BATH TREATMENTS MODELLING REPORT

Proposed South Bute Finfish Pen Site, Clyde Estuary

Prepared for

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Quality Assurance

The data used in this document and their input and reporting have undergone a quality assurance review which follows established TransTech Ltd procedures. The information and results presented herein constitute an accurate representation of the data collected.

TransTech is registered with SEPA (Scottish Environment Protection Agency) for marine pen site Biomass (Ref: AMMR08v02) and Chemical discharge modelling (Ref: AMMR08v01).

Document Details

Author:

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List of Abbreviations

ADCP	Acoustic Doppler Current Profiler
EQS	Environmental Quality Standards
LST	Lowest Spring Tide
mCD	Metres below Chart Datum
SEPA	Scottish Environment Protection Agency

1. Summary

This report has been prepared in order to meet the specific requirements of the Scottish Environment Protection Agency (SEPA) for the assessment of applications for consent to use chemical bath treatments against sea lice for salmonids held in marine pens.

Bath Auto was used to determine the concentration of the chemicals Azamethiphos (Salmosan), Cypermethrin (Excis) and Deltamethrin (Alphamax) that could be used at the proposed South Bute pen site in compliance with Environmental Quality Standards (EQS).

The mid-range speeds observed at the site during a 90 day ADCP deployment were used in the modelling.

The maximum permissible quantity of Azamethiphos that can be used in a 3 hour period was predicted to be 689.9 g, at a treatment regime of 2.0 pens per 3 hour treatment and net depth of 3.08 m. A compliant pass was achieved for the long term model with a maximum treatment value of 217.8 g at a regime of 1.0 pen treatable in 24 hours, at a net depth of 1.90 m.

The maximum quantity of Cypermethrin permissible in a 3 hour period was predicted to be 124.9 g at a treatment regime of 10.0 pens per 3 hour treatment for a net depth of 2.19 m.

The maximum quantity of Deltamethrin permissible in a 3 hour period was predicted to be 46.8 g at a treatment regime of 10.0 pens per 3 hour treatment for a net depth of 2.05 m.

2. Introduction

This report has been prepared in order 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 EQS that are in place to protect the marine environment.

Bath treatments, where the fish are physically immersed in a diluted solution of the 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 (October 2008) of the SEPA Fish Farming Manual, and the results are reported to satisfy consent application requirements.

3. South Bute site information

Site details

Site name:	South Bute
Location:	Clyde Estuary
Pen group distance to head:	55.7 km^2 (measured using GIS)
Pen group distance to shore:	0.196 km (pen edge to 0 mCD at closest point, from AutoDEPOMOD plot of bathymetry)
Width of strait:	3.4 km (measured using GIS)
Average water depth for 1km^2 area:	69.3 mCD (obtained from AutoDEPOMOD gridgen file)

Pen group details

Group centre position:	211692.6 E, 653363.5 N
Number of pens:	10
Pen group configuration:	2 x 5
Pen dimensions:	120 m circumference circles
Net depth:	16.0 m
Residual current direction:	158.4° Grid North
Peak Stocking Density:	13.6 kg/m^3

4. 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.

Current meter position:	211671.8 E, 653359.8 N (21.2 m from group centre)
Minimum depth recorded by ADCP + 0.5 m for frame:	41.78 m
Sub surface cell:	35.7 m (6.08 m below LST)

Table 1. Current speeds

Duration of record (GMT)	Mean Speed in m/s	Residual parallel (U) in m/s	Residual normal (V) in m/s	Tidal amplitude parallel (U) in m/s	Tidal amplitude normal (V) in m/s
08/03/18 10:16 to 23/03/18 10:16	0.175	0.106	0.016	0.244	0.063

5. Bath treatments

SHORT TERM MODEL

For the purposes of the dispersion modelling, the receiving water was classified as a strait.

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.

Table 2. Results of Short Term Model

	Permissible quantity (g)	Pen treatment depth* (m)	% Net depth	No. of pens treatable
Azamethiphos in 3 hrs:	689.89	3.08	19.3	2
Cypermethrin in 3 hrs:	124.88	2.19	13.7	10
Deltamethrin in 3 hrs:	46.83	2.05	12.8	10

* 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 a strait.

