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TECHNICAL STANDARD

Soft Sediment Video Surveys for Marine Finfish Farms

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This document is the Technical Standard - Soft Sediment Video Surveys for Marine Finfish Farms

This Technical Standard is made pursuant to Division 1B of Part 7 of the *Environmental Management and Pollution Control Act 1994*.

I, Wes Ford, Director, EPA, make, under Section 96(Y)(1) of the *Environmental Management and Pollution Control Act 1994*, the Technical Standard - Soft Sediment Video Surveys for Marine Finfish Farms.

This Technical Standard - Soft Sediment Video Surveys for Marine Finfish Farms comes into effect on XX 2024 for the purposes of implementing Environmental Standards for Tasmanian Marine Finfish Farming 2023 pursuant to Section 96X(1)(a) of *Environmental Management and Pollution Control Act 1994*.

Wes Ford

DIRECTOR, ENVIRONMENT PROTECTION AUTHORITY

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Version Control

Version Number	Purpose/ change	Date
0.1	Consultation draft – to the public	10/04/2024

1. Purpose

The purpose of this technical standard is to ensure that soft sediment video surveys are undertaken in accordance with a consistent, quality-assured and contemporary framework and to provide the foundations for the evaluation and reporting of the survey findings.

This approach will enable the environmental effects of finfish farming to be described and changes to the local environmental condition over time to be documented. It will ensure that the environmental footprint of finfish aquaculture on the seabed remains within clearly defined benchmarks which are based on best available scientific knowledge.

The methods presented within this technical standard have been guided by publications including Macleod & Forbes (2004) and Ross et al. (2021b) and are provided as a contemporary approach for monitoring the impact of finfish farming on the seabed within Tasmanian marine and estuarine environments.

2. Scope and Context

This technical standard comprises the following elements:

- (a) methodology for establishing reference conditions;
- (b) methodology for conducting soft sediment video surveys at any location relevant to marine finfish farming, including within Farm Zones, at or beyond the boundary of Depositional Zones and at baseline and reference sites;
- (c) methodology for recording observations taken during benthic video surveys;
- (d) methodology for the calculation of Benthic Condition Index (BCI) values. The BCI (previously referred to as a quantitative video assessment) is a video scoring technique originally developed by Macleod & Forbes (2004) as a cost-effective tool to determine the condition of a lease and inform management decisions. It was later verified and modified by Ross et al. (2021b) to make it fit for purpose in all current marine finfish aquaculture regions of Tasmania.
- (e) framework for the assessment of the level of impact based on BCI values, including benchmarks for comparison;
- (f) reporting of findings.

Table A1 and Table A2 in Appendix A provide an overview of how these different aspects are covered within the *Environmental Standards for Tasmanian Marine Finfish Farming 2023* (Marine Environmental Standard).

3. Environmental Standards Requirements

The Marine Environmental Standard sets out the requirements for seabed monitoring in relation to finfish aquaculture.

Figure A1 in Appendix A provides an overview of the different types of seabed monitoring required by the Marine Environmental Standard, including soft sediment video surveys.

In short, for soft sediment environments, the Marine Environmental Standard states that:

- (a) video surveys of the seabed must be conducted within the Farm Zone and at compliance sites (at or beyond the outer boundary of the Depositional Zone) in accordance with this technical standard;
- (b) in order to compare compliance site conditions against reference conditions, video surveys at baseline sites and/or reference sites will be required;
- (c) video surveys are to be analysed to establish compliance with the Farm Zone and soft sediment ecological standards, in accordance with this technical standard;
- (d) the BCI is a central element for the assessment of compliance within the Farm Zone and at compliance sites at or beyond the Depositional Zone and is to be calculated in accordance with this technical standard.

It should be noted that in the event of any non-compliance with Farm Zone or soft sediment ecological standards, the EPA will act in accordance with the [EPA Compliance and Enforcement Policy](#) (available on the EPA website¹) and any relevant response requirements set out within the Marine Environmental Standard to determine an appropriate regulatory response.

Table 1 provides an overview of key elements of soft sediment video surveys within the context of the Marine Environmental Standard.

¹ [Compliance and Enforcement Policy 2022 \(epa.tas.gov.au\)](https://www.epa.tas.gov.au/compliance-and-enforcement-policy)

Table 1: Key elements of soft sediment video surveys

Topic	Summary
Which section of the Marine Environmental Standard relates to soft sediment video surveys?	Part 4, Division 2 (Ecological Standards and Environmental Monitoring) sets out the requirements for monitoring the environment in addition to the relevant ecological standards, reporting requirements and management responses. This includes soft sediment video surveys.
What is the purpose of the soft sediment video survey technical standard?	To set out the technical requirements for undertaking soft sediment video surveys including survey procedure, assessment of compliance with ecological standards, reporting and non-conformance protocols.
Where does monitoring occur?	Soft sediment video monitoring is conducted at pen bay sites within the Farm Zone, at compliance sites at or beyond the boundary of the Depositional Zone and at baseline and/or reference sites and any other sites considered necessary by the EPA.
When are the monitoring requirements applicable to a licence holder?	As specified in environmental licences that include requirements for soft sediment video monitoring.
What are the survey outputs?	Each survey will produce a BCI value that is used to assess performance and will allow assessment of environmental change over time.
What other environmental monitoring is undertaken in relation to the regulation of marine finfish aquaculture?	<p>Soft sediment video monitoring takes place in conjunction with a suite of other monitoring including detailed seabed surveys (physico-chemical and infauna), reference condition surveys (baseline/reference sites) and broadscale environmental monitoring programs (BEMPs).</p> <p>The information from the above surveys is used to build a comprehensive picture of benthic condition and to understand how the marine environment is responding to finfish aquaculture over time. This information is used to assist in applying relevant and proportionate management responses.</p>

4. Bibliography

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5. Definitions and Abbreviations

Act – means the *Environmental Management and Pollution Control Act 1994*.

Baseline environmental assessment – means a scientific investigation to characterise the environment and establish the initial environmental condition.

Baseline survey site – means a monitoring location (determined by the EPA) at which environmental indicators are measured to characterise the environment and establish the initial environmental condition (prior to finfish farming operations). Baseline survey sites may coincide with, but are not limited to, compliance sites and Farm Zone sites.

Benthic Condition Index (BCI) – means a semi-quantitative video scoring technique to assess and evaluate the condition of the benthic ecosystem using key visual features of soft sediment ecosystems.

Benthic ecosystem – means that part of the seabed, including the seabed surface and subsurface, that interfaces with the water column and in which significant biological activity occurs.

Biofouling debris – means biofouling flora and fauna that are removed from fish farming infrastructure and deposited on the sea floor.

Broadscale Environmental Monitoring Program (BEMP) – in relation to a lease area, means the Broadscale Environmental Monitoring Program specified by the Director under Section 23 of the Marine Environmental Standard in relation to lease area.

Compliance site – means a location determined under Section 9 of the Marine Environmental Standard to detect impacts of marine finfish farming activities at which certain environmental indicators are measured which can be compared against compliance thresholds for such environmental indicators including corresponding reference conditions.

Compliance thresholds – means thresholds defined by the EPA using environmental indicators to determine compliance at Farm Zone sites and compliance sites.

Depositional Zone – in relation to a lease or permit, means the area extending from the boundary of the Farm Zone to 35 metres beyond the boundary of the lease or permit area.

Director – means the Director, Environment Protection Authority appointed under Section 18 of the Act;

Environmental indicator – means a measurable or quantifiable characteristic relevant to the environment.

Environmental licence – means an environmental licence granted under Part 3, Division 8 of the Act, in relation to marine finfish farming only (excluding land-based or freshwater fish farming).

Extent survey – means a survey designed to identify the extent of impacts identified within Farm Zone and/or soft sediment monitoring, using compliance sites located at the boundary of the depositional zone or at other locations beyond 35m where they are needed.

