Appendix R.

Summary of response to submissions

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On 13 July 2017, NOPSEMA published the Barossa Area Development Offshore Project Proposal for public comment. The public was invited to submit their comments on the project to NOPSEMA for consideration during an eight week public comment period from 13 July to 6 September 2017. ConocoPhillips publicly advertised that the Barossa OPP was available for public comment period and communicated directly to its stakeholders, including on how to make a submission. This information was also available on the NOPSEMA and ConocoPhillips websites. Further detail on the process undertaken for the public comment period is provided in **Section 8**.

Comments received from stakeholders during the public comment period have been taken into consideration, in this revised version of the OPP submitted to NOPSEMA for Stage 2 assessment of acceptability. This appendix addresses Regulation 5D of the OPGGS Environment regulations, specifically:

5D (1) As soon as practicable after the end of the period of public comment for an offshore project proposal, the proponent:

(c) must include with the copy of the proposal:

(i) a summary of all comments received; and

(ii) an assessment of the merits of each objection or claim about a project or activity that is part of the project; and

(iii) a statement of the proponent's response or proposed response to each objection or claim, including a demonstration of the changes, if any, that have been made to the proposal as a result of an objection or claim.

A total of seven (7) submissions were received during the OPP public comment period. A summary of these comments, a merit assessment of the items raised, and ConocoPhillips' response to them is provided below.

BAROSSA AREA DEVELOPMENT OPP – RESPONSE TO PUBLIC COMMENTS

Comment received from: Anonymous

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
1. The OPP does not mention a recently discovered and undescribed species of seabird ('Timor Sea' Shearwater *Puffinus* sp.) which is known to occur in the project area. 2. A conservative approach should be taken to understanding and considering what impacts may occur to the undescribed species of seabird ('Timor Sea' Shearwater *Puffinus* sp.). 3. The OPP is inadequate in addressing the potential impacts of light and physical presence impacts on other seabirds which are restricted to the north and north-west of Australia. 4. Further field studies into the status of the undescribed 'Timor Sea' Shearwater are recommended to increase confidence about potential impacts from the project.	**Item 1:** • ConocoPhillips acknowledges that the OPP did not mention a recently discovered and undescribed species of shearwater, referred to in the received public comment as the 'Timor Sea' Shearwater. • In response, ConocoPhillips has reviewed existing literature and engaged with Dr Rohan Clarke (Monash University, leading ornithologist and co-author of the Australian Bird Guide – 2017 (Menkhorst et al. 2017)) to fully investigate the context of the information presented in relation to the shearwater species. Dr Clarke was already familiar with the project after having provided input to the development of the OPP sections related to seabirds and potential impacts. • The key findings of the review process were: ○ The description of this taxon originated from some observations in 2010, for what was identified as likely to be Persian (Arabian) Shearwaters at the time (Mustoe 2010). ○ The Persian (Arabian) or Timor Sea Shearwater are not included on the working list of Australian bird species, which indicates that records for these species have not been formally submitted (Birdlife Australia 2017). Similarly, the 'Timor Sea' Shearwater is not mentioned on the International Ornithological Congress World Bird List (2017), which is one of the international listing approaches most widely accepted. ○ Based on the current published information to date, and on advice from Dr Clarke (pers. comm.), it is currently determined to be an undescribed shearwater species. ○ Subsequent surveys since 2010 have positively identified its occurrence, including near Adele Island and near Indonesia. The majority of the sightings have been in proximity to shoals/banks and shorelines as the species is likely to forage in inshore waters and aggregate as flocks that rest on the sea surface ('rafts') in these same waters (Rohan Clarke, pers. comm.). ○ The species may be more likely to breed in Indonesian waters based on observations to date, however this remains inconclusive at this time (Rohan Clarke, pers. comm.). • In response to the comment, ConocoPhillips has incorporated a summary of the information known about this currently undescribed taxon 'Timor Sea' Shearwater, into the updated OPP. **Item 2:** • ConocoPhillips considers that the OPP adequately assesses potential impacts to the undescribed 'Timor Sea' Shearwater. • Dr Rohan Clarke (pers. comm.) has advised that based on current information, it is reasonable to conclude that drawing on other similar shearwater species as a surrogate is appropriate. Therefore, as it is reasonably expected (considering the review findings outlined above) that project-related interaction would not be any different for this undescribed species of shearwater compared to any other shearwater species that may transit the area, the impact conclusions presented in the OPP for other seabirds are valid for the undescribed 'Timor Sea' shearwater and present a conservative approach. • The impact evaluation remains that a number of migratory bird species may transit the project area along their migratory pathway and that the risk of impact to marine fauna, including seabirds, from light emissions during installation and operations in the Barossa	In consideration of item 1, ConocoPhillips has incorporated a summary of the information known about this currently undescribed taxon 'Timor Sea' shearwater, as supplementary information into the updated OPP **Section 5.6.4.1**. No further changes to the OPP are proposed in response to items 2, 3 and 4 raised in the received comment.

	offshore development area is considered low given the predicted area of influence from lighting does not contain any significant feeding, breeding or aggregation areas. **Item 3:** • ConocoPhillips notes the submission comment that 'lighting may impact an area the size of the visible radius from the facility'. This remains consistent with broad observations that potential impacts from lighting are reasonably expected to be localised and limited in extent, and comparable to any other offshore facility in the Timor Sea. The impact conclusion remains that significant impacts on bird species from light are considered unlikely. This conclusion equally applies for other species, including the Swinhoe's Storm-petrel cited in the submission, and which is already addressed in the OPP. • The OPP states that seabirds may be attracted to artificial light, thereby possibly affecting migration patterns, and could potentially collide with infrastructure and flares, however this is influenced by weather conditions. During clear weather conditions, well-lit offshore structures have minimal or no impact on avifauna, and it is not expected to have any significant interaction on a routine basis. Some conditions, for example during conditions of persistent light rain fog or mist, may result in higher risk of interaction, however these are unusual events in the Timor Sea. • ConocoPhillips has reviewed the key management controls, acceptability statements and environmental performance outcomes relevant to light and physical presence impacts and concluded that these remain appropriate for responsibly managing the risk of interaction with birds. No changes are proposed. **Item 4:** • ConocoPhillips considers that further field studies into the status of the undescribed 'Timor Sea' Shearwater are not required to inform the impact assessment in the OPP. Given the findings of the review process outlined above and the information provided by Dr Rohan Clarke (which has now been included in the updated OPP), it is reasonable to conclude that the project-related interaction would not be any different for this undescribed species of shearwater, compared to any other shearwater species that may transit the area. **References** Birdlife Australia. 2017. *Working List of Australian Birds. Version 2*. Available at: http://birdlife.org.au/conservation/science/taxonomy (accessed 14/08/2017). International Ornithological Congress. *World Bird List. 2017. Version 7.3*. Available at: http://www.worldbirdnames.org/ (accessed 14/08/2017). Menkhorst, P., Rogers, D., Clarke, R., Davies, J., Marsack, P. and K. Franklin. 2017. *The Australian Bird Guide*. CSIRO Publishing, Melbourne, Victoria. Mustoe, S. 2010. *Arabian Shearwater, a new wintering seabird taxon for Australia. 22 October 2010*. Available at: http://blogs.ecology-solutions.com.au/bird-o/2010/10/22/is-arabian-shearwater-a-new-wintering-seabird-for-australia/ (accessed 14/08/2017).	

Comment received from: Sea Turtle Foundation

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
1. The Northern Territory Olive Ridley turtles are significant in that they are the last major remaining Olive Ridley stock in South-east Asia. There are a number of anthropogenic factors that are likely to be significantly impacting the recovery of Olive Ridley turtles.	**Item 1:** • The importance of the flatback and olive ridley turtle internesting biologically important internesting areas / habitat critical to the survival is recognised and considered throughout the OPP (Section 5 Description of the environment and Section 6 Evaluation of environmental impacts and risks).	The following text has been included in the revised OPP as a key Management Control: *Dredging activities/trenching activities for the gas export pipeline installation (if required) will occur outside the peak flatback (June to September) and olive ridley (April to August) turtle internesting period when within the internesting habitat critical to the survival of these species.*

