BATH TREATMENTS MODELLING REPORT

Reintraid Finfish Pen Site, Loch a' Chàirn Bhàin, Sutherland

Prepared for

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Quality Assurance

The data presented within this document have undergone a quality assurance review which follows established TransTech Ltd procedures. The information and results presented herein constitute an accurate representation of these data.

Document Details

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CONTENTS

List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
CD	Chart Datum
EQS	Environmental Quality Standards
GMT	Greenwich Mean Time
mCD	Metres below Chart Datum
SEPA	Scottish Environment Protection Agency

EXECUTIVE SUMMARY

This report has been prepared to meet the requirements of the Scottish Environment Protection Agency (SEPA) for the consent to use chemical bath treatments against sea lice for salmonids held in marine pens. The modelling reported herein is for the proposed modification of the Reintraid pen site (i.e., sixteen 80 m circumference pens in a 50 m x 50 m mooring grid).

Bath Auto was used to determine the concentration of the chemicals Azamethiphos (Salmosan), Cypermethrin (Excis) and Deltamethrin (Alphamax) that can be used at the modified Reintraid site.

The maximum permissible quantity of Azamethiphos that can be used in a 3 hour period was predicted to be 134.4 g, at a treatment regime of 1.0 pen in 3 hours, at a net depth of 2.55 m. A compliant pass of 381.9 g at a net depth of 2.50 m was achieved for the long term model for the treatment of 3.0 pens per 24 hours.

The maximum quantity of Cypermethrin permissible in a 3 hour period was predicted to be 31.2 g at a treatment regime of 5.0 pens in 3 hours for a net depth of 2.45 m.

The maximum quantity of Deltamethrin permissible in a 3 hour period was predicted to be 11.7 g at a treatment regime of 5.0 pens in 3 hours for a net depth of 2.30 m.

1. INTRODUCTION

This report has been prepared to meet the specific requirements of SEPA for the assessment of applications for consent to use bath treatments against sea lice in marine salmonid farms. The bath treatments must comply with Environmental Quality Standards (EQS) that are in place to protect the marine environment.

Bath treatments, where the fish are physically immersed in a diluted solution of a particular chemical, require dispersion modelling (Bath Auto) to predict concentrations of the chemical in the water column at specified periods after the treatment has been completed.

The methods described in this report closely adhere to those set out in Annex G[(1)] of the SEPA Fish Farm Manual, and the results are reported to satisfy consent application requirements.

2. REINTRAID SITE INFORMATION

Site details

Site name:	Reintraid	
Distance to shore:	0.083 km	(from pen edge to MLWS at closest point)
Average water depth for 1 km^2 area:	58.62 mCD	(obtained from UKHO bathymetry and other sources[(2)], 1 km^2 area around group centre position)

Pen group details

Group centre position:	219177.2 E, 933997.1 N
Number of pens:	16
Pen group configuration:	2 x 8
Pen dimensions:	80 m circumference circle
Grid size (x by y):	50 m x 50 m grid
Working depth:	15.0 m
Peak biomass:	1834.0 tonnes
Peak stocking density:	15.01 kg/m^3
Pen group orientation:	314.3º

3. HYDROGRAPHIC DATA

The hydrographic data for the sub-surface cell are summarised below. The data were analysed using SEPA's HGdata_analysis_v7.xls (version 7.11) tool. Further details on the Acoustic Doppler Current Profiler (ADCP) deployments are available in reports previously submitted to SEPA, titled:

- "Reintraid_2023v1_Hydrographic_Report.pdf" dated 13 January 2023, and
- "Reintraid_2023v1_ND_Modelling_Method_Statement.pdf" also dated 13 January 2023.

Current meter position:	219223.8 E, 934037.8 N	(weighted mean of deployments)
Distance from group centre:	61.9 m	
Weighted mean depth for deployments:	59.23 mCD	
Sub surface cell height above bed:	55.87 m	
Duration of record:	90 days	(12/08/22 12:00 to 10/11/22 12:02:57 GMT)

Mean speed	0.060 m/s
Residual parallel (U)	0.032 m/s
Residual normal (V)	0.002 m/s
Tidal amplitude parallel (U)	0.085 m/s
Tidal amplitude normal (V)	0.039 m/s

4. BATH TREATMENT MODELLING

SHORT TERM MODEL

Using the results from the data analysis of the sub-surface current meter cell, the short term bath treatment model was run and the EQS compliance for the chemical treatments, Azamethiphos, Cypermethrin and Deltamethrin, were predicted.

