1. **Outline of Requirements**

Lessees must provide a baseline environmental survey as specified by the Secretary. A baseline environmental survey must be undertaken prior to the commencement of marine farming operations on those areas; where a new lease area is being established; or when required as a condition of varying or expanding a lease area; or where a marine farming licence is varied to allow the farming of another species not addressed by the existing baseline survey for the lease.

The environmental baseline survey report must be submitted to the Marine Farming Environment Section, Department of Primary Industries, Parks, Water and Environment (the Department) by the applicant in accordance with section 2.7 of this schedule.

The sampling is to be conducted at each of the sites shown on the enclosed map. All sampling requirements (prescribed control, sample site, spot dives or transect and farm dive GDA 94 MGA Zone 55 coordinates) of the survey are to be located and recorded using differential GPS (DGPS). All sample collection and filming is to be conducted on the same day, (or within one week if not practicable).

The applicant must notify the Marine Farming Environment Section, DPIPWE (phone (03) 6233 3370 or email mfarming.environment@dipwe.tas.gov.au) of the sampling date chosen at least 48 hrs prior to conducting the survey to enable a Marine Farming Environmental Officer to be present to audit the survey.

The person(s) undertaking the monitoring must be covered by appropriate permit(s) specific to the work. Permits include:

1. **Living Marine Resources Management Act 1995 (LMRMA):** Pursuant to s12 LMRMA, any person undertaking environmental monitoring in State waters must obtain a permit to do so insofar as such monitoring involves a breach of that Act.

2. **Threatened Species Protection Act 1995 (TSPA):** Any person knowingly collecting any specimen of a listed taxon of flora or fauna can only do so if covered by a permit issued pursuant to s51 of the TSPA. Further details can be obtained from ThreatenedSpecies.Enquiries@DPIPWE.tas.gov.au.

The baseline survey for salmonid finfish must include the following components, as detailed in section 2 of this Schedule unless otherwise directed by the Secretary:

2.1 Current measurements
2.2 Bathymetric profile
2.3 Seabed characteristics/habitat type profile
2.4 Underwater video survey
2.5 Sediment chemistry - redox, sulphide, particle size analysis, organic content, heavy metal analysis
2.6 Biological analysis* - benthic faunal analysis
2.7 Reporting of results to Marine Farming Environment Section

* This component of the Baseline Environmental Survey applies only to lease areas that are new or where an existing lease has been relocated >500m from any area previously occupied by the lease to which this schedule relates. (Note that where relevant, benthic sampling for threatened species may be specified for any baseline environmental survey.)
2. Environmental Baseline Survey Specifications

2.1 Current measurements

Current speed and direction are to be measured at a maximum of 30 minute intervals continuously over a 6 week period at one site within the lease area, at a location to be specified by the Director Marine Resources. The current meter should be located two metres above the bottom and its exact location defined by GDA 94 MGA ZONE 55 co-ordinates.

The current meter should be accurate to within 5%, and capable of detecting a current of 2.5 cm/sec. The current meter should be regularly maintained to ensure correct operation, including cleaning of fouling organisms.

Data must be presented graphically in the following format:

- Frequency of speed records – frequency (%) vs current speed interval (cm/sec), (bar chart);
- Frequency of direction records - frequency (%) vs current flow direction (°mag), (bar chart);
- Current flow direction (°mag) vs current speed (cm/sec), (scatter plot);
- Raw data plot including direction, temperature and salinity vs time, and
- Raw data plot including direction and speed vs time.

Where possible the scale on each axis should be the same. All raw data must also accompany the final baseline report in the form of excel files.

2.2 Bathymetric profile

Depths (m) accurate to 0.5m are to be measured across the lease area and for an area extending 50m beyond the boundaries of the lease area. Measurements should be made by a boat with echosounder and by differential GPS (or log measuring distance ). The records of depth should be made by soundings every 100m.

The approximate position of depth contours are to be presented on a map of the lease area.

