Note: This is presentation material only

Cage and hydrographic survey requirements

Jon Chamberlain

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Overview

- NOT part of the modelling process – WRONG!!
- Before you proceed with modelling, you will need to be satisfied that all the data collected is fit for purpose.
- Absolutely no point in starting the modelling process if you feel that the quality of the data is not up to the standard required by SEPA

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Present situation

- A large proportion of time is spent checking the data supplied with each application
- Quality of data that has been supplied has been mixed and varied
- Some of the errors are fundamental – others are technical

- Overall result is delays in the processing of applications and issuing of DINs

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

The Future

- Modelling will be done by yourselves
- Quality of the data MUST be checked by YOU
- In addition to modelling reports – application to include:
  - Site and hydrographic survey

- A useful way for you to check the data

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Site Survey

- Position Fixing
- Depth Soundings
- Data Reporting
  - Site Layout Map

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Position Fixing

- Location of cage corners and current meter
- Electronic Satellite Navigation System
  - GPS
  - DGPS
  - GLONASS
  - Galileo……..
- Quality of positional information improved with number of satellites and time in position

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Position Fixing 2

- Position system datum
  - WGS84/ETRS89
- Convert to Ordnance Survey Grid references
- Methods available as freeware on the internet

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Depth Sounding

- Depths at cage corners
- Time of sampling (corrected to GMT)

- Correct depths to chart datum (CD) from Admiralty Tide Tables

- In areas where the charts are of poor resolution – extra depth measurements should be taken.
  - Minimum of 4 additional depth soundings at 150m in cardinal directions.

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

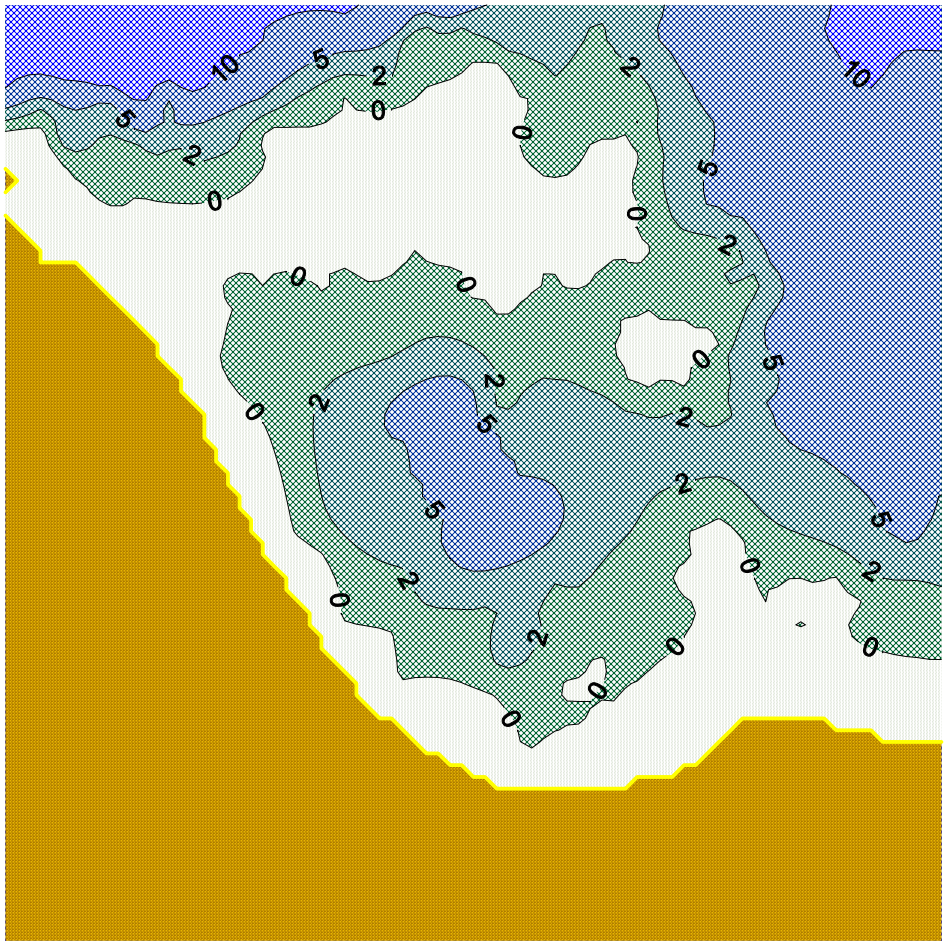
Data Reporting

- Very similar to data for Grid generation module within DEPOMOD.
- 1 km square map of the area with farm site close to the centre

