Environment Centre NT
protecting nature | living sustainably | creating a climate for change

6 July 2023

Mr Stephen Palethorpe
Secretary
Senate Standing Committee on Environment and Communications
Environment and Communications Legislation Committee

ec.sen@aph.gov.au

***Re: Environment Protection (Sea Dumping) Amendment (Using New Technologies to Fight Climate Change) Bill* 2023 (the Bill)**

The Bill amends the *Environment Protection (Sea Dumping) Act 1981* to implement Australia's international obligations arising out of two amendments to the London Protocol on the prevention of marine pollution. These amendments enable the export of carbon dioxide streams for CCS via a permit granted by the Australian Minister for the Environment.

The Bill is a key enabler of gas industry plans to significantly expand CCS in Australia, via the import and export of CO2 across international borders.

The Bill is strategically significant, since CCS (and the global trade of CO2 streams) is a crucial plank in the gas industry's global strategy to gain a social licence by appearing to act on climate, whilst simultaneously opening up new fossil fuel projects against the advice of bodies such as the International Energy Agency and IPCC. The Bill facilitates the greenwashing of significant fossil fuel expansion plans in Australia.

As ECNT understands it, the three main planned CCS import/export projects in Australia which would benefit from this legislation are:

Bayu Undan/Middle Arm (Northern Territory): the Bayu Undan CCS project in Timor Leste waters, whose the primary source of CO2 would be from Santos' offshore Barossa project. This would utilise a multi-user CCS hub proposed at Middle Arm in Darwin Harbour where carbon dioxide streams from other sources would be aggregated. Other future sources of CO2 include:

- Tamboran's proposed LNG facility at Middle Arm (noting that fracking in the Beetaloo Basin could generate 1.4 billion tonnes of GHG emissions);
- Eni's proposed offshore Verus gasfield (with 27% CO2 content);
- Proposed petrochemicals, blue hydrogen and ammonia, and other CO2-intensive industries at Middle Arm;
- The countries of Japan, Singapore and Korea (gas trading partners with the Northern Territory), who propose to send CO2 from their countries on ships to Middle Arm, due to a lack of CCS storage locations in those countries.

Tel: (08) 8981 1984 | **Fax**: (08) 8941 0387 | admin@ecnt.org | http://www.ecnt.org/
Postal: GPO Box 2120, Darwin NT 0801 | **Office:** Unit 3/98 Woods Street, Darwin Northern Territory - Australia

This project is more progressed than others in Australia, with Santos suggesting publicly that the Bayu Undan CCS project could come online as early as 2025. However, it is noted that currently no approvals are in place for any component of the Bayu Undan/Middle Arm CCS project. Nor has any environmental impact assessment been undertaken of CCS at Bayu Undan/Middle Arm. There are serious questions about the technical feasibility of CCS at Bayu Undan, as well as doubts about Santos' sequestration claims. Analysis by IEEFA suggests that even with CCS, the project will still release the same amount of carbon dioxide emissions.

Bonaparte/Middle Arm: a joint venture (Inpex, TotalEnergies, Woodside) for a CCS project in the Bonaparte Basin off the coast of the NT, which would also utilise the multi user CCS hub proposed at Middle Arm to aggregate multiple sources of CO2 streams. This project is at an early stage, with assessment underway regarding the appropriateness of the subsea formation for CCS.

Carnarvon Basin/Karratha: a joint venture (Woodside, BP, Chevron, Shell, Mimi) for a CCS project in the Carnarvon Basin off the coast of WA, which would utilise a multi-user CCS project near Karratha to "aggregate emissions from various existing sources", including from other countries.

Therefore, the Bill, if passed, will enable the gas industry to continue polluting by opening up new and highly polluting fossil fuel projects, using CCS as a justification.

ECNT notes that CCS is a false solution for climate change. It is unproven at scale, and even if sequestration volumes claimed by the industry for this project were achieved, would be only offset a small proportion of the life cycle emissions of new fossil fuel projects. Moreover, CCS:

- Has not been proven feasible or economic at scale and can only contain a fraction of source emissions. For example, a recent report by IEEFA about the much touted Norwegian Sleipner and Snohvit CCS projects demonstrates that CCS is not without material ongoing risks that may ultimately negate some or all the benefits it seeks to create;
- Prolongs dependence on fossil fuels and delays their replacement with renewable alternatives;
- Creates environmental, health and safety risks for communities with CCS infrastructure.