2.3 Seabed Characteristics and habitat profile

Location of major habitat type(s) must be detailed on a map of the lease area. The map of significant seabed features is required as an overlay for the bathymetric map. The data for the sketch map can be collected by echo or side-scan sonar, diving, or underwater video to classify the major habitat types on the seabed in the lease area. These may include, but are not limited to:

- hard bottom - rock, limestone reef, boulders, rubble etc
- soft bottom - sand, mud/silt etc
- marine plants- composition of dominant species present

2.4 Underwater Video Survey

The survey is to include an underwater video survey, made using external and internal spot dives. An internal spot dive is one made within the lease area and an external spot dive is one made outside the lease area.

External spot dives:
The spot dives are to be carried out in the locations specified on the attached map.

Each set of 35m external spot dives will consist of:

- a minimum of one upstream and one downstream set of spot dives located parallel to the lease boundary. Each set of spot dives will consist of a minimum of 3 spot dives at least 20 metres apart parallel to the lease boundary at a distance of 35m from the lease boundary. Each spot dive must record a minimum of 3 minutes of video footage. GDA 94 MGA ZONE 55 coordinates of
each spot dive must be recorded. If current flow is not known or variable, additional spot dives/transects may be required off the remaining lease boundaries.

In addition, spot dives must be conducted at 6 control sites with a sediment particle size similar to that found at the 35m compliance points. These spot dives must be at least 20m apart.

Where a transect line is used it shall consist of a weighted line of known diameter with clearly marked tags 5m apart.

**Internal spot dives:**
In addition to the external dives, spot dives must also be performed inside the lease area to characterise the habitat that exists within the lease area. GDA 94 MGA ZONE 55 co-ordinates of each within lease spot dive must be recorded. The number of habitat dives required will be dependent on the lease area to be surveyed and should be determined in accordance with the following:

<table>
<thead>
<tr>
<th>Lease area to be surveyed (Ha)</th>
<th>Number of habitat dives</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>2</td>
</tr>
<tr>
<td>6-10</td>
<td>4</td>
</tr>
<tr>
<td>11-20</td>
<td>6</td>
</tr>
<tr>
<td>21-40</td>
<td>8</td>
</tr>
<tr>
<td>41-100</td>
<td>10</td>
</tr>
</tbody>
</table>

**2.4.1 Filming Procedure**

**Spot dives:**
For regulatory spot dives filming must be conducted slowly to ensure clear images of the seabed in the vicinity of the anchor marking the spot dive are recorded. Each spot dive site must be clearly identified on the video footage. Footage must show a minimum of 3 minutes of clear footage. Filming is to include sufficient coverage of the sediments in the vicinity of the dive site together with some stationary footage recorded with the camera lens pointing vertically down. The sediment must be disturbed and video footage recorded to assess presence of outgassing (i.e. sediment is to be disturbed and camera tilted up to the vertical so that any ascending bubbles can be seen).

If an ROV is used and tethered to a shot line the operator must ensure that if sediments are stirred up, the ROV can move to clear water showing undisturbed sediments and providing optimal visibility before filming should commence.

Where relevant, filming is to be conducted with the transect line in view. Each transect must be identified on the film with the appropriate transect number e.g. T1, T2 etc. Filming must be conducted slowly along the transect line to ensure that clear images of the transect line and seabed are recorded. For a standard 40m transect, stationary video footage must be obtained at three points specified on the survey map with the camera lens pointing vertically downward with the transect line in view. The sediment must be disturbed and filmed at each specified site along the transect including vertical footage to check for the presence of outgassing on disturbance.

**2.4.2 Equipment**

All video footage is to be colour and in a standard digital format (or equivalent), to allow for computerised image analysis that will be conducted by the Department. Clear, well lit images on high quality discs are required. The camera / ROV must be capable of operating at a minimum of 3 lux. A record of the date, time and type of filming (control/transect/farm dive, etc) must be provided at the start of each filming sequence.

Underwater housing to suit the camera must be used and fitted with a minimum of 2 x 50W lights or equivalent in LED’s.

