



Eden-1 Environmental Management Plan (EMP)

Disaster Bay & Twofold Bay, NSW

Document details	The details entered below are automatically shown on the cover and the main page footer. PLEASE NOTE: This table and signature page must NOT be removed from this document.
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Document subtitle	Disaster Bay & Twofold Bay, NSW
Applicant	Auskelp Pty Ltd ABN 33 644 315 613
Development Consent	Under the State Environmental Planning Policy (Planning Systems) 2021, the Eden-1 Kelp Aquaculture Farm in Disaster Bay is classified as State Significant Infrastructure (SSI). Consequently, it requires approval from the Minister for Planning under Part 5.2 of the Environmental Planning and Assessment Act 1979
Lease Area	NSW Department of Primary Industries (NSW DPI) awarded lease area AL21/004 to Auskelp Pty Ltd on 18 May 2021, following a competitive tender process
Lease Size	200 ha
Kelp Species	Ecklonia radiata
NSW Case ID	SSD-41680467
Date	20 July 2025
Version	v1.1
Author	Christopher Ride
REAP	NGH Consulting; Nick Graham-Higgs, Brooke Marshall
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Document Update	Annual review of EMP to incorporate monitoring outcomes, improvements, corrections, and ongoing stakeholder and community feedback.
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Project Definition	Kelp Aquaculture Farm

CERTIFICATION OF EMP

Auskelp certifies that this Environmental Management Plan (EMP) has been prepared in accordance with the requirements of the Environmental Planning and Assessment Regulation 2021 and the Planning Secretary's Environmental Assessment Requirements (SEARs) for the Eden-1 Kelp Aquaculture Farm. To the best of our knowledge this EMP contains all information relevant to the environmental assessment of the proposed development.

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KEY METRICS

Key Environmental Values / Review

- Hours of Operation: 0700–1700 AEST
- Vessel Base: Snug Cove
- Processing Base: Edrom
- Port Access: No working boat access via Wonboyn Estuary
- Danger Area: Wonboyn Entrance Bar
- Corner Markers: Must meet IALA standards as required by Maritime Authorities
- Significant Storm Event: Wave height >6m Hs, Wind >80 km/h
- GPS Farm locations: Quarterly review
- Entanglement Reporting: within 4 Hours of notification
- DPI Reporting: Annual report to DPI
- Benthic Review: 2 years
- Water Quality Review: 2 years – See attached values on Page iv
- Fish Assemblages Review: 2 years
- Wild kelp Bed Review: 5 Years
- Coastal Erosion Report: 5 years
- Community Updates: Annual Reports published online
- Community Consultation: As requested by DPI Fisheries
- Fouling Assessment: 30 Days
- Mammal Entanglement or Incident Reporting: Ongoing
- Biofouling Removal: Minimum 30 Days
- Ocean Rig Inspection: Annually and Post Storm event (above max wave height 10m)
- Maximum Farm Area: 100 hectares (of 200 hectare lease area)
- Rope Gauge: Minimum 25mm
- Attachment to seabed, Screw anchors or concrete blocks (temporary only)
- Screw Anchor Depth: Minimum 3m, maximum 5m
- Labelling: Mandatory for mainlines and buoys
- Removal of Detached Infrastructure: 48 hours
- Malicious Damage: Must be reported to Maritime Police within 24 Hours
- Vessel Safety: All vessels carry EPIRB, First Aid kit and all required safety gear
- Complaints reporting: Online via Auskelp Website
- Laboratory: Biosafe environment, filtered water
- Seedstock: Collected from local area only (within 10km)
- Seedstock Heath: No contamination deployed
- Waste Disposal: No artificial waste disposal to ocean environment