Results of Short Term Model:

Treatment	Permissible quantity	Pen treatment depth*	% net depth	No. of Pens treatable
Azamethiphos in 3 hrs	134.4 g	2.55 m	17.0	1.0
Cypermethrin in 3 hrs	31.2 g	2.45 m	16.3	5.0
Deltamethrin in 3 hrs	11.7 g	2.30 m	15.3	5.0

* Treatment depth can be varied. The depths above show the number of pens treatable at an example net depth.

LONG TERM MODEL

For the purposes of the long term (72 hour) dispersion model for Azamethiphos, the receiving water was classified as open water.

Results of the Long Term Model:

Pen treatment depth = 2.50 m
Permissible quantity of Azamethiphos in 24 hrs = 381.9 g
Treatment regime = 3.0 pens in 24 hrs

The Bath Auto spreadsheet is provided along with this document and is also shown in appendix A.

FILES ACCOMPANYING THIS REPORT

- Model and results contained within:

  Reintraid_2023v1_BathAuto_v5

FILES THAT HAVE BEEN PREVIOUSLY SUBMITTED TO SEPA

- Hydrographic report and associated SEPA validated datasets which were used for the modelling:

  Reintraid_2023v1_Hydrographic_Report.pdf, 13 January 2023.

  Reintraid_90 days_hgdata_analysis_v7-S.xls.

- Method statement for TransTech's modelling of the Reintraid site:

  Reintraid_2023v1_ND_Modelling_Method_Statement.pdf, 13 January 2023.