DVD copies of the underwater footage must submitted with the report.
The report must include comments on the following:

- Sediment colour (e.g. from brown/ grey to black),
- Texture of sediments (e.g. sand, silt mud)
- Seaweed/seagrass cover
- Visibility near cages
- Variety and density of animals living on and in the seabed
- Presence of bacterial mats (e.g. Beggiatoa spp.)
- Outgassing from the sediment (including any outgassing upon disturbance)
- Presence of finfish faeces and/or feed pellets
- Any other relevant features.

2.5 Sediment chemistry

2.5.1 Visual assessment, redox and sulphide

One undisturbed sediment core is to be taken using a perspex corer with an internal diameter of at least 50 mm at each sample site specified in the survey. A written description of each core recording the following parameters is required:

- length of core measured in millimetres with a ruler;
- sediment colour, from the surface to deeper layers;
- visible animal and plant life;
- gas vesicles if present and the size and position of the vesicles in the sediment;
- any sediment smell indicating for example, the presence/absence of hydrogen sulphide;

2.5.2 Redox and sulphide

The following protocols for redox and sulphide measurement have been drawn from Macleod et al. (2004). Redox potential and sulphide concentration measurements are to be taken from each sediment core. Both redox and sulphide should be measured at 3cm depth. There are a variety of redox probes available; single cell and combination electrodes. For ease of sampling the combination electrodes are recommended. Prior to each set of measurements being taken the probe should be calibrated. Pre-packaged calibration solutions can be purchased. As calibration is sensitive to temperature it is important to note the temperature of both the calibration solution and the sample at the time of sampling. It is best if these temperatures are comparable.

To obtain a redox measurement, the probe is inserted into a port in the side of the core tube. This port must be positioned at 3cm below the sediment water interface. Redox potential values should be allowed to stabilise prior to recording. Depending on the sediment condition the measurement may settle quickly or it may take a few minutes. Redox measures the oxidation/reduction potential of the sediments by determining the availability of free hydroxyl ions. Measurement will itself affect this level and therefore the reading on the meter will continue to decline (albeit slowly) whilst the measurement is being made. Consequently it is not necessary for the probe to stabilise completely before taking a reading, simply ensure that the rate of decline has steadied. Note: that an error level of +/- 10-20mV in the final reading is acceptable. Corrected redox results and raw data are to be reported in millivolts at 3cm depth.

There are a variety of different probes available for the measurement of sulphide concentration, but again a combination electrode is recommended. Each manufacturer will have slightly different specifications regarding use, sensitivity and calibration and these should be followed carefully. Prior to each sampling occasion, a Sulphide Anti-Oxidant Buffer (SAOB) must be prepared (see technique below) and standard curves should be established for calibration.

A sediment sub-sample (2ml) is extracted from the port in the side of the core tube using a 5ml syringe, and placed in a glass vial. SAOB (2ml) is added to each jar and sulphide concentration measured (mV) by placing the probe into the jar, and slowly stirring the sediment/buffer mix until the reading stabilises. The mV readings can be converted to sulphide concentration using the calibration curve. Samples should be collected and converted sulphide results (µM) and raw data (mV) are to be reported for 3cm depth. (TAFI, 2004).
**Preparation of Sulphide Anti-Oxidant Buffer Solution (SAOB):**

The SAOB solution can be purchased or it can be prepared by adding 20.0g of NaOH (Sodium Hydroxide pellets) and 17.9g of EDTA (Ethylenediaminetetra-acetic acid) in a 250ml volumetric flask and diluting to volume with distilled water. This solution should be refrigerated until required. Just prior to use add 8.75g of ascorbic acid for every 250ml of solution required. Once ascorbic acid has been added, the solution will only remain viable for 3 hours.

**Calibration of the Sulphide Probe**

Macleod et al. (2004) provides information on calibration procedures for a Cole-Parmer 27502-40 silver/sulphide electrode. If an alternative probe is to be used, it is recommended that manufacturer guidelines are referred to for specific details.