WATER QUALITY VALUES

Parameter	Test/Method	Purpose	Expected Range / Benchmark
Temperature	In-situ sensor or CTD profiler	Growth rate, metabolic processes	10–23 °C (optimum: ~15–20 °C for <i>E. radiata</i>)
Salinity	CTD probe or refractometer	Osmotic balance, species tolerance	33–36 PSU (practical salinity units)
pH	Electrode probe (calibrated in marine conditions)	Acidification effects, nutrient speciation	8.0–8.3 (natural seawater range)
Dissolved Oxygen (DO)	Winkler titration or optical DO sensor	Ecosystem health, respiration	≥ 6 mg/L
Nitrate (NO_3^-)	Colorimetric or ion chromatography (filtered sample)	Nutrient availability for kelp	1–10 μM (seasonal variability; ≥1 μM supports growth)
Phosphate (PO_4^{3-})	Molybdenum blue colorimetry	Nutrient limitation potential	0.05–0.5 μM
Ammonium (NH_4^+)	Phenate method or ion selective electrode	Alternative nitrogen source, excretion indicator	<1 μM under ambient conditions
Silicate (SiO_4^{4-})	Molybdate colorimetric assay	For diatom and kelp growth (secondary)	2–30 μM
Total Suspended Solids	Gravimetric analysis (after filtration)	Light penetration, fouling risk	<10 mg/L (preferably <5 mg/L offshore)
Turbidity	Nephelometric Turbidity Units (NTU) via turbidimeter	Water clarity, photosynthesis	<5 NTU preferred offshore
Chlorophyll-a	Fluorometry or HPLC	Proxy for phytoplankton biomass, competition	0.2–2.0 $\mu\text{g/L}$ (oligotrophic to mesotrophic offshore)
Total Nitrogen / Total P	Combustion or persulfate digestion	Nutrient loading assessment	TN < 300 $\mu\text{g/L}$; TP < 30 $\mu\text{g/L}$ offshore
E. coli / Enterococci	Membrane filtration + MPN	Sanitary quality / human health if harvesting food	<10 CFU/100 mL (relevant for food-grade kelp)
Heavy Metals (e.g. Cu, Zn)	ICP-MS or AAS	Bioaccumulation risk / compliance	Cu < 5 $\mu\text{g/L}$, Zn < 15 $\mu\text{g/L}$ (ANZECC 95% protection)
Hydrocarbons / Oil & Grease	Infrared spectroscopy or GC-FID	Marine pollution risk	Below detection (<0.01 mg/L ideally)

1.0 ENVIRONMENTAL MANAGEMENT PLAN

Eden-1 Kelp Aquaculture Farm

Auskelp Pty Ltd | 2025

1.1 Project Overview

- Project Title: Eden-1 Kelp Aquaculture Farm
- Location: Offshore in Disaster Bay, launching from Eden Snug Cove and Edrom (Pentarch) private ramp
- Operational Period: Autumn, Winter, Spring (March–November)
- Hours of Operation: 0700–1700 AEST, no night operations (except emergency)
- Key Activities: Hatchery, deployment, monitoring, maintenance, and harvesting of kelp longline infrastructure
- Vessel Base: Snug Cove, Port of Eden & Edrom (Pentarch) Industrial Area
- Vehicle Base: Industrial area Edrom (logistics depot and maintenance facility)

1.2 Introduction

Auskelp Pty Ltd is developing an offshore kelp aquaculture farm (Eden-1) in Disaster Bay, NSW. This EMP outlines procedures to minimise and manage environmental risks during the establishment and operation of the farm. It has been designed to comply with NSW aquaculture regulations, the Environmental Planning and Assessment Act 1979 (NSW), and the Environment Protection and Biodiversity Conservation Act 1999 (Cth).

The purpose of the Environmental Management Plan (EMP) for the Eden-1 Kelp Aquaculture Farm is to provide a comprehensive, structured framework that guides all operational, environmental, and compliance-related activities associated with the development, installation, and ongoing management of the farm. The EMP is designed to ensure that the farm operates in an ecologically sustainable manner by identifying potential environmental risks and detailing specific mitigation strategies, performance standards, and monitoring protocols to manage those risks effectively. It outlines procedures for infrastructure deployment, vessel operations, biosecurity, waste handling, marine fauna interactions, and emergency response, ensuring that every aspect of the project adheres to relevant legislative requirements and best-practice guidelines.

The EMP also serves as a critical tool for regulatory compliance, providing evidence to state and Commonwealth agencies that appropriate environmental safeguards are in place and that adaptive management is embedded into the project lifecycle. It enables ongoing evaluation and continual improvement through routine monitoring, incident reporting, and stakeholder feedback, fostering transparency and accountability. Moreover, the EMP supports Auskelp's broader environmental objectives, including climate resilience, habitat protection, and marine ecosystem stewardship, while also facilitating community confidence in the project's environmental integrity. By articulating clear responsibilities, standards, and review mechanisms, the EMP ensures that the Eden-1 Kelp Aquaculture Farm contributes positively to the local marine environment and regional sustainability goals.

1.3 Objectives

- Prevent, mitigate or manage adverse impacts on the marine and coastal environment.
- Ensure operations are consistent with ecosystem-based management principles.
- Guide monitoring and adaptive management throughout the project lifecycle.
- Maintain compliance with permit conditions, regulations, and stakeholder expectations.

- This EMP is required to comply with the detailed policies and protocols set out in the following management documents:
 - Emergency Response Plan
 - Marine Fauna Interaction Plan
 - Cultural Heritage Response Plan
 - Seaweed Aquaculture Biosecurity Plan
 - Monitoring and Maintenance Plan
 - Traffic Management Plan
 - Waste Management Plan

1.4 Description of Activities

- Deployment of up to 100 one-hectare kelp rigs over 200 ha.
- Use of longline infrastructure fixed with screw anchors.
- Regular inspection, harvesting, and seasonal maintenance.
- No use of feed, chemicals, or netted enclosures.