Farm Zone – in relation to a lease or permit area, means the area bounded by the shortest line connecting the outer edges of a group of pens placed next to each other (noting that there may be more than one Farm Zone within a lease area or permit area if more than one pen bay grid is present).

Feed spill events – means the release of feed that results in a mound or contiguous layer of feed pellets on the seabed.

Georeferencing system – means Map Grid of Australia (MGA) Zone 55 (GDA 94)

Global Positioning System (GPS) – means a satellite-based radio navigation system.

Lease – means:

- (a) a lease granted under Part 4 of the *Marine Farming Planning Act 1995*; or
- (b) if there is a sub-lease in relation to the lease, the sub-lease.

Lease area – means the area which is the subject of a lease.

Lease boundary – in relation to a lease, means the perimeter of the lease area.

Licence holder – means the holder of an environmental licence as defined under Section 42B of the Act in relation to marine finfish farming (excluding land-based or freshwater fish farming).

Marine Environmental Standard – means the Environmental Standards for Tasmanian Marine Finfish Farming 2023.

Non-compliance – means any situation where a licence holder (or associate) does not comply with the requirements of their environmental licence and/or the Marine Environmental Standard.

Non-conformance – means any situation where any activities relating to this technical standard are not carried out in accordance with the specifications of this technical standard.

Pen (also fish pen) – means the physical structure in which fish are kept, typically consisting of a floating collar and attached net or nets.

Pen bay – means a defined location within a pen bay grid where a pen may be placed.

Pen bay grid – means infrastructure that creates a collection of pen bays placed next to each other.

Pen bay site – means a defined location within a lease where a soft sediment video survey is undertaken to assess the sediment condition below a pen, pen bay or other location that has already had, or is intended to have, a pen moored.

Permit – means a permit granted under Section 13(1) of the *Living Marine Resource Management Act 1995* but does not include a permit for marine farming of fish for research purposes pursuant to an arrangement under Section 161 of that Act.

Permit area – the area which is the subject of a permit.

Production cycle – in relation to a lease or pen bay grid, means the period of time from stocking a lease or a pen bay grid with finfish to the time of harvest or removal of those fish or, where a lease or pen bay grid is continuously stocked, means each 12-month period ending on a date specified by the Director.

Reference conditions – means reference conditions determined by the Director under Section 7 of the Marine Environmental Standard.

Reference site – means a reference site determined by the Director under Section 7 of the Marine Environmental Standard at which certain environmental indicators are measured.

Remotely Operated Vehicle (ROV) – means an unmanned underwater vehicle used to perform tasks and observe underwater environments.

Soft sediment video survey – means a survey undertaken by collecting video footage of the seabed in soft sediment environments, and analysing the video footage to assess the condition of the seabed, using the procedures within this technical standard.

Spontaneous gas bubble – means the release of a gas bubble from the seabed without disturbance of the seabed.

Time – refers to Australian Eastern Standard Time or Australian Eastern Daylight Time, as relevant.

6. Resource Requirements

6.1. Personnel

- 6.1.1. All personnel undertaking activities relating to the requirements of this technical standard must be competent to carry out the activity.
- 6.1.2. The licence holder must implement procedure(s) to ensure that:
 - (a) competence requirements are defined for activities relating to video analysis within this technical standard;
 - (b) suitable training and supervision are provided to personnel with respect to video analysis and associated activities, within this technical standard;
 - (c) competence of personnel undertaking video analysis and associated activities within this technical standard is assessed;
 - (d) training records are maintained (including names of personnel, dates of training and names of training provider).

6.2. Document and Record Control

- 6.2.1. The licence holder must maintain a database or record management system containing all raw data, video footage and other supporting information collected and reported on in accordance with this technical standard, for at least 5 years and must make this information available to the EPA upon written request.
- 6.2.2. Management systems must be used for the control of documents, monitoring data and video footage relating to this technical standard to ensure that they are:
 - (a) uniquely identified;
 - (b) clearly marked with current and past revision status (i.e. a revision table);
 - (c) retained to demonstrate adherence to the requirements of this technical standard;
 - (d) clearly marked with correct time and date stamp.
- 6.2.3. In accordance with Section 42(3) of the Marine Environmental Standard, all video survey footage must be supplied to the EPA on an external/portable hard drive or via a secured link to cloud storage.

6.3. Equipment

- 6.3.1. All video surveys are to be conducted with a remotely operated vehicle (ROV) fitted with a minimum of two cameras:
- (a) one internal digital camera with low light capabilities (operational capacity at a minimum of 3 lux) to collect full high-definition imagery;
 - (b) one external waterproof digital camera with a minimum of 4K video capability and video stabilization technology or equivalent.
- 6.3.2. ROVs must be equipped with a suitable external light source (preferably LEDs (light emitting diodes)) allowing for the light intensity to be adjusted to the conditions of the environment where filming is being conducted.
- 6.3.3. ROVs must accurately record date, time, survey site name, location (using global positioning system (GPS)), heading, speed, water depth and water temperature on their on-screen display for the duration of each survey.
- 6.3.4. Digital cameras must be calibrated to accurately record date and time during filming. A written record of calibration including camera make and model, serial number(s), date of audit and parameters checked must be maintained.

6.4. Image Specifications

- 6.4.1. Video survey footage submitted must:
- (a) be in full colour (using a RGB (red, green blue) colour model);
 - (b) be in a high-resolution digital image format;
 - (c) provide clear, well-lit footage of the seabed to enable all assessment features to be distinguishable, allowing for correct biological interpretation and analysis. Over-exposure of sediments should be avoided to minimise confusion between over-exposed sediments and bacterial mats (e.g. *Beggiatoa* spp.);
 - (d) be free of obstruction by any part of the ROV or other foreign object that interferes with the ability to undertake video analysis;
 - (e) be stamped with date, time, heading, speed and positional information from the differential GPS using a precise geo-location system (e.g. ultra-short baseline (USBL)) rather than the vessel's GPS;
 - (f) be saved using a consistent naming system that provides a unique survey identifier including date, lease number or control site (where appropriate), survey site name and type of footage (e.g. camera used) separated by an underscore (e.g. MF####_2023-08-06_PB##_ROV).

7. Video Survey Techniques

- 7.1.1. All filming must be conducted on one day or over consecutive days if it is not feasible to conduct all the filming in one day, unless approved by the Director in writing.
- 7.1.2. Video surveys must be undertaken by recording at least 3 minutes of seabed video footage:
- (a) at each nominated baseline and/or reference site following a specified compass bearing;
 - (b) of the seabed from the edge to the centre of the pen bay at nominated pen bay sites (Farm Zone);
 - (c) following a compass bearing parallel to the closest lease boundary at compliance sites (at or beyond the boundary of the Depositional Zone). It should be noted that where a compliance site is at a lease corner, the video footage must follow a compass bearing parallel to the closest lease boundary that is at greatest risk of organic enrichment (i.e. due to hydrodynamics and/or proximity to stocked pens) (see Appendix B, Figure B1).
- 7.1.3. Prior to recording video footage at each monitoring site:
- (a) survey information (including date, time, monitoring site name and survey type) must be clearly written onto a video information board. Pen bay identifier and/or lease number must also be included where relevant (i.e. at compliance sites or pen bay sites).
 - (b) the location of each survey site must be specified using an appropriate geo-referencing system.
- 7.1.4. Each video survey must start with clear footage of the video information board and:
- (a) for pen bay sites, clear footage of the associated finfish pen bay and the compass bearing to the pen bay centre must also be included (i.e. the intended compass bearing that the video survey should follow);
 - (b) for compliance sites, clear footage of the view of the sea surface parallel to the lease boundary and the associated compass bearing must also be included (i.e. the intended compass bearing that the video survey should follow).
- 7.1.5. The ROV must be lowered to the seafloor at the specified geo-referenced monitoring site location and start filming seabed video footage as close to the specified monitoring location as possible. For pen bay sites, this should be achieved by lowering the ROV to the seafloor in line with the edge of the finfish pen or pen bay using a weighted shot line.
- 7.1.6. While filming the seabed the ROV:
- (a) should be < 30cm above the seabed where practicable to achieve the requirements specified in Section 6.4 of this technical standard;
 - (b) should be orientated at an optimal angle to the seabed that minimises light reflection from the seabed and maximises the ability to identify the key video features (see Table 2) on the seabed to achieve the requirements specified in Section 6.4 of this technical standard;
 - (c) must move slowly (at approximately 0.5 knots) over a distance of about 50 m and provide at least 3 minutes of clear footage of the seabed to achieve the requirements specified in Section 6.4 of this technical standard.
- 7.1.7. Each soft sediment video survey must include footage of the sediment being disturbed (at the end of the survey where practicable) in addition to vertical footage to check for the presence of gas bubbles being released from the sediment.

