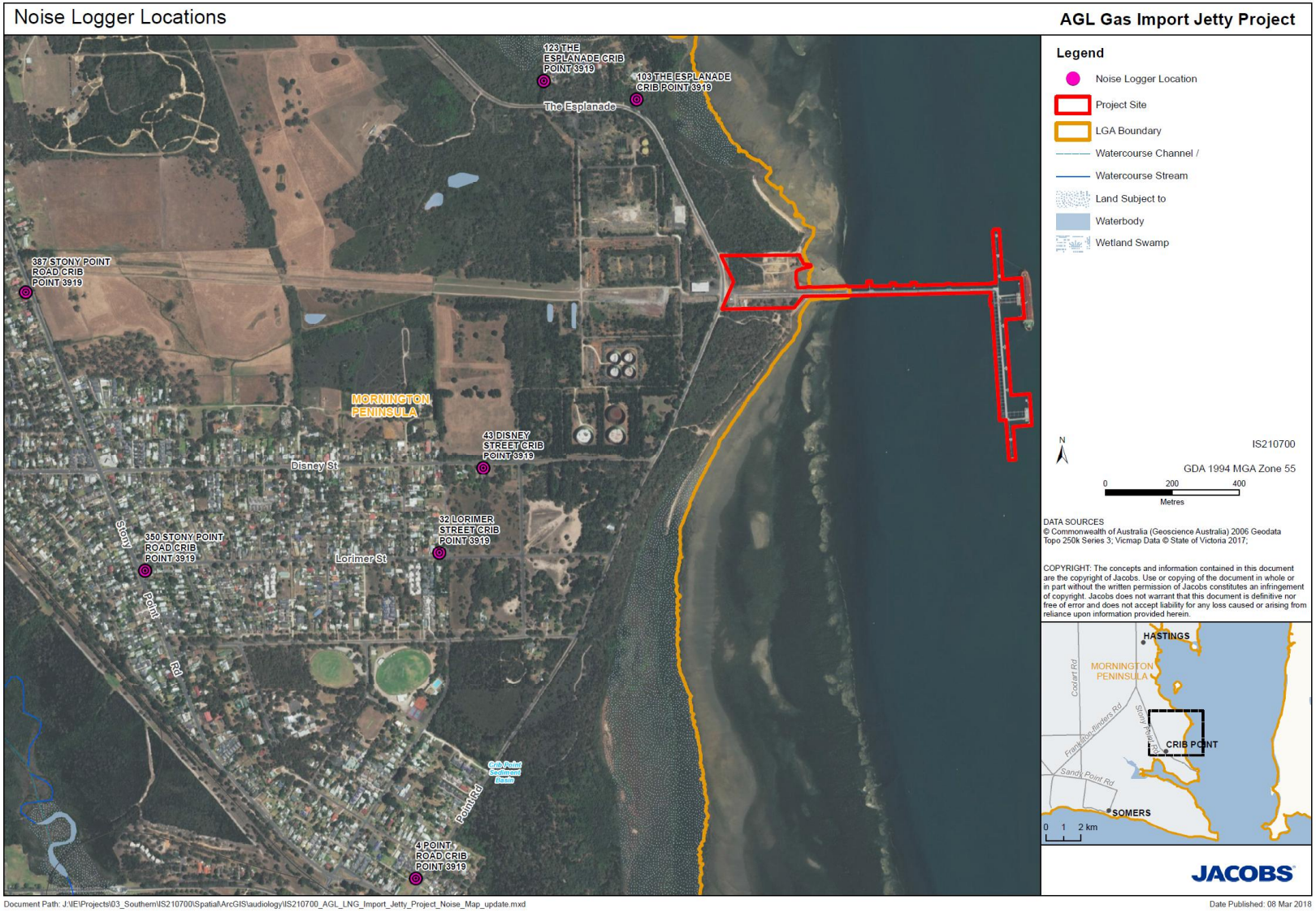


Figure 2.1 : Location of noise loggers on the mainland to the west of the Project Site

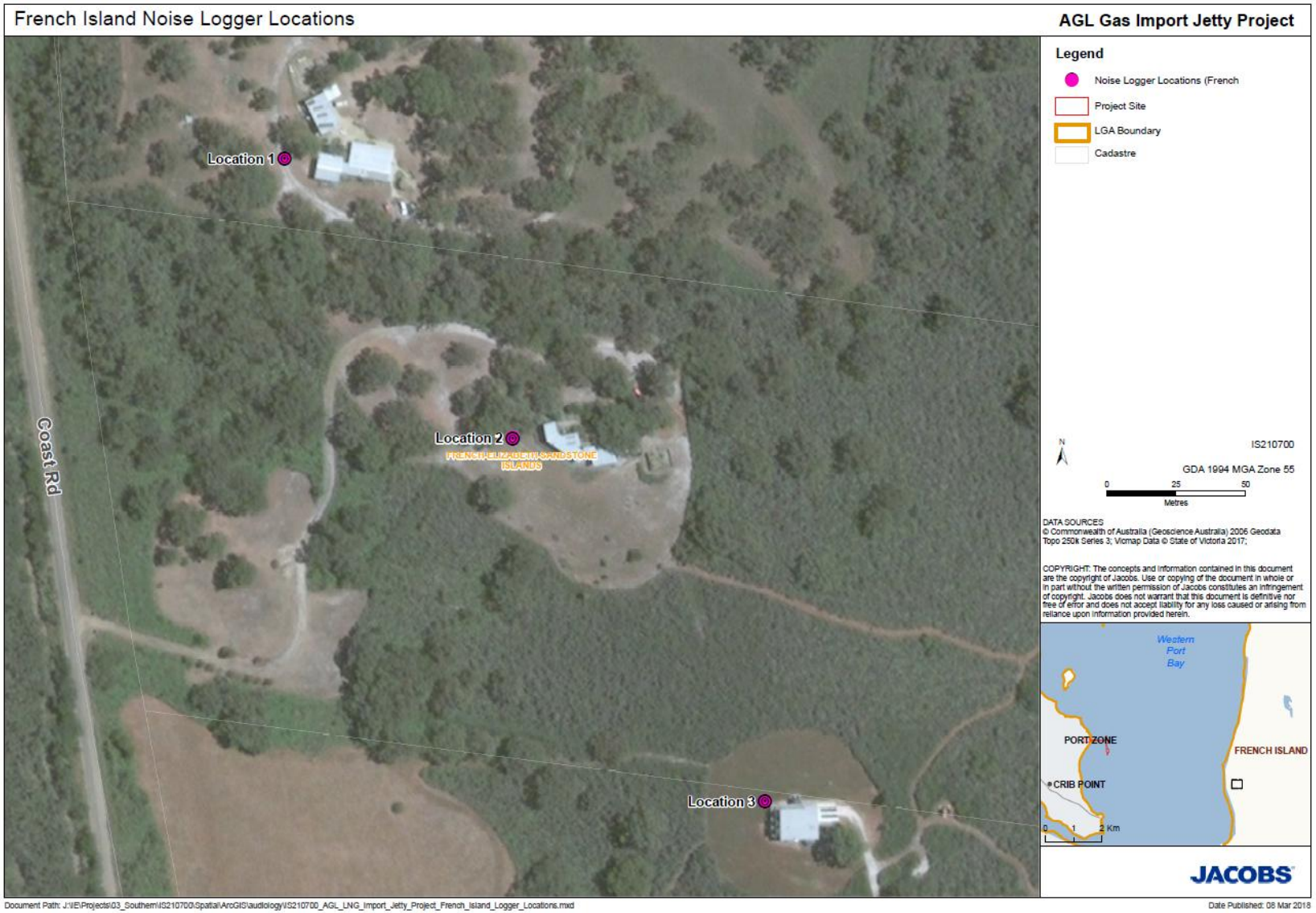


Figure 2.2: Location of noise loggers on French Island to the east of the Project Site

2.4 Project Noise Criteria

Based on the background noise level measurement results in Section 2.3, the resultant project noise criteria are presented below.

2.4.1 Construction noise criteria

Construction Guideline Noise Levels have been determined for various areas around the Project Site as listed in Table 2.6.

Table 2.6: Noise levels at the noise sensitive areas during construction

Location	Guideline Noise Levels $dBL_{Aeq,15mins}$		
	Day	Evening	Night
32 Lorimer Street, Crib Point	No specified Guideline Noise Level - noise reduction measures apply	42	Inaudible inside a habitable room
43 Disney Street, Crib Point		46	
103 The Esplanade, Crib Point		43	
132 The Esplanade, Crib Point		42	
123 The Esplanade, Crib Point		42	
4 Point Road, Crib Point		51	
350 Stony Point Road, Crib Point		55	
387 Stony Point Road, Crib Point		53	
French Island		42	

Note:

1. This includes a +5 dB penalty to noise levels due to construction noise at the Noise Sensitive Area when tonality is prominent.
2. The Evening Guideline Noise Levels have been derived by the Background Noise Level + 10 dB. If construction of the project occurs for longer than 18 months, 5 dB must be subtracted from these evening limits after 18 months.
3. Where the Evening Guideline Noise Levels applies, this noise level should be external and not within 3.5 m of a reflective surface or façade.

2.4.2 Operational noise criteria

The Recommended Noise Levels for the NSAs around the Project Site are presented in Table 2.7. These are based on both the Land Use Zones (as shown in Appendix D) and measured background noise levels.

Table 2.7: Recommended noise levels

Location	Recommended Noise Levels $dBL_{Aeq,30mins}$		
	Day	Evening	Night
32 Lorimer Street, Crib Point	51	43	40
43 Disney Street, Crib Point	58	49	46
103 The Esplanade, Crib Point	52	43 Note 1	43
123 The Esplanade, Crib Point	52	47	43
132 The Esplanade, Crib Point	54	45	42
4 Point Road, Crib Point	51	46	41
350 Stony Point Road, Crib Point	53	48	42
387 Stony Point Road, Crib Point	55	49	40
French Island Residential Locations Note 2	45	37	34

Note 1: The Recommended Noise Level at this location is based on a limited amount of data due to noise events polluting the measurements. Consequently, this value may be overly conservative as usually the Evening Recommended Noise Level will be higher than the Night Recommended Noise Level.

Note 2: The Recommended Noise Levels for French Island are based on the lowest background noise levels measured.

3. Assessment

3.1 Methodology

Acoustic modelling has been used to predict operational noise at the NSAs.

3.1.1 Noise Model

An acoustic model has been developed of the jetty site and surrounding NSAs. This has been created using the acoustic software SoundPLAN version 7.4. This is an environmental noise modelling software package which has implemented the ISO 9613-2 noise propagation model. The ISO methodology considers noise attenuation by:

- Geometrical spreading
- Atmospheric absorption
- Ground effects
- Meteorological conditions conducive of the propagation of noise
- Barriers
- Topography and distance between the source and receiver.

The model in SoundPLAN includes:

- Topography
- Noise sources associated with construction or operation
- Receivers
- Ground absorption
- Meteorological conditions.

The model inputs of the noise model are as defined below:

- Temperature: 10°C
- Relative Humidity: 70%
- Receiver Height: 1.5 m
- Reflection order: 3.

3.2 Assumptions

The following assumptions apply to the noise model:

- Dimensions of the FSRU and LNG carrier are based on average dimensions of existing FSRU of 295 m (L) x 46 m (W) x 23 m above sea level (H)
- All equipment runs for 100% of the time over the half hour assessment period (except the Security Boat)
- Four tugboats are used to guide the visiting LNG carrier to the mooring location beside the FSRU
- While the Port of Hastings only have two operational tugboats, it was modelled that if the LNG carrier mooring needs four tugboats, these additional tugboats will be similar to that of the Port of Hastings tugboats
- During operation the FSRU running on maximum capacity (which includes the use of the auxiliary boilers). It is assumed that the ventilation fans are installed inside the engine room(s), and noise attenuators are installed between the fans and openings on façade. This will ameliorate engine noise break out through the ventilation duct to outside.

- Noise events from the operations of the End of Line Facilities are based on the SoundPlan model provided by AECOM, for details of End of Line Facilities refer to the AECOM report (AECOM 2018).
- Sweeping of the sea bed is undertaken as a routine activity by the Port of Hastings Development Authority. The jetty will not be used when sweeping activities occur, hence sweeping has not been assessed.

3.3 Modelling Scenarios

The following scenarios have been modelled for the assessment which include operations from the AGL Gas Import Jetty Project and End of Line Facilities:

- Scenario 1: Mooring of LNG carrier, nitrogen offloading at End of Line Facilities
- Scenario 2: Mooring of LNG carrier, nitrogen injection at End of Line Facilities
- Scenario 3: Operation of FSRU, regasification, nitrogen offloading at End of Line Facilities
- Scenario 4: Operation of FSRU, regasification, nitrogen injection at End of Line Facilities

The sources modelled for each of the above scenarios are presented in Appendix A**.**

3.4 Source Noise Levels

Source noise levels for the equipment have been determined through:

- Discussions with AGL
- Measurements of United Diesel off-loading operations
- Literature search on operation of FSRU and the regasification process
- Empirical equations where noise data is not available using "*Engineering Noise Control*", Bies D. and Hansen C., Fourth Edition, Spon Press 2009.

The overall sound power levels used in the acoustic model are based on the reference plant design and measurements, and presented below in Table 3.1.

Table 3.1: Source sound noise levels

Source	Sound Power Level dB(A)	Notes
AGL Gas Import Jetty Project		
Tugboat	101	· For use during mooring · Based on measurements of engine intake on-board Port of Hastings Svitzer tugboats (dominant noise source of tugboat)
Security Boat	96	· Based on measurements of Port of Hastings security boat (LW Marine) · Operates for a maximum of five minutes in a "worst-case" half hour period
Engine Exhaust with large muffler	85	· 6000 kW reciprocating engine, MAN 6L51/60 DF · Muffler based on empirical "Large Muffler with low pressure drop" Table 10.6 – "*Noise Control for Buildings and Manufacturing Plants",* Miller L., Bolt, Beranek and Newman Incorporated,1981
Engine Exhaust with large muffler	87	· 9000 kW reciprocating engine, MAN 9L51/60 DF · Empirical estimation of engine · Muffler based on empirical "Large Muffler with low pressure drop" Table 10.6 – "*Noise Control for Buildings and Manufacturing Plants",* Miller L., Bolt, Beranek and Newman Incorporated,1981
Regas Boiler Exhaust	88	· Based off a large boiler – 25500 kW (Alfa Laval – Aalborg 3-Pass Boiler)

Source	Sound Power Level dB(A)	Notes
		· Empirical estimation of boiler
Ventilation Axial Fan	78	· Through silencers · Fan technical specifications: 75 kW, 1180 RPM, 44 m^3/s · Empirical estimation of fan and silencers · Includes reciprocating engine case noise emissions via duct
Regasification Booster Pump 1	101	· 1900 kW, maximum (3600) RPM · Empirical estimation of pump
Regasification Booster Pump 2	101	· 1300 kW, maximum (3600) RPM · Empirical estimation of pump
Moored LNG carrier	115	· Noise level from Witte, J., "*Noise from moored ships*", Internoise 2010, Lisbon, Portugal · ~300000 Dead Weight Tonnage, average noise level
Loading Arm	100	· Noise level provided by EMCO Wheaton · Spectrum from Jacobs Noise Database
Pipeline Project – End of line Facilities		
Refer to AECOM report regarding the End of Line Facilities (AECOM 2018)		

It is also proposed that there will be three regasification seawater pumps, located below the decking surface. As these pumps are not exposed to the atmosphere, noise levels were predicted to be negligible in comparison with other sources on the site.

Note: If during the procurement and design phase the selected items of equipment exceed the noise levels in Table 3.1, additional mitigation may be required.

3.5 Construction Activities

It is assumed that most construction activities will be undertaken during Normal Working Hours. There are no Guideline Noise Levels applicable during Normal Working Hours and therefore an assessment has not been undertaken.