1.5 Infrastructure Guidelines

- Minimum 25mm longlines
- Deployment of screw anchors
- All longlines and buoys labelled

1.6 Key Environmental Values and Risks

- Benthic Environment: Dominated by soft sediments with no mapped seagrass or reef habitat.
- Water Quality: High natural flushing; no nutrient discharge from operations.
- Marine Fauna: Presence of cetaceans, pinnipeds, and pelagic fish species.
- Navigation and Visual Amenity: Remote location with minimal traffic and limited visual impact.

1.7 Waste and Debris

- No organic waste (e.g., faeces, shell, gut) or feed inputs generated.
- Kelp is fully utilised in harvest; no effluent discharge.
- All damaged ropes and infrastructure will be reused or disposed of under NSW EPA guidelines.
- Marine debris collection protocols in place.

1.8 Benthic and Habitat Management

- Screw anchors selected to minimise footprint (~4 m deep, small diameter).
- Design avoids critical habitats and sensitive substrata.
- Longlines suspended ~10 m above seafloor to reduce shading.

1.9 Marine Fauna Interaction Management

- Marine Fauna Interaction Plan (MFIP) and Observer Protocols implemented.
- Taut-rope system minimises entanglement risk.
- Entanglement risk rated 'moderate' due to conservative precaution.

- Real-time entanglement response procedure in place.

1.10 Water Quality

- No additional nutrient input or sedimentation from operations.
- Water quality testing not required due to negligible risk; however water quality metrics will be actively monitored against baseline data to measure water quality degradation/improvement.

1.11 Vessel Operations and Navigation

- All vessels to adhere to NSW navigation guidelines and use designated access routes.
- Notification to AMSA
- Locations and mapping on Auskelp's website.
- Navigation aids maintained as per IALA recommendations.
- Information boards located at the following boat ramps: Wonboyn, Eden Quarantine Bay, Eden Snug Cove.

1.12 Monitoring and Adaptive Management

- Structural Integrity and Stability Monitoring Program (SISMP).
- Annual benthic visual inspections by divers or ROV.
- Entanglement and fauna incident logs maintained and reported.
- Marine debris audits and mitigation actions.

1.13 Community and Cultural Heritage Engagement

- Aboriginal Cultural Heritage Assessment completed with Biosis.
- Community info sessions held; updates published online.
- Feedback incorporated into site design and operations.
- Ongoing annual reports and community feedback available via website: www.auskelp.net
- Information posters displayed at Greenglades Beach information board (in agreement with NSW Parks and Wildlife).
- Annual community consultation meetings in Eden.

1.14 Roles and Responsibilities

- Auskelp Environment Manager oversees implementation and ongoing update of the EMP.
- Marine Operations Crew trained in the following protocols:
 - Emergency Response Plan
 - Marine Fauna Interaction Plan
 - Cultural Heritage Response Plan
 - Seaweed Aquaculture Biosecurity Plan
 - Monitoring and Maintenance Plan
 - Traffic Management Plan
 - Waste Management Plan
- Annual Environmental Management Plan (EMP) review to incorporate monitoring outcomes, improvements, corrections, and ongoing stakeholder and community feedback.

1.15 Reporting and Compliance

- Annual environmental performance and deployment report submitted to DPI and relevant agencies.
- Immediate reporting of any entanglement or significant incidents.
- EMP publicly available on project website.

of buoyancy if kelp biomass accumulates and increases the load on the backbone. The floats are designed to maintain optimal tension in the backbone, while their low-drag profile ensures minimal hydrodynamic resistance. This float configuration allows for the integration of additional buoyancy if needed during peak kelp growth periods, ensuring system stability and resilience throughout seasonal cycles. The infrastructure is designed to meet or exceed international standards for mooring systems in high energy, open-ocean aquaculture use.

The screw anchors are developed to eliminate need for chain, making the quiet and less likely to fail due to corrosion. The longline rope is bolted through a polymer thimble to the lay-flat (with plastic shield – see Fugue 4) which is bolted to the screw anchor. Because the screw anchor is 3–6m into seafloor the metal helix has reduced corrosion due to lower oxygen levels. The blue plastic shield surrounding the lay-flat rope prevents chafing, and the screw anchor design has an expected 30-year lifespan if installed and maintained correctly.