8. Video Analysis

- 8.1.1. Key resources that must be used when undertaking soft sediment video surveys for regulatory monitoring purposes include:
- (a) the Illustrated Scoring Guide: Soft Sediment Video Surveys, available on the [EPA website](#)². This reference document provides further information on the identification and scoring of video features necessary to calculate BCI values;
 - (b) the soft sediment video survey scoring template for establishment of reference conditions (baseline and reference sites), available on the [EPA website](#)³. This template must be used to record survey information, tabulate video analysis observations and calculate the BCI value at baseline and reference sites during the initial establishment of reference conditions, in accordance with the template instructions (see Section 9 of this technical standard for more information);
 - (c) the soft sediment video survey scoring template for Farm Zone surveys (pen bay sites), available on the [EPA website](#)⁴. This template must be used to record survey information, tabulate video analysis observations and calculate the BCI value at Farm Zone sites, in accordance with the template instructions (see Section 10 of this technical standard for more information);
 - (d) the soft sediment video survey scoring template for compliance site surveys, available on the [EPA website](#)⁵. This template must be used to record survey information, tabulate video analysis observations and calculate BCI values at compliance sites and a subset of reference sites and compare these to site-specific compliance thresholds and reference conditions, in accordance with the template instructions (see Section 11 of this technical standard for more information);
- 8.1.2. The environmental licence holder must ensure that the most up-to-date version of each template above, is used.
- 8.1.3. Soft sediment video survey footage must be analysed to identify the video features set out in Table 2 (below) and scored based on the scoring levels and weightings (BCI value = scoring level x weighting) defined in Table 2.
- 8.1.4. All video feature categories must be scored and entered into the relevant soft sediment scoring template with the exception of the dorvilleid polychaete worm categories which are only scored in Macquarie Harbour. In all other regions dorvilleid polychaete worms must be scored within the 'Other worms (Annelids) including spoon worms (Echiurans)' category.

² epa.tas.gov.au/salmon

³ epa.tas.gov.au/salmon

⁴ epa.tas.gov.au/salmon

⁵ epa.tas.gov.au/salmon

Table 2: Video features, scoring levels and weighting to calculate BCI¹ values for soft sediment video surveys (amended from Ross et al. 2021a and Ross et al. 2021b).

Video features		Scoring levels				Weighting
		0	1	2	3	
Seabed observations	Gas bubbling	Absent	On disturbance	Spontaneous outgassing	-	-10
	Sediment colour	Normal ²	Not normal ²	-	-	-1
	Feed pellets/ faeces	Absent	Few	Many	Feed spill	-1
	Biofouling debris	Absent	Sparse	Moderate to dense	-	-1.5
	Bacterial coverage (<i>Beggiatoa</i> spp.)	Absent	Thin patchy or isolated patches	Thick patchy or thin extensive	Thick extensive or streaming	-1.5
	Algal cover	Absent	Sparse	Moderate	Dense	1.5
Worms	Worm tubes/ casts	Absent	Present	-	-	1
	Capitellid polychaete worms (<i>Capitella</i> sp.)	Absent	Few (<10)	Many (≥10)	-	-1.5
	Dorvilleid polychaete worm (<i>Schistomerings loveni</i>) ³	Absent	Few (<30)	Many (≥30)	-	-1.5
	Dorvilleid polychaete worm (<i>Ophryotrocha shieldsi</i>) ³	Absent	Few (<30)	Many (≥30)	-	-1.5
	Sabellid polychaete worms	Absent	Few (<10)	Many (≥10)	-	1
	Other worms (Annelids) including spoon worms (Echiurans)	Absent	Few (<3)	Many (≥3)	-	1.5
Echinoderms	Northern Pacific sea-star (<i>Asterias amurensis</i>)	Absent	Few (<3)	Many (≥3)	-	-1
	Other sea-stars	Absent	Few (<3)	Many (≥3)	-	1
	Brittle stars (Ophiuroids)	Absent	Present	-	-	1.5
	Heart urchins (<i>Echinocardium cordatum</i>)	Absent	Few (<3)	Many (≥3)	-	1
Molluscs	Dog whelks (<i>Nassarius</i> spp.)	Absent	Few (<10)	Many (≥10)	-	-1
	New Zealand screw shell (<i>Moaricolpus roseus</i>)	Absent	Few (<10)	Many (≥10)	-	1
	Side-gilled slugs (Pleurobranchidae)	Absent	Few (<3)	Many (≥3)	-	-1
Crustaceans	Squat lobsters (Galatheidae)	Absent	Few (<3)	Many (≥3)	-	-1
	Pie crust crab (<i>Metacarcinus novaezelandiae</i>)	Absent	Few (<3)	Many (≥3)	-	-1
	Swarming epibenthic crustaceans	Absent	Few (<3)	Many (≥3)	-	1
	Other crustaceans	Absent	Few (<3)	Many (≥3)	-	1
Other	Fish	Absent	Few (<3)	Many (≥3)	-	1
	Other fauna	Absent	Few (<3)	Many (≥3)	-	1
	Burrows/ mounds	Absent	Few	Many	Dense	1.5
	Faunal tracks	Absent	Present	-	-	1

¹ BCI values are calculated by multiplying the relevant scoring level by the weighting for each video feature and adding these together.

² Compared to reference conditions

³ Dorvillies only to be scored in Macquarie Harbour. In all other regions the presence of dorvillies will be included in 'Other worms (Annelids) including spoon worms (Echiurans)'.

- 8.1.5. Key video analysis outputs to be calculated within the soft sediment scoring templates for each video survey are summarised in Table 3:
- (a) for the establishment of reference conditions (baseline or reference site), the lowest reference condition BCI value and the 20th percentile BCI value must be used as compliance thresholds for compliance site surveys.
 - (b) for Farm Zone (pen bay site) video surveys, results must be compared against Farm Zone ecological standards (Marine Environmental Standard, Section 44) to assess compliance and determine whether any Farm Zone response requirements are triggered (Marine Environmental Standard, Section 45).
 - (c) for compliance site video surveys, results must be compared against soft sediment ecological standards (Marine Environmental Standard, Section 47) to assess compliance and determine whether any soft sediment response requirements are triggered (Marine Environmental Standard, Section 48).
 - (d) for re-surveyed reference sites, the median BCI value must be compared against established reference condition BCI values to assess whether reference conditions have significantly changed.
- 8.1.6. In addition:
- (a) in any instances where >5 of the same species of worm (see Table 2) are observed within a survey, the survey location and video time stamp should be recorded and reported to the EPA;
 - (b) where swarms of *Nebalia* sp. are identified within a survey, the survey location and video time stamp should be recorded and reported to the EPA;
 - (c) Where any non-native species are first identified at a lease, compliance site or reference site the survey location and video time stamp should be recorded and reported to the EPA to help track their range distribution;
 - (d) Where any endangered species are identified within a survey, the survey location and video time stamp should be recorded and reported to the EPA.

Table 3: BCI values to be calculated from video analysis.