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Site Layout Map - 1



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

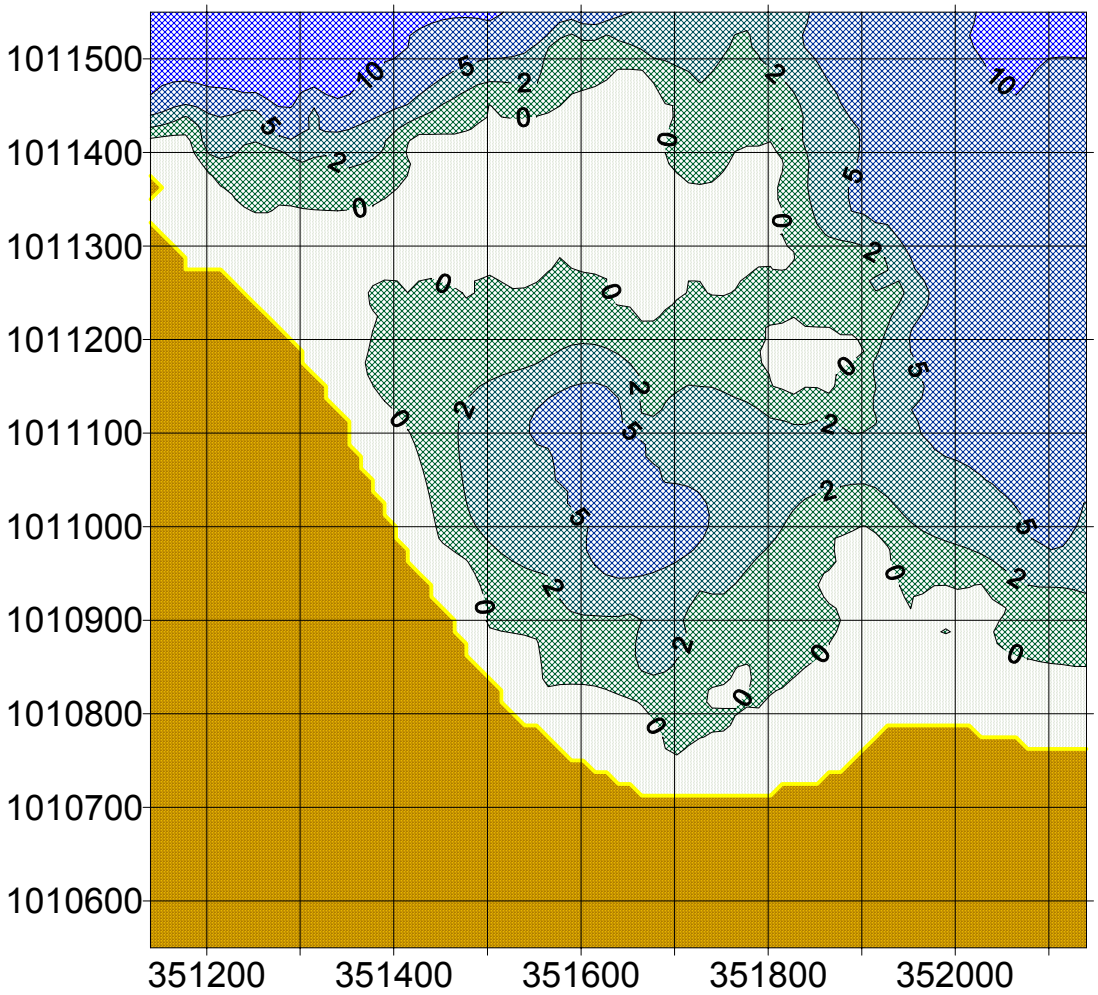
Data Reporting

- Very similar to data for Grid generation module within DEPOMOD.
- 1 km square map of the area with farm site close to the centre
- Overlain with OS-National Grid co-ordinate graticules