Details are as follows:

- **Screw Anchors:** The minimum sized helical screw anchors for Eden-1 are rated for static load capacity of 25t and torque verification of 35 kN in fine grain sand, embedment depth of 4 m, and helix diameter 450–650 mm. Larger screw anchors can be utilised and depth can be increased to 6m if required. In fine sandy substrates typical of Disaster Bay, BMT assessment confirms that anchors installed at 3.5–4 m depth can achieve theoretical holding capacities of 80–100 kN (Brown, D.A., 2013).
- **Polypropylene Rope (25–35 mm):** The minimum breaking strength (MBS) of marine-grade 3-strand polypropylene rope ranges from ~58 kN (25 mm) to ~106 kN (35 mm), as per standards reported by Cordage Institute (CI-1303-04). The working load limit (WLL) with a standard safety factor of 5:1 equates to ~11.6 kN (25 mm) and ~21.2 kN (35 mm) respectively (Cordage Institute, 2004; Samson Rope Technologies, 2019).
- **Specified load margins** are sufficient to resist anticipated dynamic and static loads even under peak swell and maximum drag/weight conditions. Dynamic wave loading, including drag from kelp biomass and vertical surge, was incorporated into the mooring design using conservative assumptions for biomass load (~30 kg/m dropper line), buoyancy-induced uplift, and wave/current drag. It is expected that kelp will be harvested at 5kg/m, therefore well under load limits.



Figure 2: Typical screw anchor shaft with helix and pivot point (Credit: Blue Harvest 2025).

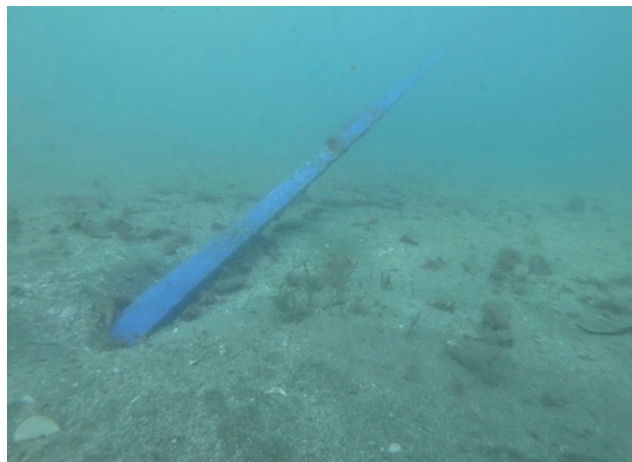


Figure 3: Installed screw anchor lay-flat pivot, located Jervis Bay, NSW (Credit: Blue Harvest 2025).

2.2 Weekly Visual Inspections

On-water inspections are to be conducted weekly, weather permitting, using support vessels equipped with safety and inspection tools including underwater drone. Inspections include:

- Surface condition of buoys, longlines, and floats.
- Tension levels of longlines and droplines.
- Evidence of rope chafing, slack, twisting, or visible wear.
- Visual signs of marine growth or surface biofouling.
- GPS position cross-checks against lease boundary coordinates.
- Visibility and condition of corner markers.
- Integrity of any signage or labels (e.g. "Auskelp" IDs).

All findings are to be logged using standardised field inspection sheets. Minor issues are to be rectified immediately; major issues must be reported within 24 hours to management and, if applicable, to Fisheries NSW.

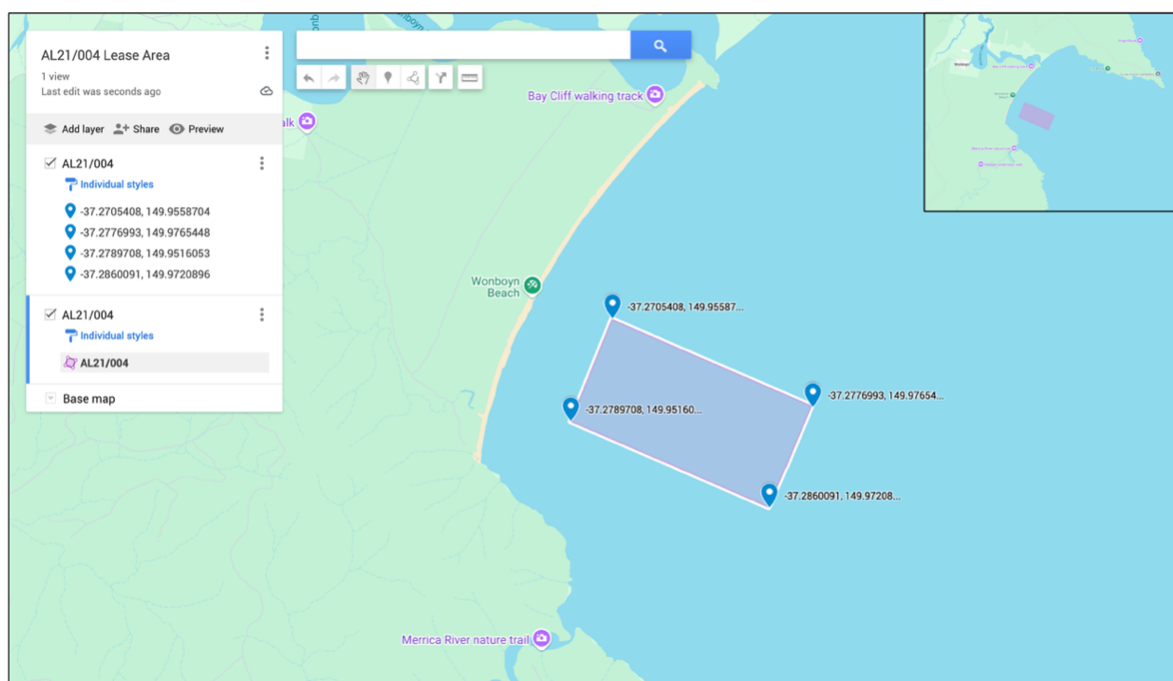


Figure 4: AL21/004 Lease Coordinates, Disaster Bay, NSW (Credit: Google).