3.6 Operational Noise

The environmental noise impact has been assessed for the following scenarios:

- Scenario 1: Mooring of LNG carrier, nitrogen offloading at End of Line Facilities
- Scenario 2: Mooring of LNG carrier, nitrogen injection at End of Line Facilities
- Scenario 3: Operation of FSRU, regasification, nitrogen offloading at End of Line Facilities
- Scenario 4: Operation of FSRU, regasification, nitrogen injection at End of Line Facilities

Noise contours in Crib Point and French Island have been provided for the above scenarios in Appendix C. The predicted dB(A)L_{eq} noise levels are applicable for any 30-minute period.

3.6.1 Scenario 1: Mooring of LNG carrier, nitrogen offloading at End of Line Facilities

Noise model for Scenario 1 includes:

- Four tugboats guiding the idling LNG carrier to and from the mooring location beside the FSRU.
- The FSRU operating on minimal capacity
- Nitrogen offloading at End of Line Facilities (refer to AECOM report for details (AECOM 2018))

The highest predicted noise levels at NSAs in five representative locations have been presented in Table 3.2.

Table 3.2: Highest predicted noise levels at surrounding NSAs for Scenario 1

Noise sensitive area	Recommended noise levels $dBL_{Aeq,30mins}$			Predicted noise levels $dBL_{Aeq,30mins}$		Compliance? (Y / N)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
132 The Esplanade, Crib Point	54	45	42	33	32	Y	Y	Y
14 Governors Road, Crib Point	54	45	42	32	32	Y	Y	Y
107 The Esplanade, Crib Point	52	43	43	31	30	Y	Y	Y
123 The Esplanade, Crib Point	52	47	43	28	28	Y	Y	Y
French Island Properties	45	37	34	26	26	Y	Y	Y

3.6.2 Scenario 2: Mooring of LNG carrier, nitrogen injection at End of Line Facilities

Noise model for Scenario 2 includes:

- Four tugboats guiding the idling LNG carrier to and from the mooring location beside the FSRU.
- The FSRU operating on minimal capacity
- Nitrogen injection at End of Line Facilities (refer to AECOM report for details (AECOM 2018))

The highest predicted noise levels at NSAs in five representative locations have been presented in Table 3.3.

Table 3.3: Highest predicted noise levels at surrounding NSAs for Scenario 2

Noise sensitive area	Recommended noise levels $dBL_{Aeq,30mins}$			Predicted noise levels $dBL_{Aeq,30mins}$		Compliance? (Y / N)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
132 The Esplanade, Crib Point	54	45	42	32	32	Y	Y	Y
14 Governors Road, Crib Point	54	45	42	32	32	Y	Y	Y
107 The Esplanade, Crib Point	52	43	43	30	30	Y	Y	Y
123 The Esplanade, Crib Point	52	47	43	27	27	Y	Y	Y
French Island Properties	45	37	34	26	26	Y	Y	Y

3.6.3 Scenario 3: Operation of FSRU, Regasification, Nitrogen offloading at End of Line Facilities

Noise model for Scenario 3 includes:

- FSRU operating at maximum capacity (including use of auxiliary boilers).
- Two high pressure gas unloading arms
- Idling of the LNG carrier
- Nitrogen offloading at End of Line Facilities (refer to AECOM report for details (AECOM 2018))

The highest predicted noise levels at NSAs in five representative locations have been presented in Table 3.4.

Table 3.4: Highest predicted noise levels at surrounding NSAs for Scenario 4

Noise sensitive area	Recommended noise levels $dBL_{Aeq,30mins}$			Predicted noise levels $dBL_{Aeq,30mins}$		Compliance? (Y / N)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
132 The Esplanade, Crib Point	54	45	42	32	32	Y	Y	Y
14 Governors Road, Crib Point	54	45	42	31	31	Y	Y	Y
107 The Esplanade, Crib Point	52	43	43	30	30	Y	Y	Y
123 The Esplanade, Crib Point	52	47	43	29	28	Y	Y	Y
French Island Properties	45	37	34	17	17	Y	Y	Y

3.6.4 Scenario 4: Operation of FSRU, Regasification, Nitrogen Injection at End of Line Facilities

Noise model for Scenario 4 includes:

- FSRU operating at maximum capacity (including use of auxiliary boilers).
- Two high pressure gas unloading arms
- Idling of the LNG carrier
- Nitrogen Injection at End of Line Facilities (refer to AECOM report for details (AECOM 2018))

The highest predicted noise levels at NSAs in five representative locations have been presented in Table 3.5.

Table 3.5: Highest predicted noise levels at surrounding NSAs for Scenario 5

Noise sensitive area	Recommended noise levels $dBL_{Aeq,30mins}$			Predicted noise levels $dBL_{Aeq,30mins}$		Compliance? (Y / N)		
	Day	Evening	Night	Day	Evening/Night	Day	Evening	Night
132 The Esplanade, Crib Point	54	45	42	32	32	Y	Y	Y
14 Governors Road, Crib Point	54	45	42	31	31	Y	Y	Y
107 The Esplanade, Crib Point	52	43	43	30	29	Y	Y	Y
123 The Esplanade, Crib Point	52	47	43	28	28	Y	Y	Y
French Island Properties	45	37	34	17	17	Y	Y	Y

3.7 Discussion

The above predicted results indicate that the operation of AGL Gas Import Jetty Project and associated End of Line Facilities comply with the Project noise criteria detailed in Section 2.4 for all modelling scenarios for all periods.

The above predicted noise levels do not include the operational noise from existing United Petroleum facilities on the jetty. As it is possible that both AGL and United facilities will be in operation simultaneously, noise from United has been considered in this report. This section presents a discussion of the proposed AGL Project on the existing noise levels in the area.

Among all the scenarios presented in Section 3.6 above, Scenarios 1 and 2 generate the most potential impact to the surrounding NSAs. The dominant noise sources are the four tug boats for the AGL Project during the mooring of the visiting LNG carrier. There is currently no noise level data regarding the operation of the United facility. Based on the conservative assumption that the United facility is currently operating at threshold limits of the Recommended Noise Levels, a comparison can be made between predicted AGL Project noise levels and existing United facility noise levels. Refer to Table 3.6 below.

Table 3.6: Comparison between Predicted AGL Project Noise Levels and Existing United Noise Levels

Noise sensitive area	Predicted AGL Noise Levels (Scenario 1) $dBL_{Aeq,30mins}$		Assumed Existing United Operational Noise Levels $dBL_{Aeq,30mins}$			Combined Noise Levels $dBL_{Aeq,30mins}$		
	Day	Evening/Night	Day	Evening	Night	Day	Evening	Night
132 The Esplanade, Crib Point	33	32	54	45	43	54	45	43
14 Governors Road, Crib Point	32	32	54	45	43	54	45	43
107 The Esplanade, Crib Point	31	30	52	43	43	52	43	43
123 The Esplanade, Crib Point	28	28	52	47	43	52	47	43
French Island Properties	26	26	45	37	35	45	37	35

The comparison table above indicates that assuming that the United Facility is currently operating at the threshold limits of the Recommended Noise Levels, the introduction of the proposed AGL Project will not increase the existing noise levels in Noise Sensitive Areas.

In summary, the noise environment in the surrounding NSAs will not be changed due to the AGL Project based on the assumptions stated above. The noise currently experienced by the residents due to United's operation at the jetty is unlikely to increase even when AGL Project and the United facility operating simultaneously.

4. Conclusion

The noise requirements for construction and operation of the AGL Gas Import Jetty Project have been determined in accordance with *Noise Control Guidelines* Publication 1254 and *Noise from Industry in Regional Victoria* respectively.

Construction is assumed to be conducted during Normal Working Hours. There are no applicable Guideline Noise Levels for this time period, although lowest noise work practices and equipment are expected.

An acoustic model has been created to predict the impact of operational noise at the Noise Sensitive Areas surrounding the jetty. The operational scenarios modelled included the mooring of the visiting LNG carrier, the regasification process as well as nitrogen offloading and injection operations at the End of Line Facilities.

The conclusions of the operational noise assessment are presented below:

- Operations of the AGL Gas Import Jetty Project and the End of Line Facilities comply with the NIRV Recommended Noise Levels at all time periods, activities include:
  - Mooring of LNG carrier
  - FSRU operation including regasification process
  - Injection and offloading of nitrogen at end of line facilities
- There may be instances that the existing United operations on the jetty occur simultaneously with the proposed AGL operations, assuming that United are operating at the threshold limits of NIRV Recommended Noise Levels during day, evening and night period at each NSAs, the following can be concluded:
  - Operations of the AGL Project and End of Line Facilities will not increase the existing noise levels when United is operating simultaneously.
  - The residents surrounding the Project Site are unlikely to perceive a change in noise levels when AGL Project and End of Line Facilities commence operation.

5. References

AECOM (2018), Crib Point Pakenham Pipeline Project, Acoustic Assessment, DRAFT, prepared by AECOM for APA Group.

Appendix A. Equipment for each modelled scenario

Table A.1: Equipment modelled in each scenario

Source	Equipment modelled in each scenario		
	Mooring of LNG carrier	FSRU regasification processing	End of Line Facilities
Tugboat (Svitzer – Port of Hastings)	4	-	**Refer to report prepared by AECOM (2018)**
Compressor / Cyclone	-	2	
Engine Exhaust with large muffler	1	2	
Engine Exhaust with large muffler	-	2	
Regasification Boiler Exhaust	-	2	
Ventilation Axial Fan	1	4	
Regasification Booster Pump 1	-	1	
Regasification Booster Pump 2	-	1	
Moored LNG carrier	1	1	
Metering Station	-	1	
Nitrogen Injection Kit	-	1	
Loading Arms	-	2	
Security Boat	1	-	

Appendix B. Noise Logging

Table B.1: Noise logging equipment

Measurement location	Equipment / serial number	Date of calibration	Notes
43 Disney Street, Crib Point	ARL Ngara / 8780E2	12/05/2017	N/A
32 Lorimer Street, Crib Point	ARL Ngara / 8780B9	12/05/2017	Within 2 m of a façade
103 The Esplanade, Crib Point	ARL Ngara / 87811E	29/06/2016	Logger shutdown on 12/09/2017 (due to battery failure). This was prior to intended 8-day logging period, however the data collected (over 6 days) was sufficient to determine background noise levels. Data was removed from the determination of background levels due to presumed fauna noise.
123 The Esplanade, Crib Point	ARL Ngara / 8780E3	29/06/2016	Data was removed from the determination of background levels due to weather (wind and rain) and industrial noise sources.
4 Point Road, Crib Point	ARL Ngara / 878110	14/07/2016	Data was removed from the determination of background levels due to excessive road noise and industrial noise sources.
350 Stony Point Road, Crib Point	ARL Ngara / 8780B9	12/05/2017	Data was removed from the determination of background levels due to excessive road noise and industrial noise sources.
387 Stony Point Road, Crib Point	ARL Ngara / 8780E2	12/05/2017	Data was removed from the determination of background levels due to excessive road noise and localised residential noise.
French Island: Location 1	ARL Ngara / 8780E3	29/06/2016	Data was removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources.
French Island: Location 2	ARL Ngara / 8780B7	12/05/2017	Data was removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources
French Island: Location 3	ARL Ngara / 8780B9	12/05/2017	Data was removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources.