	Establishing reference conditions	Pen bay sites	Compliance sites	Reference conditions (re-survey)
Survey site BCI value	X	X ¹	X	X
Lowest survey site BCI value ²	X			
20 th percentile BCI value ³	X			
Median BCI value		X ⁴	X ⁵	X ⁶

- 1 The results of the pen bay site (Farm Zone) soft sediment video survey analysis must be assessed against the Farm Zone ecological standards (Marine Environmental Standard, Section 44) to determine whether any Farm Zone response requirements are triggered (Marine Environmental Standard, Section 45).
- 2 The lowest BCI value is to be used as compliance thresholds applicable at or beyond the boundary of the Depositional Zone (Section 11.1 of this technical standard)
- 3 The 20th percentile BCI value for all survey sites is to be used as a compliance threshold applicable at or beyond the boundary of the Depositional Zone (Section 11.1 of this technical standard).
- 4 The median BCI value for all pen bays surveyed is to be used to assess whether Farm Zone response requirements are relevant (Marine Environmental Standard, Section 45(4)).
- 5 The median BCI value is to be compared against the 20th percentile reference condition BCI value to assess whether significant change has occurred (Marine Environmental Standard, Section 47(3)) and whether any soft sediment response requirements are relevant (Marine Environmental Standard, Section 48(1)(a)).
- 6 The results of re-surveyed reference sites are to be compared against previously established reference conditions to determine whether reference conditions have significantly changed.

9. Establishment of Reference Conditions

In relation to soft sediment video surveys, soft sediment reference conditions (henceforth 'reference conditions' within this technical standard) are used as a benchmark to determine significant change in the assessment of compliance with soft sediment ecological standards at compliance sites (Marine Environmental Standard, Section 47).

Depending on the circumstances of each lease, reference conditions will be determined by the Director (in accordance with Section 7 of the Marine Environmental Standard) using information collected:

- (a) during a baseline environmental assessment survey for all new leases or leases which have been dormant for five years or more (Section 16 of the Marine Environmental Standard; Section 9.1 of this technical standard); or
- (b) at soft sediment reference sites for all finfish farms that are already established prior to the implementation of the Marine Environmental Standard and where no baseline survey has been undertaken, or the existing baseline survey does not satisfy the requirements of these contemporary standards (Section 9.2 of this technical standard).

In instances where neither of the above options are available, information collected at survey sites taken along a gradient leading away from a marine finfish farm or any other information that is deemed relevant by the Director may be used by the Director to establish reference conditions (Marine Environmental Standard, Section 7).

In cases involving a lease variation or expansion, where the varied or expanded portion of the lease is likely to have already been impacted by existing farming operations, a habitat assessment may be carried out. Where the habitat is considered to be the same as that observed within the existing lease area, then existing reference conditions may be applied to the new lease area unless otherwise determined by the Director. Where the habitat is considered to differ from that within the existing lease area, reference conditions specific to the varied or expanded portion of the lease may be determined using suitable reference sites.

For leases where reference conditions are established using information obtained from baseline soft sediment video survey data, reference sites must also be specified for each lease and surveyed prior to the commencement (or recommencement) of finfish farming on that lease.

Regardless of the method for determining reference conditions, a representative subset of reference sites must be re-surveyed at each peak production (see Section 11 of this technical standard) and used to assess the likelihood of significant broadscale change to environmental conditions over time. Where data from the subset of reference sites indicates significant change from established reference conditions is likely, all reference sites are to be re-surveyed. If all re-surveyed reference conditions indicate significant change from established reference conditions, the Director will consider the most up to date information (which may include additional monitoring to ensure that observed broadscale changes are not associated with finfish aquaculture) in relation to determining more appropriate reference conditions.

9.1. Baseline Soft Sediment Video Survey

- 9.1.1. For all new leases (or leases which have been dormant for five years or more) baseline environmental assessment surveys must be undertaken in accordance with Section 16, Section 17 and Section 18 of the Marine Environmental Standard and any technical standard made for the purpose.
- 9.1.2. The location and number of baseline soft sediment video survey sites will be determined by the Director.
- 9.1.3. A minimum of 17 suitable baseline soft sediment video survey sites must be surveyed and analysed in accordance with the video survey and analysis techniques within Section 7 and Section 8 of this

technical standard to establish reference conditions to assess compliance using the 20th and 80th percentiles as benchmarks for significant change (with 95% confidence).

9.2. Reference Sites

- 9.2.1. In accordance with Section 5 and Section 7 of the Marine Environmental Standard, the location of soft sediment reference sites will be determined by the Director. Suitable reference sites must have comparable physical, physico-chemical and biological characteristics to baseline sites, such as:
- (a) water depth;
 - (b) sediment chemistry;
 - (c) hydrodynamics;
 - (d) sediment type;
 - (e) faunal composition.
- 9.2.2. Where no baseline survey has been undertaken, or the existing baseline survey does not satisfy the requirements of these contemporary standards, suitable reference sites will be selected based on the physical, physico-chemical and biological characteristics of compliance sites, and any other information considered relevant.
- 9.2.3. A minimum of 17 suitable soft sediment reference sites must be surveyed and analysed in accordance with the video survey and analysis techniques within Section 7 and Section 8 of this technical standard to establish reference conditions for assessing compliance using the 20th and 80th percentiles as benchmarks for significant change (with 95% confidence).
- 9.2.4. Where baseline soft sediment video surveys are being undertaken, soft sediment video surveys at a minimum of 17 reference sites must also be undertaken and compared with baseline soft sediment video survey data to ensure suitability for ongoing use.

9.3. Preparation of Reports

- 9.3.1. After completion of the baseline and/or reference site video surveys to establish reference conditions, a soft sediment video survey report must be submitted to the EPA within 30 days of the survey date or by a date(s) otherwise specified by the Director in writing.
- 9.3.2. The report must provide a summary of survey information including:
- (a) contact details;
 - (b) survey personnel;
 - (c) vessel used to carry out survey;
 - (d) date(s) the survey was undertaken;
 - (e) weather conditions for the duration of the survey.
- 9.3.3. The baseline report or reference site video survey report must include:
- (a) a map with the location of all baseline/reference sites visible and with all surveyed baseline/reference sites marked;
 - (b) filming information including details of equipment used to carry out the filming;

- (c) a summary table outlining the date, dive number for any given survey day, start time, end time, the approved monitoring site location, the video start and end co-ordinates, depth, video compass bearing and weather conditions with respect to each episode of filming. Video start and end time and co-ordinates must be determined from the ROV on screen display;
- (d) a section summarising the key findings from video analysis as tabulated in the soft sediment video survey scoring template, including any observations relating to Section 8.1.6 of this technical standard;
- (e) a summary of all incidences of non-conformance as per Section 12 of this technical standard.

9.3.4. The report must be accompanied by:

- (a) access to the digital video footage specific to the survey (via cloud storage or external hard drive);
- (b) results of the baseline or reference site video survey and associated survey information tabulated within soft sediment video survey scoring template for the establishment of reference conditions, available on the [EPA website](#)⁶;
- (c) geospatial file(s) showing the extent of the video survey, using Differential Global Positioning Systems (DGPS) method of correction. Geospatial projection and datum details must be included as part of the data supplied. Files must be supplied as shapefiles (.shp) or any file format required by the EPA with date and time attributes. Data files must be saved using a consistent naming convention that provides a unique survey identifier including date, lease number (or control site as relevant), survey site name and type of data (e.g. geospatial) separated by an underscore (e.g. 2023-08-06_MF####_PB##_geospatial).

⁶ epa.tas.gov.au/salmon

10. Farm Zone

Farm Zone monitoring involves undertaking soft sediment video surveys which identify key video features on the seabed underneath finfish pens or pen bay grids (pen bay sites). This information is used to determine the environmental condition of soft sediment within the Farm Zone and assess compliance against Farm Zone ecological standards (Marine Environmental Standard, Section 44).