2.3 Alternate Visual Inspections – Greenglades Beach

If ocean conditions prevent vessel access, alternate visual inspections will be carried out from the shoreline at Greenglades Beach using binoculars, drone-mounted cameras, or high-resolution still/video footage. Key items observed include:

- Buoy and float positioning.
- Surface swell and interaction with visible infrastructure.
- Presence of floating or beached debris.
- Potential marine wildlife interactions.

This alternative procedure ensures continued monitoring even during adverse sea conditions and supports early detection of failures that may be drifting toward the coast.

2.4 Monthly Monitoring

Monthly tasks form the second tier of regular maintenance and include:

- Verification of all GPS anchor and marker positions.
- Spot checks of mooring line integrity and tension.
- Photographic documentation of structural components.
- Water testing for key parameters (temperature, wave height, direction, wave period).
- Inspection and maintenance of mooring line attachments and lines.
- Analysis of growth rates and kelp canopy coverage, via removal, drop-camera or drone.

2.5 Annual Diver-assisted Inspections

Every 12 months, divers or drones will conduct underwater infrastructure inspections. This includes:

- Examination of seabed anchor points and screw anchors.
- Identification and classification of marine growth and fouling organisms.
- Verification of mooring line embedment and wear.
- Photo and or video documentation for reporting and analysis.
- Where fouling is identified beyond acceptable thresholds, manual cleaning or rotation/replacement of components will be undertaken.

2.6 Annual Servicing

Once per year, all structural components will undergo full service and, where necessary, replacement. The servicing includes:

- Replacement of any line or shackle with >20% visible wear or ageing.
- Pressure cleaning of buoys and inflatable floatation devices.
- Cleaning and retagging of all marked components.
- Audit of Auskelp ID tags and infrastructure labelling.
- Review of operations against annual performance metrics.

2.7 Post-storm Inspections

After significant storm events exceeding the below parameters, a full inspection must occur within 48 hours, subject to safe weather conditions:

- Wave heights >6 m Hs or
- Sustained winds >60 km/h
- Winds above 80 km/h

These inspections will focus on:

- Dislodged, twisted, or broken longlines.
- Changes in buoyancy levels.
- Signs of anchor drag or seabed disturbance.
- Tangled droplines or clumped biomass.
- Missing floats or markers.

If needed, divers or drones will be deployed for underwater checks when safe. Initial inspections may rely on drone imagery or surface vessels with sonar.

2.8 Biofouling Management

Biofouling is a major maintenance concern in long-term kelp farming. Management practices include:

- Regular cleaning of high-growth areas such as buoys and risers.
- Rotation of lines out of the water for drying and mechanical brushing.
- Recording of fouling levels in annual reports, including type of fouling and extent.

2.9 Equipment Design and Redundancy

To minimise systemic failure:

- All longlines are independent, not daisy-chained.
- Anchors use 4-metre deep insertion of screw anchors for increased holding power.
- Lines are tensioned for vertical and horizontal compliance.

According to Bui et al. (2023), infrastructure that aligns with prevailing swell significantly reduces tensile loading, which supports the long-term success of the designated Eden-1 layout.

2.10 Infrastructure Labelling and Recovery

In the unlikely event of a longline detachment, the design and environmental conditions suggest that any dislodged infrastructure would drift shoreward toward Greenglades Beach, rather than into open ocean or high-traffic maritime zones. This is due to the prevailing eastward swell direction, the farm's proximity to the coastline and the hydrodynamics of Disaster Bay. The longline system's orientation, parallel to the dominant swell, minimizes lateral loading and reduces the risk of structural failure. The farm employs individual longlines rather than interconnected arrays, a configuration that enhances resilience by isolating potential failures and preventing cascading effects across the system.

All infrastructure components, including buoys and corner markers, must be clearly labelled with the "Auskelp" designation and AL21/004, facilitating prompt identification and recovery. In accordance with regulatory requirements, Auskelp is committed to the immediate collection of any detached infrastructure to mitigate environmental impacts and navigational hazards.