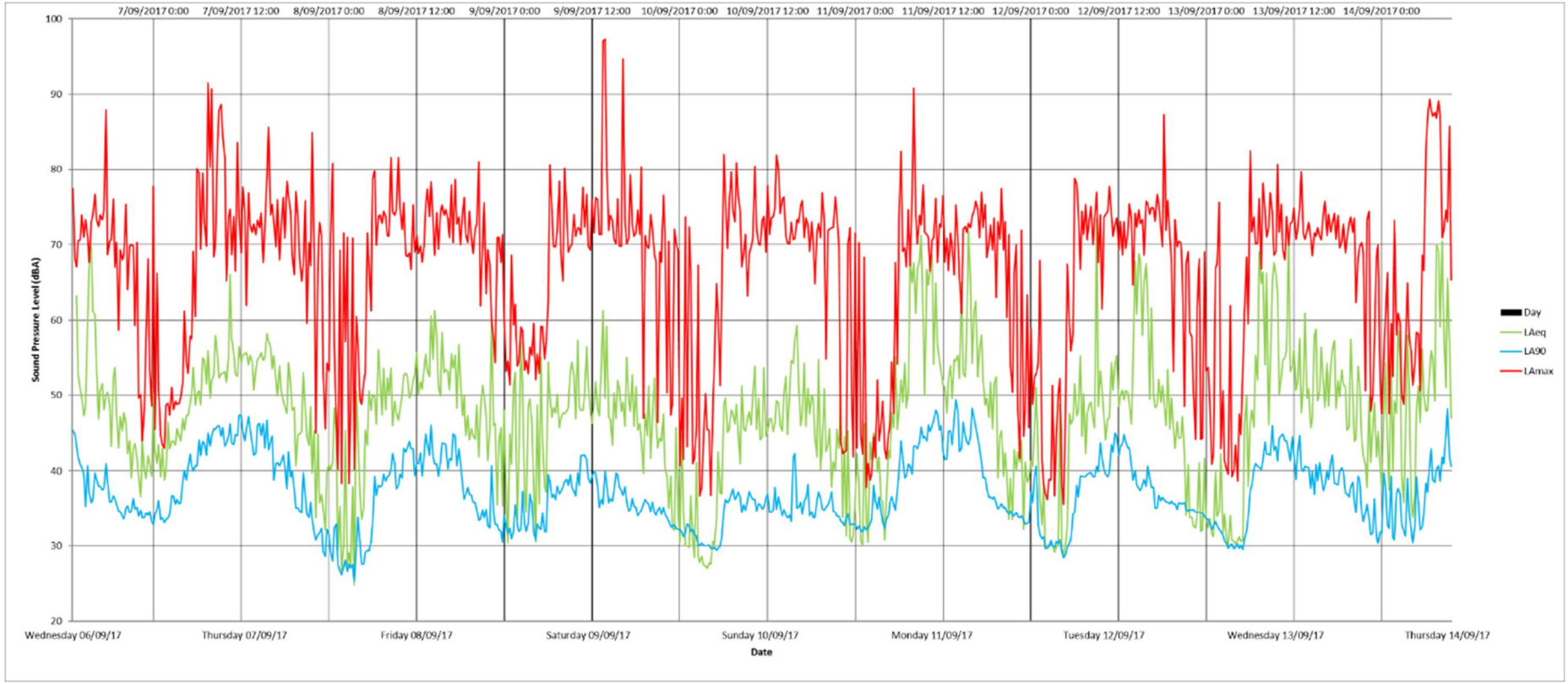


Figure B.1: Measured sound pressure levels at 43 Disney Street, Crib Point

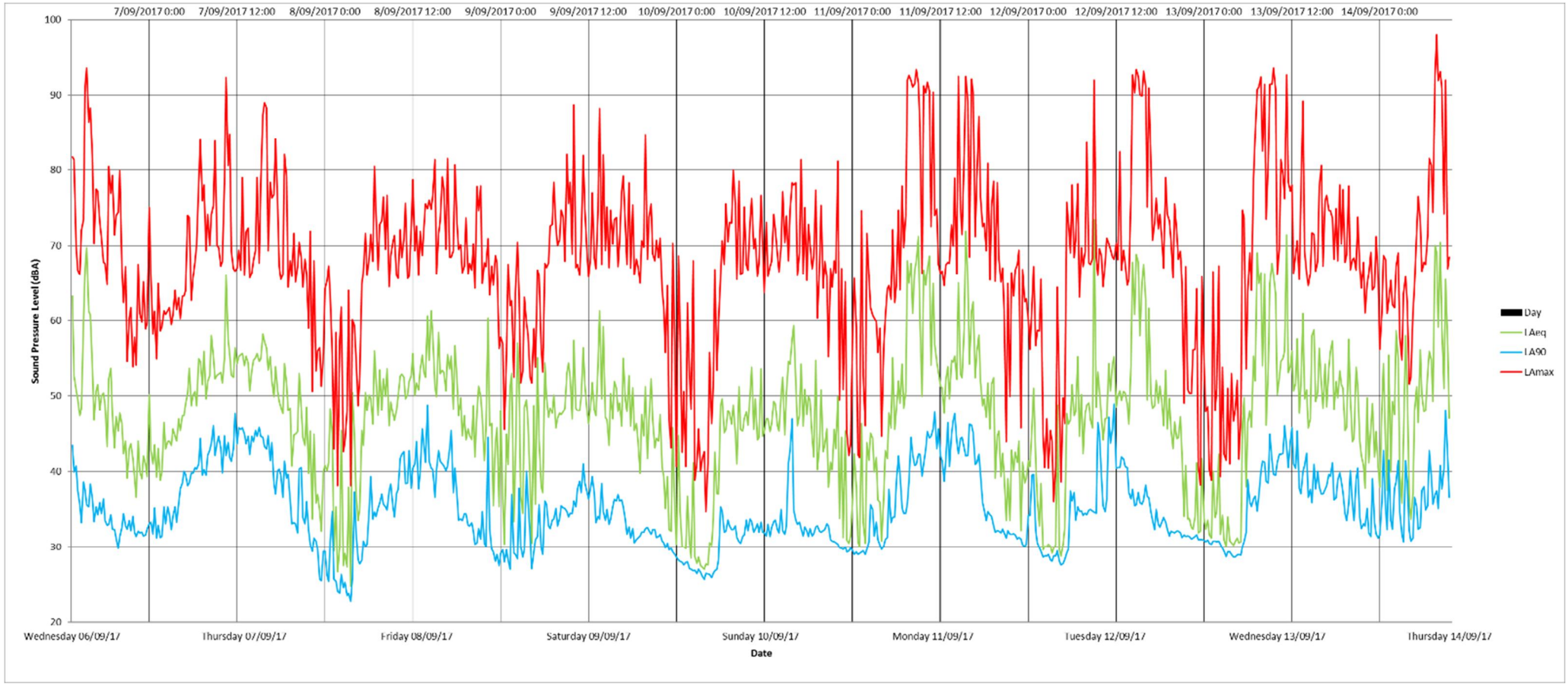


Figure B.2: Measured sound pressure levels at 32 Lorimer Street, Crib Point

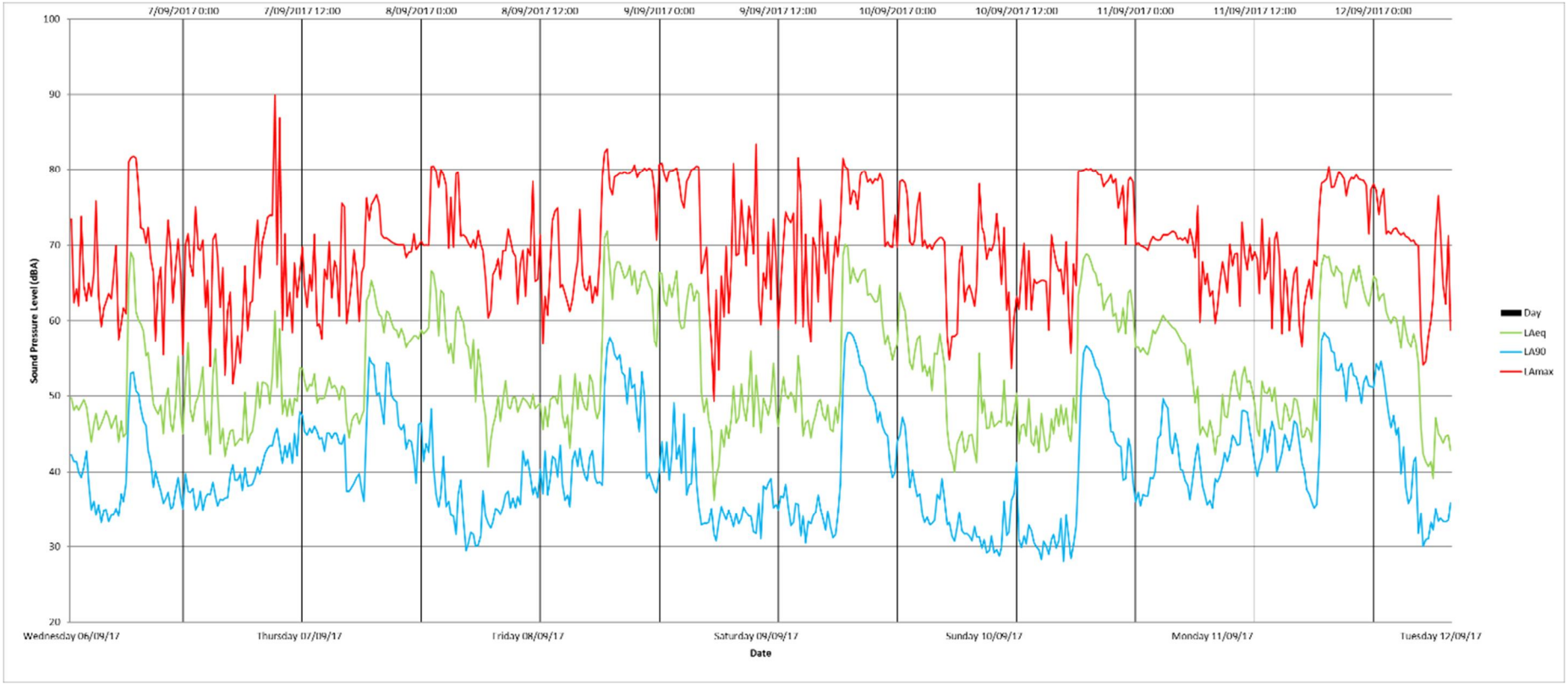


Figure B.3: Measured sound pressure levels at 103 The Esplanade, Crib Point

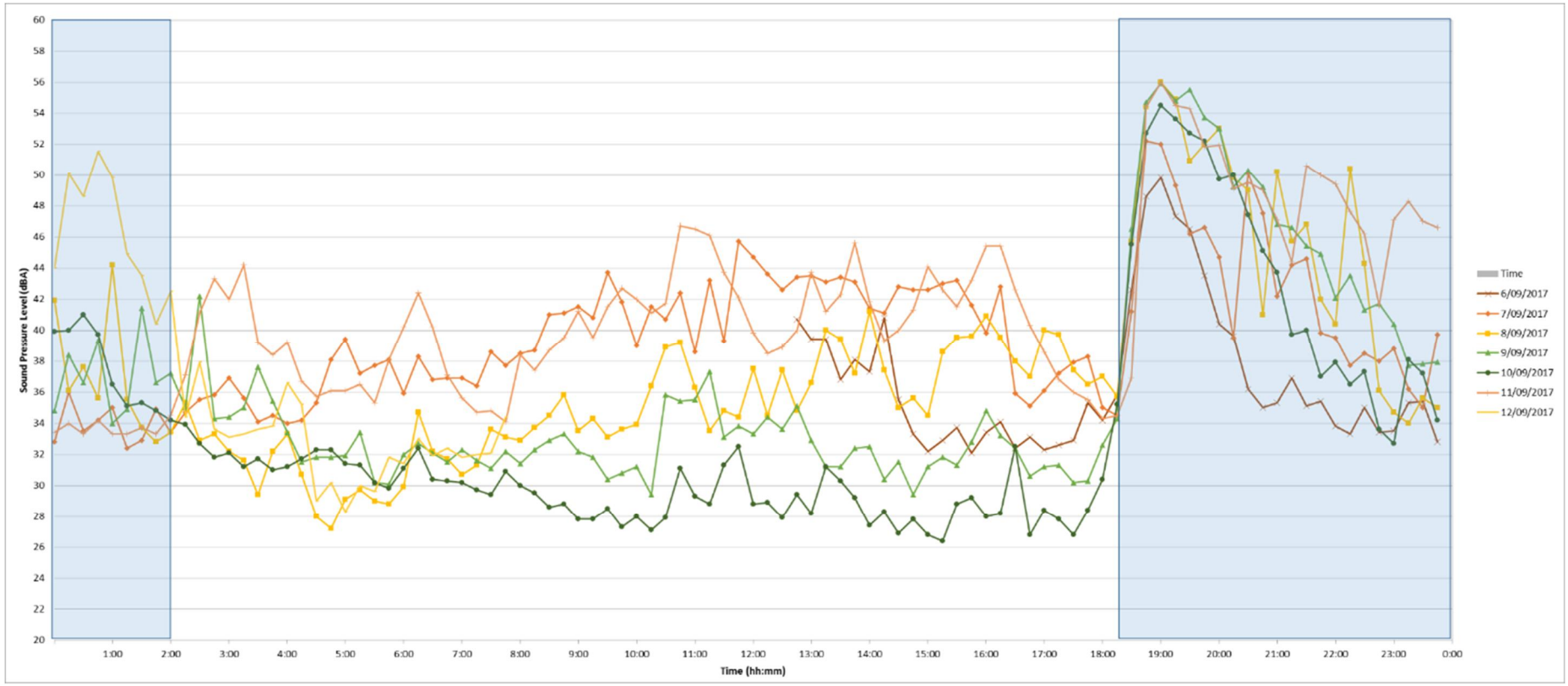


Figure B.4: Daily measured $L_{A90,15mins}$ at 103 The Esplanade, Crib Point. The shaded areas have been removed from the determination of the background levels due to presumed fauna noise.

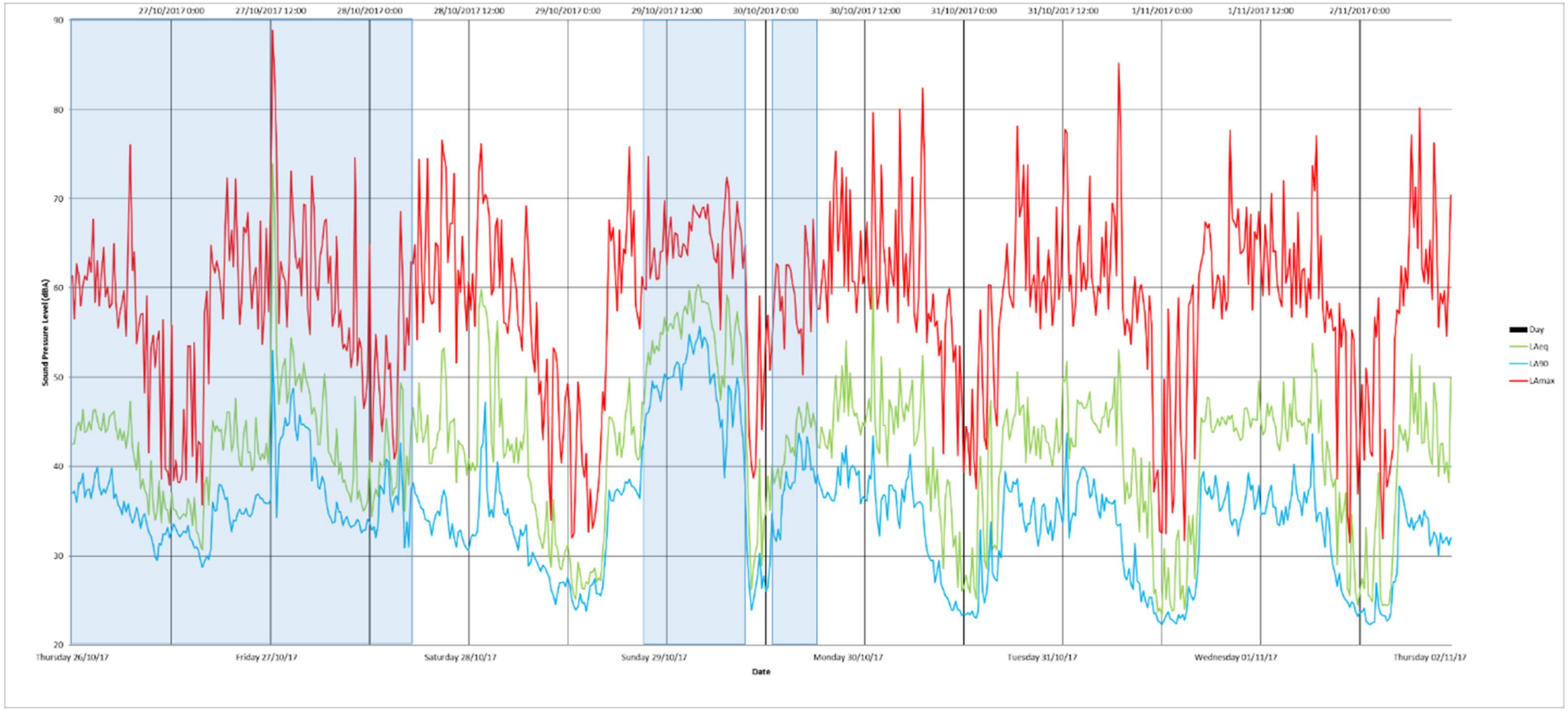


Figure B.5: Measured sound pressure levels at 123 The Esplanade, Crib Point. The shaded areas have been removed from the determination of background levels due to weather (wind and rain) and industrial noise sources.

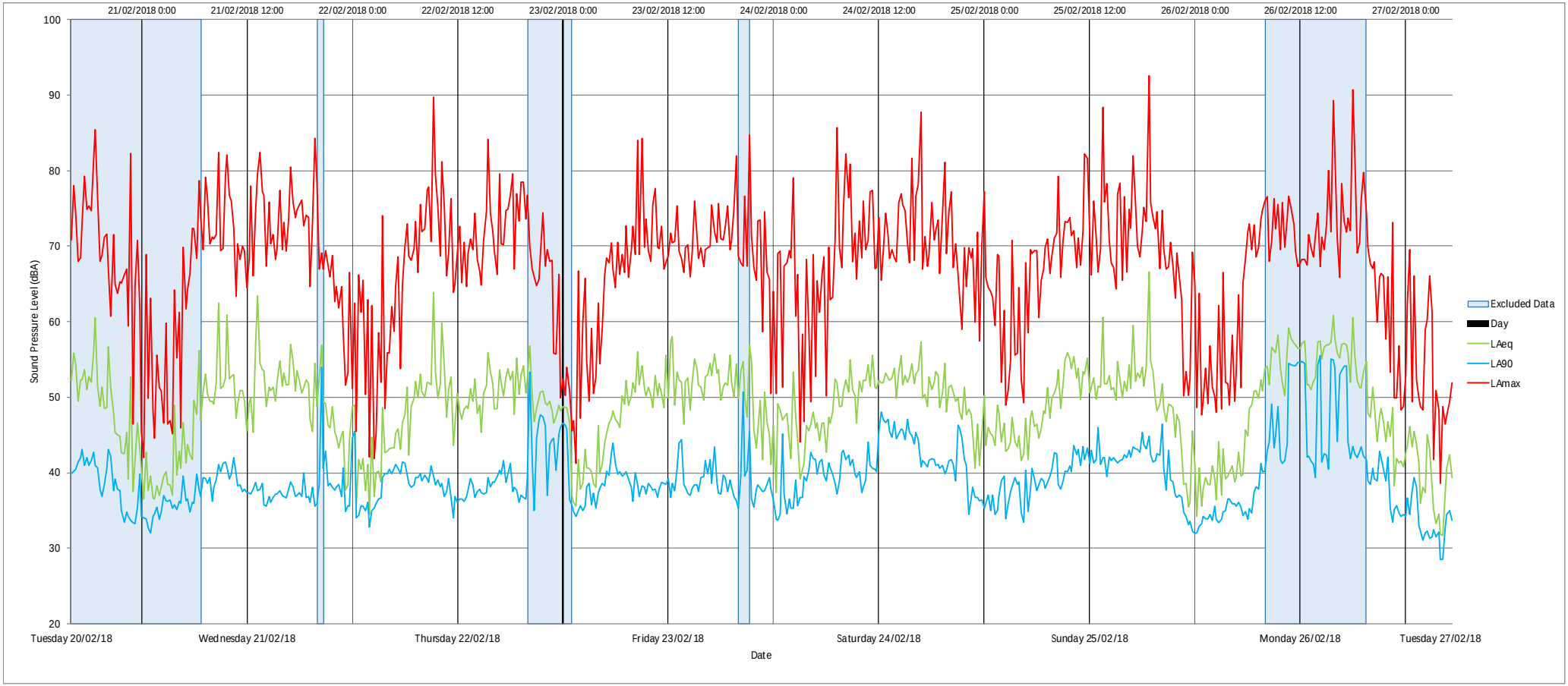


Figure B.6 : Measured sound pressure levels at 4 Point Road, Crib Point. The shaded areas have been removed from the determination of background levels due to excessive road noise and industrial noise sources.

