TECHNICAL MEMORANDUM

DATE March 26, 2015 **REFERENCE No.** 1314220006-127-TM-Rev0 / 1416711

TO Nathan Gloag
Woodfibre LNG Limited

FROM Glenn Wagner **EMAIL** gwagner@golder.com

WOODFIBRE LNG LIMITED - RESPONSE TO INFORMATION REQUEST #53A

1.0 INTRODUCTION

This memorandum provides the information requested within Information Request #53a from the BC Ministry of Environment (MOE) during the working group review of Woodfibre LNG Ltd.'s Environmental Assessment Application under the BC Environmental Assessment Act.

Information request 53a is reiterated as follows:

> *"If not provided already, submit the calculation and inputs used to generate the pseudo stack height for all flares. The prediction of wind (as shown by the wind rose graph) does not look reasonable at the project location given the topography of the area, which may result in unlikely air quality impact locations around the project location. To determine the validity of the predicted wind, the technical reviewer must review the following information: A small-scale map showing the grid point (or points) selected to determine the wind rose; and a wind speed frequency distribution graph and table for the location."*

The small-scale map showing the grid point chosen to generate the project windrose as well as the wind speed frequency distribution table and graph are provided in Section 2.0. The calculation and inputs used to generate the pseudo stack height for the flares is provided in Section 3.0.

2.0 WIND

The location of the CALMET grid cell used to represent the project location is shown in Figure 1. The wind speed frequencies from the CALMET model at the project site are provided in Table 1 and Figure 2.

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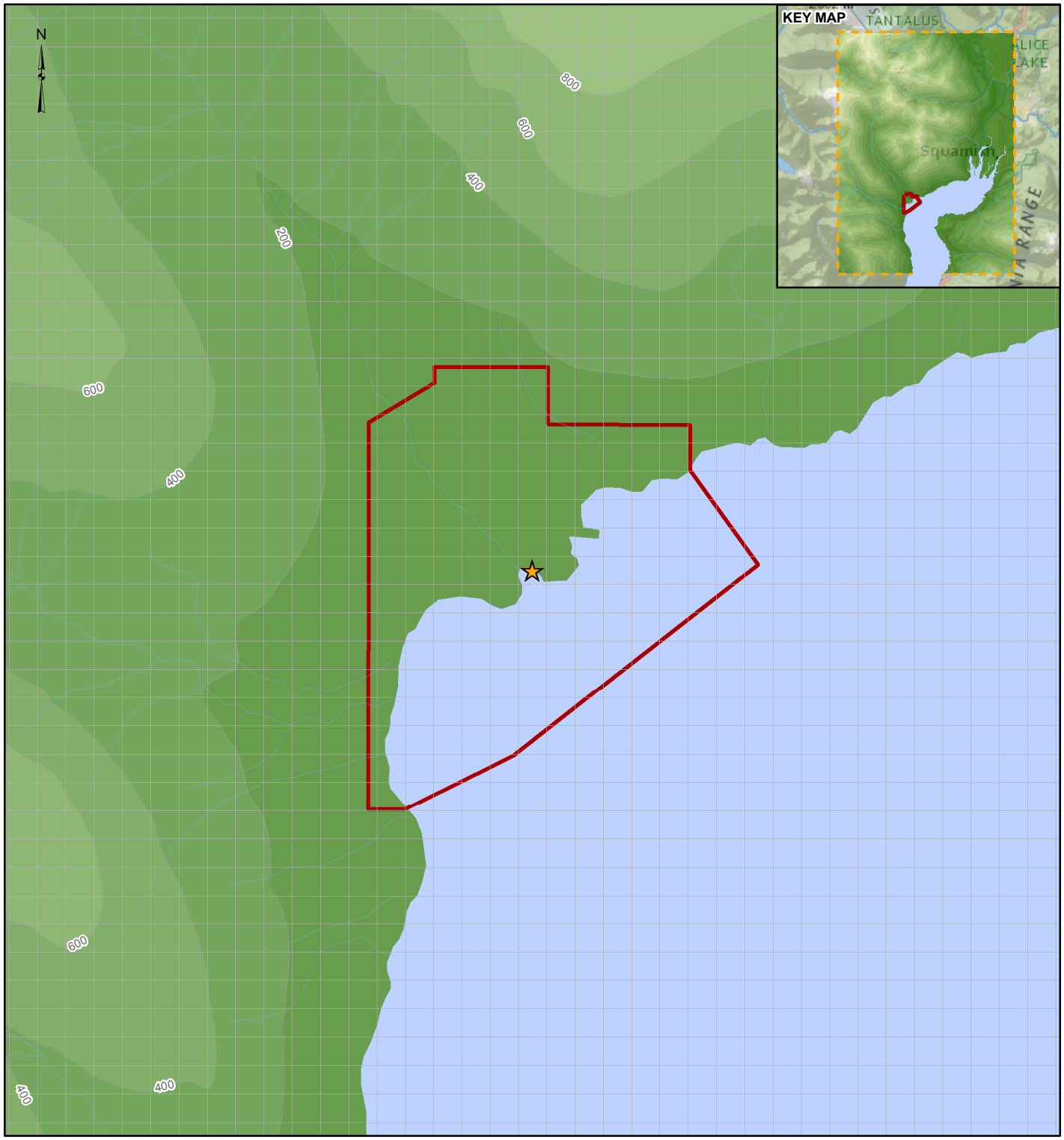

LEGEND

- CALMET WIND DATA EXTRACTION POINT
- CALMET GRID - 100 m x 100 m
- PROJECT AREA
- CALMET NESTED DOMAIN
- WATERCOURSE
- WATERBODY

TERRAIN ELEVATION (masl)

- 0 - 200
- 201 - 400
- 401 - 600
- 601 - 800
- 801 - 1,000
- 1,001 - 1,200
- 1,201 - 1,400
- 1,401 - 1,600
- 1,601 - 1,800
- 1,801 - 2,000
- 2,001 - 2,200

0 400 800

1:20,000 METERS

REFERENCE(S)

1. ORIGINAL TERRAIN DATA FROM GEOBASE. ALL RIGHTS RESERVED

CLIENT
WOODFIBRE LNG LIMITED.