2.5.3 **Particle size Analysis**

A subsample of sediment from the top 100mm of each core should be placed in container of known volume (fill to top). Gently wet sieve each sample through a sieve stack of 4, 2, 1 mm, 500 μm, 250 μm, 125 μm, 63 μm either by hand or using a sieve shaker. The less than 63 μm fraction is allowed to drain away, i.e. not collected. The material remaining on each sieve is carefully removed and placed in a graduated cylinder. A known volume of water is added (this volume should remain consistent throughout the procedure). The volume of sediment from this fraction is measured as the displaced volume. This process should be repeated for all sieve fractions.

The sum of all sieve fractions subtracted from the initial volume will give the less than 63 μm fraction. The data is to be provided in an Excel spreadsheet and graphed as cumulative percentages.

2.5.4 **Organic Content**

A single undisturbed sediment core is to be taken using a perspex corer with an internal diameter of at least 50 mm at each sample site specified in the survey for the purposes of organic content analysis. The top 3 cm of each core is to be oven dried at 60°C prior to analysis of total organic carbon (loss on ignition at 450°C in a muffle furnace for 4 hours).

2.5.5 **Heavy Metal Analysis**

A single undisturbed sediment core is to be taken using a perspex corer with an internal diameter of at least 50 mm at each sample site specified in the survey for the purposes of heavy metal analysis. The top 3 cm of sediment within the core must be transferred to an acid washed glass jar and stored at a constant, cool temperature whilst conducting the survey. Samples must be submitted to and processed by a NATA accredited laboratory. Analysis should include the following metals As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Zn. Results of all metal analyses are to be presented in the baseline report.

2.6 **Biological analysis**

This component of the Baseline Environmental Survey applies only to lease areas that are new or where an existing lease has been relocated >500m from any area previously occupied by the lease to which this schedule relates. (Note: that where relevant, benthic sampling for threatened species may be specified for any baseline environmental survey.)

**Benthic faunal analysis:**

Single Van Veen grabs or diver collected wide-diameter core samples (150mm diameter x depth 100mm) are to be taken at each of the sample sites located 35 metres from the nominated boundaries, or any other designated sampling site. Each benthic sample should be sieved through a 1 mm sieve and all fauna identified to family level and counted. It will be necessary however, to take the identification of several taxa down to
species level. These groups currently include (but are not limited to) the Family Capitellidae, Family Turitellidae (See Annexure II for sampling protocols) and all introduced marine species.

Each benthic sample should be processed separately and identically.

Preservation/Retention of Samples:
All fauna collected must be preserved in formaldehyde solution. After identification and enumeration of the organisms, they are to be transferred to 70% alcohol for long-term storage. Storage jars must be labelled (inside and outside) with details of date of collection, site location, collection method, and collectors' and identifiers' name. The jars are to be stored for at least 5 years in a readily accessible place so that confirmation of identification can be investigated at a later date if required.

2.7 Reporting of Results to the Department

2.7.1 Final Baseline Report
The final baseline report must be submitted within one month of conducting the baseline survey for sites that have undergone an expansion in lease area, or have relocated to an area within 500m of the old lease site. In cases where benthic and/or current data is required as part of the baseline survey, an interim report should be submitted one month after the survey was conducted with the final report including all other results submitted no later than four months after the baseline survey was conducted.

All requirements for reporting of the baseline survey are to be incorporated into a single document. It is important that the document is a complete record of work undertaken.

The raw data must be provided as hard copy and electronically in the formats specified below in Annexure 1 to this Schedule or as otherwise required by the Director. A concise interpretation of the data should be provided for each parameter in the report. The report should comply with the requirements of Annexure 1.

All documents lodged with the Department must be approved by and submitted in full by the applicant.

The Director, Marine Resources must approve the assessment and interpretation of baseline information prior to issuing any written authorisation to the applicant to allow marine farming to commence.

3. Map
A map of sampling sites and their co-ordinates relating to this licence will be provided to the lessee and, if requested, to person(s) undertaking the survey.

References
Annexure 1

ENVIROMENTAL ASSESSMENT OF LEASE AREA #

Marine Farming Lease No.:

Applicant’s name:

Name of Person(s) / organisation conducting environmental assessment:

Introduction: Preamble to the report indicating any previous work done relevant to this report and work done at the lease area.