Figure B.7 : Measured sound pressure levels at 350 Stony Point Road, Crib Point. The shaded areas have been removed from the determination of background levels due to excessive road noise and industrial noise sources.

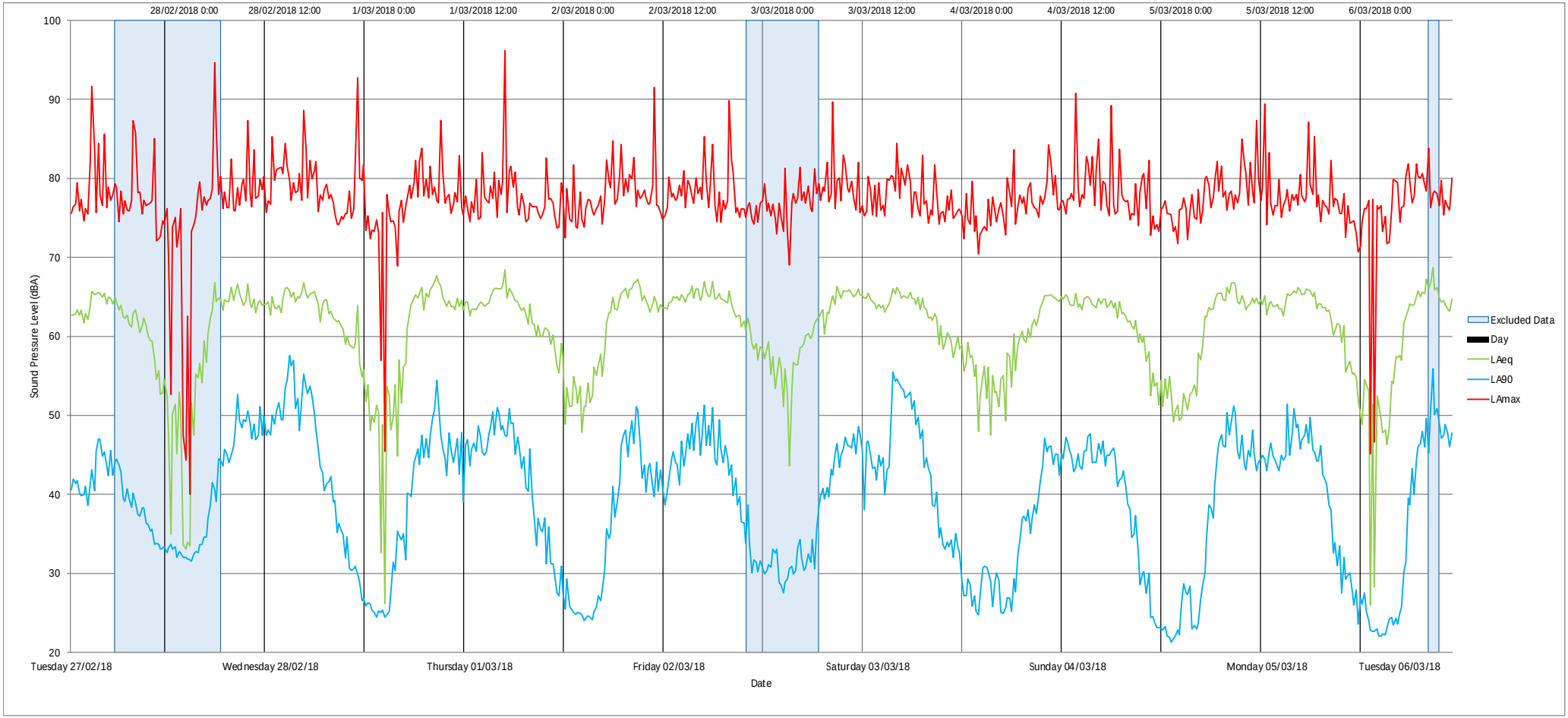


Figure B.8 : Measured sound pressure levels at 387 Stony Point Road, Crib Point. The shaded areas have been removed from the determination of background levels due to excessive road noise and localised residential noise sources.

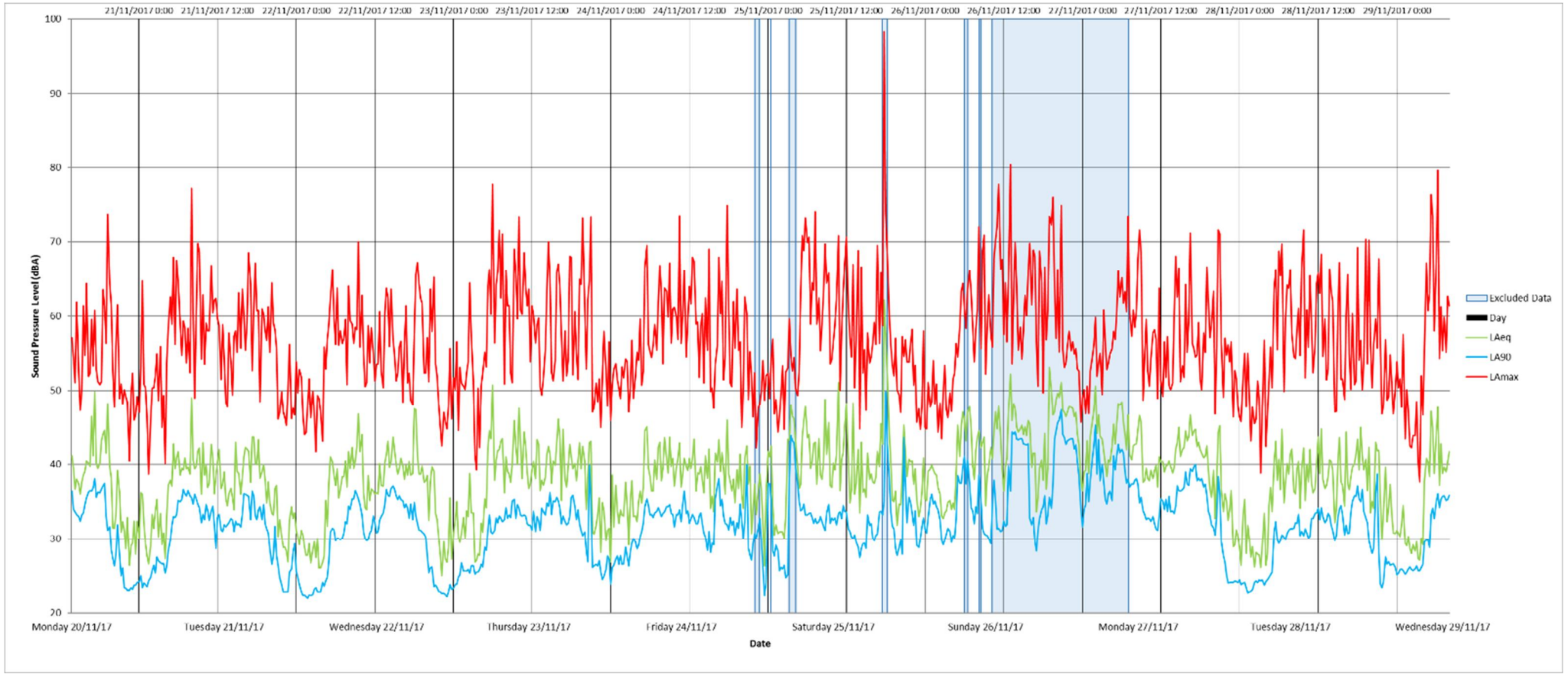


Figure B.9: Measured sound pressure levels at Location 1, French Island. The shaded areas have been removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources.

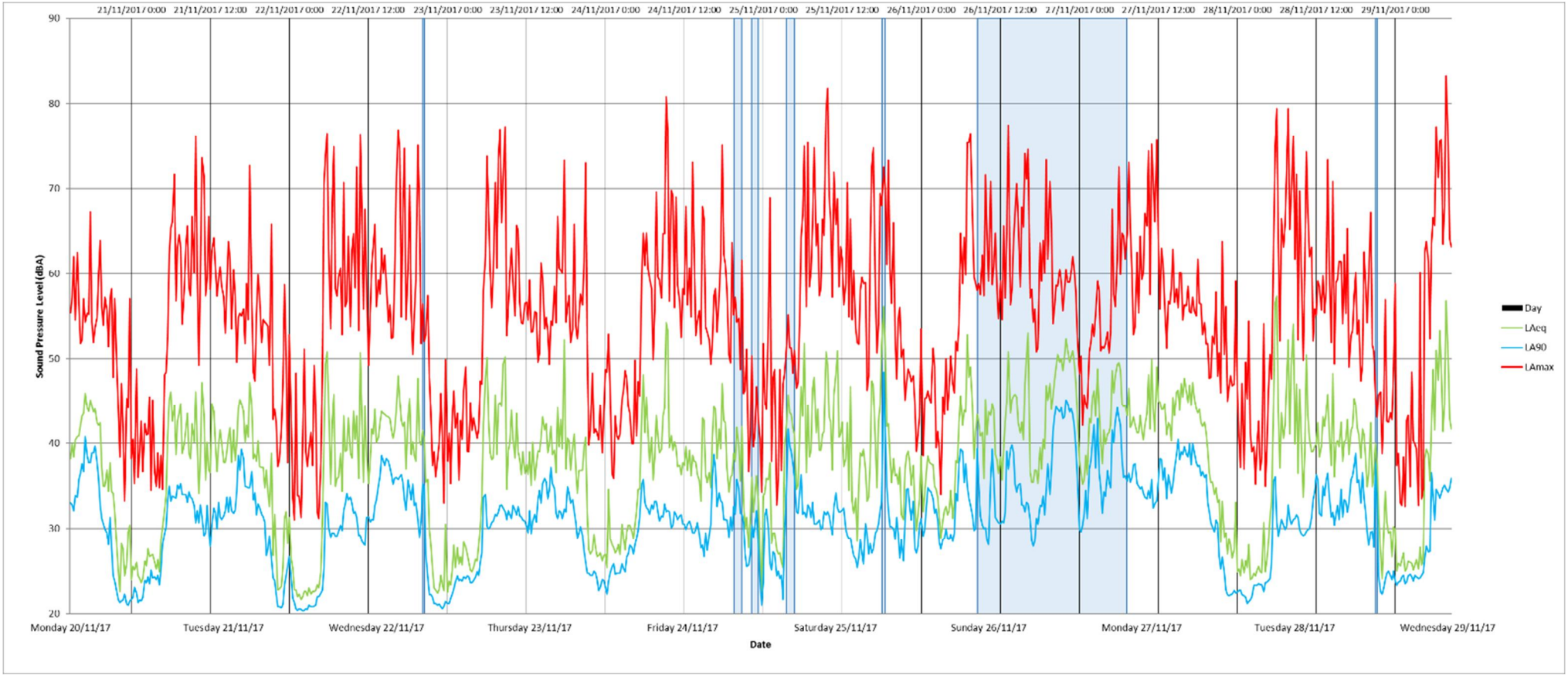


Figure B.10: Measured sound pressure levels at Location 2, French Island. The shaded areas have been removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources.

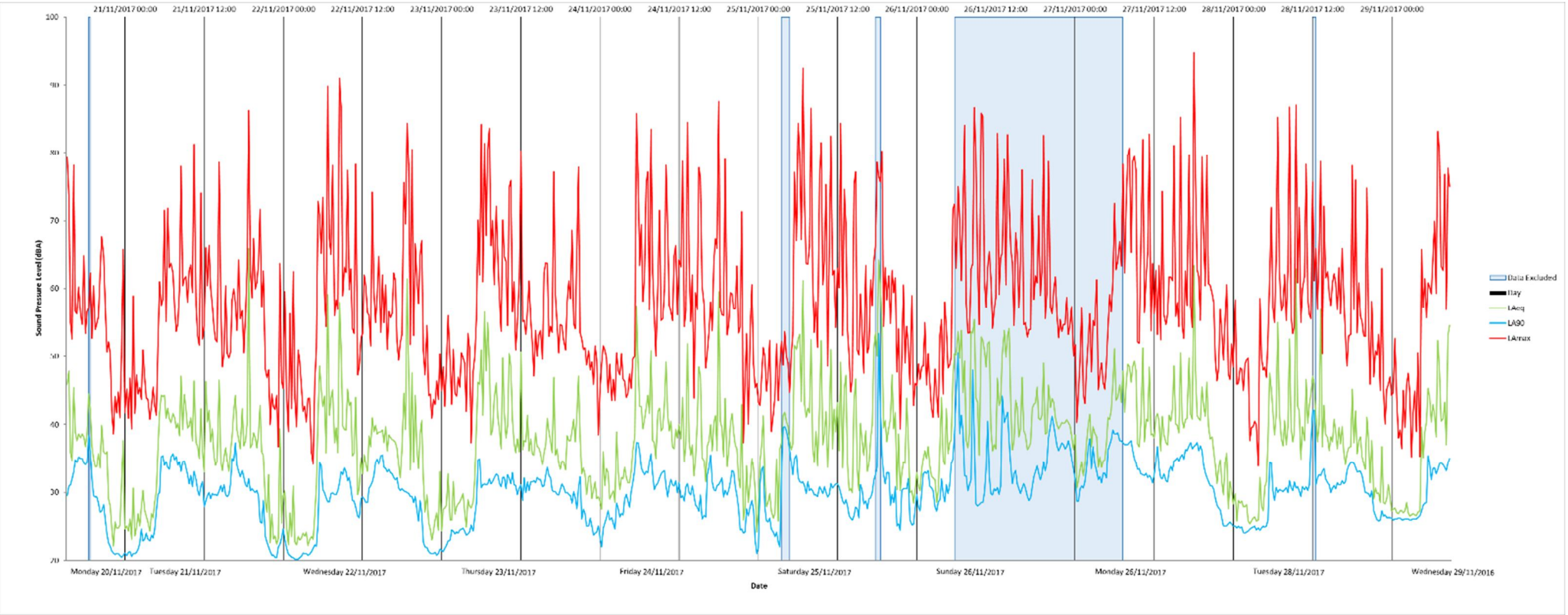
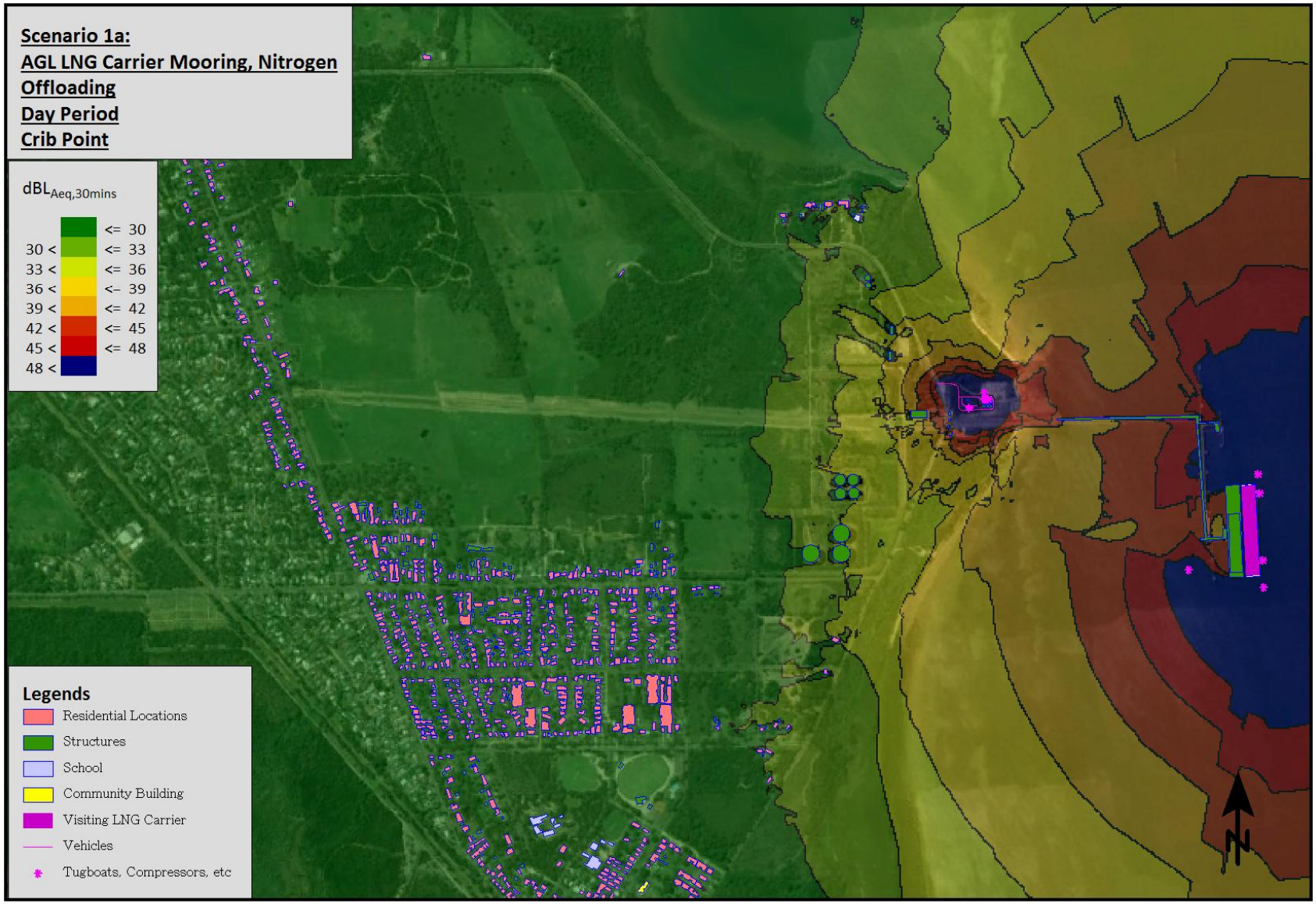