10.1. Ecological Standards and Compliance Thresholds

- 10.1.1. Compliance thresholds for Farm Zone soft sediment video surveys are referred to within the Farm Zone ecological standards and are used to assess whether the licence holder is compliant (Marine Environmental Standard, Section 44).

Extract from Marine Environmental Standard, Section 44, p. 28:

44. Farm Zone Ecological Standards

(1) The licence holder must ensure that:

(a) no spontaneous gas bubbles are released from the sediment; and

(b) no feed spill events occur; and

(c) the benthic condition index (BCI) value of any surveyed pen bay is greater than or equal to zero.

10.2. Survey Timing

- 10.2.1. Farm Zone soft sediment video surveys must be conducted during each peak feed input period in accordance with Section 39 and Section 43 of the Marine Environmental Standard.

10.3. Pen Bay Sites

- 10.3.1. For the purpose of Section 43, Section 44 and Section 45 of the Marine Environmental Standard, pen bay sites are to be randomly selected across the Farm Zone by the Director. These sites will be used to assess compliance with Farm Zone ecological standards and trigger any Farm Zone response requirements within the Farm Zone.
- 10.3.2. The minimum number of pen bay sites to be surveyed and analysed for each Farm Zone is dependent on the total feed intended to be used within the Farm Zone during the current production cycle, see Table 4 for details.
- 10.3.3. Additional pen bay sites may be required by the Director (in accordance with Section 43 of the Marine Environmental Standard) including situations where there is less than five metres of water depth between the bottom of the nets and the seabed at low tide for any given pen or pen bay, in accordance with Section 39(2)(b) of the Marine Environmental Standard.
- 10.3.4. Pen bay sites must be surveyed and analysed in accordance with the video survey and analysis techniques within Section 7 and Section 8 of this technical standard.

Table 4: Minimum number of pen bay sites required for Farm Zone soft sediment video surveys

Total amount of feed to be used within the Farm Zone during the current production cycle (Tonnes)	Minimum number of pen bay sites
≤500	7
500 – 1,500	8
1,501 – 2,500	9
2,501 – 3,500	10
3,501 – 4,500	11
4,501 – 5,500	12
5,501 – 6,500	13
6,501 – 7,500	14
7,501 – 8,500	15
8,501 – 9,500	16
>9,500	16 pen bay sites + 1 additional pen bay site for every additional 1,000 tonne increment in total feed used above 9,500 tonnes

10.4. Preparation of Reports

- 10.4.1. After completion of the Farm Zone soft sediment video surveys, a Farm Zone soft sediment video survey report must be submitted to the EPA within 30 days of the survey date(s) in accordance with Section 43 of the Marine Environmental Standard.
- 10.4.2. The Farm Zone soft sediment video survey report must provide details of survey information including:
- (a) contact details;
 - (b) marine lease (and/or permit) surveyed and lease (and/or permit) manager;
 - (c) survey personnel;
 - (d) vessel used to carry out survey;
 - (e) date(s) the survey was undertaken;
 - (f) a summary of weather conditions for the duration of the survey.
- 10.4.3. The Farm Zone soft sediment video survey report must include:
- (a) a map of the lease or permit area with the location of the Farm Zone and pen bay sites surveyed clearly visible;
 - (b) filming information including details of equipment used to carry out the filming;
 - (c) a table detailing the total feed input (tonnes) and stocking and fallowing information for each pen or pen bay within the Farm Zone since the last fallow period;
 - (d) a summary table outlining the date, dive number for any given survey day, start time, end time, the video start and end co-ordinates, depth, video compass bearing, weather conditions and whether the dive was associated with a stocked or fallowed pen or pen bay with respect to each episode of filming. Video start and end time and co-ordinates must be determined from ROV on screen display;

- (e) the key findings from video analysis as tabulated in the soft sediment video survey scoring template, including any observations relating to Section 8.1.6 of this technical standard. This section must clearly identify sites where soft sediment video surveys show evidence of non-compliance with Farm Zone ecological standards (Marine Environmental Standard, Section 44).
- (f) any Farm Zone response requirements (Marine Environmental Standard, Section 45) triggered in relation to individual pen bay sites or Farm Zones, and information detailing what actions will be taken, or have been taken, to adequately implement the Farm Zone response requirements;
- (g) information on the intended farm stocking management plan for the site over the next production cycle including a schematic of pen bays or pen bay grid(s) and information outlining the timing/ duration of intended fallowing by pen bay. Where the location of any pen bays is to be varied within the pen bay grid/ Farm Zone or a new pen bay or pen bay grid is proposed, the schematic must also show the location of new pen bays/ pen bay grids relative to the current pen bay grid, clearly showing all pen bay identifiers and the intended month of restocking;
- (h) details of all marine debris identified, actions taken and evidence of removal and disposal;
- (i) details of all incidences of non-conformance as per Section 12 of this technical standard.

10.4.4. In addition to any requirements stipulated within the Environmental Licence, the report must be accompanied by geospatial file(s) showing the extent of the video survey, using DGPS method of correction. Geospatial projection and datum details must be included as part of the data supplied. Files must be supplied as shapefiles (.shp) or any file format required by the EPA with date and time attributes. Data files must be saved using a consistent naming convention that provides a unique survey identifier including date, lease number (or control site as relevant), survey site name and type of data (e.g. geospatial) separated by an underscore (e.g. 2023-08-06_MF####_PB###_geospatial).

11. Depositional Zone

Monitoring at or beyond the outer boundary of the Depositional Zone (at compliance sites) involves undertaking soft sediment video surveys which identify key features on the seabed. This information is used to determine the environmental condition of the seabed at or beyond the boundary of the Depositional Zone.

The environmental condition of the seabed at compliance sites is compared against reference conditions to assess compliance with soft sediment ecological standards (Marine Environmental Standard, Section 47).

In addition, a representative number of reference sites must be re-surveyed at peak feed input in accordance with Section 46(1)(a) of the Marine Environmental Standard to determine whether previously established reference conditions remain relevant (see Section 9 of this technical standard).

11.1. Ecological Standards and Compliance Thresholds

- 11.1.1. Compliance thresholds for compliance site soft sediment video surveys are referred to within the soft sediment ecological standards and are used as a benchmark to assess whether the licence holder is compliant (Marine Environmental Standard, Section 47).

Extract from Marine Environmental Standard, Section 47, p. 29:

47. Soft sediment Ecological Standards

- (1) The licence holder must ensure that at any soft sediment compliance site the benthic condition index (BCI) value is not below the lowest reference condition BCI value;*
- (2) The licence holder must ensure that at any soft sediment compliance there are no:*
- (a) gas bubbles arising from the sediment; or*
 - (b) fish feed pellets on the sediment.*
- (3) The licence holder must ensure that the median BCI value, when calculated for all soft sediment compliance sites combined, does not significantly change from reference conditions for that lease or permit area.*
- (4) The licence holder must ensure that at any soft sediment compliance site, when compared with reference conditions, there are no:*
- (a) significant changes in sediment redox potential or sulphide concentration; or*
 - (b) significant changes in sediment infauna diversity, richness, or abundance.*

- 11.1.2. Compliance thresholds that relate to BCI values (Section 47(1) and Section 47(3) of the Marine Environmental Standard) are determined based on the relevant reference condition BCI values (see Section 9 of this technical standard).
- 11.1.3. In relation to Section 47(1) of the Marine Environmental Standard, the lowest reference condition BCI value refers to the lowest relevant baseline or reference site BCI value used in the determination of reference conditions.
- 11.1.4. In relation to BCI values at compliance sites within this technical standard, significant change is defined as a median BCI value (calculated from all surveyed compliance sites) that is less than the 20th percentile of the reference condition BCI value.

11.2. Survey Timing

- 11.2.1. Compliance site soft sediment video surveys must be conducted during each peak feed input period in accordance with Section 46 of the Marine Environmental Standard.
- 11.2.2. A representative subset of reference sites must be re-surveyed during each peak feed input period in accordance with Section 46 of the Marine Environmental Standard.