ECNT's primary submission is the Bill should not be passed.

Alternatively, ECNT submits that the Bill should not be passed until the following matters are resolved and/or incorporated into relevant legislation and policy/regulation:

- the permitting provisions in the Bill are sparse and not sufficiently prescriptive, leaving considerable discretion to the Minister;
- there appears to be no requirement for environmental impact assessment to be undertaken prior to the grant of a permit;

Tel: (08) 8981 1984 | **Fax**: (08) 8941 0387 | admin@ecnt.org | http://www.ecnt.org/
Postal: GPO Box 2120, Darwin NT 0801 | **Office:** Unit 3/98 Woods Street, Darwin Northern Territory - Australia

- the relationship between the Bill and other regulatory frameworks (including the Offshore Petroleum and Greenhouse Gas Storage Act, the EPBC Act, and state-based environmental assessment regimes) is unclear;
- responsibilities around transboundary liability in the event of accidents are unclear;
- the impact on emissions inventory reporting and Paris Agreement target compliance is unclear;
- the relationship with the Safeguard Mechanism is unclear;
- (with respect to Bayu Undan) the regulatory capacity and readiness on the part of Timor Leste is unclear. In particular, it is unclear whether Timor Leste can ensure the same level of environmental protection as Australia, or the mechanism by which that can or will occur.
- the consistency of any activities and trade with the global effort to achieve the Paris Agreement is not established.

Background to Bayu Undan/Middle Arm CCS project

Santos' offshore Barossa project is located approximately 200km north of Darwin. It is one of the most polluting gas projects in the world, due to its very high CO2 content (approximately 18%). It is opposed by Tiwi Traditional Owners, who have halted drilling for the project after two successful Federal Court cases. Santos proposes to pipe Barossa gas to its LNG facility located at Middle Arm for processing. This would "backfill" the LNG facility, which has been supplied gas from the Bayu Undan field in East Timorese waters for approximately 20 years.

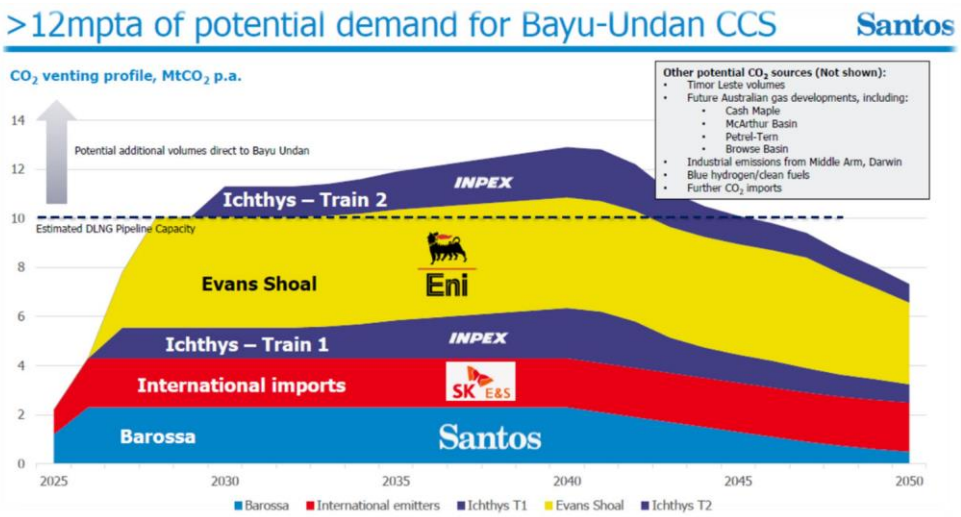
In order to "manage" the significant greenhouse gas emissions associated with the project, Santos proposes to construct a CCS project, possibly in a joint venture with other gas companies (including Inpex, Woodside, Eni, and Xodus) who are assessing the feasibility of CCS at Middle Arm with CSIRO. The CCS project would comprise:

- construction of a new facility at Middle Arm (precise location unknown), which would separate and pressurise CO2 from the Barossa gas;
- piping the CO2 under high pressure to the Bayu Undan field along the existing pipeline;
- injection of the CO2 in the depleted Bayu Undan field in East Timorese waters;
- once the Bayu Undan field is "full", joint venture partners propose to store CO2 in subsea geological formations in the Petrel Sub-Basin (Inpex is currently undertaking exploration to ascertain the suitability of the Petrel Sub-Basin for this purpose).