In accordance with NSW Fisheries requirements:

- All equipment is labelled "Auskelp" with the unique Lease ID.
- All displaced items must be reported to Fisheries NSW within 48 hours.
- Retrieval must occur within 72 hours.
- NSW Fisheries DPI may utilise the aquaculture security bond to recover any unclaimed components.
- A shoreline clean-up protocol is in place for debris that drifts to Greenglades Beach.

2.11 Recordkeeping and Reporting

Auskelp will maintain digital recording systems to track the following:

- Monthly inspections.
- Diver or drone footage and condition ratings.
- Incident and repair logs.
- Reporting deadlines and permits.
- All records are stored for minimum 10-years and made available upon request to regulators.

2.12 Best Practice Alignment

The Eden-1 Monitoring and Maintenance Program has been developed to align with recognised national and international aquaculture industry standards for environmental sustainability, infrastructure integrity, and compliance with regulatory expectations. The program includes regular inspections, infrastructure audits, marine fauna interaction reporting, and adherence to ecologically sustainable practices, and it will continue to be adaptive—refining and evolving as new information, operational experience, and scientific insights become available. The program draws upon the following key standards and protocols:

- NSW Department of Primary Industries (DPI) Aquaculture Strategy
- National Guidelines for the Ecologically Sustainable Development of Marine Aquaculture in Australia (FRDC & DAWE)
- Environmental Risk Assessment Guidelines for Aquaculture (DAWE/FRDC, 2020)
- Ecosystem-Based Fisheries Management (EBFM) Framework
- FAO (2021) Seaweed Aquaculture Best Practice Guidelines
- UNEP (2022) Global Standards for Sustainable Seaweed Farming
- Norwegian Directorate of Fisheries (2018) Mooring and Net Pen Standards
- GreenWave (2020) Offshore Regenerative Seaweed Cultivation Protocols

2.13 Adaptive Management

Auskelp's Monitoring and Maintenance Program will undergo:

- Ongoing review of infrastructure failure or repair rates.
- Performance benchmark update based on global data.
- External technical audit (if triggered).
- Re-training of staff on any procedural changes.

2.14 Mooring and Anchoring System

- Anchor Type: Helical screw anchors used to secure infrastructure to the seafloor.
- Installation Depth: Screw anchors must be embedded to a minimum depth of 3.0 metres into soft sediment to ensure holding capacity and reduce risk of dislodgement.
- Anchor Material: Anchors must be marine-grade galvanised or stainless steel, corrosion-resistant for a minimum 10-year marine service life.
- Anchor Load Testing: 10% of installed anchors per rig must be randomly selected and load-tested to minimum expected storm loads.
- Anchor Spacing: Anchors must be spaced to maintain a minimum 10m clearance between anchor points on neighbouring longlines.

2.15 Longline and Backbone Cables

- Main Backbone Line Diameter: Minimum 25 mm synthetic rope (e.g. polyester or HMPE), or equivalent strength mooring cable.
- Breaking Strain: Rope must have a certified minimum breaking load of 45 tonnes.
- Buoyancy Compensation: Longlines must be tensioned using flotation buoys (minimum every 20 m or as required) to maintain vertical clearance from seabed and avoid sagging.
- Rope Material: Only UV-stabilised, marine-grade ropes shall be used; polypropylene ropes are prohibited due to degradation and entanglement risk.

- Taut-Rope Design: Ropes must be kept under constant tension with no slack lines permitted at any time.
- Identification: All longlines will carry visible ID tags coded by rig number.

2.16 Dropper Lines and Grow-Out Assemblies

- Dropper Line Spacing: Must be spaced no closer than 1.0 m apart to avoid shading and allow for kelp movement.
- Dropper Length: Dropper lines must terminate on average at least 10 m above the seabed to protect benthic habitat.
- Connection Hardware: Use corrosion-resistant shackles, swivels, and quick-release clips to minimise gear failure.

2.17 Surface Buoys and Marking

- Navigation Buoys: Perimeter of lease must be marked by IALA-compliant cardinal or special markers, with reflective and radar-visible surfaces.
- Farm Identification: Each farm unit must have a clearly visible nameplate with DPI Lease ID.
- Buoy Anchoring: Surface buoys must be securely attached to separate mooring lines from production infrastructure to avoid entanglement.
- Identification: All buoys to be marked with visible ID tags coded by rig number.

2.18 Inspection and Maintenance

- Monthly Inspections: Visual inspection of all infrastructure (anchors, ropes, buoys, dropper lines) must be conducted at least once every 30 days.
- Storm Inspection: Additional inspection is mandatory after any storm exceeding 6 m significant wave height (as reported by Eden Waverider buoy).
- Integrity Checklist: All inspections must be documented with checklists covering:
 - Tension and wear of ropes
 - Anchor position/holding
 - Dropper wear and fouling
 - Buoyancy and line sagging
 - Marine growth removal
- Annual Diver or ROV Survey: A seabed survey must be conducted annually to inspect for anchor scouring, debris accumulation, and benthic disturbance.