Table 3. Results of Long Term Model

	Permissible quantity (g)	Pen treatment depth (m)	% Net depth	No. of pens treatable
Azamethiphos in 24 hrs:	217.76	1.90	11.9	1

The results of the long term model override those of the short term and therefore 1 pen may be treated per day.

The Marine Sum and Bath Auto spreadsheets are provided along with this document and are also shown in appendices 1 and 2.

APPENDIX 1

South_Bute_2018v1-M_marine_sum_v3.xls (Version 3.13) Treatment Worksheet

Fish farm site at : South Bute, Clyde Estuary **Receiving water : 0**

Consent No. : 0 **Team area : 0**

Current data summary

LEVEL	Mean	%<=0.09 m/s	Major axis	major amp./ minor amp.	Residual speed	Residual direction	Vector av. residual
Sub-surface	0.180	28%	150	3.84	0.110	158	**0.073 m/s at 156 degrees**
Cage-bottom	0.170	30%	150	4.30	0.080	153	
Near-bed	0.110	51%	145	4.35	0.030	163	

Bath Treatments

	Azimethiphos	Cypermethrin	Deltamethrin
Recommended 3h consent mass:	689.89 g	124.88 g	46.83 g
Recommended 24h consent mass:	217.8 g		
Equivalent treatable volume:	6898.9 m3	24976.0 m3	23415.0 m3
	2177.6 m3		

In-feed Treatments

Peak Biomass: 2500.0 t

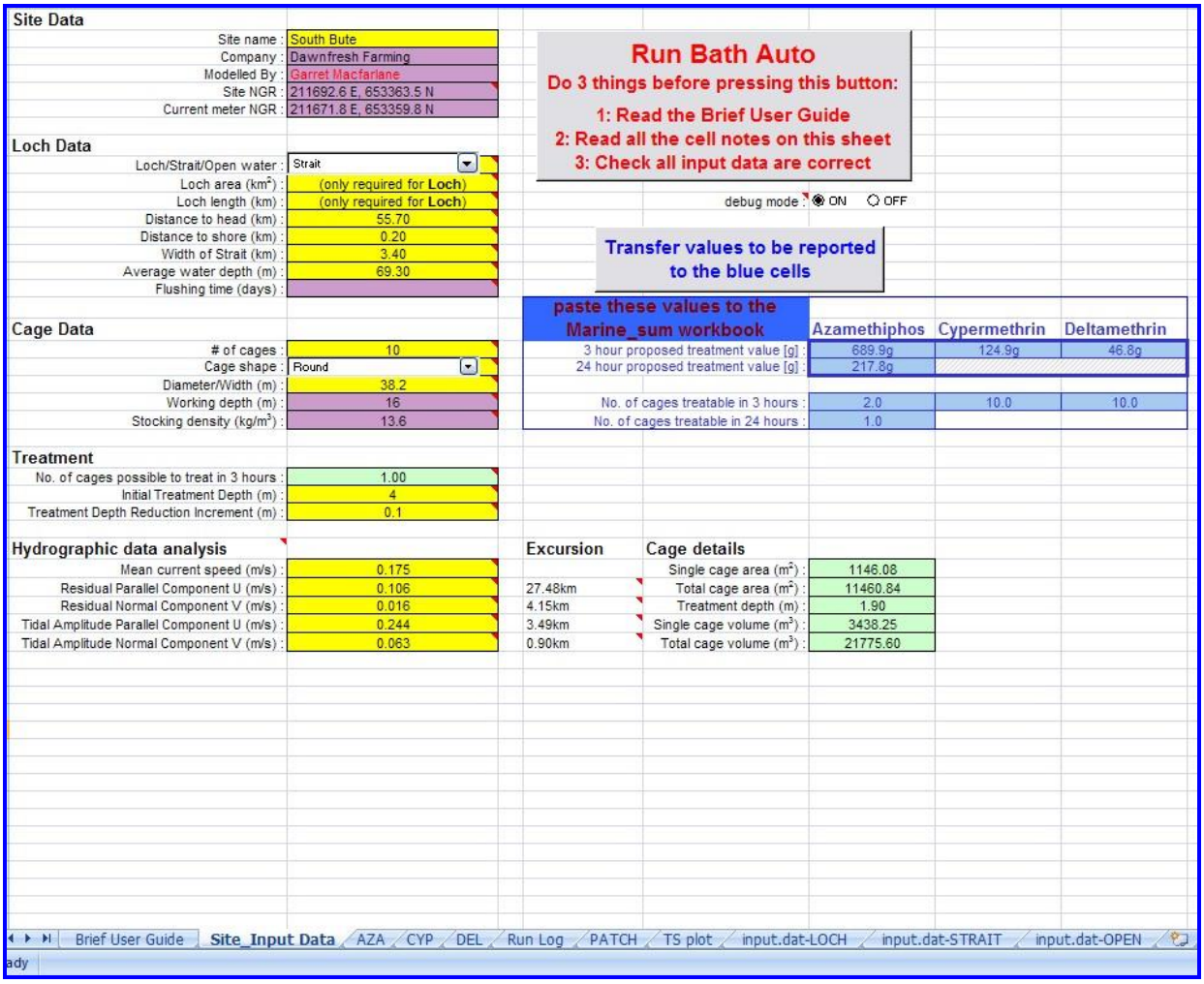
	Far-field	Near-field	
AZE:			
	TFBZ	EMBZ TAQ	EMBZ MTQ
Recommended consent mass:			875.0 g
Equivalent treatable biomass:	NO-DATA	NO-DATA	2500.0 t
Area of impact at far-field EQS:			
Mass balance:			
Affected area:	0.0 km2	0.0 km2	
Receiving area:	10.0 km2	10.0 km2	
Mean concentration within near-field AZE:			