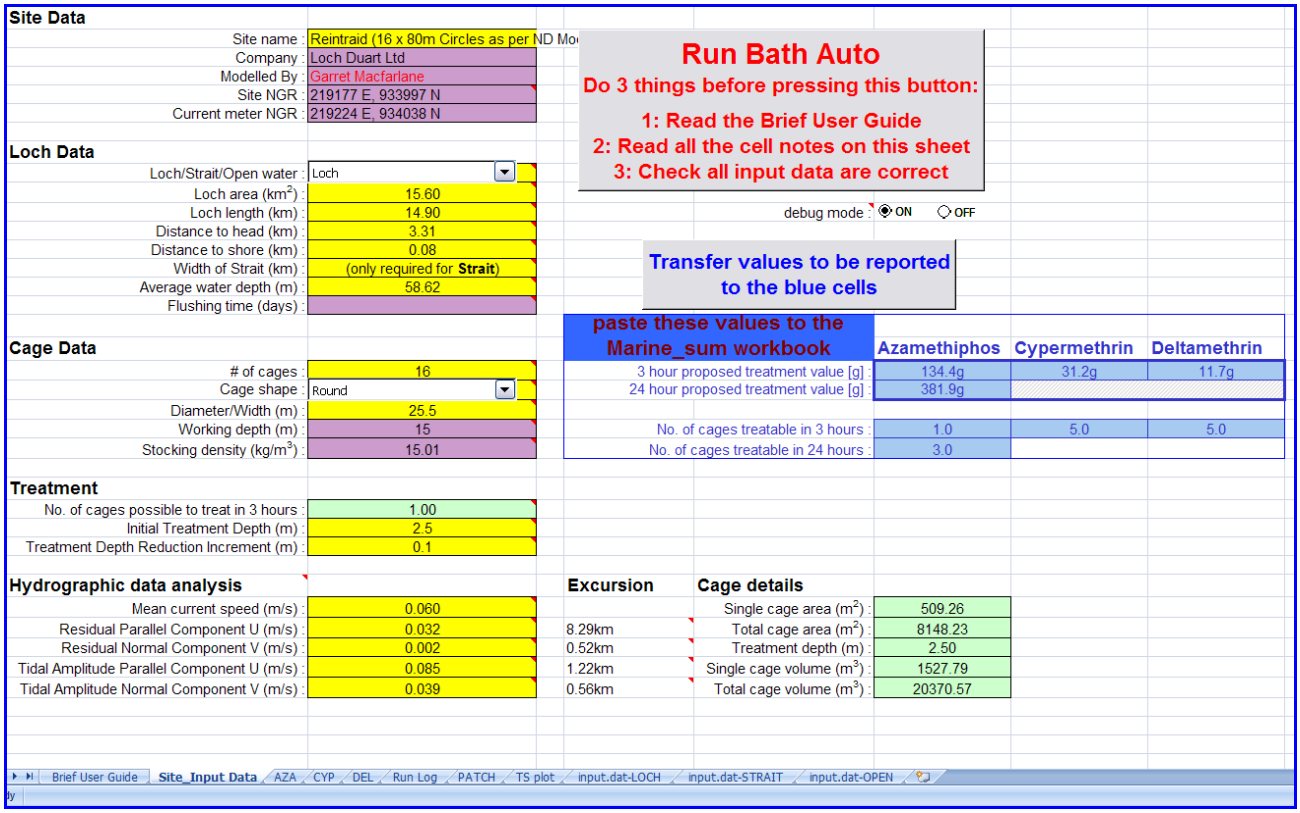
REFERENCES

(1) Annex G. Models for assessing the use of chemicals in bath treatments. v2.2. Scottish Environment Protection Agency. 31 October 2008.

(2) Sea bed digital elevation model at 1 arc seconds utilising single and multi-beam hydrographic survey data - gridded bathymetry. Created by OceanWise Ltd using data from the UK Hydrographic Office and other agencies. Source: emapsite.com.

APPENDIX A

Reintraid_2023v1_BathAuto_v5.xls (Version 5.1)



Site Data

Site name :	Reintraid (16 x 80m Circles as per ND Mo
Company :	Loch Duart Ltd
Modelled By :	Garret Macfarlane
Site NGR :	219177 E, 933997 N
Current meter NGR :	219224 E, 934038 N

Run Bath Auto

Do 3 things before pressing this button:

1: Read the Brief User Guide
2: Read all the cell notes on this sheet
3: Check all input data are correct

debug mode : ON OFF

Loch Data

Loch/Strait/Open water :	Loch
Loch area (km^2) :	15.60
Loch length (km) :	14.90
Distance to head (km) :	3.31
Distance to shore (km) :	0.08
Width of Strait (km) :	(only required for **Strait**)
Average water depth (m) :	58.62
Flushing time (days) :	

Transfer values to be reported to the blue cells

Cage Data

# of cages :	16
Cage shape :	Round
Diameter/Width (m) :	25.5
Working depth (m) :	15
Stocking density (kg/m^3) :	15.01

paste these values to the Marine_sum workbook

	Azamethiphos	Cypermethrin	Deltamethrin
3 hour proposed treatment value [g] :	134.4g	31.2g	11.7g
24 hour proposed treatment value [g] :	381.9g		
No. of cages treatable in 3 hours :	1.0	5.0	5.0
No. of cages treatable in 24 hours :	3.0		

Treatment

No. of cages possible to treat in 3 hours :	1.00
Initial Treatment Depth (m) :	2.5
Treatment Depth Reduction Increment (m) :	0.1

Hydrographic data analysis

		Excursion
Mean current speed (m/s) :	0.060	
Residual Parallel Component U (m/s) :	0.032	8.29km
Residual Normal Component V (m/s) :	0.002	0.52km
Tidal Amplitude Parallel Component U (m/s) :	0.085	1.22km
Tidal Amplitude Normal Component V (m/s) :	0.039	0.56km

Cage details

Single cage area (m^2) :	509.26
Total cage area (m^2) :	8148.23
Treatment depth (m) :	2.50
Single cage volume (m^3) :	1527.79
Total cage volume (m^3) :	20370.57

Brief User Guide | Site_Input Data | AZA | CYP | DEL | Run Log | PATCH | TS plot | input.dat-LOCH | input.dat-STRAIT | input.dat-OPEN