It is proposed that other parties would be able to utilise the CCS facility at Middle Arm, including Eni (from its proposed Verus field), Woodside (presumably from the Greater Sunrise field), Inpex, petrochemicals facilities, blue hydrogen facilities, LNG facilities (including Tamboran's proposed LNG processing and export hub).

No environmental impact assessment has been undertaken of the Bayu Undan/Middle Arm CCS project, and Santos currently holds no environmental approvals for this CCS project (offshore or onshore).

The Middle Arm project has been branded one of many possible "Net Zero Zones" across Australia by APPEA, where "carpooling of carbon" (and associated cost reductions) can be realised by CCS facilities being utilised by multiple projects. The CCS facility is key to the gas industry's expansion plans in the Northern Territory (onshore and offsore), including its social licence.



Above figure from: https://www.laohamutuk.org/Oil/Project/Bayu/CCS/230105ANPM-CCS.pdf

Legal background to London Convention and London Protocol

The Bill amends the *Environment Protection (Sea Dumping) Act 1982* (the Act) – this Act implements Australia's international obligations under Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention) and the 1996 Protocol to the Convention (London Protocol), which are the global treaties that protect the marine environment from pollution caused by dumping of wastes.

Since 2006, the London Protocol has provided a basis in international environmental law to allow CO2 storage beneath the seabed when it is safe to do so, and to regulate the injection of CO2 into sub-seabed geological formations for permanent isolation. This entered into force in 2007. However, the export of waste was prohibited b Article 6 of the London Protocol.

In 2009, an amendment to Article 6 was adopted by the Contracting Parties to the London Protocol to enable the export of carbon dioxide streams to another country for CCS provided that the protection standards of all other London Protocol requirements have been met between cooperating countries. The responsibilities have to be clearly agreed between cooperating countries, and the same control conditions need to be applied if the receiving country is not a party to the Protocol (which has requirements for permitting based on risk assessment and environmental impact, contained in theCO2 Specific Guidelines).

However, the 2009 amendment is not yet in force as it needs to be ratified by being formally accepted by two thirds of the Parties to the London Protocol. Acceptance had been very slow with just ten of the 53 contracting parties (Norway, UK, Netherlands, Iran, Finland, Estonia, Sweden, Denmark, Korea and Belgium) having accepted the amendment.

In 2019, the London Protocol agreed to a "provisional application" to allow Contracting Parties to use the 2008 amendment before it comes into force. Only six of the above ten Contracting Parties have provisionally accepted the London Protocol – Belgium, Denmark, Netherlands, Norway, Republic of Korea and Sweden.

To implement the 2009 amendment, the Act would need to be amended to allow permitting to accommodate CO2 that has been imported for sub-seabed sequestration.

The Bill would require the Minister's satisfaction of certain matters prior to the granting of a CO2 export permit. They are summarised above, but the operative provision relevant to risk assessment and management of CCS is the requirement for a permit to be in accordance with Annex 2 to the London Protocol.

A Framework has been developed by the Contracting Parties – the "Risk Assessment and Management Framework for CO2 Sequestration in Sub-Seabed Geological Structures" to ensure compatibility with Annex 2 to the London Protocol. Compliance with the Framework is not referred to in the Bill, nor required.

The Contracting Parties have also adopted the Specific Guidelines on Assessment of CO2 Streams for Disposal into Sub-Seabed Geological Formations (the Specific Guidelines). These guidelines provide the assessments and considerations required in issuing a permit. They address CO2 stream characterization, site selection and characterization, environmental impact assessment, risk assessment, monitoring, mitigation and remediation plans, and risk management. Compliance with the Specific Guidelines is not referred to in the Bill, nor required.

The operative provisions of the Bill

The Bill prohibits the export of carbon dioxide streams from carbon dioxide capture processes for CCS if that export is not in accordance with a permit (ss 10D(1)).

The Bill inserts ss 19(7B) into the Act, which provides that the Minister may grant a permit for the export of CO2 streams for CCS if the Minister is satisfied:

(a) of the matters referred to in paragraphs 4.1, 4.2 and 4.3 of the Annex 1 to the London Protocol.

[NB: This relevantly states that CO2 streams may only be considered for dumping if:
1. disposal is into a sub-seabed geological formation;
2. they consist overwhelmingly of CO2.
3. No wastes or other matter are added for the purpose of disposing of those wastes.]