Modelled by : Garret Macfarlane date : 16/12/2018 **Not Yet Approved by SEPA**

SEPA (MS:H-M) Approved by : date :

APPENDIX 2

South_Bute_2018v1-M_BathAuto_v5.xls (Version 5.1)



Site Data

Site name :	South Bute
Company :	Dawnfresh Farming
Modelled By :	Garret Macfarlane
Site NGR :	211692.6 E, 653363.5 N
Current meter NGR :	211671.8 E, 653359.8 N

Loch Data

Loch/Strait/Open water :	Strait
Loch area (km²) :	(only required for **Loch**)
Loch length (km) :	(only required for **Loch**)
Distance to head (km) :	55.70
Distance to shore (km) :	0.20
Width of Strait (km) :	3.40
Average water depth (m) :	69.30
Flushing time (days) :	

Cage Data

# of cages :	10
Cage shape :	Round
Diameter/Width (m) :	38.2
Working depth (m) :	16
Stocking density (kg/m³) :	13.6

Treatment

No. of cages possible to treat in 3 hours :	1.00
Initial Treatment Depth (m) :	4
Treatment Depth Reduction Increment (m) :	0.1

Hydrographic data analysis

		Excursion
Mean current speed (m/s) :	0.175	
Residual Parallel Component U (m/s) :	0.106	27.48km
Residual Normal Component V (m/s) :	0.016	4.15km
Tidal Amplitude Parallel Component U (m/s) :	0.244	3.49km
Tidal Amplitude Normal Component V (m/s) :	0.063	0.90km

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

Transfer values to be reported to the blue cells

paste these values to the Marine_sum workbook	Azamethiphos	Cypermethrin	Deltamethrin
3 hour proposed treatment value [g] :	689.9g	124.9g	46.8g
24 hour proposed treatment value [g] :	217.8g		
No. of cages treatable in 3 hours :	2.0	10.0	10.0
No. of cages treatable in 24 hours :	1.0		

Cage details

Single cage area (m²) :	1146.08
Total cage area (m²) :	11460.84
Treatment depth (m) :	1.90
Single cage volume (m³) :	3438.25
Total cage volume (m³) :	21775.60

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

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