Methods and results: The methods used for the assessment of each parameter and the results are to be presented in the same order as in the environmental assessment requirements. Data must be summarised in tables and graphs and the raw data attached as appendices.

Interpretation: An interpretation of the data providing an integrated understanding of the results must be included in the report. Any unusual results should be highlighted.

Data: Original, raw data shall be provided as hard copy and in electronic form (either on disc or via email) which is compatible with the database system and software currently used by the Marine Farming Environment Section. Results are to be provided electronically in Excel spreadsheets and Access Database files (Templates will be provided) and appropriate digital footage in Pal format is to accompany the report.

The data must include:

- date, time, weather conditions of the sampling day;
- Unless otherwise specified, DGPS files DXF (Drawing Exchange Format)/ESRI (Environmental Systems Research Institute) shape file format providing position fixes and at least one spm (State permanent mark) reference fix. Data files are to include date and time attributes;
- current meter results and interpretation* - electronic data must be supplied;
- an interpretation of video footage (using the Microsoft Access Database template file provided and employing assessment techniques identified in section 7.1, Macleod and Forbes 2004);
- description and interpretation of core profiles;
- interpretation (written and graphical) of redox results recorded from cores;
- interpretation (written and graphical) of sulphide results recorded from cores;
- interpretation (written and graphical) of sediment particle size analysis;
- interpretation (written and graphical) of heavy metal analysis; and
- where relevant, an interpretation of results (written and graphical) from the benthic organisms from grab/core samples*

* Note that where current meter and/or benthic infaunal assessment is required as part of the baseline survey, an interim report covering all other parameters must be submitted within one month of the survey. Relevant data, analysis and interpretation of biological/current information is to be provided within four months of the survey date and the reporting of this information is to be consistent with the format detailed above.
Annexure II

Given the limited information on the distribution and ecology of *Gazameda gunnii*, the Department has sought advice from a number of recognised Tasmanian marine mollusc experts regarding appropriate sampling strategies for this species, and compiled the following draft sampling protocol:

**Habitat**

Sampling should be undertaken within areas of coarse sand (i.e. > 1mm particle size), shell-grit and fine gravel occurring in depths of 3 to 80 m within development proposals (Note: Departmental and TAFI data shows *G.gunnii* occurring within fine sand, particle size >0.125 mm).

Note: Sampling is not required within estuaries (including the Derwent River upstream from Taroona; the Huon River upstream of Police Point; the Tamar River upstream of the Batman Bridge; and Macquarie Harbour).

**Sample number**

The below table indicates the number of benthic grabs/cores (e.g. Van Veen grab, 15 cm diameter corer) that should be taken within relevant habitat in a development proposal area. **If dead *Gazameda sp*. shells occur in any of the initial samples then the number of samples should be doubled.** Sampling should aim to cover the full depth range of suitable habitat but otherwise be randomly located.

<table>
<thead>
<tr>
<th>Area of relevant habitat (hectares)</th>
<th>Initial # of samples</th>
<th>Total # of samples if dead <em>G.gunnii</em> in initial samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>&lt;5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>&lt;20</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>&lt;100</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>&lt;1000</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

**Processing samples**

Benthic samples should be sorted through a maximum sieve size of 4 mm.

Dead shells should be retained and confirmed as *G.gunnii* by a suitably qualified person.

Any live *G. gunnii* should be photographed with a good quality macro-camera.

Collected individuals of *G. Gunnii* are to be placed in a container of fresh seawater for relocation.

Individuals of *G. Gunnii* are to be relocated to a location nearby that is outside of the proposed area identified for impact and that will provide similar habitat including water depth and substrate composition.

Numbers and location of individuals relocated must be recorded.

The time taken for relocation must, where practicable be kept to a minimum.

A report detailing results of the survey including data occurrences of dead and relocated individuals of *G. gunnii* must be provided to the Director in an electronic form suitable for entry into the Natural Values Atlas within 90 days of collection. Required data includes species name, location information including grid reference in GDA 94 and location variation in metres, observer name, observation date, number of individuals and/or approximate area occupied.