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Site Layout Map - 2



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

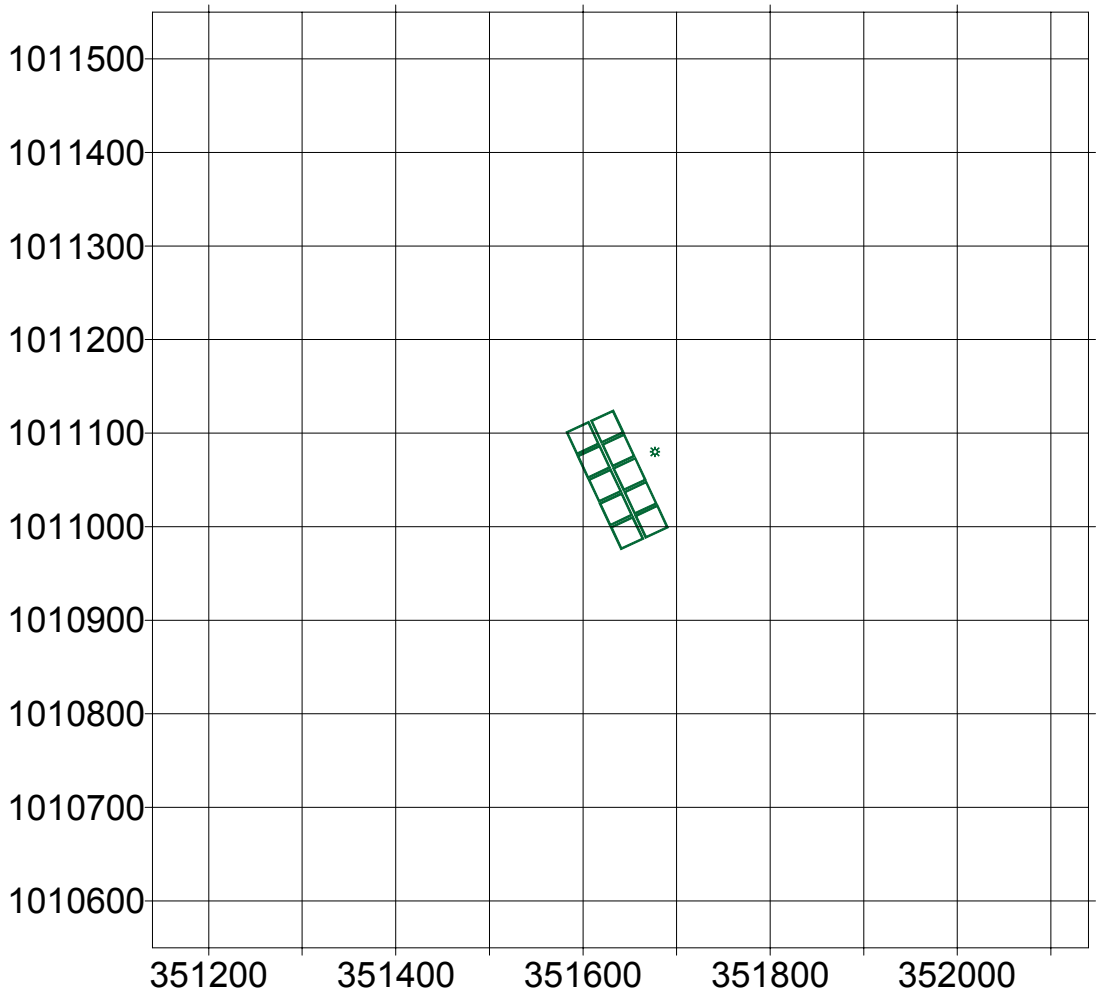
Data Reporting

- Very similar to data for Grid generation module within DEPOMOD.
- 1 km square map of the area with farm site close to the centre
- Overlain with OS-National Grid co-ordinate graticules
- Location of the cage, current meter and met station