11.3. Compliance Sites

- 11.3.1. For the purpose of Section 46, Section 47 and Section 48 of the Marine Environmental Standard, soft sediment compliance sites will be located at or beyond the boundary of the Depositional Zone (i.e. 35 m from the lease boundary) parallel to each lease boundary at distances no greater than 300m apart unless otherwise determined by the Director in writing. The position of each soft sediment compliance site will be determined by the Director in accordance with Section 9 of the Marine Environmental Standard.
- 11.3.2. A two-tiered soft sediment monitoring framework will be implemented for soft sediment compliance sites. See Figure B2 in Appendix B for an overview of the two-tiered monitoring framework.
- 11.3.3. For Tier I monitoring, compliance site surveys must be conducted at a minimum of 6 soft sediment compliance sites considered by the Director to be at the highest risk of organic enrichment from finfish farm operations. In addition, for each lease boundary considered to be at high risk of organic enrichment, a minimum of 4 compliance sites chosen by the Director must be surveyed. Risk in this context is to be assessed using information on:
 - (a) farm management during the current production cycle;
 - (b) historical environmental performance of the lease;
 - (c) local hydrodynamics;
 - (d) any other relevant scientific information.
- 11.3.4. Where non-compliance with Section 47(1) and Section 47(2) of the Marine Environmental Standard is observed at $\geq 50\%$ of compliance sites surveyed for Tier I monitoring, Tier II monitoring is triggered.
- 11.3.5. Tier II monitoring requires all compliance sites established in accordance with Section 11.3.1 of this technical standard, to be surveyed.
- 11.3.6. Where non-compliance with Section 47(3) of the Marine Environmental Standard is observed during Tier II monitoring, Section 48(1)(a) applies. For the purpose of Section 47(3), significant change is defined as a median compliance site BCI value (calculated from all compliance sites) that is less than the 20th percentile reference condition BCI value.
- 11.3.7. With the exception of 'isolated patches' (defined as $< 25\%$ of the field of view and that are not associated with other patches of bacterial cover within the video footage), observations of bacterial coverage at compliance sites trigger an extent survey to be carried out at the time of the compliance monitoring (Tier I or Tier II).
- 11.3.8. An extent survey site must be established at a distance of 50m from the compliance site where bacterial coverage has been identified within video footage. An extent video survey must be undertaken in line with and parallel to the affected compliance site survey trajectory. Where further bacterial coverage is identified within the extent survey, a second extent survey must be

conducted at a distance of 50m away from the first, and so on until the outer boundary of bacterial coverage has been defined. See Figure B3 in Appendix B.

- 11.3.9. Soft sediment compliance site surveys and extent surveys must be conducted and analysed in accordance with the video survey and analysis techniques within Section 7 and Section 8 of this technical standard.

11.4. Reference sites

- 11.4.1. Soft sediment video surveys must be undertaken at a minimum of 6 of the soft sediment reference sites specified under Section 9 of this technical standard, to assess the likelihood of significant broadscale change in environmental conditions since reference conditions were determined by the Director.
- 11.4.2. Soft sediment reference sites must be surveyed and analysed in accordance with the video survey and analysis techniques within Section 7 and Section 8 of this technical standard.
- 11.4.3. In relation to BCI values at reference sites re-surveyed during peak feed input period (Section 11.2.2 of this technical standard), significant change is defined as a median BCI value (calculated from six reference sites to derive a 95% confidence interval) that is between the 20th and 80th percentile of the reference condition BCI value (Section 9 of this technical standard).
- 11.4.4. Where data from the re-surveyed reference sites is indicative of significant change from established reference conditions (i.e. the median BCI value calculated for six reference sites is less than the 20th percentile, or more than the 80th percentile reference condition BCI value), all reference sites are to be re-surveyed and analysed to calculate a median BCI value and 20th and 80th percentiles BCI values (with 95% confidence) for comparison to previously determined reference conditions.
- 11.4.5. In situations where analysis from all re-surveyed reference sites indicates significant change from previously established reference conditions, the Director will consider the most up-to-date information available (which may include a requirement for additional monitoring to ensure that observed broadscale changes are not associated with finfish aquaculture) in relation to determining more appropriate reference conditions.

11.5. Preparation of Reports

- 11.5.1. After completion of the compliance site and reference site soft sediment video surveys, a report must be submitted to the EPA within 30 days of the survey date(s) in accordance with Section 46 of the Marine Environmental Standard.
- 11.5.2. The soft sediment video survey report must provide details of survey information (for all relevant surveys) including:
 - (a) contact details;
 - (b) associated marine lease (or permit) and lease (or permit) manager;
 - (c) survey personnel;
 - (d) vessel used to carry out survey;
 - (e) date(s) survey was undertaken;
 - (f) weather conditions for the duration of the survey.

- 11.5.3. Regarding the compliance site soft sediment video survey, the report must include:
- (a) a map of the lease area, Farm Zone(s) and the location of all compliance sites and reference sites, with surveyed compliance sites and re-surveyed reference sites clearly marked;
 - (b) filming information including details of equipment used to carry out the filming;
 - (c) a table outlining the date, dive number for any given survey day, start time, end time, the approved compliance site and re-surveyed reference site co-ordinates, the video start and end co-ordinates, depth, compass bearing and weather conditions with respect to each episode of filming. Video start and end time and co-ordinates must be determined from the ROV on screen display;
 - (d) the key findings from video analysis as tabulated in the soft sediment video survey scoring template, including any observations relating to Section 8.1.6 of this technical standard;
 - (e) details of compliance sites where soft sediment video surveys show evidence of non-compliance in relation to the soft sediment ecological standards (Marine Environmental Standard, Section 47) or the presence of bacterial coverage;
 - (f) details of any soft sediment response requirements (Marine Environmental Standard, Section 48) triggered in relation to the soft sediment compliance survey;
 - (g) information clearly identifying whether the median BCI of re-surveyed sites indicate significant change from previously determined reference conditions;
 - (h) information detailing what actions will be taken, or have been taken, to adequately implement the soft sediment response requirements and/or non-compliance with soft sediment ecological standards (Marine Environmental Standard, Section 47);
 - (i) details of all marine debris identified, actions taken and evidence of removal and disposal;
 - (j) details of all incidences of non-conformance as per Section 12 of this technical standard.
- 11.5.4. In addition to any requirements stipulated within the Environmental Licence, the report must be accompanied by geospatial file(s) showing the extent of the video survey, using DGPS method of correction. Geospatial projection and datum details should be included as part of the data supplied. Files must be supplied as shapefiles (.shp) or any file format required by the EPA with date and time attributes. Data files must be saved using a consistent naming convention that provides a unique survey identifier including date, lease number (or control site as relevant), survey site name and type of data (e.g. geospatial) separated by an underscore (e.g. 2023-08-06_MF####_PB##_geospatial).

12. Non-Conformance

- 12.1.1. The licence holder must have a documented procedure(s) approved by the EPA which must be followed when any aspect of their soft sediment video surveys (baseline, reference site, Farm Zone or compliance site surveys) do not conform to the requirements of this technical standard.
- 12.1.2. This procedure must ensure that incidences of non-conforming soft sediment video survey work are:
 - (a) recorded;
 - (b) investigated;
 - (c) evaluated for significance and to assess whether survey results are valid; and
 - (d) evaluated to determine risk of recurrence and identify any corrective actions within the licence holders organisational procedures that may be implemented to reduce risk of future non-conformance.
- 12.1.3. Where non-conformance has occurred the licence holder must notify the EPA by email to salmon.reg@epa.tas.gov.au of the non-conformance occurring, including information regarding the non-conformance as per Section 12.1.2 of this technical standard and must advise of any proposed revision to survey methodology and/or timing as relevant, for approval by the EPA.
- 12.1.4. Details (as per Section 12.1.2 of this technical standard) of all non-conformances must be included within all relevant reports submitted to the EPA.