Figure B.11: Measured sound pressure levels at Location 3, French Island. The shaded areas have been removed from the determination of background levels due to weather (thunder and rain), outboard motors and wildlife noise sources.

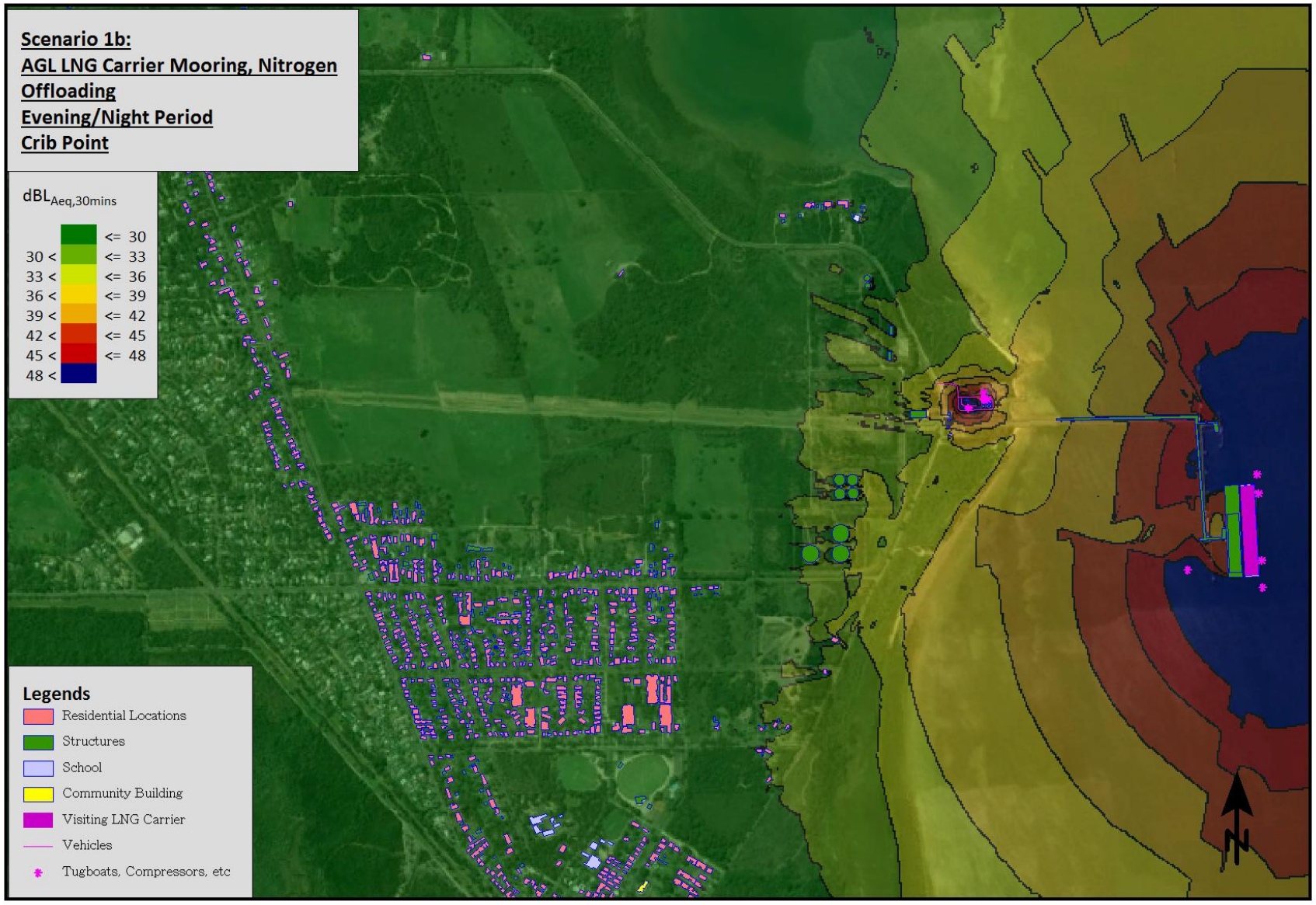
Appendix C. Noise Contours

Scenario 1a: LNG carrier mooring, nitrogen offloading – Day period


Scenario 1a:
AGL LNG Carrier Mooring, Nitrogen Offloading
Day Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

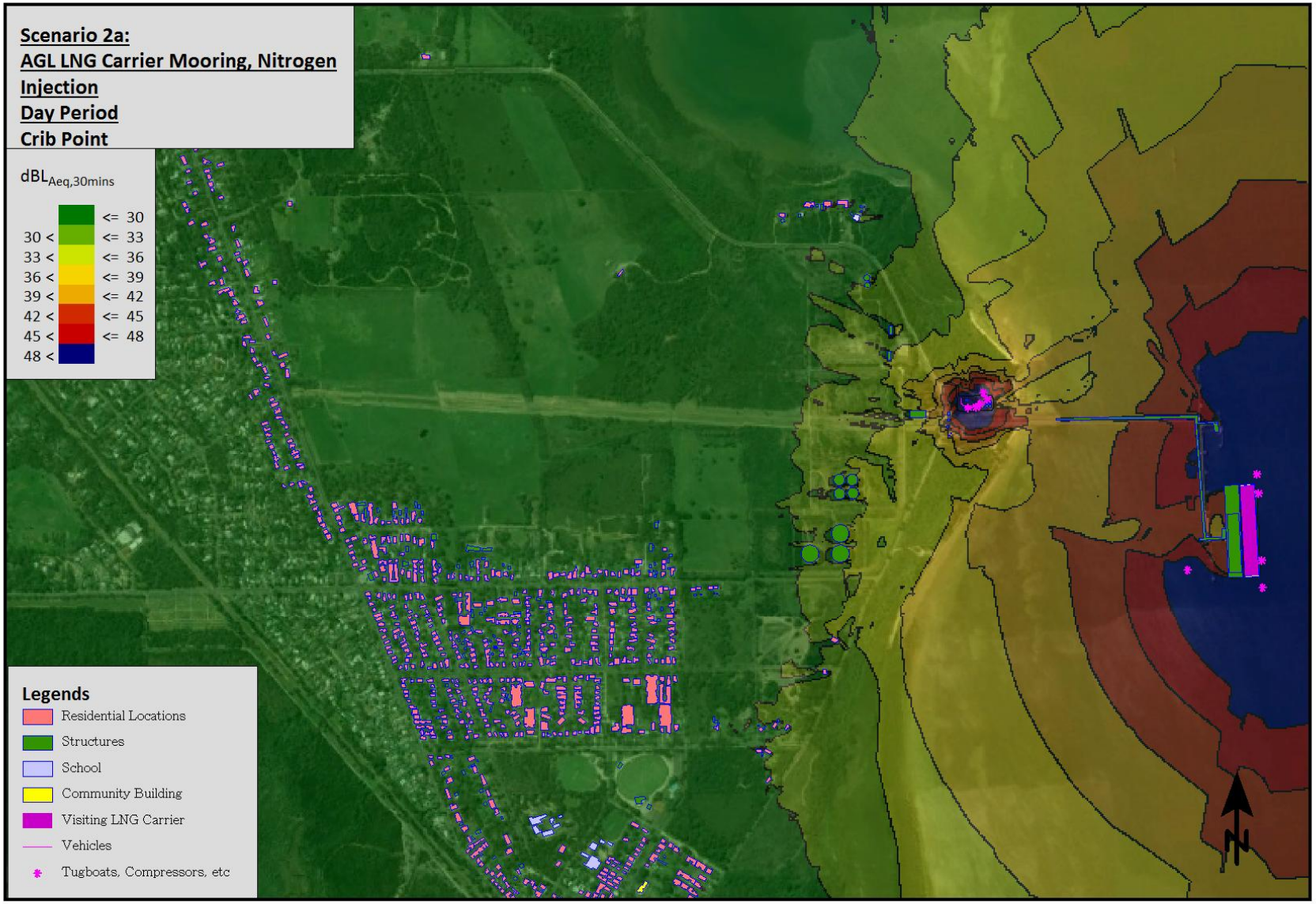

Scenario 1a:
AGL LNG Carrier Mooring, Nitrogen Offloading
Day Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

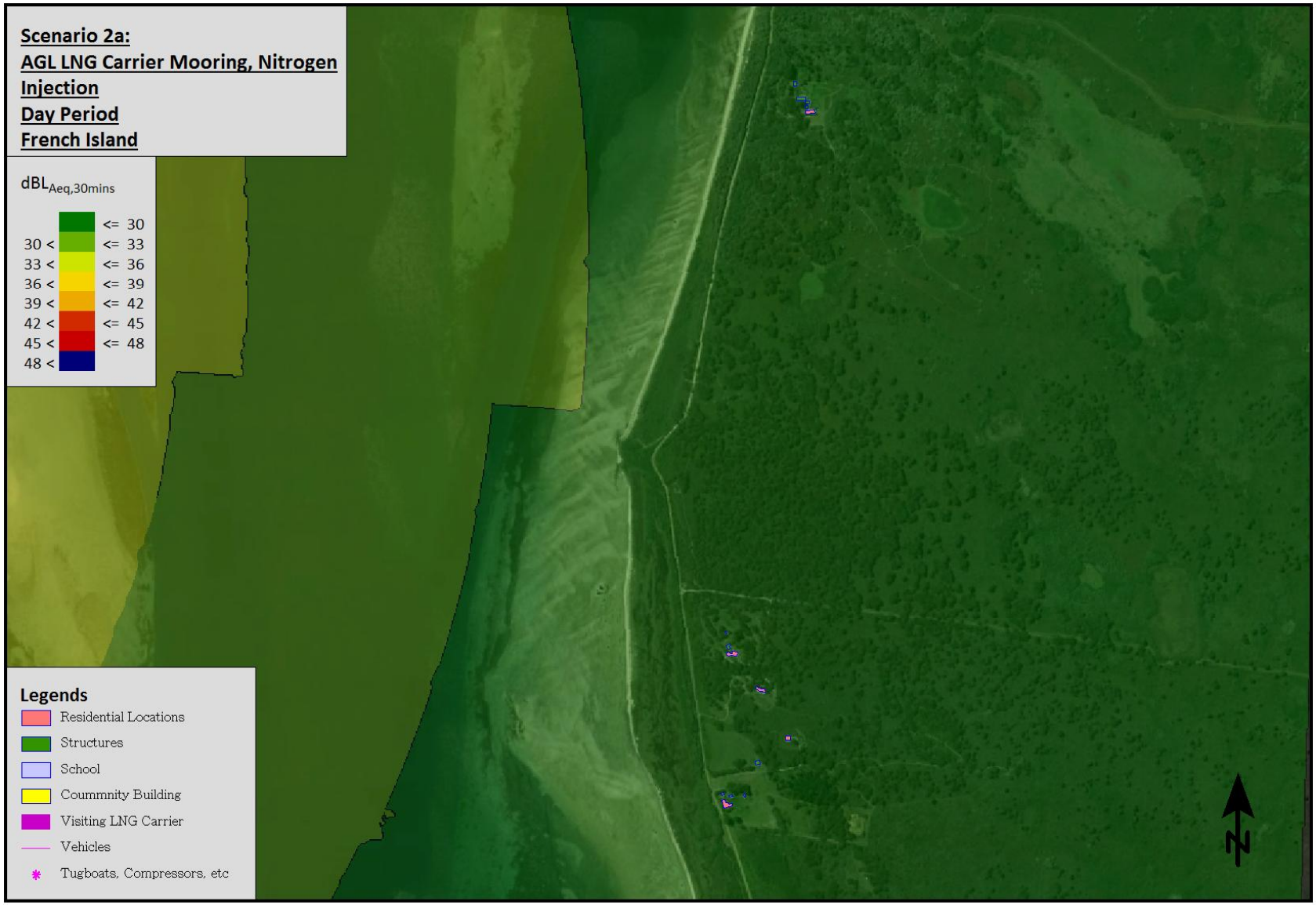
Scenario 1b: LNG carrier mooring, nitrogen offloading – Evening and night period


Scenario 1b:
AGL LNG Carrier Mooring, Nitrogen Offloading
Evening/Night Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