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

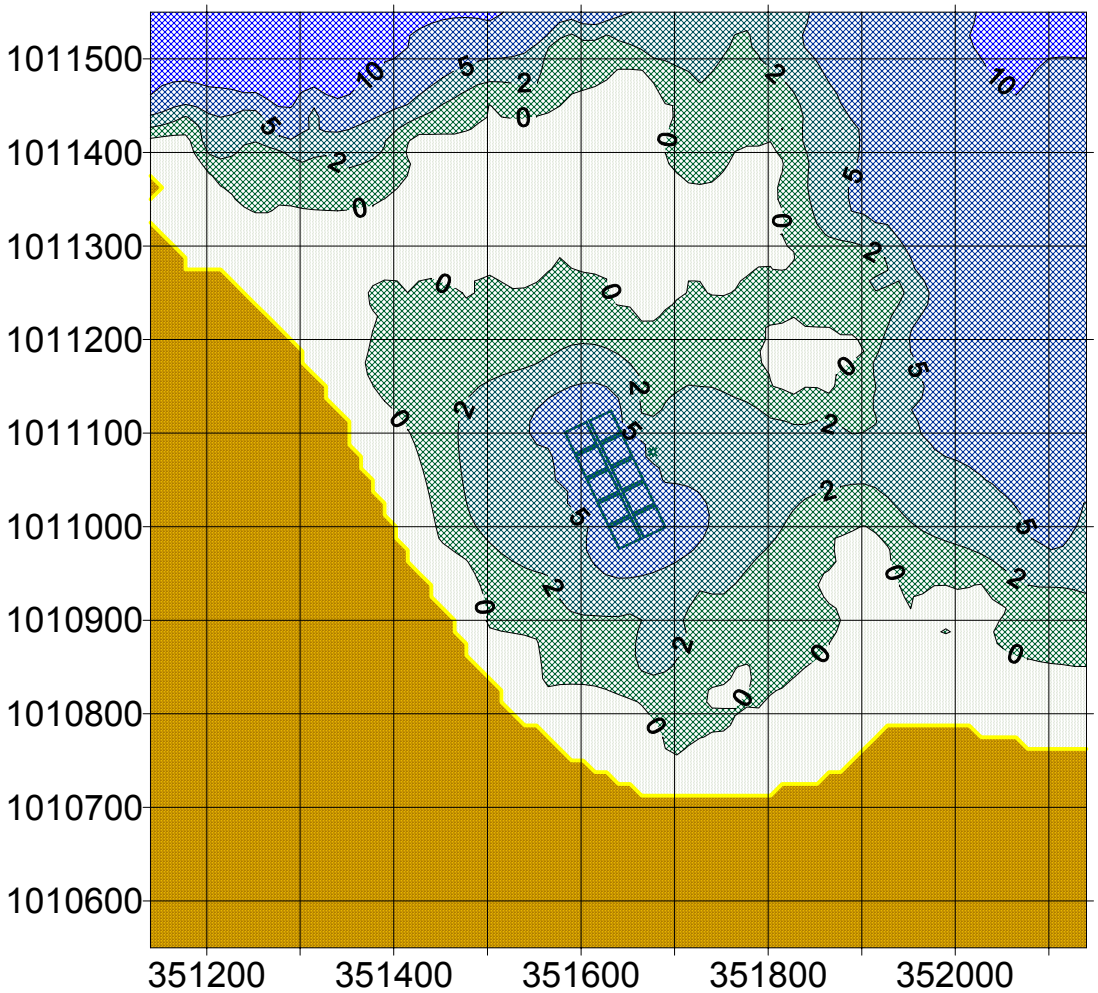
Site Layout Map - 3



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Site Layout Map – 4



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

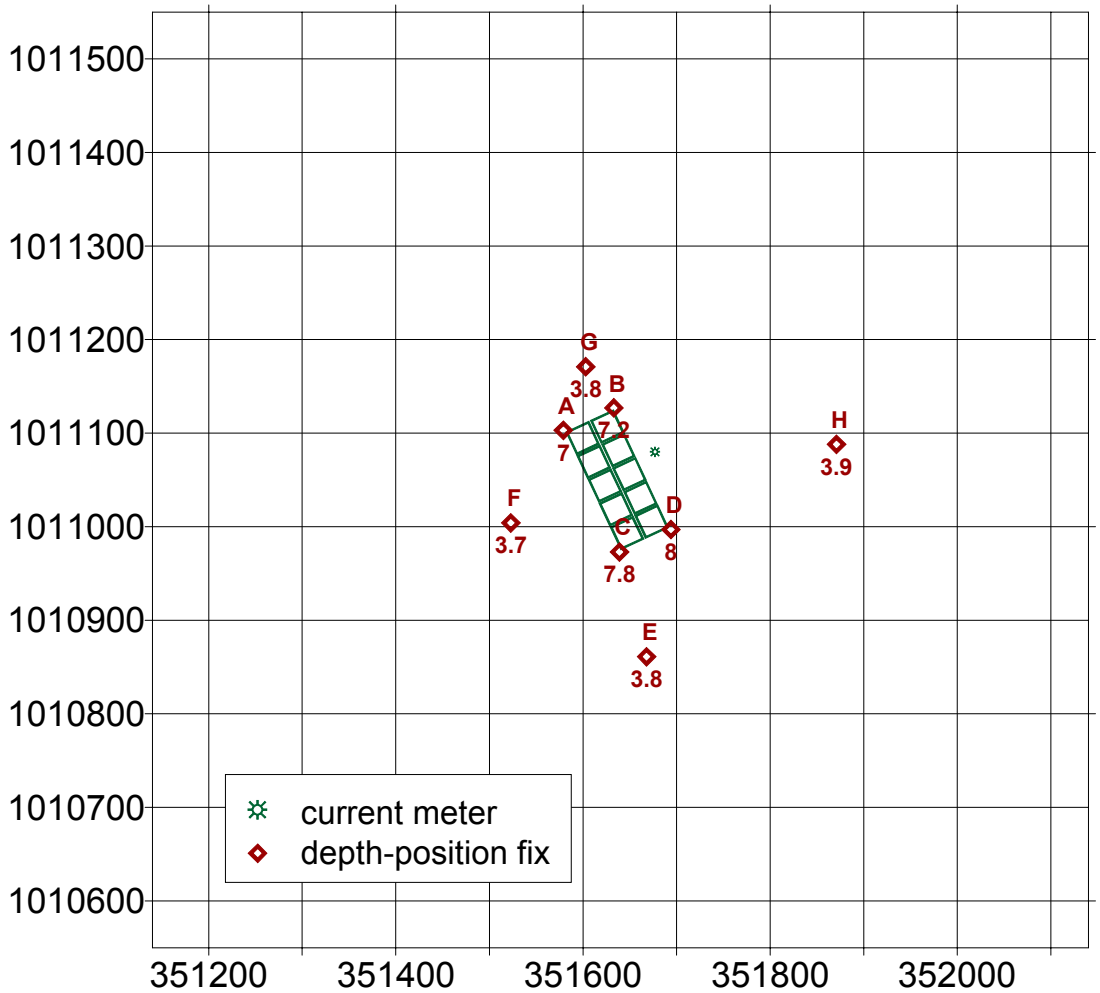
Data Reporting

- Very similar to data for Grid generation module within DEPOMOD.
- 1 km square map of the area with farm site close to the centre
- Overlain with OS-National Grid co-ordinate graticules
- Location of the cage, HG meter and met station
- Positions and depths of corners (and extra points)