Appendices

Appendix A

Table A1: Overview of Farm Zone soft sediment video survey requirements within the Marine Environmental Standard

Requirements	Marine Environmental Standard Section	Comments
Conduct survey	Section 43 (1)	Peak production requirements (Section 41) are applicable
Comply with ecological standards	Section 44	
Implement response measures	Section 45	Either to individual pen bays (Section 45 (1), (2), (3) & (5)) or for a pen bay grid (Section 45 (4))
Provide report	Section 43 (2) & (3)	Includes access to survey footage

Table A2: Overview of compliance site soft sediment video survey requirements within the Marine Environmental Standard

Requirements	Marine Environmental Standard Section	Comments
Conduct survey	Section 46 (1)	Peak production requirements (Section 41) are applicable
Comply with ecological standards	Section 47	Comparison with reference conditions is required in Section 47 (1) & (3)
Implement response measures	Section 48	Actions required under Section 48 are subject to a separate technical standard
Provide report	Section 46 (1)(c) & (2)	Includes access to survey footage

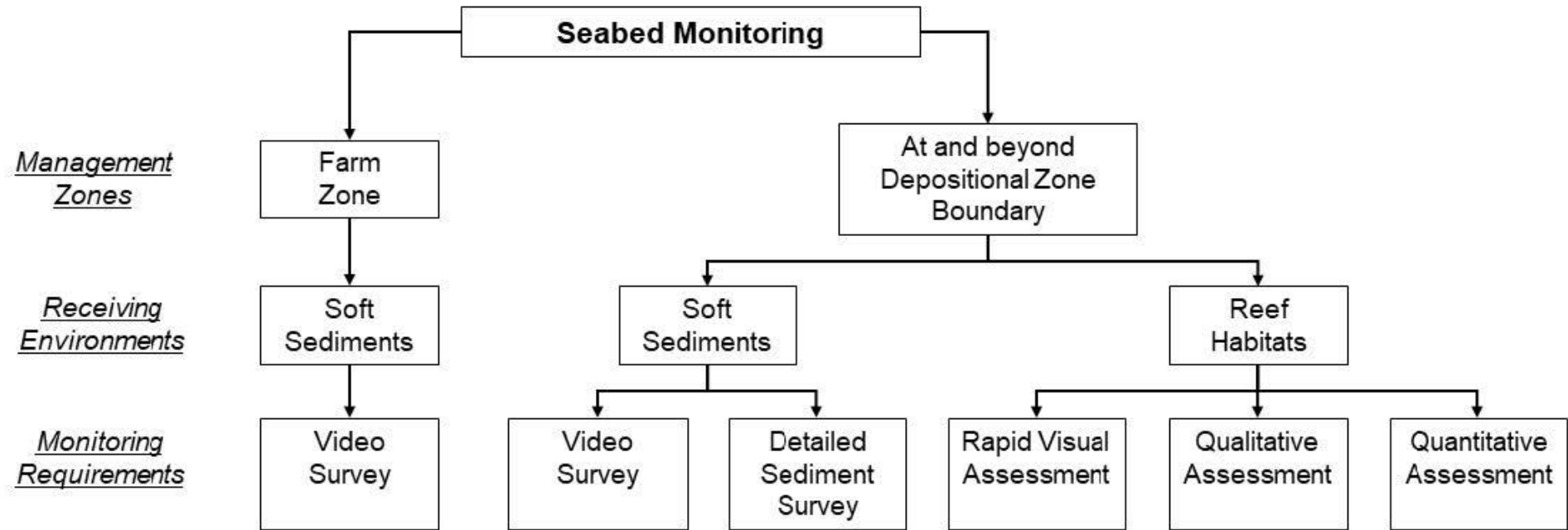


Figure A1: Overview of monitoring requirements for different receiving environments in the Farm Zone and at or beyond the Depositional Zone boundary, as per the Marine Environmental Standard (Reprinted from Companion Paper – Environmental Standards for Tasmanian Marine Finfish Farming 2023 by the Department of Natural Resources and Environment Tasmania, 2023)

Appendix B

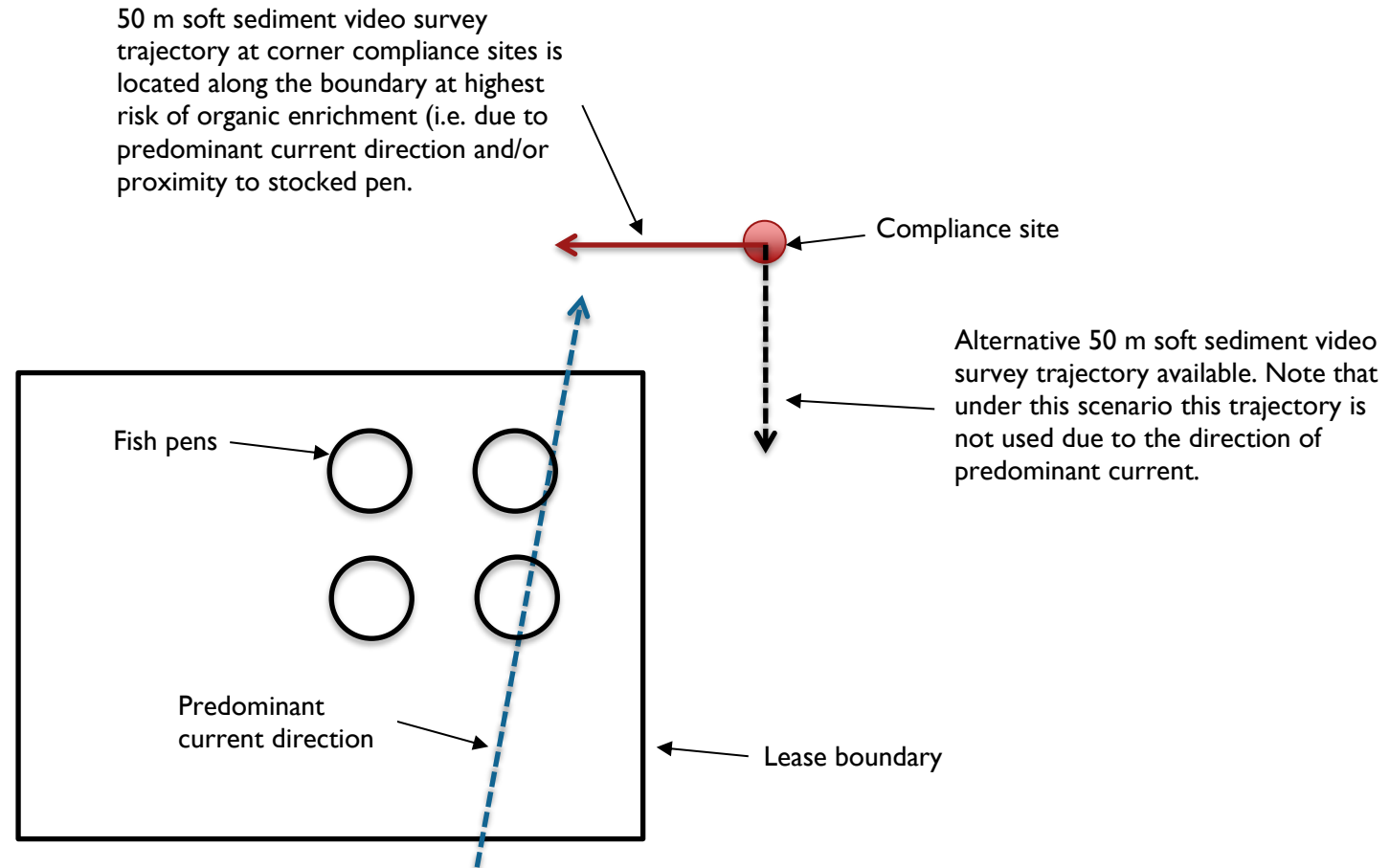


Figure B1: Schematic to illustrate the trajectory (relative to lease boundaries) on which soft sediment video surveys must be undertaken when compliance sites are located at lease corners. For each compliance site on lease corners, one trajectory should be chosen based on the greatest risk of organic enrichment likely to be observed.