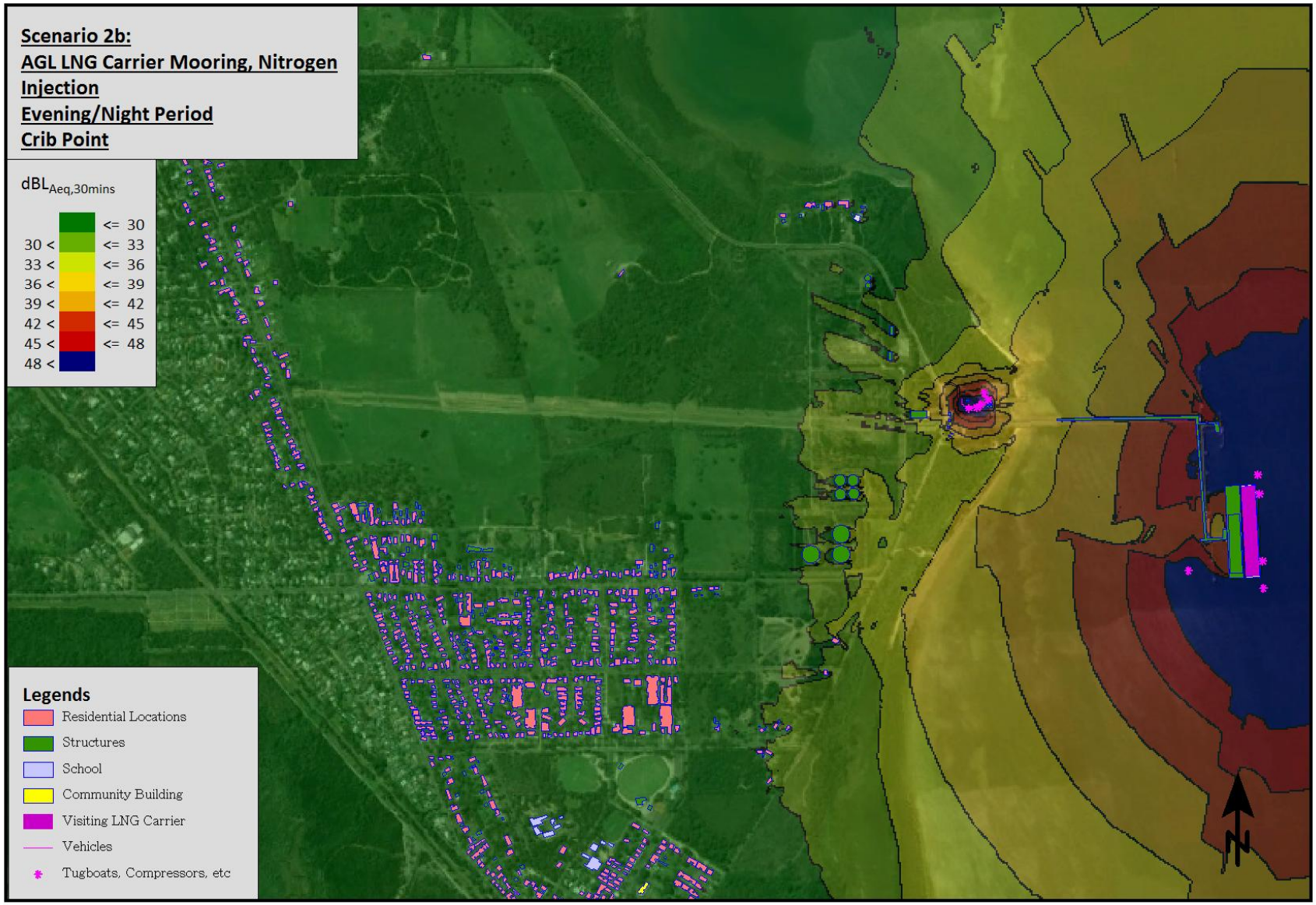

Scenario 1b:
AGL LNG Carrier Mooring, Nitrogen Offloading
Evening/Night Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

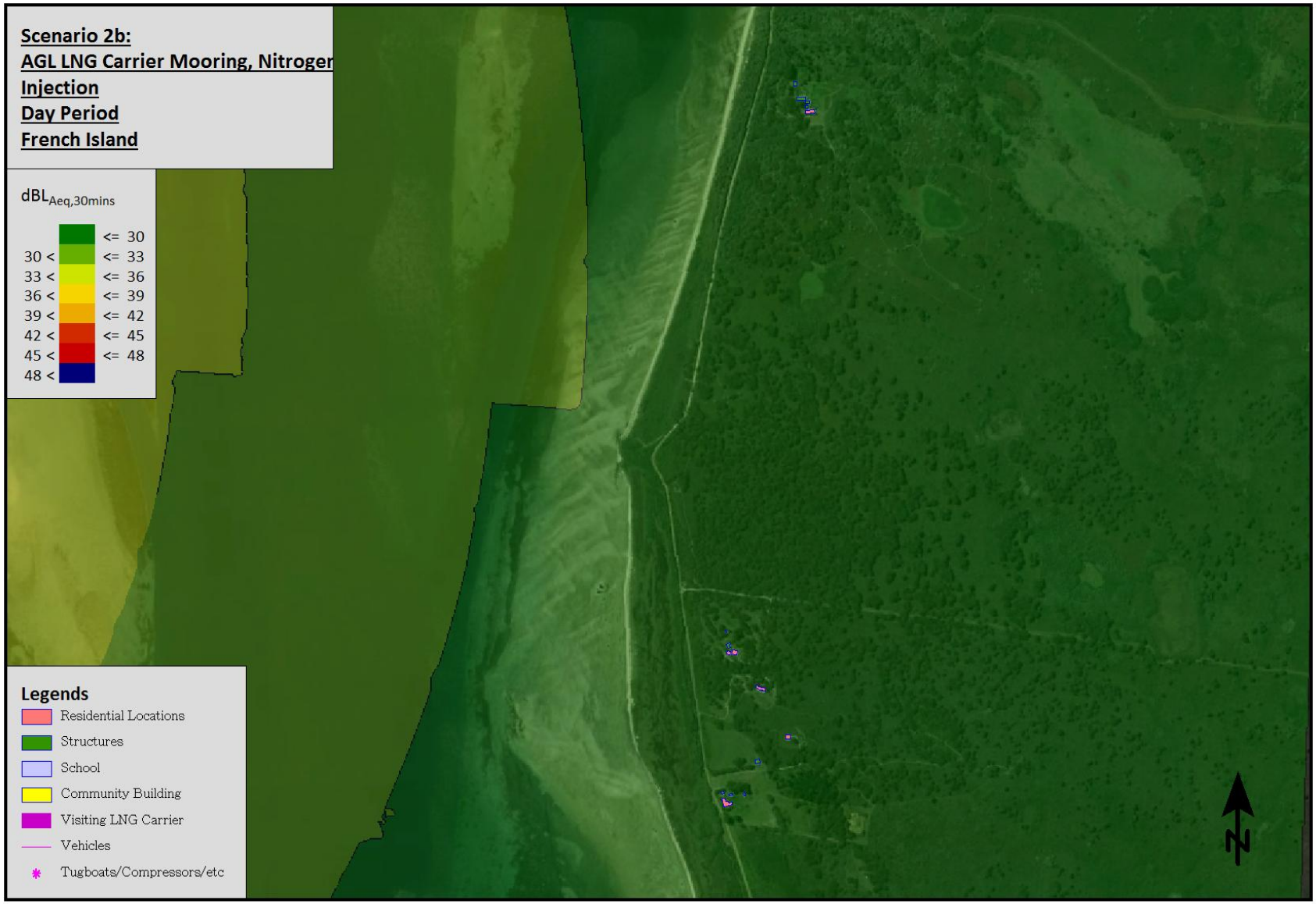
Scenario 2a: LNG carrier mooring, nitrogen injection – Day period


Scenario 2a:
AGL LNG Carrier Mooring, Nitrogen Injection
Day Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

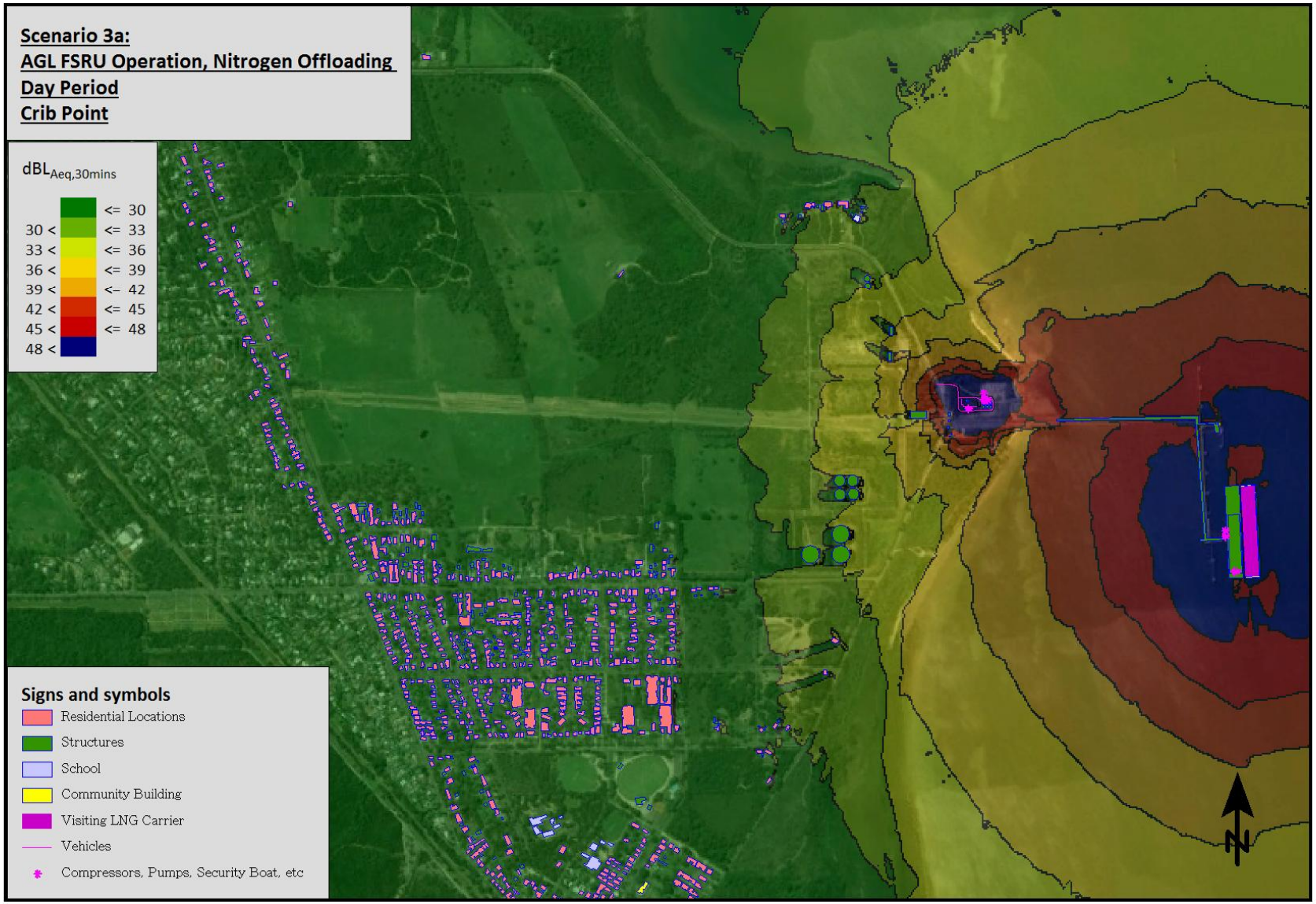

Scenario 2a:
AGL LNG Carrier Mooring, Nitrogen Injection
Day Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Coummnity Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

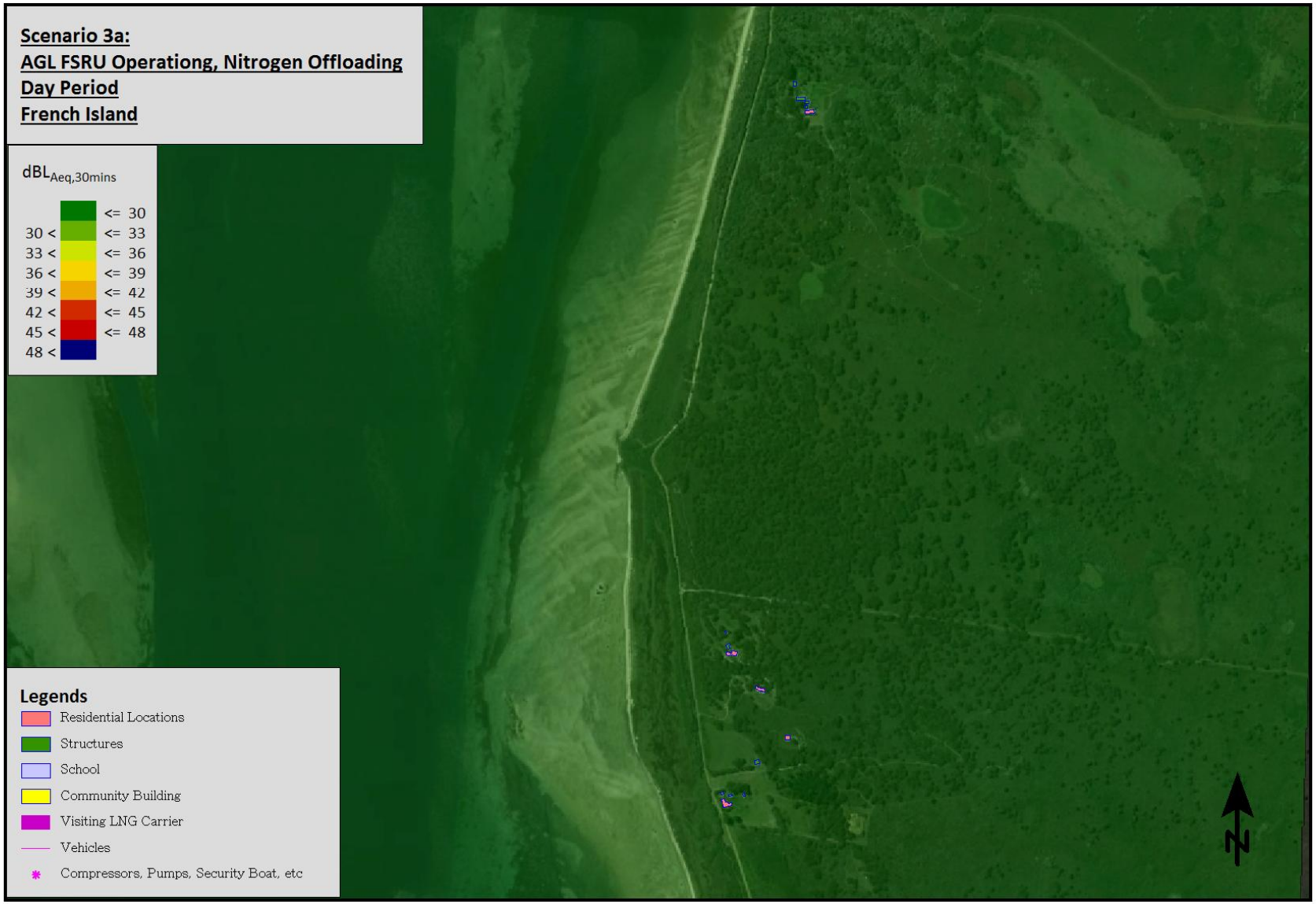
Scenario 2b: LNG carrier mooring, nitrogen injection – Evening and night period


Scenario 2b:
AGL LNG Carrier Mooring, Nitrogen Injection
Evening/Night Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats, Compressors, etc
N