2. The export pipeline transects an area that the Turtle Recovery Plan identifies as being habitat critical to the survival of flatback and Olive Ridley turtles; out to 20 km from the Tiwi Islands. 3. Nesting females may be displaced from nesting habitat and hatchling mortality is likely to increase given their attraction to project lighting sources. 4. Impacts to nesting and hatchling turtles in the vicinity of the Tiwi Islands have the effect of limiting marine turtle's capacity to recover and therefore have potential to significantly impact the population. Therefore, these impacts should be eliminated wherever possible. The pipe-laying activity should occur outside peak nesting and hatchling emergence periods (April – September).	• ConocoPhillips recognises that the Northern Territory olive ridley turtle stock is significant as the last major remaining olive ridley turtle stock in south-east Asia, and the Tiwi Islands and surrounding nearshore waters contain important nesting and internesting habitat for this stock, as defined in the Recovery Plan for Marine Turtles in Australia (the Recovery Plan) (DoEE 2017). • At the time of publishing the original OPP for public comment, two factors influenced the spatial extent of the dry gas export pipeline corridor as presented: a. The independent review of the Commonwealth Marine Reserves (CMR) Network had recommended that part of the (then) Oceanic Shoals CMR (currently a multiple use zone) be revised to include a habitat protection zone on the eastern side of the CMR. This introduced uncertainty as to whether the project would be able to gain approvals to install the gas export pipeline in that area if the review's recommendations were adopted (the Management Plans are currently being revised following a public comment period). Consequently, a pipeline corridor that provided the option to install part of the pipeline within the now proposed habitat protection zone, or completely outside of the proposed habitat protection zone was included in the original OPP. b. The spatial extent of the corridor included in the original OPP was based on the level of project engineering available at that time and did overlap a small area of the olive ridley turtle internesting area defined in the Recovery Plan (DoEE 2017). • In the period between publication of the OPP for public comment and re-submission of the OPP for stage two assessment of acceptance by NOPSEMA, information derived from additional field surveys and engineering studies became available. ConocoPhillips considered the new information, including in the context of the olive ridley turtle internesting Biologically Important Area (BIA) and the comments raised in public comment submissions. Consequently, potential pipeline routes that would have overlapped the internesting BIA for olive ridley turtles nesting on the Tiwi Islands were removed as options. • Shortly after submission to NOPSEMA for stage two assessment of acceptability, the DoEE released spatial data for (draft) habitat critical to the survival of olive ridley and flatback turtles, via the National Conservation Values Atlas. The internesting habitat critical to the survival of flatback turtles and olive ridley turtles is 60 km and 20 km respectively, surrounding the Tiwi Islands. • The internesting habitat critical to the survival of olive ridley turtles covers a much greater spatial extent than the internesting BIA, which is restricted to a 20 km buffer from the high-density nesting beaches on the north-west coast of the Tiwi Islands, • In parallel to NOPSEMA assessment for acceptability, ConocoPhillips continued to progress gas export pipeline route engineering and consequently was able to rule out several potential routes within the pipeline corridor based on consideration and evaluation of a range of factors, including feasibility and the potential for environmental impacts. This has resulted in a refined gas export pipeline corridor that provides the best option for the project, including minimising potential environmental impacts (Table 4.10 from the OPP for a comparative assessment of the pipeline corridor alternatives). However, based on the evaluation, the pipeline corridor cannot avoid the internesting habitat critical to the survival of flatback and olive ridley turtles, but the corridor has been reduced as much as possible (prior to final pipeline routing studies) and now only overlaps approximately 3.7% and 3.2% of the total internesting habitat critical to the survival of these species, respectively. • The actual area of seabed within the internesting habitat critical to the survival for flatback and olive ridley turtles that will be directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles).	Given the fact that 'habitat critical to the survival of a species' is provided specific consideration in the Recovery Plan for Marine Turtles in Australia (DoEE 2017a) which is a statutory instrument under the EPBC Act, the impact assessment presented in Section 6 of the OPP has been updated to explicitly use the internesting habitat critical to the survival of flatback and olive ridley turtles as the point of reference to inform the potential risk and impact conclusions. The relevant impact assessment text has been amended as follows: Seabed disturbance – direct impacts *Disturbance of the seabed is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles, fish and sharks/rays. The majority of these species are generally present within the water column and are not solely reliant on benthic habitat (Section 5.6). The area of seabed to be disturbed within the project area also represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively, in which individuals may rest on the seabed between nesting events. However, as outlined above, the actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). Taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles.* *Additionally, although some loss of marine turtle foraging habitat is likely to occur as a result of the installation of the gas export pipeline on the seabed, such foraging habitat is widely represented in the region and any loss is expected to be negligible. Environmental, geophysical and bathymetric surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. Therefore, the physical presence of the gas export pipeline is not expected to adversely impact on biologically important behaviours or biologically important habitat, including habitat critical to the survival of marine turtles.*

	• Based on the impact assessment (Section 6 of the OPP) and given the small overlap of the gas export pipeline corridor with internesting habitat critical to the survival of olive ridley turtles (3.2%) and the short duration of time pipelay activities are expected to take to complete within the internesting habitat critical to survival for the species (approximately 1 – 2 months), ConocoPhillips is not proposing to avoid pipelay activities within this area, either spatially or temporally. • While the refinement of the gas export pipeline corridor cannot avoid the habitat critical to the survival of flatback and olive ridley turtles, it does avoid the internesting BIA for olive ridley turtles and with no pipelay installation activities to occur within the olive ridley internesting BIA at any time, including during peak nesting and hatchling emergence periods for this species (April to September). **Item 2:** • ConocoPhillips recognises that the Tiwi Islands and surrounding nearshore waters contain important nesting and internesting habitat for the Northern Territory olive ridley turtle stock, as well as the Arafura Sea flatback turtle stock, as defined in the Recovery Plan for Marine Turtles in Australia (the Recovery Plan) (DoEE 2017). • As outlined above, the gas export pipeline route has been further refined and remains outside of the olive ridley turtle internesting BIA defined in the Recovery Plan for Marine Turtles, however due to engineering and environmental constraints, the refined corridor cannot avoid the (draft) habitat critical to the survival of olive ridley turtles. • Although the pipeline corridor does overlap internesting habitat critical to the survival of flatback and olive ridley turtles, undertaking pipeline installation activities within this area during anytime of the year is considered consistent with the objectives and requirements of the Recovery Plan for Marine Turtles. Demonstration of alignment with the objectives and requirements of the Recovery Plan for Marine Turtles in relation to project activities are provided in the revised OPP, including seabed disturbance (Table 6-14) and light emissions (Table6-30). • Taking into account the outcomes of a professional review by Pendoley (2017; (Appendix Q of the OPP), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles, the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). Those studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles. • In summary, light from installation vessels, as well as direct and indirect impacts from seabed intervention techniques, are unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities and localised extent of any potential impacts.	Seabed disturbance – indirect impacts *There is potential for a small portion of internesting habitat critical to the survival of flatback and olive ridley turtles to be affected by increased sedimentation/turbidity as seabed intervention works for the gas export pipeline may be required within the internesting habitat critical to the survival of these species. The potential loss or reduction in quality of habitat may temporarily reduce available foraging and internesting habitats available for marine turtles. In the context of indirect impacts, potential marine turtle habitat may be lost indirectly through an increase in localised turbidity in the water column.* *There is likely to be temporary indirect impacts on potential foraging habitat in the immediate vicinity of the pipeline installation activities. The majority of the benthic habitats within the pipeline corridor are expected to be characterised by filter feeders and burrowers/crinoids, with a substantial portion of the area supporting no benthic habitat (as summarised previously in Section 5.5.2.2). These habitats are well represented elsewhere within the region, with foraging grounds for flatback and olive ridley turtles represented across the wider Timor Sea (Figure 5-18). The area that may be indirectly affected is also not known to support biologically important foraging grounds for flatback or olive ridley turtles (Figure 5-18). Environmental, geophysical and bathymetric surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. In addition, the area has naturally high levels of turbidity and periodic severe events associated with cyclones. Flatback and olive ridley turtles are known to naturally feed in turbid, shallow inshore waters. It is expected that sedimentation effects from seabed intervention activities will be localised in extent, commensurate with the nature of specific method(s) that will be further assessed as part of activity-specific EPs. In summary, there may be a temporary, localised, indirect impact on flatback and olive ridley turtles associated with the loss of benthos, resulting in a negligible temporary reduction in foraging habitat. However, individual turtles are expected to simply move to similar habitats that are well represented in the region, with no significant population level impacts predicted. Therefore, indirect impacts to foraging habitat are not expected to adversely impact on biologically important behaviours or habitat critical to the survival of marine turtles.* *Internesting habitat in the immediate vicinity of the pipeline installation activities may be impacted by sedimentation/turbidity, however, the potential impact is considered low due to the restricted spatial extent that could be impacted by sedimentation/turbidity and as other significant areas for internesting occur beyond the gas export pipeline corridor (Figure 5-18), i.e. the corridor only overlaps 3.7% and 3.2% of the internesting habitat critical to the survival of flatback and olive ridley turtles, respectively. Drawing on the comparable case studies described earlier in this section for similar pipeline intervention activities, the area of local disturbance may be expected to be in the order of several hundred metres (e.g. as described for the Macedon project, with separation buffer of up to 700 m from primary features) to several kilometres (e.g. as observed for Gorgon nearshore trenching, with elevated turbidity observed within 2 km), depending on the nature of the activities and local seabed and oceanographic conditions at the time.*

	Item 3: • ConocoPhillips considers that pipelay activities within the internesting habitat critical to the survival of flatback and olive ridley turtles will not have the effect of displacing females from nesting habitat, nor result in a likely increase in hatchling mortality, based on consideration of the following: *Seabed disturbance* Direct impacts: • As mentioned above, the area of seabed to be disturbed within the project area represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively. • The actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). • The vast majority of suitable internesting habitat remains outside the gas export pipeline corridor and is available for internesting turtles, including water depths < 30 m deep, in which internesting turtles are known to rest in the days leading up to re-nesting. • Therefore, any direct impacts from seabed disturbance are highly unlikely to result in the displacement of nesting female flatback and olive ridley turtles. Indirect impacts: • Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat. • Gas export pipeline Installation activities, including seabed intervention techniques, within the internesting habitat critical to the survival of olive ridley turtles are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature. *Lighting* • The OPP stated that studies have shown that hatchling turtles may be affected by light produced up to 18 km from the nesting beach (Hodge et al. 2006). It should be noted that this reference relates to light emissions from a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels of light emissions than a typical pipelay vessel. • The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. Note that the pipe welding deck for modern pipelay vessels (such as the Castorone, which recently laid the gas export pipeline for the Ichthys development) is typically encased within the vessel structure, reducing light spill to the marine environment when compared to vessel where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically well lit for operational safety. Cranes are typically the highest point on pipelay vessels. External	*Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat.* *The portion of internesting habitat critical to the survival of olive ridley turtles that is intersected by the gas export pipeline corridor is located off the west and south-west coast of Bathurst Island, where olive ridley turtles are known to nest only in low density numbers (Whiting et al. 2007a; Chatto and Baker 2008). This area is distant from the high-density nesting beaches on the north-west coast of Melville Island. Additionally, the pipeline corridor is located in water depths > 30 m where it overlaps with the internesting habitat critical to the survival of olive ridley turtles. As described above, studies have demonstrated that while turtles may be present in offshore waters with water depths of up to 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. It is therefore expected that internesting olive ridley turtles would only be transiting within, or in the vicinity of, the gas export pipeline corridor in very low numbers. The gas export pipeline corridor overlaps only approximately 3.2% of the internesting habitat critical to the survival of olive ridley turtles, meaning the vast majority of the internesting habitat critical to the survival of the species would not be impacted and would be available for any potentially displaced individual internesting olive ridley turtles to use. Installation activities, including seabed intervention techniques, are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature. Therefore, indirect impacts from gas export pipeline installation activities within the internesting habitat critical to the survival of olive ridley turtles will not prevent any biologically important behaviours from occurring.* *Turtles are not deemed to be physiologically affected by an increase in suspended sediments associated with sediment-generating activities (DSD 2010). As part of the INPEX Ichthys project nearshore environmental monitoring program, an analysis of observed patterns of distribution and abundance of turtles and dugongs around Darwin Harbour and surrounding nearshore waters before and after dredging operations concluded that, "…while spatial and temporal variation has been observed in the distribution and abundance of turtles and dugongs over the duration of the program, on the balance of evidence these differences appear most likely due to natural variation. As such, following the completion of the Dredging Phase of monitoring, there is no indication of any major changes to turtle or dugong populations in the Darwin region as a result of dredging activities" (Cardno 2014). This observation supports the impact conclusion that population level impacts are not expected, including if dredging were required in the event that the final pipeline route is located outside (to the east) of the Oceanic Shoals marine park.* *Therefore, any potential indirect impacts to internesting habitat critical to the survival of flatback and olive ridley turtles, and/or to interesting females,*

	lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision. • The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point. The pipelay vessel will be directly visible at this distance. Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), the highest point of the vessel will be directly visible from the shoreline out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels. • The temporary presence of the pipelay vessels in the area will not significantly increase the volume of existing vessel traffic in the area. The area west and south-west of the Tiwi Islands is subject to considerable vessel traffic. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system (CTS) indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor. These are typically commercial vessels (e.g. container vessels, tankers etc.) moving to and from ports throughout southeast Asia. Vessel traffic of this nature has been operating in the region for decades. *Nesting turtles* • Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area. • There is no evidence that suggests internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat. Therefore, the displacement of nesting females from preferred nesting habitats or from the biologically important internesting area is considered highly unlikely. *Hatchlings* • Artificial light from coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest: ○ Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and ○ Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources. • Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995).	*are expected to be short term at any one area and localised, with only a small number of individuals being affected and the potential to impact nesting behaviour is also considered low.* *To further address potential impacts and risks to the marine environment associated with installation of the gas export pipeline, further engineering and field studies will be undertaken as the project design progresses. Detailed management controls to address sedimentation/turbidity will also be further evaluated and defined as part of the development and implementation of the gas export pipeline installation EP.* Light emissions *The gas export pipeline corridor is located closer to the Tiwi Islands (approximately 6 km at the closest point), however, there are no permanent light sources associated with this subsea infrastructure. Project vessels will be the only project-related light source within the gas export pipeline corridor during installation, planned operational maintenance and decommissioning activities.* *The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point and a pipelay vessel would be directly visible at this distance. The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. The pipe welding deck for modern pipelay vessels is typically encased within the vessel structure, reducing light spill to the marine environment when compared to vessels where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically lit for operational safety. Cranes are typically the highest point on pipelay vessels. External lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision.* *Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), line of sight calculations have estimated that the highest point of the vessel will be directly visible from the vessel out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels.* *As outlined above, modelling of light density levels for a drill rig showed that light reduced to levels comparable with a quarter moon to full moon night sky (0.01–0.1 Lux) within 1.2 km, with light density levels equivalent to a moonless clear night sky and a quarter moon sky (< 0.01 Lux) predicted within 12.6 km (Woodside 2014). Given that light emissions from pipelay vessels are more representative of point sources and drill rigs (as opposed to large industrial facilities), it is considered that the pipelay vessel will appear as relatively small lit object on the water's horizon. Any diffuse light glow emitted from the vessel is expected to be minimal on the Tiwi Islands coastline and largely insignificant as it would be comparable to the light level on a moonless clear night sky and a quarter moon sky. It is also expected that the temporary presence of the pipelay vessels in the area will not significantly increase the volume of vessel traffic that operates in the area. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest*

	• Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean. • Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, flatback hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017). • Thums et al. (2016) demonstrated that hatchling turtles in the sea are attracted to artificial lights, however the influence on turtle behaviour was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however the orientation did not result in disorientation. • The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. • Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated while within the vicinity of the acoustic tag array. • It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at the closest possible point within the pipeline corridor; at this distance, the illumination perceived by hatchling turtles on the nearest beaches on Bathurst Island with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky. • The risk of hatchlings becoming trapped in a light pool in proximity to the pipelay vessel is low given: pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary; while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel; hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents; and hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds	*point of the pipeline corridor (Figure 5-26). These are typically commercial vessels (e.g. container vessels, tankers, etc.) moving to and from ports throughout south-east Asia. During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area.* *Light impacts to internesting flatback and olive ridley turtles are of particular relevance to this impact assessment, given the fact that the pipeline corridor intersects internesting habitat critical to the survival of flatback and olive ridley turtles (Figure 5-14). The percentage proportion of the internesting habitat critical to the survival of flatback and olive ridley turtles that is intersected by the gas export pipeline corridor is 3.7% and 3.2%, respectively. However, the actual area likely to be affected by light emissions during pipeline installation at any one time will be considerably smaller given the reality that the area of disturbance will be based on a vessel slowly moving along a defined pipeline route. There is no evidence, published or anecdotal to suggest internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat (Pendoley 2017; Appendix Q, Witherington and Martin 2003). Light spill is likely to be localised to within a few kilometres of the pipeline installation activity, and the internesting turtle population are exposed to existing light spill from shipping activities using the area between the gas export pipeline corridor and the Tiwi Islands as a channel for entry/exit to Darwin Harbour (Figure 5-26). The number of internesting turtles potentially exposed to the pipeline operations over a 6–12 month period during installation is low given the peak internesting period (June to September for flatbacks and April to August for olive ridley) is a subset of the installation period.* *As discussed in Section 6.4.3, taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area that flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, with the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles being > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat and remaining outside the corridor and available for internesting turtles. In summary, light from installation vessels is unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities (approximately 6–12 months).* *Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest*

	are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low. **References** Department of the Environment (DoEE). 2017. (Final) The Recovery Plan for Marine Turtles in Australia. Department of the Environment and Energy, Canberra, Australian Capital Territory. Harewood, A. and Horrocks, J.A. 2008. Impacts of coastal development on hawksbil hatchling survival and swimming success during the initial offshore migration. Biological Conservation, 141, 394-401. Hodge, W. (Joel), Limpus, C.J., Smissen, P., 2006. Queensland Turtle Conservation Project: Hummock Hill Island nesting turtle study, 2006 (Conservation Technical and Data Report No. Volume 2006 Number 9). Environmental Protection Agency, Brisbane. Lohmann, K.J., Lohmann, C.M.F., 1992. Orientation to oceanic waves by green turtle hatchlings. Journal of Experimental Biology 171: 1–13. Lohmann, K.J., Salmon, M., Wyneken, J., 1990. 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Florida Marine Research Institute Technical Report TR-2 3rd Edition Revised, Florida Department of Environmental Protection, Tequesta, Florida, United States of America.	*construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area.* *The primary light sensitive receptors in the gas export pipeline corridor of particular relevance are hatchling flatback and olive ridley turtles located on the shores of the Tiwi Islands. Hatchlings emerging from the sand locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon and away from elevated silhouettes of dunes and/or vegetation bordering the beach on the landward side (Limpus 1971, Salmon et al. 1992, Limpus and Kamrowski 2013, Pendoley and Kamrowski 2016). Artificial light from onshore coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest:* • *Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and* • *Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources.* *Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995).* *While some studies have shown hatchling orientation to be disrupted by light produced at distances of up to 18 km from the nesting beach this has been from large onshore coastal industrial facilities (Hodge et al. 2007 in Pendoley 2017), not offshore sources. Other studies have demonstrated that diffuse light glow from these light sources does not cause hatchling disorientation beyond 4.8 km from the light source (Limpus 2006) and individual lights as point sources have been reported to disorient hatchling turtles up to a few hundred metres (Limpus 2006). The impact observed by Hodge et al. (2007) (cited in Pendoley 2017) was limited to misorientation, with hatchling turtles taking a slightly longer path to reach the sea. The light source was a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels and intensity of light emissions than a typical pipelay vessel. While the work of Hodge et al. (2007) provides evidence of potential impacts of artificial light from large industrial facilities on hatchling turtle behaviour, caution should be used in making inferences about light sources that differ in nature and scale.* *Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the*

	Item 4: • ConocoPhillips' considers that the key management controls and environmental performance outcomes presented in the OPP are appropriate to manage the risk to acceptable levels and maintain consistency with the requirements of the draft Recovery Plan. Therefore, ConocoPhillips does not consider that pipe-laying activity in proximity to the internesting habitat critical to the survival of flatback and olive riley turtles should have to occur outside peak nesting and hatchling emergence periods (April – September). • As mentioned above, undertaking pipeline installation activities within the internesting habitat critical to the survival of flatback and olive ridley turtles during anytime of the year is considered consistent with the objectives and requirements of the Recovery Plan for Marine Turtles. A demonstration of alignment with the objectives and requirements of the Recovery Plan for Marine Turtles in relation to project seabed disturbance (Table 6-14) and light emissions (Table 6-30) and has been provided in the revised OPP.	*shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean.* *Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017).* *Hatchlings are not trapped indefinitely in light pools and eventually continue the migration offshore (Thums et al. 2013, 2016). However, they may be exposed to an increased risk of predation when trapped in light spill from vessels. Overnight observations of flatback turtle hatchlings trapped by the light spill from a pipelay barge moored approximately 10 km off the east coast of Barrow Island found hatchlings remained within the light spill in the lee of the barge all night until dawn when they swam away from the barge and were carried away by currents (K. Pendoley pers. comm. 2003). None of the monitored hatchlings were predated. These observations, together with experimental results that demonstrated the attraction of hatchlings to light at sea over 150 m (Thums et al. 2016), suggests that hatchlings carried by currents into the vicinity (estimated 500 m–1,000 m) of a pipelay barge can become trapped by light (Pendoley 2017). While hatchling turtles in the sea are attracted to artificial lights, the influence on turtle behavior and impact to hatchlings was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however, the misorientation did not result in disorientation. The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated. It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at the closest possible point within the pipeline corridor. At this distance, the illumination perceived by hatchling turtles on the nearest beaches on the*