(b) that there is an agreement between Australia and the other country that includes the matters covered by paragraphs 2.1 and 2.2 in the Annex to Resolution LP 3(4) adopted on 30 October 2009 by the Contracting Parties to the Protocol; and

[NB: This states that such an agreement must include:
1. confirmation and allocation of permitting responsibilities between the exporting and receiving countries, consistent with the provisions of this Protocol and other applicable international law.
2. In the case of export to non-contracting Parties, provisions at a minimum equivalent to those contained in this Protocol, including those relating to the issuance of permits and permit conditions for complying with the provisions of annex 2, to ensure that the agreement does not derogate from the obligations of Contracting Parties to protect and preserve the marine environment.]

(c) that the grant of the permit would be in accordance with Annex 2 to the Protocol;

Specifically, Annex 2 requires that before dumping, a country must:

- evaluate alternatives to dumping,
- pursue opportunities to prevent waste at the source,
- control sources of contamination,
- perform a comparative risk assessment of the proposed dumping and its alternatives,
- refuse permits for dumping if another option (based on an established hierarchy of options) for handling the waste is practical,
- provide a detailed description and characterisation of the waste,
- develop a national action list,
- comply with the established parameters on dump-site selection, and
- perform a detailed assessment of potential effects from the dumping.

Most importantly, Annex 2 requires that permits are only granted if "impact evaluations are completed, and monitoring requirements are determined." These impact evaluations must assess each disposal option for its potential impacts on "human health, living resources, amenities and other legitimate uses of the sea." It

must define the "nature, temporal and spatial scales and duration of expected impacts." A country must also perform ongoing field monitoring of a dumping project.

(d) of any other matters the Minister considers relevant.

Once the Bill is passed, Australia must deposit an instrument of ratification, and a declaration of provisional application for the 2008 amendment at the International Maritime Organisation.

What are the environmental risks of subsea CCS?

Environmental risks of CCS and its import/export include unintentional releases of CO2 streams into the environment during transport in ships and pipelines and from storage facilities. This could lead to:

- Adverse impacts on marine plants and animals, and groundwater including through ocean acidification and asphyxiation;
- Local high CO2 concentrations in the air, which could seriously harm animals or people including through asphyxiation (this is a risk offshore, but also at onshore CCS hubs including Middle Arm near population centres in Darwin);
- Seismic events, subsidence and displacement of formation fluids and aquifers during CO2 injection.

While the gas industry has tended to underplay the risks associated with CCS, the escape of CO2 could result in severe and irreversible environmental harm.

The following comments apply to the proposed CCS facility at Bayu Undan, but similar considerations would apply to other subsea CCS facilities.

There are very few examples worldwide of natural gas pipelines that have been successfully repurposed to transmit pressurised CO_2, and none approaching the distance anticipated for CCS at Bayu-Undan. The feasibility and risks of transporting CO_2 via pipeline depend on the impacts of severe weather on the pipeline, the chemical composition of impurities expected in the CO_2 stream that can cause corrosion, the pressures and weights of the gas, challenges related to changing the flow direction, and technical specifications of the pipeline design.

Severe weather increases the risks of straining CO_2 pipelines by eroding their support structures or subjecting them to heavy water flows that can cause them to rupture. On 22 February 2020, a CO_2 pipeline ruptured near Satartia, Mississippi that released an estimated total of 31,4052 barrels of CO_2. The cause of the Satartia rupture was stress on the pipeline when heavy rains led to a landslide,

which created axial strain on the pipeline and resulted in a full circumferential girth weld failure.[1] The pipeline that ruptured in Satartia was made of a stronger grade of steel than the Bayu-Undan pipeline and was designed to better transport CO_2.

Corrosion poses another risk of pipeline rupture. Unlike methane, which comprises the bulk of natural gas, CO_2 forms an acid (carbonic acid, H_2CO_3) with any exposure to water, which is strongly corrosive to carbon steel.[2] Common acid-forming impurities like sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) in CO_2 streams also contribute to a much greater corrosion potential than natural gas.[3] Because of the limitations of capture technologies, CO_2 transported through pipelines will unavoidably contain impurities, threatening pipeline integrity.[4]

The existing Bayu-Undan pipeline is already vulnerable to corrosion. The Bayu-Undan pipeline, which became operational in 2005, is constructed from American Petroleum Institute (API) 5L X65 carbon steel,[5] which can be vulnerable to corrosion and stress particularly when exposed to trace amount of water and sulphur dioxide (SO_2).[6] Corrosion-resistant alloys with specialised coatings may be selected for new CO_2 pipelines, but it is unlikely Santos could retrofit an existing pipeline like Bayu-Undan with corrosion-resistant coatings.