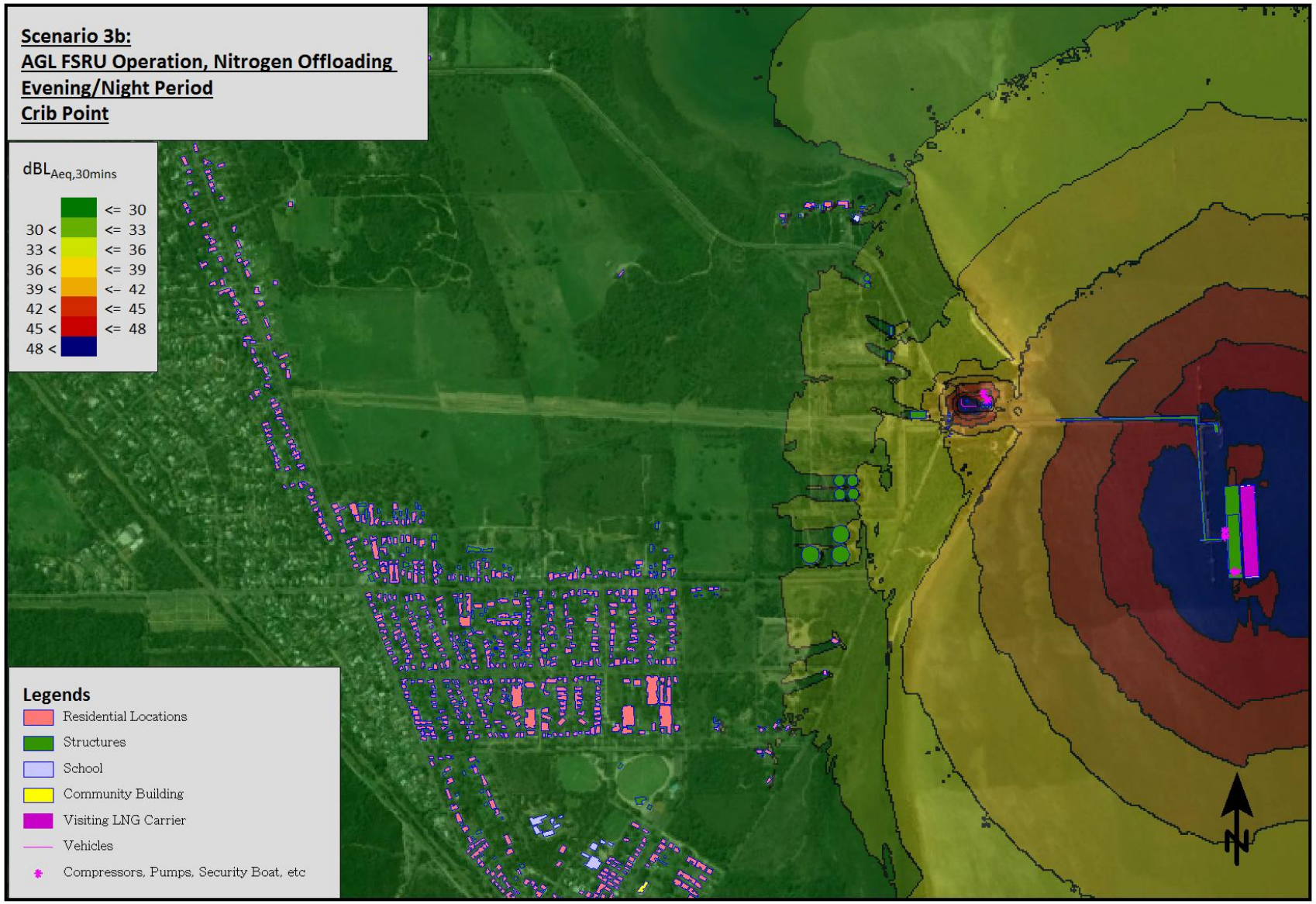

Scenario 2b:
AGL LNG Carrier Mooring, Nitroger
Injection
Day Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Tugboats/Compressors/etc
N

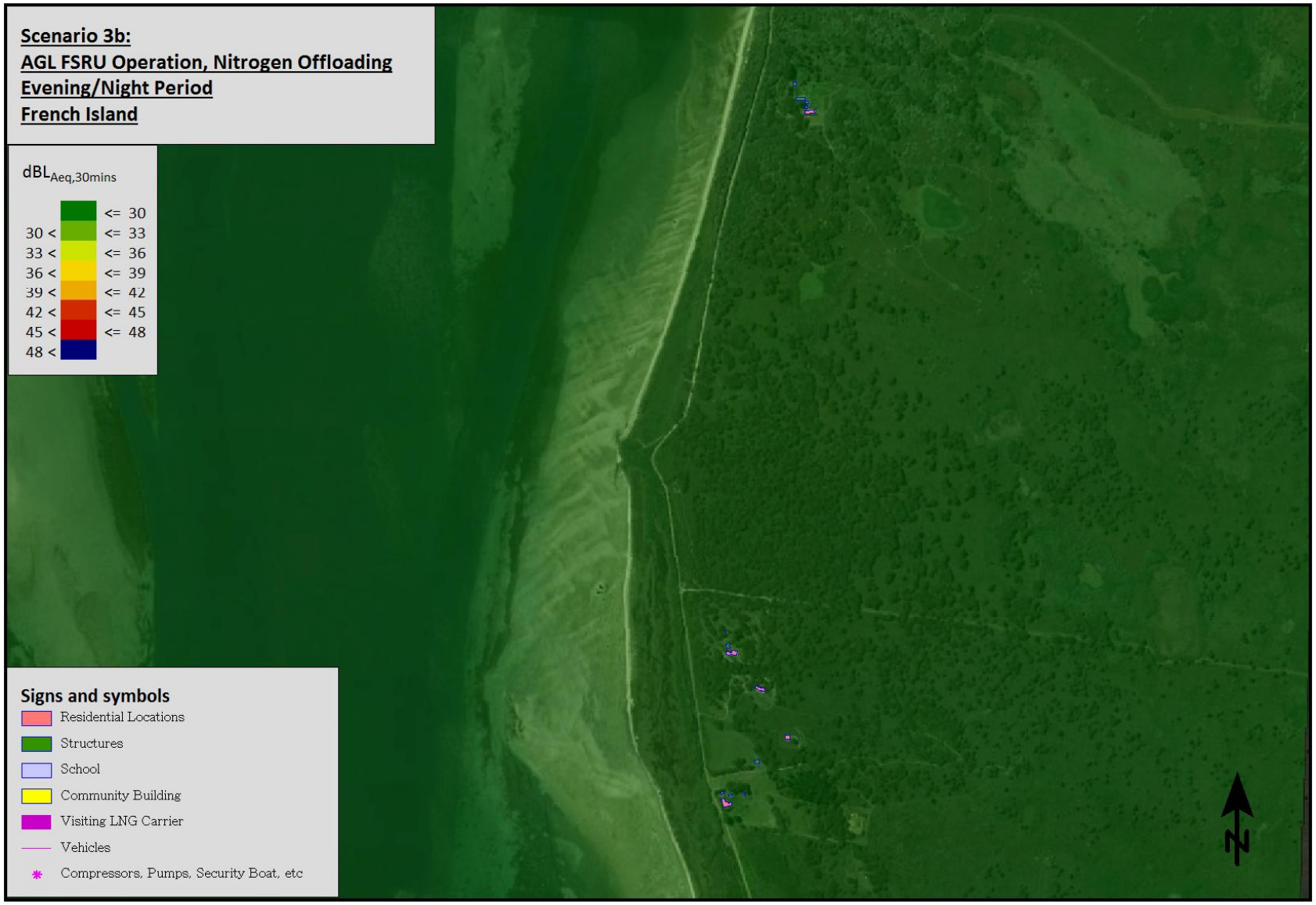
Scenario 3a: FSRU operation, nitrogen offloading – Day period


Scenario 3a:
AGL FSRU Operation, Nitrogen Offloading
Day Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Signs and symbols
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

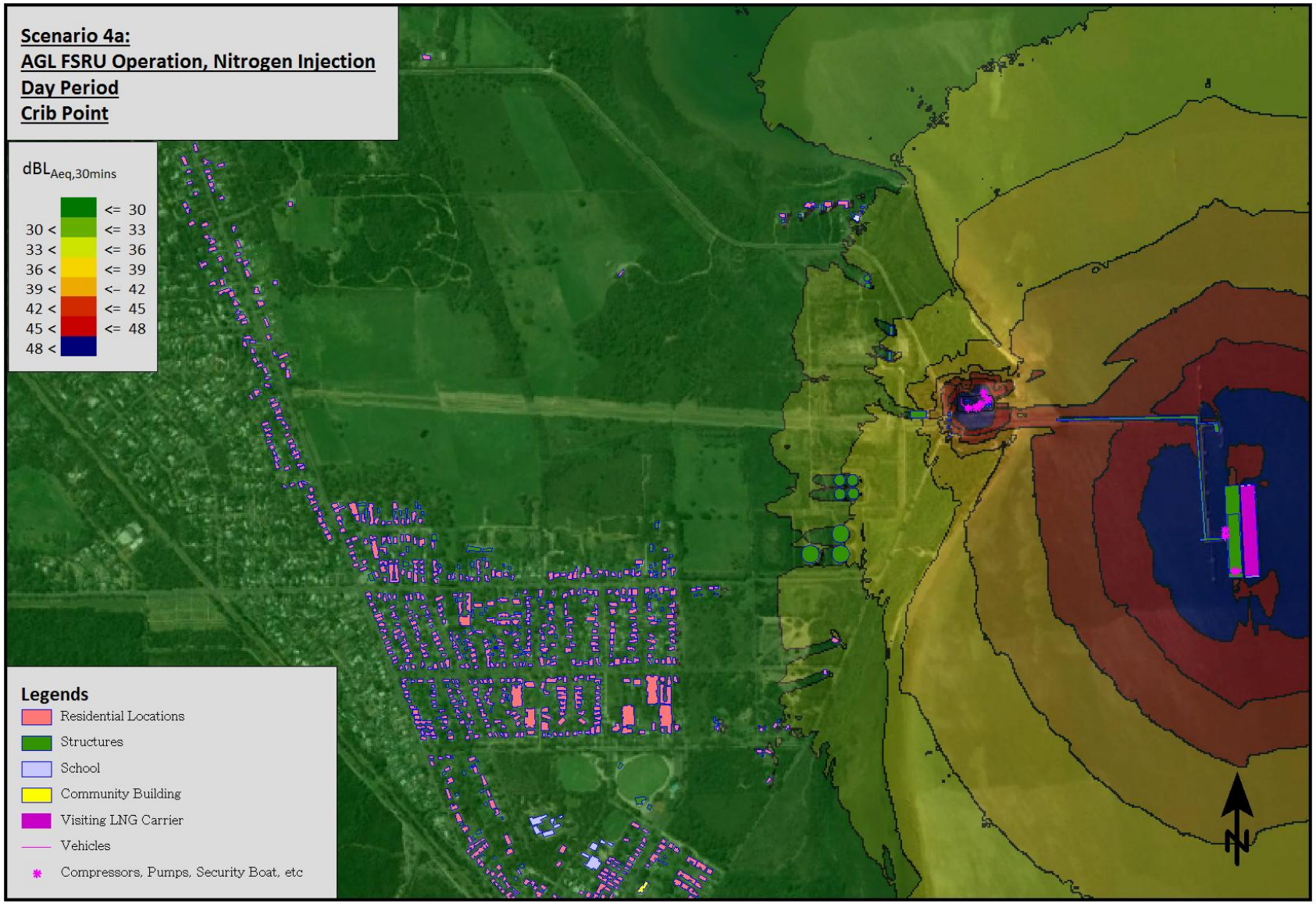

Scenario 3a:
AGL FSRU Operationg, Nitrogen Offloading
Day Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

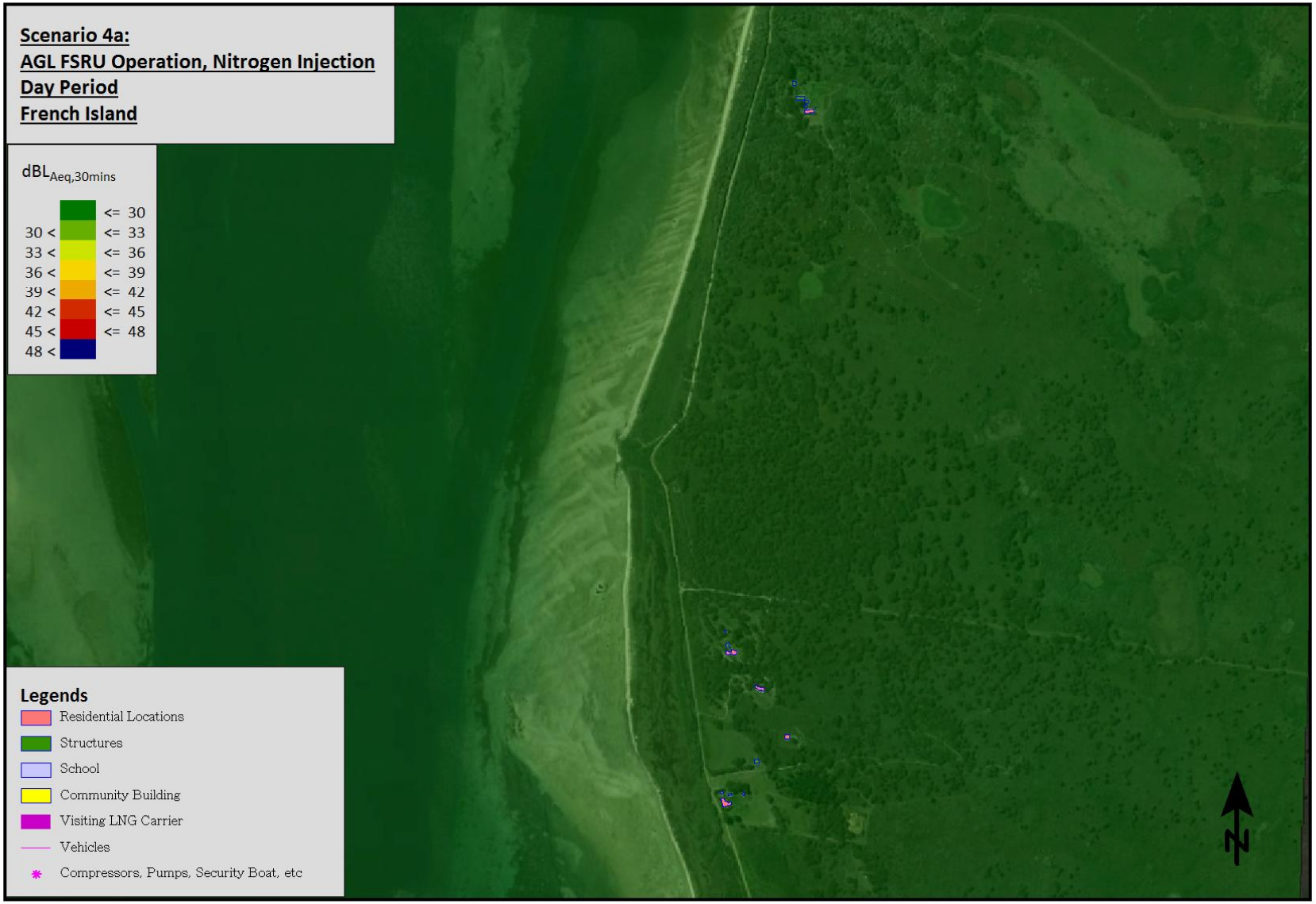
Scenario 3b: FSRU operation, nitrogen offloading – Evening and night period


Scenario 3b:
AGL FSRU Operation, Nitrogen Offloading
Evening/Night Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