		Tiwi Islands with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky, and therefore, is unlikely to have the same effect. *The risk of trapping and possible increased risk of predation is greatest in the southern end of the pipeline corridor where it passes at its closest point to Bathurst Island off Cape Fourcroy. The risk of this occurring is considered relatively low when taking into account: the limited time the pipelay vessel and associated support vessel will be present at any one location off the west coast of the Tiwi Islands, the temporally restricted peak hatchling season (June – September for flatback turtles and April – August for olive ridley turtles), the low risk of hatchlings intersecting a small zone (approximately 500 m–1,000 m) around the pipelay vessel over which they might be influenced to orient towards the vessel lights, the currents in the area mean there is a low likelihood the hatchlings will be in slow moving water (< 0.5 knots) that would allow them to swim against a current towards the light source and then remain in the light, and the short (overnight) time frame the hatchlings could be trapped. Any hatchlings that do become trapped in the light spill from a vessel may be at risk from an increased risk of predation, however, the risk of this is likely reduced due to the distance offshore from predator rich inshore waters. The risk to the flatback and olive ridley turtle populations from the light spill during pipelay installation activities is therefore considered to be low and undetectable against normal population fluctuations.* *An assessment against the significance impact criteria in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance is provided in Appendix Q. The installation of the Barossa gas export pipeline at any time of year is not expected to represent a significant risk to flatback and olive ridley turtles at a population level, taking into consideration:* • *the relatively short 6–12 month time frame of the pipeline installation is insignificant within the context of the long breeding period of marine turtles and so the time frame the breeding females are potentially exposed to the project is low* • *pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary.* • *the seasonally dispersed nesting behaviour reduces the risk of exposure to the entire breeding population* • *while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel* • *hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents* • *hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low.*

		In summary, the impact evaluation demonstrates that impacts to turtles from light during pipeline installation at any time of year are not anticipated to result in impacts at a population level, with the risk to the marine turtle populations from the proposed pipeline installation considered to be low and undetectable against normal population fluctuations. Determinable impacts at a population level from temporary and localised changes in internesting habitat critical to the survival of flatback and olive ridley turtles are not expected given the fact that the light emitted from project vessels will only affect turtles present within a small portion of the available internesting habitat critical to the survival of these species. With regard to potential impacts to hatchlings, individual female turtles also generally do not breed each year. For example, flatback turtles have been observed to breed at intervals between one to five years (mean of 2.7 years) (DoEE 2017d). Olive ridley turtles, however, differ to the other marine turtle species in that the majority (over 60%) of females nest every year (IUCN 2017). Taking this into account, the likelihood of population level impacts is further reduced as it is unlikely that the entire population will be nesting/internesting in any one season. The implementation of key management controls will provide for acceptable environmental outcomes, taking into account the short-term transient nature of effects during the pipeline activities.

Comment received from: MFW Consultants

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
The Barossa Project should be required to geosequestrate the CO_2 removed from the feed gas stream, given the precedent set by the Gorgon project.	• **The Barossa Project should be required to geosequestrate the CO_2 removed from the feed gas stream, given the precedent set by the Gorgon project.** • As raised in the submission, reservoir CO_2 content across the Greater Gorgon gas fields is variable, but broadly ranging between 11-15 mol%. However, it should be noted that it was not a regulatory requirement that the Gorgon project geosequestrate CO_2. Furthermore, the total net emissions for the Gorgon project during operations (6.1 Mtpa CO_2-e, Chevron 2015) are still significantly greater than those proposed for the Barossa offshore project (estimated to be between 2.1 and 3.8 Mtpa CO_2-e from feed gas and operations), even taking into account the CO_2 that the Gorgon project will geosequestrate. • While it is acknowledged that the Barossa reservoir has a relatively high CO_2 content, native reservoir CO_2 content is highly variable and dependent on the specific reservoir characteristics. Contrary to assertions in the submission about volumes of CO_2 vented from the Project, Section 4.3.5.6 of the OPP states that early reservoir modelling indicates that between 1.4 and 2.1 Mtpa of CO2 emissions would be removed from the feed gas and vented from the FPSO facility. As presented in Section 4.3.5.6 of the OPP, the Barossa CO_2 content is within the range of other comparable offshore oil and gas developments in the region that have received environmental approval post the Gorgon Project and not been required to geosequestrate CO2. • In the longer term, carbon capture and storage (CCS) may be a key technology to meet long-term greenhouse gas reduction goals both domestically and internationally as recognised by the Intergovernmental Panel on Climate Change in their Fifth Assessment Report. However, significant barriers still exist to making it a viable option for the vast majority of projects, most notably cost, complexity along the value chain, and long-term liability issues. CCS is one of multiple carbon reduction options for an operating facility and needs to be assessed on its technological and economic merits alongside the suite of other available options. In the near term, CCS is not a commonly available, economically viable carbon reduction solution and expectations about the contribution of CCS towards emission reduction targets needs to be tempered accordingly.	There are no proposed changes to the OPP.

	• Section 4.4.3 of the OPP (Design/activity alternatives) provides an overview of the evaluation of alternative options that were considered for the management of GHG emissions and includes discussion around the evaluations made in relation to the possible reinjection of native CO_2. In summary, for geosequestration to be viable, the storage project must be economically viable, technically feasible, safe, environmentally and socially sustainable and acceptable to the community. When assessed against both business economic challenges and viable alternatives to manage emissions, geosequestration was not considered a reasonably practicable alternative for the following reasons: ○ geosequestration is technically challenging, unproven over the long-term ○ it would render the Barossa development uneconomic and no development would proceed. • A no development option is not a desirable outcome for ConocoPhillips, nor for reducing emissions as natural gas, including from the Barossa Area Development project, will make an important contribution to both domestic and international emission reduction targets, as espoused by the Paris Agreement. • Natural gas is fundamental to a shift towards a lower carbon and more efficient energy system. Increasing use of natural gas for power generation is widely acknowledged as a key pillar of the world's transition to a lower carbon future. Furthermore, gas production is recognised as the logical partner for increasing renewable generation, where it can supplement renewables during falls in output or spikes in demand. • ConocoPhillips is committed to incorporating engineering design controls that reduce atmospheric and GHG emissions through energy efficient design where practicable, and will responsibly manage emissions in accordance with the regulatory requirements and policy context at the time. *Reference:* Chevron 2015. Gorgon Gas Development and Jansz Feed Gas Pipeline: Greenhouse Gas Abatement Program Report. https://www.chevronaustralia.com/docs/default-source/default-document-library/gorgon-emp-greenhouse-gas-abatement-program.pdf?sfvrsn=4	

Comment received from: Environmental Defenders Office (EDO) for the Australian Marine Conservation Society (AMCS)

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
Background ConocoPhillips' assessment of the proposed Project is relatively thorough. Cumulative impacts should be considered. 1. An agreement has been made between Commonwealth Departments to conduct a Strategic Environmental Assessment (SEA) for the petroleum activities in NT coastal waters, however the report for this study is not yet available. **Impacts on important internesting areas for flatback and olive ridley turtles** 2. Nesting females may be displaced from preferred nesting habitat and hatchling mortality is likely to increase given their attraction to project lighting sources. 3. Impacts to nesting and hatchling turtles in the vicinity of the Tiwi Islands have the effect of limiting marine turtle's capacity to recover. To mitigate this potential impact, pipe-laying activities should not occur during the	**Background** ConocoPhillips appreciates the acknowledgement that the assessment is relatively thorough. The Barossa OPP represents the culmination of a significant volume of studies and multidisciplinary inputs to provide a whole-of-project assessment, appropriate at this early stage of project definition. An assessment of all relevant environmental impacts and risks has been completed, across all phases of development, and also considered in a cumulative context (Section 6.5). **Item 1:** • It is noted that the Commonwealth Government is still progressing the Strategic Assessment of offshore petroleum activities in the coastal waters of the NT. While independent of this OPP, it is understood that the SEA is intended to assess the effectiveness of the authorisation process for petroleum activities in NT coastal waters to be conferred to NOPSEMA, for the protection of matters protected under Part 3 of the EPBC Act (protected matters) to streamline environmental approvals. • The scope of this OPP is for assessment of the Barossa offshore development in Commonwealth waters (i.e. the proposed development is outside of NT coastal waters), and is structured to align with the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and current NOPSEMA guidance.	**Impacts on important internesting areas for flatback and olive ridley turtles** The following text has been included in the revised OPP as a key Management Control: *Dredging activities/trenching activities for the gas export pipeline installation (if required) will occur outside the peak flatback (June to September) and olive ridley (April to August) turtle internesting period when within the internesting habitat critical to the survival of these species.* Given the fact that 'habitat critical to the survival of a species' is provided specific consideration in the Recovery Plan for Marine Turtles in Australia (DoEE 2017a) which is a statutory instrument under the EPBC Act, the impact assessment presented in Section 6 of the OPP has been updated to explicitly use the internesting habitat critical to the survival of flatback and olive ridley turtles as the point of reference to inform the potential risk and impact conclusions. The relevant impact assessment text has been amended as follows:

peak nesting and hatchling emergence periods between April and September.

Acoustic impacts

4. High energy acoustic impacts in the vicinity of the FPSO related to pile-driving and seismic activity may result in mortality to small fish species and phytoplankton and are also likely to impact marine mammals and turtles by displacing them from habitats and interfere with communications, feeding and potentially navigation. Known periods of whale migration should be avoided to reduce impacts of displacement or behavioral change.