2.19 Debris Management and Retention

- Rope Ends and Offcuts: All rope trimmings, old gear, and floats must be retained onboard and disposed of on land per EPA guidelines.
- Waste Collection Kit: Each vessel must carry a dedicated marine debris retrieval kit including nets, gloves, and storage bins.
- Recovery Response Plan: Immediate action must be taken to recover any lost gear or detached kelp infrastructure within 48 hours of detection.

2.20 End-of-Life Gear Management

- Component Tracking: All structural components must be tagged and recorded for life-cycle tracking and replacement scheduling.

- Reuse Policy: Reusable gear must be cleaned and redeployed where appropriate; degraded gear must be recycled or disposed on land.
- Fallowing Protocol: Infrastructure must be fully removed from any rig left fallow for more than 24 months.

2.21 Detached Gear

- Any detached infrastructure to be removed within 48 hours of notification.

3.0 HATCHERY PROTOCOLS

3.1 Genetic Source and Seedstock

- Local Genetic Integrity:
 - All seedstock must be sourced from wild or farmed sporophytes collected within the Disaster Bay bioregion to preserve local genotypes of *Ecklonia radiata*.
- Wild Sporophyte Collection:
 - Only healthy, mature *E. radiata* individuals may be collected.
 - Collection must be documented with location, date, and permit compliance.
 - No more than 5% of plant biomass may be harvested from any individual kelp bed per collection event – only the sori section will be removed under Section 37 collection basis or from wild storm-cast kelp.
- Provenance Tracking:
 - All spore release batches must be traceable to specific collection sites, logged in a genetic and spatial database.

3.2 Biosecurity and Containment

- Bio-secure Environment:
 - The hatchery must be a fully enclosed, controlled-access facility with separate entry and viewing zones, disinfection footbaths, and PPE requirements.
- Water Source and Filtration:
 - Intake seawater must be filtered to 1 µm and pasteurised prior to use.
 - Recirculation systems must be isolated by life-stage (spores, gametophytes, sporophytes, juveniles).
 - Contamination Testing:
- Weekly testing of water and culture tanks for:
 - Bacterial contamination (e.g. *Vibrio* spp.)
 - Fungal spores and protozoa
 - Algal competitors or pests (e.g. diatoms, cyanobacteria)
- Fouling Management:
 - Tanks and substrates must be cleaned every 30 days using non-toxic, marine-safe agents.
 - Biofilm must be removed from tank walls and settlement substrates (e.g. twine or string).
- Quarantine Protocols:
 - All incoming wild kelp must be inspected for disease or fouling prior to sori induction.

3.3 Spore Release and Cultivation

- Spore Collection Standards:
 - Induction events must be conducted under sterile conditions using filtered and UV-treated seawater.
 - Monitoring to ensure balanced ratio between male and female gametophytes
- Density Management:
 - Spore loading must be <100,000 spores/ml to avoid over-colonisation.
- Substrate Specification:
 - Only natural fibre twine or biodegradable ropes may be used as settlement media.

- Substrates must be manufacturer certified as sterile prior to use.
- Attachment Monitoring:
 - Attachment success must be visually assessed within 48–72 hours of gametophyte attachment.
 - Ongoing monitoring to ensure healthy and symmetrical blade growth of sporophytes.

3.4 Juvenile Cultivation Conditions

- Light and Temperature Control

Cultivation tanks must maintain:

 - Temperature: 15–18°C
 - Light: 12:12 or 16:8 L:D cycle at 60–100 $\mu\text{mol photons m}^2/\text{s}$
- Aeration and Mixing:
 - Adequate aeration must be provided to ensure even nutrient distribution and prevent anoxia.
- Growth Assessment:
 - Juvenile sporophyte length and density must be measured weekly to ensure uniform development.
 - Any signs of dieback, discoloration, mutation, or fungal growth must be investigated and quarantined.

3.5 Pre-Deployment and Transport

- Deployment Criteria:
 - Juveniles must reach a minimum size of 1–3 mm before ocean out-planting to ensure resilience.
- Health check – each batch must undergo a pre-deployment health check confirming absence of:
 - Pathogens
 - Competing algae
 - Visible fouling
 - Mutation
- Transport Protocols:
 - Twines must be transported in moist, cool conditions with no direct sunlight.
 - Maximum time from hatchery to ocean deployment: <24 hours.

3.6 Recordkeeping and Reporting

- Culture Logbooks:
 - Daily records of temperature, light, water changes, growth metrics, and mortalities.
 - Detailed records of seedstock deployed on a per longline basis.
- Batch Identification:

Each batch must have a unique ID code linking to:

 - Source seedstock location
 - Culture conditions
 - Specific plant identifier
 - Date of seeding
 - Age at deployment
 - Deployment rig

- Ocean conditions
- Audit Trail:
 - All hatchery activities must be auditable and made available for inspection by regulators (NSW DPI or EPA).