Over-pressurisation can also lead to pipeline rupture. Natural gas and CO_2 have different requirements for the pressures at which they can be safely and effectively transported; this makes it particularly difficult to repurpose a pipeline designed to carry one type of gas to carry the other. Although repurposing natural gas pipelines for CO_2 transport is a popular idea among proponents keen to lower construction costs,[7] doing so often depends on the pipeline's ability to operate safely at higher pressures.

CO_2 is usually transported via pipeline at very high pressures (1500-2200 pounds per square inch at gauge (**psig**)) for efficient transmission.[8] Few existing natural gas pipelines are, in practice, viable

[1] U.S Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Failure Investigation Report – Denbury Gulf Coast Pipelines LLC Pipeline Rupture/Natural Force Damage, (26 May 2022).
[2] Gregory Cooney *et al.*, *Evaluating the Climate Benefits of CO2-Enhanced Oil Recovery Using Life Cycle Analysis*, 49, Environ. Sci. Technol., 7491–7500 (2015).
[3] Steven Jansto, *Risks and Potential Impacts from Carbon Steel Pipelines in Louisiana Transporting and Processing Variable Produced Gases such as Carbon Dioxide (CO2), Hydrogen (H2), Methane (CH4)* (2022).
[4] V. E. Onyebuchi *et al.*, *A systematic review of key challenges of CO2 transport via pipelines*, 81, Renew. Sustain. Energy Rev., 2563–2583 (2018).
[5] Santos Ltd. Bayu-Undan to Darwin Gas Export Pipeline Environment Plan, 7710-057-EIS-0001, https://docs.nopsema.gov.au/A856933. See Table 2-2: Structural Design parameters for the Pipeline, at 28.
[6] Kaiyang Li & Yimin Zeng, *Long-term corrosion and stress corrosion cracking of X65 steel in H2O-saturated supercritical CO2 with SO2 and O2 impurities*, 362, Constr. Build. Mater., 129746 (2023).
[7] Patrick Rabindran, H. Cote & I. Winning, *Integrity Management Approach to Reuse of Oil and Gas Pipelines for CO2 Transportation* (2011) (weblink); Onyebuchi et al., *supra* note 15.
[8] Suoton P. Peletiri, Nejat Rahmanian & Iqbal M. Mujtaba, *CO2 pipeline design: A review*, 11, Energies, 2184 (2018).

options for handling these pressures.[9] The high pressure results in the CO_2 being transported in a supercritical fluid phase, meaning it is no longer a gas. However, pressures must be carefully maintained to keep CO_2 in this desired high-density fluid phase, and typically CO_2 pipeline diameter, wall thickness, and compression infrastructure are all intentionally designed to sustain CO_2 within the required pressure range.[10] Conversely, natural gas transmitted in offshore pipelines in gas phase are generally within a lower pressure range. This is the case for the Bayu-Undan gas pipeline; it would normally operate at much lower pressures over its entire 500 km length than would be typical for supercritical CO_2. For instance, the outlet pressure at the Darwin LNG plant is typically 754 psig, a pressure at which CO_2 would no longer be in its most efficiently transmissible form.[11]

Successful conversion of pipelines from natural gas to CO_2 transmission are globally rare and limited to short pipeline lengths, over which transmission of gas-phase CO_2 (rather than supercritical) is more feasible.[12] Indeed, there are only two known examples of an operational repurposed natural gas pipeline: the West Gwinville Pipeline, a 16-inch diameter pipeline spanning just 50 miles operated by Denbury Resources in Mississippi,[13] and theOCAP Pipeline in the Netherlands which repurposed a 26-inch diameter, 51-mile oil pipeline to transport gas phase CO_2 at 101-304 psig.[14] Neither of these examples points to the viability of Santos's proposal.

Repurposing a natural gas pipeline could significantly alter the overall mass load of the pipeline, and this increased mass can increase the risk of a pipeline rupture. The density of the supercritical phase CO_2 could be as much as 10 times greater than the density of natural gas, while the density of CO_2 in gas phase is more like natural gas.[15] Therefore, if CO_2 is transported in gas phase the weight and mass of the pipeline may not change. However, for supercritical phase CO_2, the weight of the pipeline may increase 10-fold. As above, it is not likely that transporting the CO_2 in gas phase is technically possible or efficient at the distance required.