GHG emissions

5. ConocoPhillips needs to explain how the impacts of ocean acidification have been taken into account, including how the precautionary principle has been operationalized for this project; and address Australia's international obligations to reduce emissions and explain how the Project is justified in the face of those obligations and application of principles of ecologically sustainable development.

   The broader impact of releasing these gasses should be acknowledged and reduced as much as possible and also offset.

Discharges

6. Concern about the effects of produced water and impacts to local marine biodiversity. Monitoring programs should be rigorously designed to statistically detect change and thresholds for contamination. Contaminated water and drill cuttings will increasingly become an issue with additional proposed developments for the region, programs should be designed to reflect this.

Offsets

7. Consideration should be given to an offset strategy for impacts that cannot be mitigated.

As such, the SEA for petroleum activities in NT coastal waters is not relevant to the Barossa offshore development.

Impacts on important internesting areas for flatback and olive ridley turtles

Item 2:

- ConocoPhillips considers that pipelay activities within the internesting habitat critical to the survival of flatback and olive ridley turtles will not have the effect of displacing females from nesting habitat, nor result in a likely increase in hatchling mortality, based on consideration of the following:

Seabed disturbance

Direct impacts:

- The area of seabed to be disturbed within the project area represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively.
- The actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles).
- The vast majority of suitable internesting habitat remains outside the gas export pipeline corridor and is available for internesting turtles, including water depths < 30 m deep, in which internesting turtles are known to rest in the days leading up to re-nesting.
- Therefore, any direct impacts from seabed disturbance are highly unlikely to result in the displacement of nesting female flatback and olive ridley turtles.

Indirect impacts:

- Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat.
- Gas export pipeline Installation activities, including seabed intervention techniques, within the internesting habitat critical to the survival of olive ridley turtles are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature.

Lighting

- The OPP stated that studies have shown that hatchling turtles may be affected by light produced up to 18 km from the nesting beach (Hodge et al. 2006). It should be noted that this reference relates to light emissions from a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels of light emissions than a typical pipelay vessel.
- The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. Note that the pipe welding deck for modern pipelay vessels (such as the Castorone, which recently laid the gas export pipeline for the Ichthys development) is typically encased within the vessel structure, reducing light

Seabed disturbance – direct impacts

Disturbance of the seabed is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles, fish and sharks/rays. The majority of these species are generally present within the water column and are not solely reliant on benthic habitat (Section 5.6). The area of seabed to be disturbed within the project area also represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively, in which individuals may rest on the seabed between nesting events. However, as outlined above, the actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). Taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles.

Additionally, although some loss of marine turtle foraging habitat is likely to occur as a result of the installation of the gas export pipeline on the seabed, such foraging habitat is widely represented in the region and any loss is expected to be negligible. Environmental, geophysical and bathymetric surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. Therefore, the physical presence of the gas export pipeline is not expected to adversely impact on biologically important behaviours or biologically important habitat, including habitat critical to the survival of marine turtles.

Seabed disturbance – indirect impacts

There is potential for a small portion of internesting habitat critical to the survival of flatback and olive ridley turtles to be affected by increased sedimentation/turbidity as seabed intervention works for the gas export pipeline may be required within the internesting habitat critical to the survival of these species. The potential loss or reduction in quality of habitat may temporarily reduce available foraging and internesting habitats available for marine turtles. In the context of indirect impacts, potential marine turtle habitat may be lost indirectly through an increase in localised turbidity in the water column.

	spill to the marine environment when compared to vessel where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically well lit for operational safety. Cranes are typically the highest point on pipelay vessels. External lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision. • The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point. The pipelay vessel will be directly visible at this distance. Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), the highest point of the vessel will be directly visible from the shoreline out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels. • The temporary presence of the pipelay vessels in the area will not significantly increase the volume of existing vessel traffic in the area. The area west and south-west of the Tiwi Islands is subject to considerable vessel traffic. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system (CTS) indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor. These are typically commercial vessels (e.g. container vessels, tankers etc.) moving to and from ports throughout southeast Asia. Vessel traffic of this nature has been operating in the region for decades. *Nesting turtles* • Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area. • There is no evidence that suggests internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat. Therefore, the displacement of nesting females from preferred nesting habitats or from the biologically important internesting area is considered highly unlikely. *Hatchlings* • Artificial light from coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest: ○ Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and ○ Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources.	*There is likely to be temporary indirect impacts on potential foraging habitat in the immediate vicinity of the pipeline installation activities. The majority of the benthic habitats within the pipeline corridor are expected to be characterised by filter feeders and burrowers/crinoids, with a substantial portion of the area supporting no benthic habitat (as summarised previously in Section 5.5.2.2). These habitats are well represented elsewhere within the region, with foraging grounds for flatback and olive ridley turtles represented across the wider Timor Sea (Figure 5-18). The area that may be indirectly affected is also not known to support biologically important foraging grounds for flatback or olive ridley turtles (Figure 5-18). Environmental, geophysical and bathymetric surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. In addition, the area has naturally high levels of turbidity and periodic severe events associated with cyclones. Flatback and olive ridley turtles are known to naturally feed in turbid, shallow inshore waters. It is expected that sedimentation effects from seabed intervention activities will be localised in extent, commensurate with the nature of specific method(s) that will be further assessed as part of activity-specific EPs. In summary, there may be a temporary, localised, indirect impact on flatback and olive ridley turtles associated with the loss of benthos, resulting in a negligible temporary reduction in foraging habitat. However, individual turtles are expected to simply move to similar habitats that are well represented in the region, with no significant population level impacts predicted. Therefore, indirect impacts to foraging habitat are not expected to adversely impact on biologically important behaviours or habitat critical to the survival of marine turtles.* *Internesting habitat in the immediate vicinity of the pipeline installation activities may be impacted by sedimentation/turbidity, however, the potential impact is considered low due to the restricted spatial extent that could be impacted by sedimentation/turbidity and as other significant areas for internesting occur beyond the gas export pipeline corridor (Figure 5-18), i.e. the corridor only overlaps 3.7% and 3.2% of the internesting habitat critical to the survival of flatback and olive ridley turtles, respectively. Drawing on the comparable case studies described earlier in this section for similar pipeline intervention activities, the area of local disturbance may be expected to be in the order of several hundred metres (e.g. as described for the Macedon project, with separation buffer of up to 700 m from primary features) to several kilometres (e.g. as observed for Gorgon nearshore trenching, with elevated turbidity observed within 2 km), depending on the nature of the activities and local seabed and oceanographic conditions at the time.* *Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat.* *The portion of internesting habitat critical to the survival of olive ridley turtles that is intersected by the gas export pipeline corridor is located off the west and south-west coast of Bathurst Island, where olive ridley turtles are*

	• Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995). • Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean. • Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, flatback hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017). • Thums et al. (2016) demonstrated that hatchling turtles in the sea are attracted to artificial lights, however the influence on turtle behaviour was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however the orientation did not result in disorientation. • The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. • Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated while within the vicinity of the acoustic tag array. • It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at the closest possible point within the pipeline corridor; at this distance, the illumination perceived by hatchling turtles on the nearest beaches on Bathurst Island with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky. • The risk of hatchlings becoming trapped in a light pool in proximity to the pipelay vessel is low given: pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary; while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel; hatchlings are unable to swim against fast moving tides and currents and a few individuals might be	*known to nest only in low density numbers (Whiting et al. 2007a; Chatto and Baker 2008). This area is distant from the high-density nesting beaches on the north-west coast of Melville Island. Additionally, the pipeline corridor is located in water depths > 30 m where it overlaps with the internesting habitat critical to the survival of olive ridley turtles. As described above, studies have demonstrated that while turtles may be present in offshore waters with water depths of up to 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. It is therefore expected that internesting olive ridley turtles would only be transiting within, or in the vicinity of, the gas export pipeline corridor in very low numbers. The gas export pipeline corridor overlaps only approximately 3.2% of the internesting habitat critical to the survival of olive ridley turtles, meaning the vast majority of the internesting habitat critical to the survival of the species would not be impacted and would be available for any potentially displaced individual internesting olive ridley turtles to use. Installation activities, including seabed intervention techniques, are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature. Therefore, indirect impacts from gas export pipeline installation activities within the internesting habitat critical to the survival of olive ridley turtles will not prevent any biologically important behaviours from occurring.* *Turtles are not deemed to be physiologically affected by an increase in suspended sediments associated with sediment-generating activities (DSD 2010). As part of the INPEX Ichthys project nearshore environmental monitoring program, an analysis of observed patterns of distribution and abundance of turtles and dugongs around Darwin Harbour and surrounding nearshore waters before and after dredging operations concluded that, "…while spatial and temporal variation has been observed in the distribution and abundance of turtles and dugongs over the duration of the program, on the balance of evidence these differences appear most likely due to natural variation. As such, following the completion of the Dredging Phase of monitoring, there is no indication of any major changes to turtle or dugong populations in the Darwin region as a result of dredging activities" (Cardno 2014). This observation supports the impact conclusion that population level impacts are not expected, including if dredging were required in the event that the final pipeline route is located outside (to the east) of the Oceanic Shoals marine park.* *Therefore, any potential indirect impacts to internesting habitat critical to the survival of flatback and olive ridley turtles, and/or to interesting females, are expected to be short term at any one area and localised, with only a small number of individuals being affected and the potential to impact nesting behaviour is also considered low.* *To further address potential impacts and risks to the marine environment associated with installation of the gas export pipeline, further engineering and field studies will be undertaken as the project design progresses. Detailed management controls to address sedimentation/turbidity will also be further evaluated and defined as part of the development and implementation of the gas export pipeline installation EP.*

	trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents; and hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low. • In summary, light from installation vessels, as well as direct and indirect impacts from seabed intervention techniques, are unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities and localised extent of any potential impacts. **Item 3:** • The importance of the flatback and olive ridley turtle internesting biologically important internesting areas / habitat critical to the survival is recognised and considered throughout the OPP (Section 5 Description of the environment and Section 6 Evaluation of environmental impacts and risks). • ConocoPhillips recognises that the Northern Territory olive ridley turtle stock is significant as the last major remaining olive ridley turtle stock in south-east Asia, and the Tiwi Islands and surrounding nearshore waters contain important nestingand internesting habitat for this stock, as defined in the Recovery Plan for Marine Turtles in Australia (the Recovery Plan) (DoEE 2017). • At the time of publishing the original OPP for public comment, two factors influenced the spatial extent of the dry gas export pipeline corridor as presented: a. The independent review of the Commonwealth Marine Reserves (CMR) Network had recommended that part of the Oceanic Shoals CMR (currently a multiple use zone) be revised to include a habitat protection zone on the eastern side of the CMR. This introduced uncertainty as to whether the project would be able to gain approvals to install the gas export pipeline in that area if the review's recommendations were adopted (the Management Plans are currently being revised following a public comment period). Consequently, a pipeline corridor that provided the option to install part of the pipeline within the now proposed habitat protection zone, or completely outside of the proposed habitat protection zone was included in the original OPP. b. The spatial extent of the corridor included in the original OPP was based on the level of project engineering available at that time and did overlap a small area of the olive ridley turtle internesting area defined in the Recovery Plan (DoEE 2017). • In the period between publication of the OPP for public comment and re-submission of the OPP for acceptance by NOPSEMA, information derived from additional field surveys and engineering studies became available. ConocoPhillips considered the new information, including in the context of the olive ridley turtle internesting BIA and the comments raised in public comment submissions. Consequently, potential pipeline routes that would have overlapped the internesting BIA for olive ridley turtles nesting on the Tiwi Islands were removed as options. • Shortly after submission to NOPSEMA for stage two assessment of acceptability, the DoEE released spatial data for (draft) habitat critical to the survival of olive ridley and flatback turtles, via the National Conservation Values Atlas. The internesting habitat critical to the survival of flatback turtles and olive ridley turtles is 60 km and 20 km respectively, surrounding the Tiwi Islands. • The internesting habitat critical to the survival of olive ridley turtles covers a much greater spatial extent than the internesting BIA, which is restricted to a 20 km buffer from the high-density nesting beaches on the north-west coast of the Tiwi Islands.	Light emissions *The gas export pipeline corridor is located closer to the Tiwi Islands (approximately 6 km at the closest point), however, there are no permanent light sources associated with this subsea infrastructure. Project vessels will be the only project-related light source within the gas export pipeline corridor during installation, planned operational maintenance and decommissioning activities.* *The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point and a pipelay vessel would be directly visible at this distance. The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. The pipe welding deck for modern pipelay vessels is typically encased within the vessel structure, reducing light spill to the marine environment when compared to vessels where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically lit for operational safety. Cranes are typically the highest point on pipelay vessels. External lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision.* *Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), line of sight calculations have estimated that the highest point of the vessel will be directly visible from the vessel out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels.* *As outlined above, modelling of light density levels for a drill rig showed that light reduced to levels comparable with a quarter moon to full moon night sky (0.01–0.1 Lux) within 1.2 km, with light density levels equivalent to a moonless clear night sky and a quarter moon sky (< 0.01 Lux) predicted within 12.6 km (Woodside 2014). Given that light emissions from pipelay vessels are more representative of point sources and drill rigs (as opposed to large industrial facilities), it is considered that the pipelay vessel will appear as relatively small lit object on the water's horizon. Any diffuse light glow emitted from the vessel is expected to be minimal on the Tiwi Islands coastline and largely insignificant as it would be comparable to the light level on a moonless clear night sky and a quarter moon sky. It is also expected that the temporary presence of the pipelay vessels in the area will not significantly increase the volume of vessel traffic that operates in the area. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor (Figure 5-26). These are typically commercial vessels (e.g. container vessels, tankers, etc.) moving to and from ports throughout south-east Asia. During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area.* *Light impacts to internesting flatback and olive ridley turtles are of particular relevance to this impact assessment, given the fact that the pipeline corridor intersects internesting habitat critical to the survival of flatback and olive*

	• In parallel to NOPSEMA assessment for acceptability, ConocoPhillips continued to progress gas export pipeline route engineering and consequently was able to rule out several potential routes based on consideration and evaluation of a range of factors, including feasibility and the potential for environmental impacts. This has resulted in a refined gas export pipeline corridor that provides the best option for the project, including minimising potential environmental impacts (refer Table 4.10 from the OPP for a comparative assessment of the pipeline corridor alternatives). However, based on the evaluation, the pipeline corridor cannot avoid the internesting habitat critical to the survival of flatback and olive ridley turtles, but the corridor has been reduced as much as possible (prior to final pipeline routing studies) and now only overlaps approximately 3.7% and 3.2% of the total internesting habitat critical to the survival of these species, respectively. • The actual area of seabed within the internesting habitat critical to the survival for flatback and olive ridley turtles that will be directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). • Given the small overlap of the gas export pipeline corridor with internesting habitat critical to the survival of olive ridley turtles (3.2%) and the short duration of time pipelay activities are expected to take to complete within the internesting habitat critical to survival for the species (approximately 1 – 2 months), ConocoPhillips is not proposing to avoid pipelay activities within this area, either completely or temporally. • While the refinement of the gas export pipeline corridor cannot avoid the habitat critical to the survival of flatback and olive ridley turtles, it does avoid the internesting BIA for olive ridley turtles and with no pipelay installation activities to occur within the olive ridley internesting BIA at any time, including during peak nesting and hatchling emergence periods for this species (April to September). • Although the pipeline corridor does overlap internesting habitat critical to the survival of flatback and olive ridley turtles, undertaking pipeline installation activities within this area during anytime of the year is considered consistent with the objectives and requirements of the Recovery Plan for Marine Turtles. Demonstration of alignment with the objectives and requirements of the Recovery Plan for Marine Turtles in relation to project activities are provided in the revised OPP, including seabed disturbance (Table 6-14) and light emissions (Table6-30). • Taking into account the outcomes of a professional review by Pendoley (2017; (Appendix Q of the OPP), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles, the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). Those studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles.	*ridley turtles (Figure 5-14). The percentage proportion of the internesting habitat critical to the survival of flatback and olive ridley turtles that is intersected by the gas export pipeline corridor is 3.7% and 3.2%, respectively. However, the actual area likely to be affected by light emissions during pipeline installation at any one time will be considerably smaller given the reality that the area of disturbance will be based on a vessel slowly moving along a defined pipeline route. There is no evidence, published or anecdotal to suggest internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat (Pendoley 2017; Appendix Q, Witherington and Martin 2003). Light spill is likely to be localised to within a few kilometres of the pipeline installation activity, and the internesting turtle population are exposed to existing light spill from shipping activities using the area between the gas export pipeline corridor and the Tiwi Islands as a channel for entry/exit to Darwin Harbour (Figure 5-26). The number of internesting turtles potentially exposed to the pipeline operations over a 6–12 month period during installation is low given the peak internesting period (June to September for flatbacks and April to August for olive ridley) is a subset of the installation period.* *As discussed in Section 6.4.3, taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area that flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, with the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles being > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat and remaining outside the corridor and available for internesting turtles. In summary, light from installation vessels is unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities (approximately 6–12 months).* *Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses*

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Florida Marine Research Institute Technical Report TR-2 3rd Edition Revised, Florida Department of Environmental Protection, Tequesta, Florida, United States of America. **<u>Acoustic impacts</u>** **<u>Item 4:</u>** • As detailed in the OPP, impacts to cetaceans at a population level from underwater noise generated by the project is considered highly unlikely given the Barossa offshore	*elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area.* *The primary light sensitive receptors in the gas export pipeline corridor of particular relevance are hatchling flatback and olive ridley turtles located on the shores of the Tiwi Islands. Hatchlings emerging from the sand locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon and away from elevated silhouettes of dunes and/or vegetation bordering the beach on the landward side (Limpus 1971, Salmon et al. 1992, Limpus and Kamrowski 2013, Pendoley and Kamrowski 2016). Artificial light from onshore coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest:* • *Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and* • *Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources.* *Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995).* *While some studies have shown hatchling orientation to be disrupted by light produced at distances of up to 18 km from the nesting beach this has been from large onshore coastal industrial facilities (Hodge et al. 2007 in Pendoley 2017), not offshore sources. Other studies have demonstrated that diffuse light glow from these light sources does not cause hatchling disorientation beyond 4.8 km from the light source (Limpus 2006) and individual lights as point sources have been reported to disorient hatchling turtles up to a few hundred metres (Limpus 2006). The impact observed by Hodge et al. (2007) (cited in Pendoley 2017) was limited to misorientation, with hatchling turtles taking a slightly longer path to reach the sea. The light source was a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels and intensity of light emissions than a typical pipelay vessel. While the work of Hodge et al. (2007) provides evidence of potential impacts of artificial light from large industrial facilities on hatchling turtle behaviour, caution should be used in making inferences about light sources that differ in nature and scale.* *Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean.*