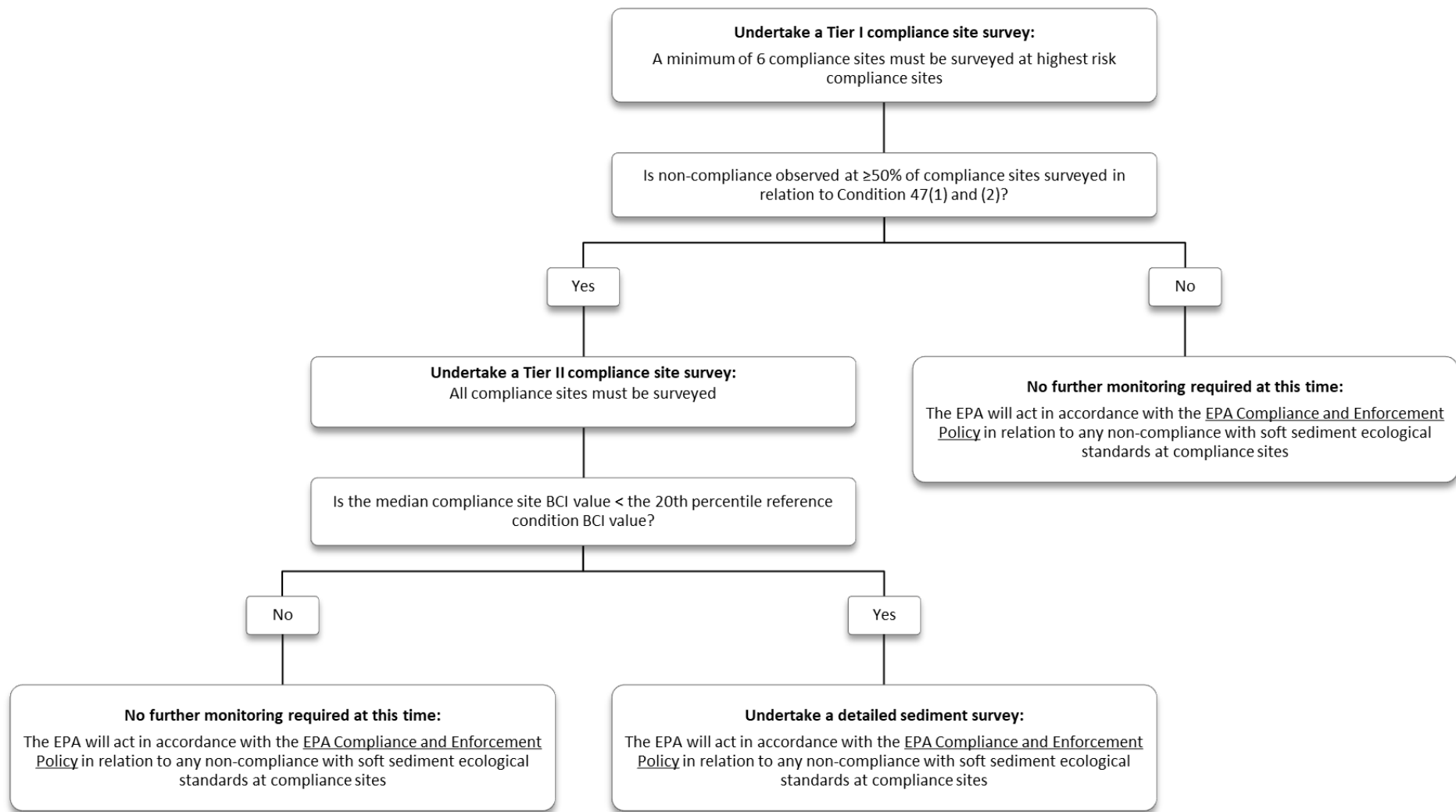


Figure B2: Flow diagram to illustrate how the Tier I and Tier II compliance site soft sediment video surveys and compliance site detailed sediment surveys interact within the regulatory monitoring framework for finfish farm compliance sites. It should be noted that if any bacterial coverage (with the exception of ‘isolated patches’) is observed during soft sediment video surveys, extent surveys are triggered.

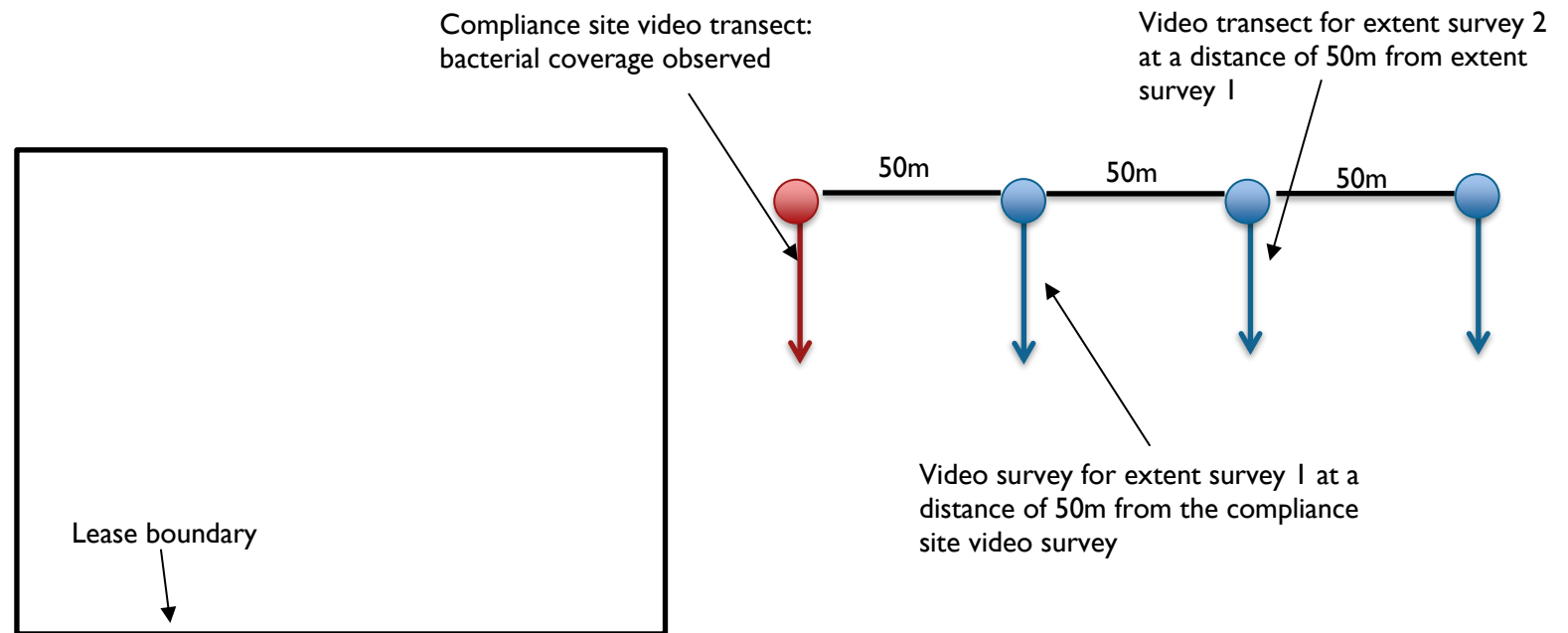


Figure B3: Schematic to illustrate the location and trajectory (relative to lease boundaries) of extent surveys. Where bacterial coverage (excluding ‘isolated patches’) has been observed at a compliance site, extent surveys must be undertaken parallel to compliance site video survey trajectories, at 50m intervals away from the lease until the extent of bacterial coverage has been defined.



ENVIRONMENT PROTECTION AUTHORITY