3.7 Waste and Discharge Management

- Effluent Treatment:
 - If applicable, discharges must meet EPA standards for total suspended solids, nutrients, and pathogens.
- Solid Waste Disposal:
 - Sludge or biofouling debris must be collected, dewatered, and disposed of at licensed facilities or composted under controlled conditions.

4.0 VESSEL OPERATIONS

4.1 Vessel Type and Specifications

- Vessel Suitability (Working Boats):
 - Only vessels suitable for offshore operations in exposed marine conditions may be used.
 - Skippers must hold a valid NSW Coxswain Grade 1 or higher certification.
- Engine Type:
 - Where possible, engines must be four-stroke or equivalent low-emission types to reduce fuel, noise, and oil pollution. If required, marine grade diesel engines will be used for working boats.
- Working Boat Length and Draft Limits:
 - Maximum vessel length: <25 m.
 - Maximum draft: <1.5 m.
- Support or Emergency Response Vessel:
 - Minimum 7.5m.
 - Maximum draft 600 mm.
 - Only vessels suitable for offshore operations in exposed marine conditions may be used.
 - Not used for harvesting.
- Noise Mitigation:
 - All vessels must be fitted with mufflers and compliant with marine noise standards.
 - Vessel operations must adhere to Marine Fauna Interaction Plan (MFIP) regarding acoustic proximity to whales and dolphins.

4.2 Navigation and Safety Compliance – Working Boats

- Access: Operation via Twofold Bay (Sug Cove and Edrom).
- Restriction: No access for via Wonboyn Lake Entrance.
- Licensing:
 - All skippers must hold a valid NSW Coxswain Grade 1 or higher certification.
 - All crew must complete NSW Maritime safety induction and biosecurity protocols.
- Vessel Registration:
 - All boats must be registered and marked in accordance with NSW maritime laws.
- Navigation Aids:
 - Vessels must be equipped with:
 - GPS
 - AIS transponders (where applicable)
 - Radar reflectors
 - Marine radio (VHF)
- Lighting:
 - All boats must use navigational lighting compliant with IALA standards.
 - Night operations must be minimised or avoided unless for emergency purposes.

4.3 Biosecurity and Environmental Controls

- Vessel Cleaning:

- Boats must be cleaned and inspected regularly to avoid biofouling transfer.
- Hulls, props, and bilge areas should be free of marine pests, sediment, and algae.
- Waste Protocols:
 - No discharges of oil, litter, sewage, or bilge water are permitted within the lease area or NSW waters.
 - A spill response kit must be carried onboard Working Boats at all times.
- Ballast Water Management:
 - If utilised, no uptake or release of ballast water within the lease area unless treated and logged in accordance with Australian Ballast Water Management Requirements (DAWE, 2021).

4.4 Operating Conduct in and Around the Lease

- Speed Restrictions:
 - Maximum speed within 500 m of the lease: <6 knots
 - Maximum speed inside the lease area: <4 knots
- Approach Guidelines:
 - Vessels must maintain minimum separation distances from marine mammals as per NSW approach distance rules – See Marine Fauna Interaction Plan (MFIP).
- Mooring and Anchoring:
 - No anchoring allowed within the lease other than on designated service moorings.
- Vessel Traffic:
 - Vessel movement within the lease must follow designated paths between rows to avoid damage to infrastructure.

4.5 Maintenance and Monitoring Operations

- Minimum Inspection Frequency:
 - All deployed infrastructure (longlines, floats, anchors) must be visually inspected by vessel at least once per month.
- Data Collection Support:
 - Vessels must assist with routine water sampling, seabed observation, and fauna monitoring, as required by the EMP or Marine Fauna Management Plan.
- Weather and Sea State Policy:

No vessel operations permitted during:

 - Sustained winds >25 knots
 - Significant wave height >2.5 m
 - Visibility <1 nautical mile

4.6 Emergency Response and Incident Reporting

- Emergency Equipment:

All vessels must carry:

 - First aid kits
 - Lifejackets for all personnel
 - EPIRBs or PLBs
 - Fire extinguisher and flares
- Incident Protocol:

- Any entanglement, gear loss, oil spill, or marine fauna collision must be reported within 24 hours to both Auskelp management and the relevant NSW authority.
- Any workplace injury must be reported immediately.
- Any altercation or incident relating to other maritime users must be documented immediately and reported management and relevant government body, depending on severity.
- Any malicious damage to infrastructure must be reported to Maritime Police and Port Authority within 24 hours.

■ Communications:

- All operational boats must maintain VHF radio contact with shore base or other farm vessels at all times during offshore work.

NOTICE TO REAP:

This document will be updated and amended based on feedback from SSD Process

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Email: info@auskelp.net

Website: www.auskelp.net