	development area does not contain any regionally significant feeding, breeding, aggregation areas or migration corridors for marine mammals. • The noise assessment presented in the OPP demonstrates that any spatial and temporal scale of behavioural response effects would be limited to the localised area surrounding the FPSO location. Any impacts from seismic (vertical seismic profiling of the development wells) and pile driving operations are expected to be short-term. • Therefore, the key management controls and supporting environmental performance outcomes included in the OPP are appropriate to manage the risk of underwater noise to acceptable levels. • ConocoPhillips therefore considers that seasonal restriction of vertical seismic profiling and pile driving activities is not warranted or appropriate. • The impact assessment within the OPP addresses the potential for mortality of small fish species and zooplankton and behavioural responses to marine turtles within very close proximity to the acoustic source during vertical seismic profiling (VSP conducted from the MODU) and pile driving (if required during FPSO mooring installation). • As stated within the OPP, expected sound levels emitted from the seismic source during VSP are expected to be approximately 190 dB re 1 µPa at 1 m which is well below the impulsive noise threshold for mortality and potential mortal injury for fish and plankton of 207 dB re 1 µPa (Table 6-20 of the OPP). • The OPP impact assessment concluded that given the expected sound levels and thresholds of marine fauna, there is the potential for behavioural change responses to marine mammals, marine reptiles and fish in close proximity to the VSP source (within hundreds of metres). The Barossa offshore development area and immediate surrounds do not contain any significant feeding, breeding or aggregation areas for marine mammals and reptiles. Therefore, there is likely to be a limited abundance of individuals present in the area at any time with individuals likely to be traversing through the area • ConocoPhillips considers that the impact assessment and conclusion within the OPP remains valid for fish and plankton in relation to potential impacts from VSP. • The impact assessment for pile driving underwater noise acknowledges that mortality of fish and plankton may be possible within close proximity to the FPSO. Table 6-21 of the OPP provides the modeled distances for the mortality/potential for mortal injury threshold for fish form underwater pile driving noise as ranging from 0.20 to 0.34 km from the noise source. • For marine turtles, the OPP stated that underwater noise emissions generated from pile driving activities were predicted to cause behavioural responses or injury within approximately 14.4 km and 0.2 km, respectively (Table 6-21 of the OPP). Considering the open ocean location of the Barossa offshore development area and significant distance to internesting habitat critical to the survival of marine turtles and shoals/banks, only individual turtles may be affected as they transit the area. No impacts at a population level are anticipated. • No changes to the OPP are proposed. **<u>Greenhouse gas emissions</u>** **Item 5:** Ocean Acidification • ConocoPhillips acknowledges the potential link between GHG emissions and ocean acidification as an emerging global issue, as cited by the article written by the GBRMPA. More generally, ConocoPhillips recognises that human activity, including the burning of fossil fuels, is contributing to increased concentrations of greenhouse gases (GHG) in the	*Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017).* *Hatchlings are not trapped indefinitely in light pools and eventually continue the migration offshore (Thums et al. 2013, 2016). However, they may be exposed to an increased risk of predation when trapped in light spill from vessels. Overnight observations of flatback turtle hatchlings trapped by the light spill from a pipelay barge moored approximately 10 km off the east coast of Barrow Island found hatchlings remained within the light spill in the lee of the barge all night until dawn when they swam away from the barge and were carried away by currents (K. Pendoley pers. comm. 2003). None of the monitored hatchlings were predated. These observations, together with experimental results that demonstrated the attraction of hatchlings to light at sea over 150 m (Thums et al. 2016), suggests that hatchlings carried by currents into the vicinity (estimated 500 m–1,000 m) of a pipelay barge can become trapped by light (Pendoley 2017). While hatchling turtles in the sea are attracted to artificial lights, the influence on turtle behavior and impact to hatchlings was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however, the misorientation did not result in disorientation. The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated. It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at the closest possible point within the pipeline corridor. At this distance, the illumination perceived by hatchling turtles on the nearest beaches on the Tiwi Islands with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky, and therefore, is unlikely to have the same effect.* *The risk of trapping and possible increased risk of predation is greatest in the southern end of the pipeline corridor where it passes at its closest point to Bathurst Island off Cape Fourcroy. The risk of this occurring is considered relatively low when taking into account: the limited time the pipelay vessel and associated support vessel will be present at any one location off the west coast of the Tiwi Islands, the temporally restricted peak hatchling*

	atmosphere that can lead to adverse changes in global climate and other effects such as ocean acidification. However, climate change is a global phenomenon and it is not possible to meaningfully quantify the causal relationship between GHG emissions from a single facility and the manifestation of climate change impacts, such as ocean acidification, at a local or regional scale. • Notwithstanding the difficulties in drawing links between single facility emissions and global climate change trends, the Barossa Area Development will generate a new source of natural gas which is widely acknowledged as a key pillar of the transition to a lower carbon future. Natural gas from the Barossa Area Development will contribute to displacement of other more carbon-intensive fuels globally, such as coal, resulting in a lowering of global GHG emissions which in turn will help to counter the impacts of global climate change, such as ocean acidification. On a lifecycle comparison basis, independent analysis (Worley Parsons 2011) suggests that compared to using coal fired power generators in China, for every tonne of CO_2e emissions associated with the use of natural gas, including LNG production, up to 4.3 tonnes of CO_2e emissions are avoided. • Notwithstanding the links between climate change and ocean acidification, use of the precautionary principle as an argument to oppose the Barossa Area Development would prevent the supply of a lower carbon fuel in the form of natural gas, which would otherwise make a positive contribution toward global emissions reduction efforts and counter the adverse effects of climate change, including ocean acidification. • Regarding GHG emissions from the Barossa Area Development itself, section 4.4.3 of the OPP (Design/activity alternatives) provides an overview of the evaluation of alternative energy efficient design options being considered for the management of GHG emissions. These and future evaluations will continue to inform engineering design for ongoing operations to optimize the GHG emissions profile to the greatest extent possible. ConocoPhillips will responsibly manage emissions in accordance with the regulatory requirements and policy context at the time. Australia's international obligations • ConocoPhillips is an active contributor to Government climate change policy deliberations, and provided a submission to the most recent discussion paper on policy settings in support of the Australian Government's 2030 emissions reduction target, as per its commitment under the Paris Agreement. • In its submission, ConocoPhillips highlighted the global nature of climate change and the need for both national and global action. Australia has an important role to play in reducing global emissions, and the domestic natural gas and LNG industries are long-term key contributors in this effort. • Natural gas is fundamental to a shift towards a lower carbon and more efficient energy system. Increasing use of natural gas for power generation is widely acknowledged as a key pillar of the world's transition to a lower carbon future. Furthermore, gas production is recognised as the logical partner for increasing renewable generation, where it can supplement renewables during falls in output or spikes in demand. • Natural gas, including from the Barossa Area Development project, will make an important contribution to both domestic and international emission reduction targets, as espoused by the Paris Agreement. • As discussed in Section 7.5 of the OPP, the Barossa Area Development is consistent with the principles of Ecologically Sustainable Development in the following ways. As a backfill development to extend the life of the existing DLNG facility, it will continue to meet long-term demand for a low-carbon transition fuel in the form of natural gas. The OPP demonstrates that this will be done in an environmentally responsible manner. Investment in	*season (June – September for flatback turtles and April – August for olive ridley turtles), the low risk of hatchlings intersecting a small zone (approximately 500 m–1,000 m) around the pipelay vessel over which they might be influenced to orient towards the vessel lights, the currents in the area mean there is a low likelihood the hatchlings will be in slow moving water (< 0.5 knots) that would allow them to swim against a current towards the light source and then remain in the light, and the short (overnight) time frame the hatchlings could be trapped. Any hatchlings that do become trapped in the light spill from a vessel may be at risk from an increased risk of predation, however, the risk of this is likely reduced due to the distance offshore from predator rich inshore waters. The risk to the flatback and olive ridley turtle populations from the light spill during pipelay installation activities is therefore considered to be low and undetectable against normal population fluctuations.* *An assessment against the significance impact criteria in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance is provided in Appendix Q. The installation of the Barossa gas export pipeline at any time of year is not expected to represent a significant risk to flatback and olive ridley turtles at a population level, taking into consideration:* • *the relatively short 6–12 month time frame of the pipeline installation is insignificant within the context of the long breeding period of marine turtles and so the time frame the breeding females are potentially exposed to the project is low* • *pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary.* • *the seasonally dispersed nesting behaviour reduces the risk of exposure to the entire breeding population* • *while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel* • *hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents* • *hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low.* *In summary, the impact evaluation demonstrates that impacts to turtles from light during pipeline installation at any time of year are not anticipated to result in impacts at a population level, with the risk to the marine turtle populations from the proposed pipeline installation considered to be low and undetectable against normal population fluctuations. Determinable impacts at a population level from temporary and localised changes in internesting habitat critical to the survival of flatback and olive ridley turtles are not expected given the fact that the light emitted from project vessels will only affect turtles present within a small portion of the available internesting habitat critical to the survival of these species. With regard to potential*

	the initial development and ongoing operations will be a long term source of significant income and employment opportunities for Australia. **Discharges** **Item 6:** • ConocoPhillips acknowledges and agrees that monitoring programs require a level of scientifically robust design to inform the adaptive management of operational discharges. This commitment is reflected in the key management control which states that *'an environmental monitoring program (Section 7.2.3) and adaptive management framework (Section 7.3) will be applied to manage PFW and cooling water discharges.'* • The OPP provides an outline of the environmental monitoring framework for the project, which includes: ○ monitoring of the environment in the area influenced by project activities ○ verification monitoring of the PFW discharge stream during operations to confirm compliance with the management controls ○ periodic testing of produced formation water discharges to characterise the discharge stream and inform triggers that are appropriate for the sensitivity of local organisms. ○ development of trigger actions to support implementation of the monitoring framework and used to inform and refine the monitoring parameters. • Considering that an OPP is prepared in the early stage of a project, further detail on the environmental monitoring that will be undertaken throughout the life of the project will be further refined as part of the forward process of developing detailed activity-specific EPs. • To minimise potential impacts, ConocoPhillips will also adopt an adaptive management framework to actively manage routine discharges throughout the life of the project. • Taking into account the scenario raised in the received comment, should additional developments occur in the region the adaptive management framework to be adopted will inform management decisions and enable flexibility to adapt the monitoring approach over time to take into consideration any changes to the existing marine environment or environmental legislation, new technologies and new information. • In summary, considering the nature of the Barossa offshore development area (i.e. sparse and representative benthic communities and absence of any key feeding, breeding and aggregation areas for marine fauna), ConocoPhillips considers that the key management controls and supporting environmental monitoring framework outlined in the OPP are appropriate to appropriate manage the risk of planned discharges to acceptable levels. **Offsets** **Item 7:** • Australian Government policies including the Emissions Reduction Fund, Safeguard Mechanism and National Carbon Offset Standard are in place to ensure Australia meets its climate change commitments under the Paris Agreement. The applicability of these policies to post-2020 projects, which includes the Barossa Area Development, is still under consideration. Once climate change policy applicability to the Barossa Area Development is determined, ConocoPhillips will give further consideration to the role of offsets in meeting its compliance obligations. Reference WorleyParsons (2011), *Greenhouse Gas Emissions Study of Australian CSG to LNG*, April 2011.	*impacts to hatchlings, individual female turtles also generally do not breed each year. For example, flatback turtles have been observed to breed at intervals between one to five years (mean of 2.7 years) (DoEE 2017d). Olive ridley turtles, however, differ to the other marine turtle species in that the majority (over 60%) of females nest every year (IUCN 2017). Taking this into account, the likelihood of population level impacts is further reduced as it is unlikely that the entire population will be nesting/internesting in any one season. The implementation of key management controls will provide for acceptable environmental outcomes, taking into account the short-term transient nature of effects during the pipeline activities.* **Acoustic impacts** No changes to the OPP are proposed. **Greenhouse gas emissions** No changes to the OPP are proposed. **Discharges** No changes to the OPP are proposed. **Offsets** No changes to the OPP are proposed.