PROJECT
WOODFIBRE,
HOWE SOUND, B.C.

TITLE
CALMET WIND DATA EXTRACTION POINT AT PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-03-24
DESIGNED	TB
PREPARED	JW
REVIEWED	CB
APPROVED	GW

PROJECT NO.	PHASE	REV.	FIGURE
1416711	2000	A	01

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A

25mm

0

PATH: Y:\burnaby\CAD-GIS\Client\Woodfibre LNG\Howe_Sound\09_PROJECTS\1416711_WLNG_EA\02_PRODUCTION\Air\WOODFIBRE_ATMOSPHERIC_ENVIRONMENT_Air_Quality_FIGURE_01_Wind_Data_Extraction_FINAL.mxd

Table 1: CALMET Wind Speed Frequencies at Project Site

calm	0.2 to 1 m/s	1 to 2 m/s	2 to 3 m/s	3 to 4 m/s	4 to 5 m/s	5 to 6 m/s	6 to 7 m/s	>7 m/s
0.81%	20.15%	34.51%	27.13%	10.66%	4.88%	1.68%	0.17%	0.01%

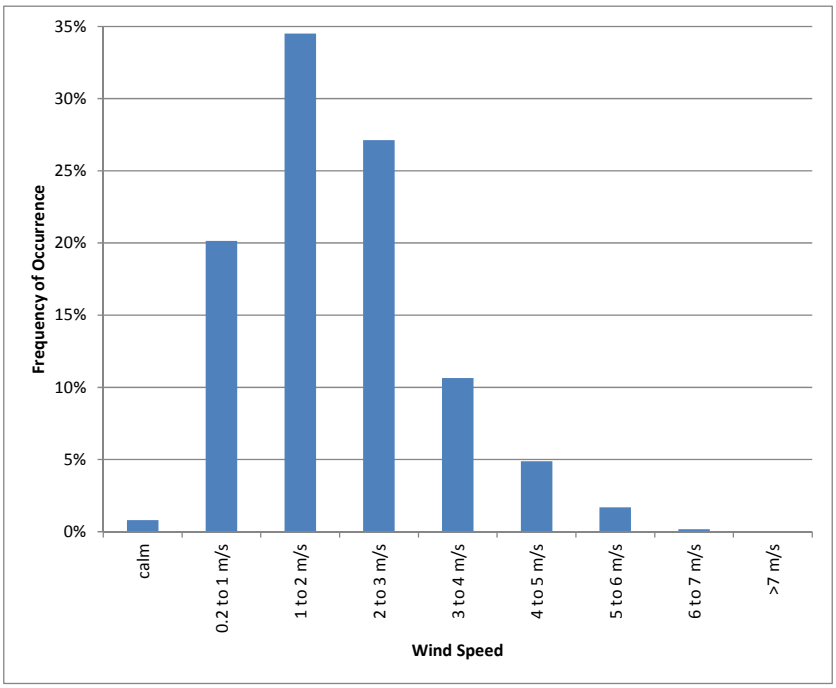

Figure 2: CALMET Wind Speed Frequencies at Project Site

3.0 FLARE PSEUDO STACK HEIGHT

Pseudo parameters for the flares were calculated using the methods outlined in Chapter 11 of the *Guidelines for Air Quality Dispersion Modelling in British Columbia* (British Columbia Ministry of Environment, March 2008) [BC Modelling Guideline]. As described in the BC Modelling Guideline, most air dispersion models are not explicitly capable of handling flares. Therefore, pseudo stack parameters need to be calculated to allow dispersion from flares to be simulated using conventional point source inputs. These pseudo stack parameters result in plume rise from the flares being taken into account within the assessment. The physical stack parameters of each flare stack were provided by WLNG and are summarized in Table 2.

Table 2: Physical Flare Parameters

Flare	Physical Stack Height [m]	Total Heat Release [BTU/hour]	Total Heat Release[1] [cal/s]	Effective Flare Height [m]
Flare WWGF (Depressuring Feed Gas)	100	11,849,164,800	829,441,536	183.6
Flare LPCF (Shut down Tank RG)	100	3,059,232,000	214,146,240	143.8
Flare CDGF (Major Maintenance of MR Compressor Unit)	100	31,933,528,000	2,235,346,960	234.3

[1]. Total Heat Release in cal/s were calculated by assuming 1 BTU = 252 calories

The effective (or pseudo) flare heights shown in Table 2 were calculated based on the BC Modelling Guideline as follows:

$$Effective\ flare\ height\ [m] = HSTK + 0.00456 \times THR^{0.478}$$

Where

HSTK = Physical Stack Height [m]

THR = Total Heat Release [cal/s]

Sample calculation for WWGF:

$$Effective\ flare\ height\ [m] = 100 + 0.00456 \times 829441536^{0.478}$$

$$Effective\ flare\ height\ [m] = 183.6$$

4.0 CLOSURE

We trust the above information provides that requested from the MOE toward resolving Information Request 53a.

GOLDER ASSOCIATES LTD.

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DC/SC/lih

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