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

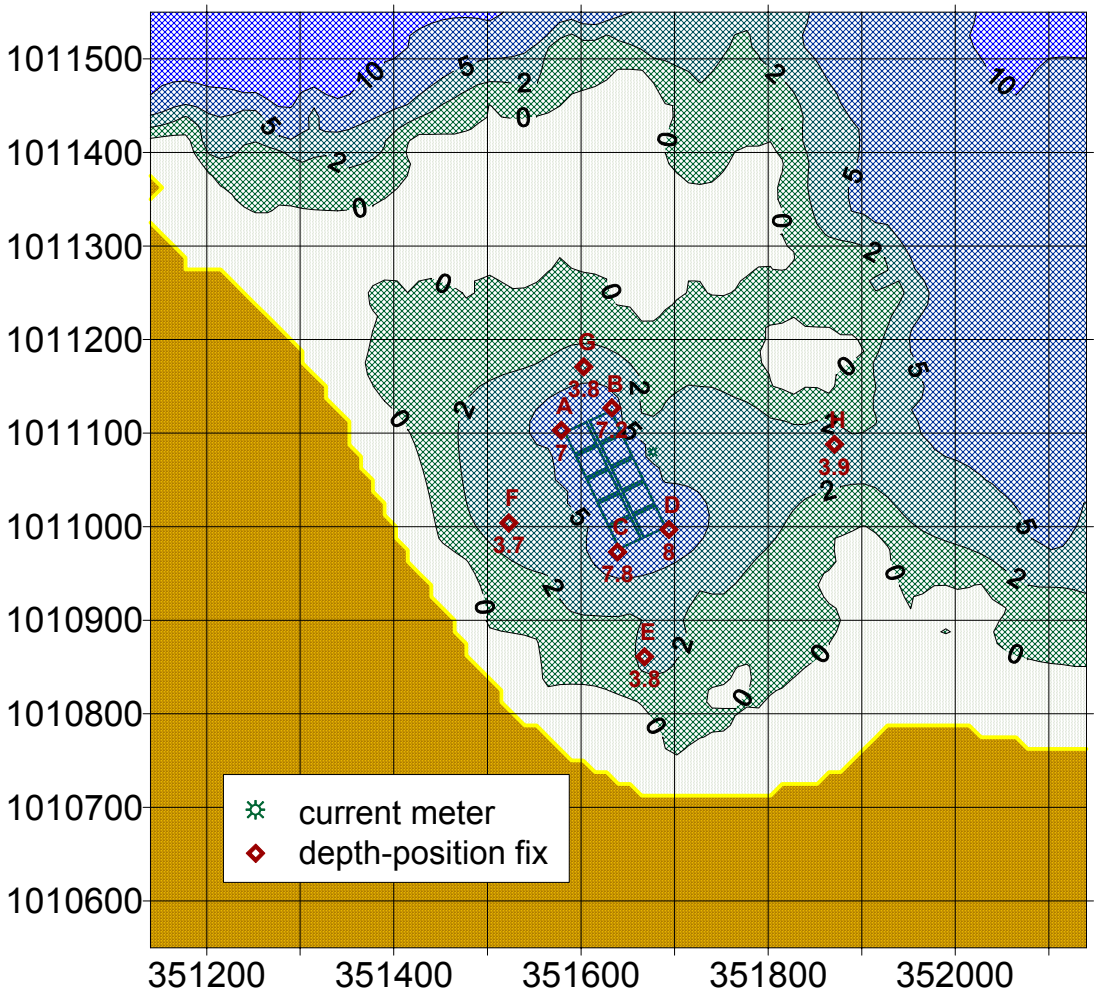
Site Layout Map - 5



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Site Layout Map - 6



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Data Reporting

- All information to be recorded in a table

Table 2.1 **Extract of example survey report table**

	Time		Tide ht	Depth (m)		Position			duration
label	BST	GMT	(m-ATT)	sounding	(CD)	WGS84	NGR	#Sat	(mins)
A	14:42	13:42	2.7	9.7	7	58°59.058'N 2°50.649'W	351579 1011103	7	5
B	14:44	13:48	2.6	9.8	7.2	58°59.072'N 2°50.593'W	351633 1011127	8	4
C	14:51	14:55	2.6	10.4	7.8	58°58.989'N 2°50.585'W	351639 1010973	8	4
…	…	…	…	…	…	…	…	…	…

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Hydrographic Survey

- Minimum requirements
  - 15 day (spring-neap/half lunar cycle)
- Longer deployments may allow clearer determination of tidal components
- Lowest acceptable temporal resolution – 20 mins

Table 3.1 Current data duration and resolution (minimum requirement)

Resolution (interval between records) (minutes)	Frequency (records per hour)	Number of records
1	60	21601
2	30	10801
3	20	7201
5	12	4321
6	10	3601
10	6	2161
12	5	1801
15	4	1441
20	3	1081

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Equipment and Moorings

- Pressure Gauges
- Current Meters
- Deployment Position
- Meteorological Data

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Pressure Gauge

- Allows corroboration of
  - Deployment depth
  - Timing
  - Duration
- Allows comparison of tidal movement with current velocity and flow
- Integral with near-bed current meter or separate bed-mounted tide gauge

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Current Meters

- Generally either:

- Discrete measuring device

or

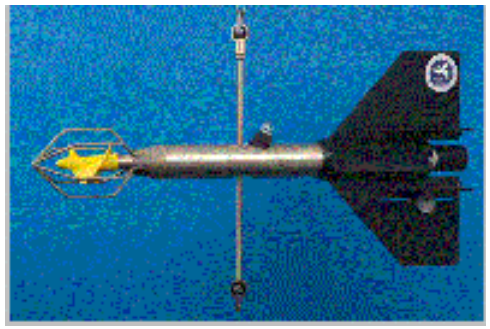
- Profiling Instruments

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Discrete Measuring Devices

- Mechanical Meters



- Electromagnetic Meters

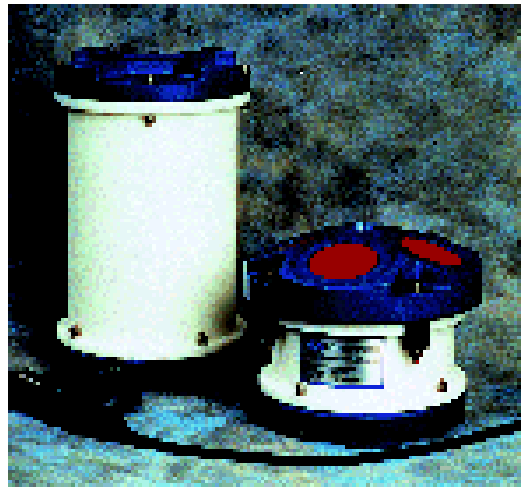
- Acoustic Meters

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Profiling Instruments

- ADP/ADCPs
- Require careful configuration



- Must be set up with respect to
  - Averaging interval
  - Number of “pings”
  - Cell Size
  - Deployment Depth

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Profiling Instruments

- Estimated Standard Deviation not exceed 1 cm/s
- Height of transducer, blanking distance and cell size must still meet near bottom depth criterion
- Near bottom depth or cell size should not exceed 3m
- Tilt/Roll within device limits
- Acoustic frequency should be selected to return reliable flow estimates through the full deployment depth