Further, pipelines being repurposed for CO_2 transport for geologic sequestration may necessitate the reversal of inlet to outlet. Reversing flow direction can alter where the stresses on the pipeline are the greatest.[16] These stresses can increase the risk of rupture or damage and therefore must be assessed.

[9] David E. Dismukes, Michael Layne & Brian F. Snyder, *Understanding the challenges of industrial carbon capture and storage: an example in a U.S. petrochemical corridor*, 38, Int. J. Sol. Energy, 13–23 (2019).
[10] Peletiri, Rahmanian, and Mujtaba, *supra* note 28.
[11] Ibid.
[12] Peletiri, Rahmanian, and Mujtaba, *supra* note 28.
[13] Dismukes, Layne, and Snyder, *supra* note 29.
[14] Global CCS Institute 2014, The Global Status of CCS: 2014, Melbourne, Australia (weblink)
[15] E. Østby *et al.*, 'Safely repurposing existing pipeline infrastructure for CO2 transport – Key issues to be addressed' *Pipeline Technology Journal* (2022) (weblink)
[16] US Pipeline and Hazardous Materials Safety Administration, *Guidance for Pipeline Flow Reversals, Product Changes, and Conversion to Service* (2014) (weblink)

Environment Centre NT
protecting nature | living sustainably | creating a climate for change

Does Timor Leste currently satisfy the matters covered by paragraphs 2.1 and 2.2 in the Annex to Resolution LP 3(4) adopted on 30 October 2009 by the Contracting Parties to the Protocol (i.e., does Timor Leste's regulatory regime comply with the requirements of the London Protocol)?

In short, it is unclear whether Timor-Leste's regulatory regime complies with the requirements of the London Protocol, as this depends on the legal interpretation and analysis of Timor-Leste's regulations on environmental assessment, monitoring, and compliance. However, as described below, regardless of Timor-Leste's regulatory compliance, international CCS projects can proceed in Timor-Leste's waters under the Protocol as long as the agreement which governs the project sufficiently confirms and allocates the permitting responsibilities between concerned countries and the project permits adhere to certain minimum standards.

Article 4 of the Protocol requires that parties adopt administrative or legislative measures to ensure that the issuance of permits and permit conditions comply with the provisions of Annex 2 to the Protocol. Under the 2009 Amendment, the country where injection occurs is generally responsible for ensuring compliance with guidelines for projects on transboundary sub-seabed geological formations and for projects with a potential for subsurface transboundary movement. However, when exporting to non-party states, parties must ensure that the exchange meets the requirements of the Protocol.

Timor-Leste is not a party to the London Protocol and therefore, in the case of the Barossa CCS proposal, the onus is on Australia (as a party) to ensure compliance. **Australia must ensure that Timor-Leste enters an export/import agreement that adheres to the Protocol requirements.** That agreement must clearly allocate permitting responsibilities, and paragraph 2.2 of the 2009 Amendment requires that, "in the case of export to non-Contracting Parties, provisions [must be] at a minimum equivalent to those contained in this Protocol, including those relating to the issuance of permits and permit conditions for complying with the provisions of annex 2, to ensure that the agreement or arrangement does not derogate from the obligations of Contracting Parties under this Protocol to protect and preserve the marine environment [emphasis added]." This means that Australia would be required to make sure that any permits granted by Timor Leste satisfy the Annex 2 criteria of the Protocol (reviewed below) and additionally, that the arrangement would uphold general principles of marine conservation established under the Protocol.

Yours sincerely,

Kirsty Howey

Tel: (08) 8981 1984 | **Fax:** (08) 8941 0387 | admin@ecnt.org | http://www.ecnt.org/
Postal: GPO Box 2120, Darwin NT 0801 | **Office:** Unit 3/98 Woods Street, Darwin Northern Territory - Australia

Environment Centre NT

protecting nature | living sustainably | creating a climate for change

Tel: (08) 8981 1984 **|** **Fax**: (08) 8941 0387 **|** admin@ecnt.org **|** http://www.ecnt.org/
Postal: GPO Box 2120, Darwin NT 0801 **|** **Office:** Unit 3/98 Woods Street, Darwin Northern Territory - Australia