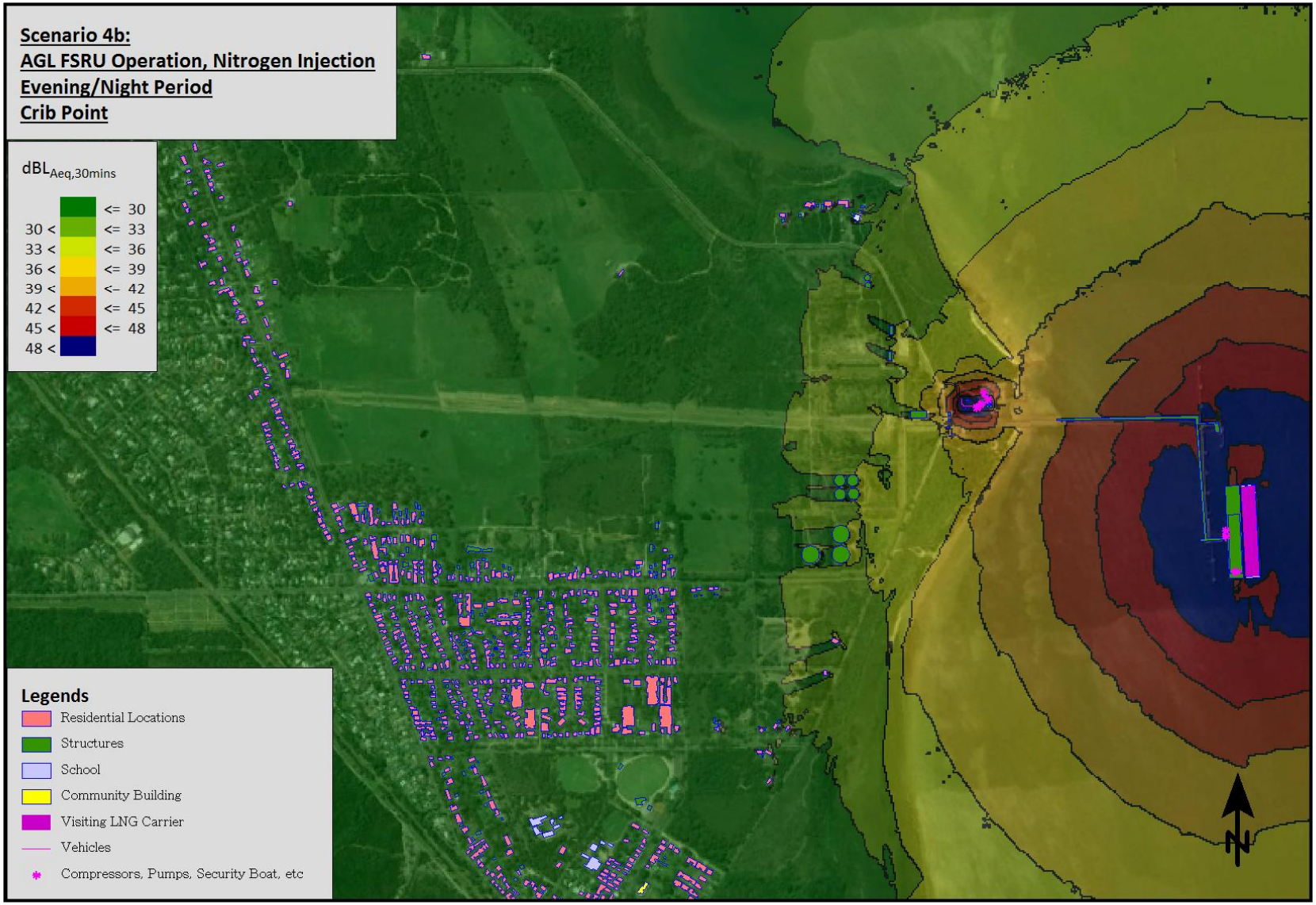

Scenario 3b:
AGL FSRU Operation, Nitrogen Offloading
Evening/Night Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Signs and symbols
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

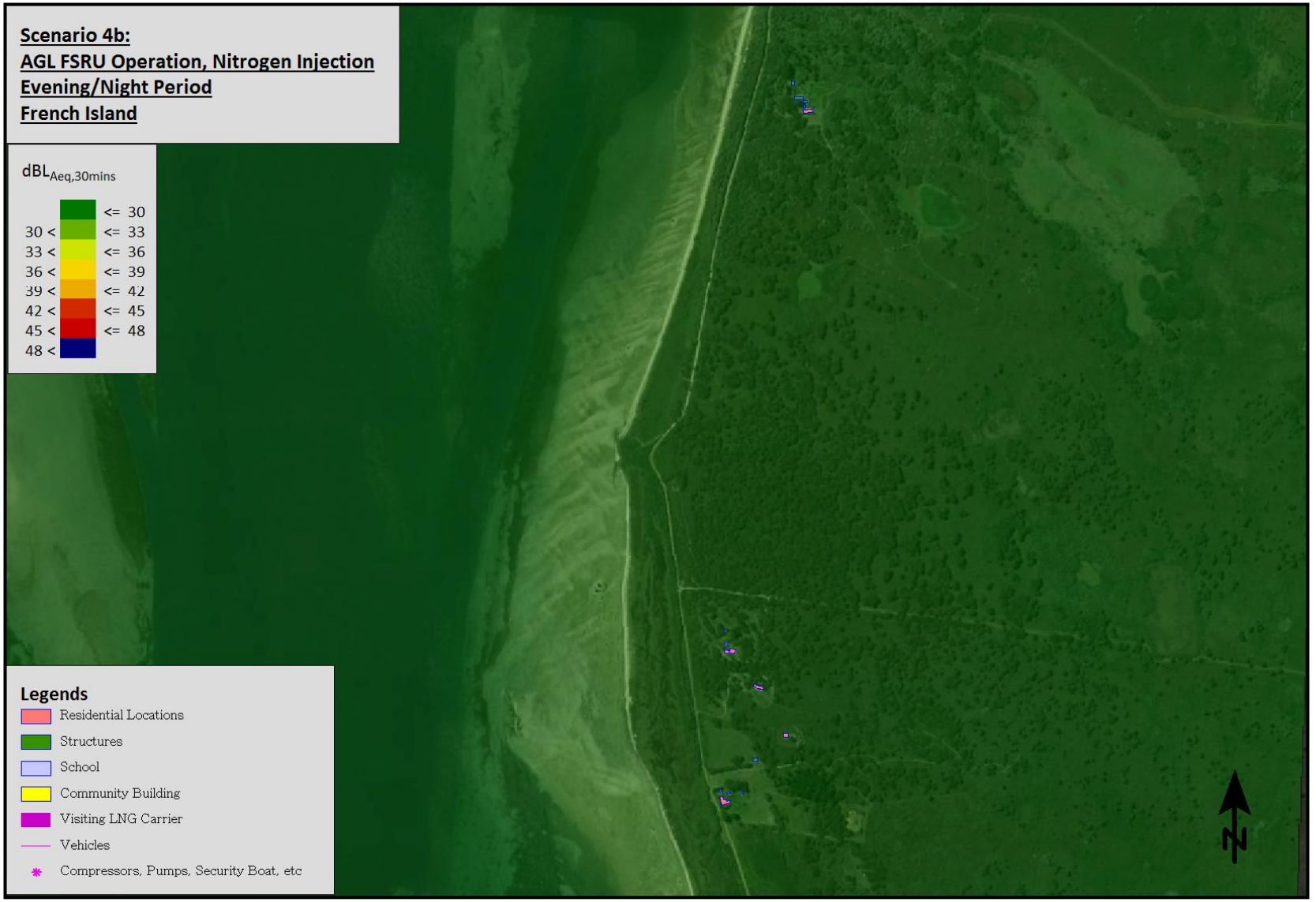
Scenario 4a: FSRU operation, nitrogen injection – Day period


Scenario 4a:
AGL FSRU Operation, Nitrogen Injection
Day Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N


Scenario 4a:
AGL FSRU Operation, Nitrogen Injection
Day Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

Scenario 4b: FSRU operation, nitrogen injection – Evening and night period


Scenario 4b:
AGL FSRU Operation, Nitrogen Injection
Evening/Night Period
Crib Point
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N


Scenario 4b:
AGL FSRU Operation, Nitrogen Injection
Evening/Night Period
French Island
dBLAeq,30mins
<= 30
30 < <= 33
33 < <= 36
36 < <= 39
39 < <= 42
42 < <= 45
45 < <= 48
48 <
Legends
Residential Locations
Structures
School
Community Building
Visiting LNG Carrier
Vehicles
Compressors, Pumps, Security Boat, etc
N

Appendix D. Planning Land Use Maps

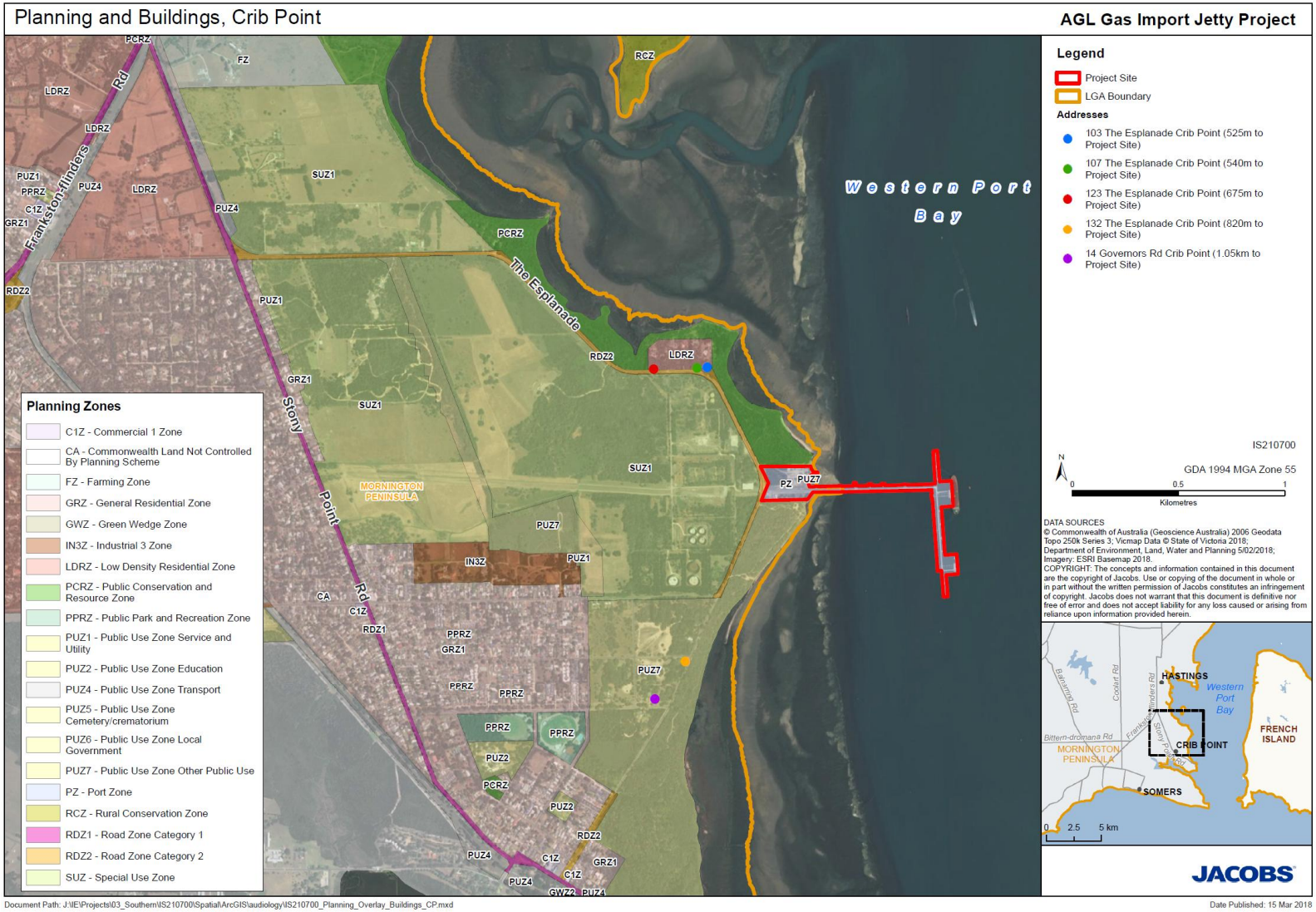


Figure D.1 : Planning Land Use Zones - Crib Point

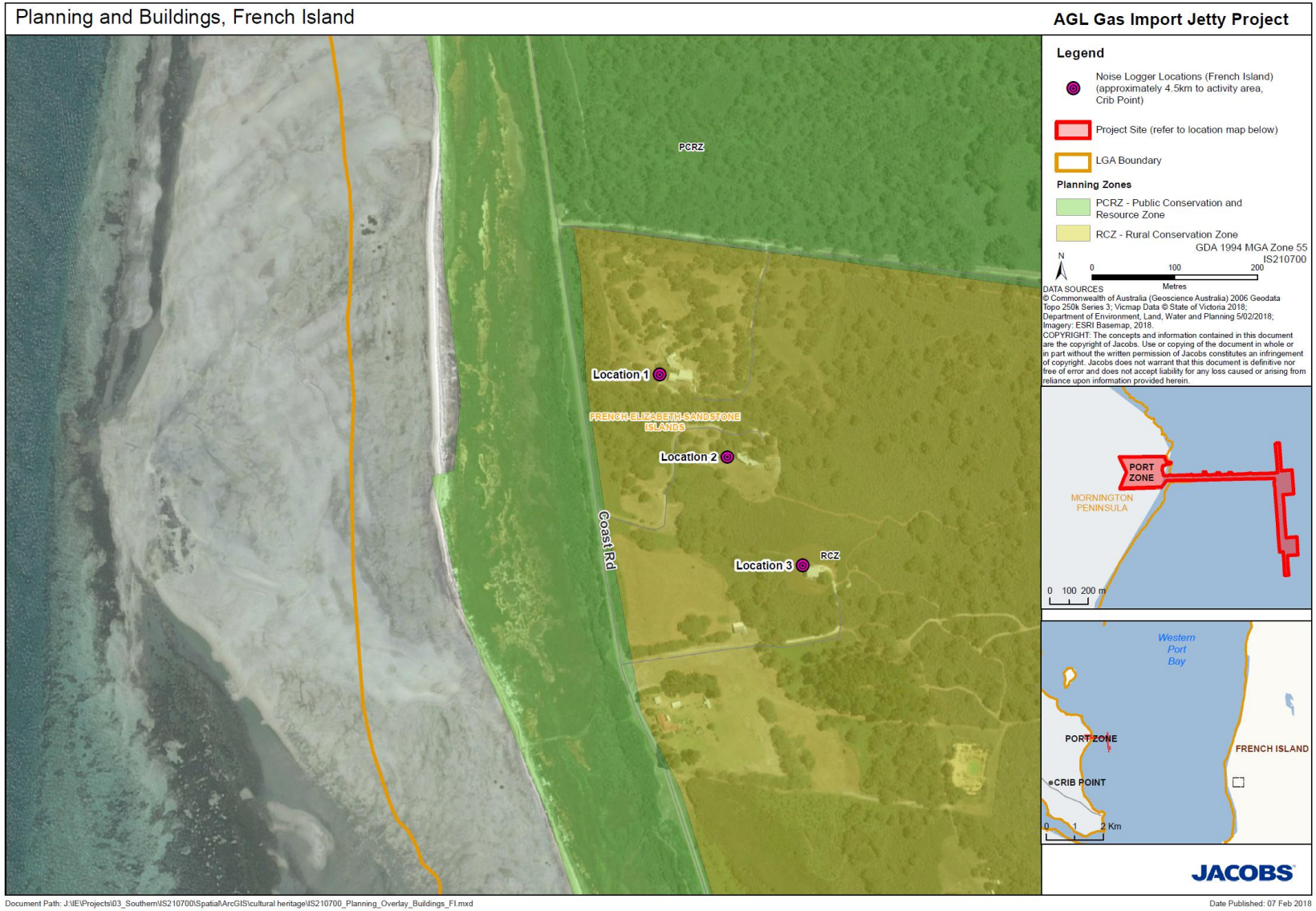


Figure D.2 : Planning Land Use Zones - French Island