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Current Meters

- All instruments should meet the following criteria:

Table 3.2 Equipment specifications

	accuracy	precision	resolution	range
speed	≤1 cm/s	≤1 cm/s	≤1 cm/s	≥3 cm/s
direction	≤5°	≤3°	≤1°	0° to 360°
pressure	**≤0.05 dBar**	≤0.02 dBar	≤0.01dBar	**≥0 dBar**
acoustic instruments should also include:				
tilt/roll	**≤0.5°**	≤0.5°	≤0.1°	**0° to ≥20°**
temperature	**≤0.5°**	≤0.5°C	≤0.1°C	**≤0° to >25°C**

- Note definitions of Accuracy, Precision and Resolution

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Deployment Position

- Current meter should be:
  - in similar water depth - ideally +/- 5m of cages
  - Within 150m of the centre of the cage group
- Adjacent groups may be represented by a single deployment if the 150m condition is met
- Large sites in excess of 500m should be characterised by TWO deployments

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

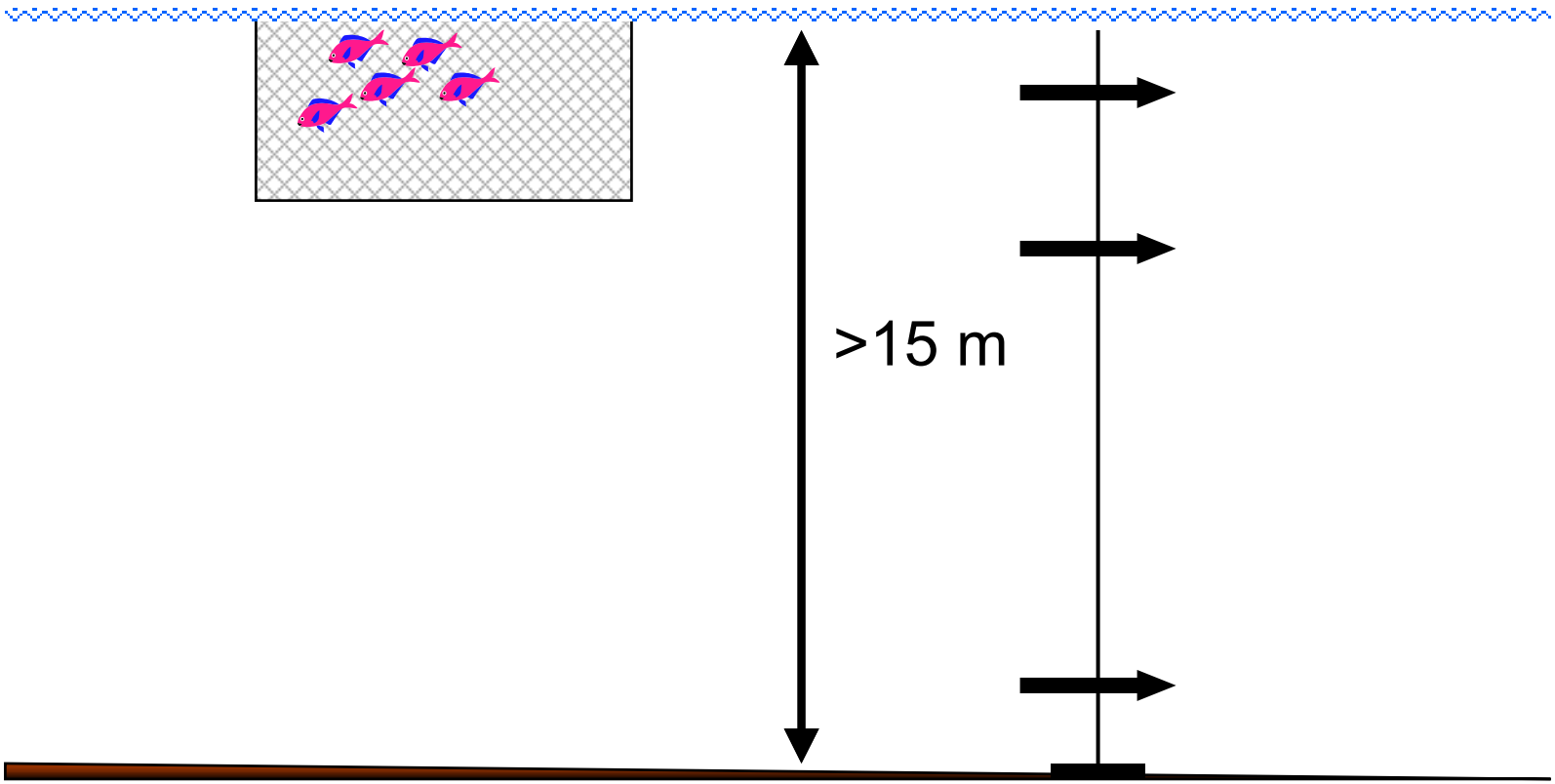
Depth of Data Retrieval

- At sites in excess of 15m – data should be collected at THREE depths

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Hydrographic Data



SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Depth of Data Retrieval

- At sites in excess of 15m – data should be collected at THREE depths

- Near bottom – as close to the bed as practicable
- Sub-surface – 5m below the lowest predicted spring
- Cage bottom – corresponding to the bottom of cages

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Depth of Data Retrieval

- At sites in less than 15m – data MAY be collected at TWO depths

- Near bottom – as close to the bed as practicable
- Sub-surface – 5m below the lowest predicted spring

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Meteorological Data

- Met Data concurrent with the current meter deployment.
- From a site that is representative of the cage group

- Wind speed and direction
  - Minimum – 3 times a day during daylight hours
  - Preferable – Automatically logged hourly average values (including hourly maximum gusts)

- Must be at least THREE consecutive days with wind speed less than 10 m/s (19.3 knots)

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Data Processing

- Accepted that errors will occur
  - Technical faults
  - Environmental factors

- EVERY EFFORT MUST BE MADE TO MINIMISE THESE EFFECTS

- SEPA will accept the repair of up to 6 hours (Maximum) of data in any 15 day data set.

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Numerical Data

- Current data should be supplied
  - Raw data as downloaded from the instrument
  - Processed Data (ASCII text or Spreadsheet)
- Presented in the following format:

Hydrographic data

MINIMUM REQUIREMENT				ADDITIONAL PARAMETERS				
date & time	speed	direction	depth	east	north	pressure	salinity	temperature
GMT	m/s	°True	m	m/s	m/s	dBar	PSU	°C
11/2/02 13:15	0.035	234	17.51					
11/2/02 13:25	0.042	245	17.47					
...	...	...	...	...	...	...	...	...

Meteorological data

MINIMUM REQUIREMENT			ADDITIONAL PARAMETERS
date & time	mean speed	direction	maximum gust
GMT	m/s	°True	m/s
11/2/02 13:15	3.7	155	7.4
11/2/02 14:15	4.2	153	9.6
...	...	...	...

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Data Analysis

- Key Statistical Values for each depth
  - This should be carried out on the 'fixed' data
- Mean Speed
- Ranked Percentage of mean speed
- 3 cm/s as a ranked percentage

Current direction should be analysed for frequency and percentage of occurrence in the following bin ranges:								
>0°≤10°	>10°-≤20°	>20°-≤30°	>30°-≤40°	>40°-≤50°	>50°-≤60°	>60°-≤70°	>70°-≤80°	>80°-≤90°
>90°-≤100°	>110°-≤120°	>120°-≤130°	>130°-≤140°	>140°-≤150°	>150°-≤160°	>160°-≤170°	>170°-≤180°	>180°-≤190°
>190°-≤200°	>210°-≤220°	>220°-≤230°	>230°-≤240°	>240°-≤250°	>250°-≤260°	>260°-≤270°	>270°-≤280°	>280°-≤290°
>290°-≤300°	>310°-≤320°	>320°-≤330°	>330°-≤340°	>340°-≤350°	>350°-≤360°			

Current speed should be analysed to derive the following percentile values:										
0 (minimum)	1	5	10	25	50 (median)	75	90	95	99	100 (maximum)

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS

Graphical Presentation

- For each depth the following graphical formats should be presented
  - Time series of speed and water depth
  - Time series of unprocessed speed and water depth
  - Time series of direction and water depth
  - Time series of unprocessed direction and water depth
  - Scatter plots
  - Cumulative vector plots
  - Bar charts of direction frequency analysis
  - Current speed against percentile

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY SAMS

Report Structure

- Site Description
- Survey Programme
- Methods (Sampling, data processing)
- Cage Survey Plot
- Cage Survey Summary Table
- HG data QA statement
- HG data summary statistics
- HG data plots
- Equipment List – specs and set-up parameters
- Survey Log sheet
- Calibration Reports

SEPA SCOTTISH ENVIRONMENT PROTECTION AGENCY

SAMS