Comment received from: Parks Australia

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
1. Parks Australia has identified that further studies are important to provide a greater level of confidence as to whether construction of the pipeline poses an acceptable level of impact on marine park values to achieve a management outcome that demonstrably minimises any impact to marine park values. 2. An environmental performance outcome (EPO) should be included in the OPP that requires further studies to examine the representativeness of species and species assemblages found within the section of the pipeline corridor that intersects the marine park, with other areas of the marine park. 3. The Director of National Parks is to be considered as a relevant person for the purposes of consultation under the Environment Regulations and is to be consulted by titleholders in the preparation of environment plans where a proposed activity is within or could impact a marine park.	**Item 1:** • ConocoPhillips agrees that additional engineering studies and environmental surveys beyond those currently presented in the OPP will provide a greater level of confidence as to the acceptability of installing a gas export pipeline in the marine park. • To date, the representativeness of species and species assemblages found within the sections of the marine park that are and are not overlapped by the pipeline corridor has been considered through the extension of the Oceanic Shoals CMR benthic habitat model produced by the Australian Institute of Marine Science (AIMS). This model was shown to have a good level of accuracy and therefore provides a sound scientific basis for understanding the values within/outside the marine park. • Analysis of the AIMS benthic habitat mapping shows that benthic habitats present within the portion of the marine park overlapped by the gas export pipeline corridor are represented in other areas of the marine park and the broader region (refer to Section 5.5.2.2 and Figure 5-9 of the OPP). • Additional baseline studies within the Oceanic Shoals marine park and the gas export pipeline corridor, including the area that overlaps the marine park, have now been completed by AIMS (25 September – 8 October 2017). The data collected during this survey is being processed and analysed with the final report due to be delivered by end of July 2018. The report will further define the benthic habitats within the marine park and pipeline corridor and allow a robust assessment that the habitats within the portion of the marine park overlapped by the pipeline corridor are represented elsewhere in the marine park outside the pipeline corridor. **Item 2:** • ConocoPhillips has adopted the recommendation by Parks Australia to include an additional environmental performance objective to reflect this commitment and inform acceptability conclusions regarding the level of impact on marine park values. **Item 3:** • ConocoPhillips notes Parks Australia's advice relating to ongoing consultation during the preparation of Environment Plans (EPs) for activities occurring within a marine park. ConocoPhillips will continue to liaise with Parks Australia and has formalised this commitment in the OPP.	In response to **Item 1**, specific sections of the OPP have been revised to emphasise that the benthic habitats found in the area of the marine park that is overlapped by the gas export pipeline corridor are represented in other areas of the marine park. The following amendments to the 'Impact assessment and risk evaluation' text in Section 6.4, have been made (specific revisions are shown by the italicised text): *The gas export pipeline corridor overlaps approximately 708 km^2 (approximately 1%) of the Oceanic Shoals marine park. Benthic habitats within the portion of the marine park overlapped by the pipeline corridor are representative of those within the broader marine park boundary. Benthic habitats within the portion of the marine park overlapped by the gas export pipeline corridor are characterised predominantly by abiotic areas that support no benthic habitat, filter feeders, burrowers/crinoids and small areas of corals and macroalgae (Figure 5-9; Heyward et al. 2017). This profile is consistent with the broader marine park where benthic habitats are similarly characterised predominantly by filter feeders, burrowers/crinoids and abiotic areas that support no benthic habitat (Figure 5-9; Heyward et al. 2017). Other benthic habitats present include small areas supporting hard corals, gorgonians, alcynon and Halimeda.* In response to **Item 2, a**n additional EPO has been included in **Table 6-15** of the OPP, as follows: *To minimise impact to representative species, assemblages and associated values of the Oceanic Shoals marine park, further studies will be used to inform final pipeline routing so the pipeline will not be installed on those representative species, assemblages and associated values if they have not been found in the marine park outside the pipeline corridor.* In response to **Item 3**, the following text has been added to **Section 8.6** of the OPP: *The EP specific consultation process continues to engage a range of stakeholders, but concentrates on specific stakeholder groups as relevant to that particular stage of development or activity. For example, consultation with the Director of National Parks will be ongoing throughout the preparation of EPs where a proposed activity is within or could impact on a marine park. Outcomes of all consultation are fully documented for provision to NOPSEMA and advice is provided to stakeholders on changes made as a result of their feedback. A summary is made available to stakeholders in the final, accepted EP summary.*

Comment received from: Northern Territory (NT) Department of Primary Industry and Resources (DPIR)

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
1. The Commonwealth Government has introduced a Bill into the House of Representatives that, if passed, will provide a mandate for the Clean Energy Finance Corporation (CEFC) to allow investment in Carbon Capture and Storage (CCS).	**Item 1** • ConocoPhillips supports the use of market-based mechanisms coordinated with energy policy. In our view, Australian Government policies of the Emissions Reduction Fund, Safeguard Mechanism and National Carbon Offset Standard provide a broadly appropriate framework in meeting Australia's climate change commitments consistent with these principles.	No changes to the OPP are proposed.

2. Incentives like that will support a wider range of low emission technologies and support further government/industry research collaborations for CO2 reduction/disposal solutions that may be investigated, for example: more in-depth and meaningful analyses of alternatives available, or potentially available, for CO2 disposal – both offshore and onshore collaboration in research and development programs to deliver reductions in CO2 emissions, collaborative efforts with neighbouring petroleum industry explorers and producers that might result in decreased emissions.	• Section 4.4.3 of the OPP (Design/activity alternatives) provides an overview of the evaluation of alternative options that were considered for the management of GHG emissions and includes discussion around the evaluation made in relation to the possible reinjection of native CO_2 and identifies that consideration was given to the feasibility of transporting CO_2 to the neighbouring Bayu-Undan field for sequestration. An evaluation of whether there were any benefits for offshore vs onshore CO_2 disposal was also undertaken during the early design stages of the project. • Natural gas is fundamental to a shift towards a lower carbon and more efficient energy system. Increasing use of natural gas for power generation is widely acknowledged as a key pillar of the world's transition to a lower carbon future. Furthermore, gas production is recognised as the logical partner for increasing renewable generation, where it can supplement renewables during falls in output or spikes in demand. • In the longer term, carbon capture and storage (CCS) may be a key technology to meet long-term greenhouse gas reduction goals both domestically and internationally as recognised by the Intergovernmental Panel on Climate Change in their Fifth Assessment Report. However, significant barriers still exist to making it a viable option for the vast majority of projects, most notably cost, complexity along the value chain, and long-term liability issues. For CCS to be viable, the storage project must be economically viable, technically feasible, safe, environmentally and socially sustainable and acceptable to the community. When assessed against both business economic challenges and viable alternatives to manage emissions, CCS was not considered a reasonably practicable alternative for the Barossa Area Development. • Given the near-term development timeline of this project and other challenges currently associated with CCS, if the bill is passed, investment in CCS by the Clean Energy Finance Corporation would not make CCS economically viable, technically feasible, safe, environmentally and socially sustainable for this project. **Item 2** • ConocoPhillips notes the DPIR's statement that investment in carbon capture and storage (CCS) and other government/industry research collaboration may result if the Bill is passed in the House of Representatives. • Given that the Bill is yet to be passed, ConocoPhillips considers this is a statement for information and not a request that the Barossa project undertake any additional research or analysis of alternatives to reduce CO_2 emissions beyond that already undertaken and detailed in the OPP. ConocoPhillips is open to collaboration with other operators on CCS alternatives and opportunities if their development plans are sufficiently advanced, or there are significant changes to legislative and investment frameworks within the timing window for the Barossa Area Development, but otherwise, it would not be feasible for this project. ConocoPhillips will continue to monitor legislative changes and will continue collaborate with other operators through the various APPEA working groups it is an active participant in. • No changes to the OPP are proposed in relation to this item.	

Comment received from: Northern Territory (NT) Department of Environment and Natural Resources (DENR) and NT Department of Tourism and Culture (DTC) – Joint Submission

Summary of items raised	ConocoPhillips assessment of merit and response	Amendments to the OPP
Maritime cultural heritage 1. A cultural heritage desktop assessment is advised to flag potentially unidentified underwater heritage issues within the project area and include a desktop review of geophysical survey data by a qualified marine archeologist.	**<u>Maritime cultural heritage</u>** **<u>Item 1:</u>** • ConocoPhillips considers that at this time a dedicated cultural heritage desktop assessment, including review of geophysical data by a qualified maritime archaeologist, is not required.	**Maritime and cultural heritage** No changes to the OPP are proposed.

Migratory and marine threatened species 2. Any pipe-laying within 20 km of the Tiwi Islands should occur, wherever possible, outside the peak turtle nesting and hatchling emergence periods of April to September. (Impact of light to nesting (displacement from preferred nesting habitat) and hatchling turtles from pipe-lay vessel) 3. Final pipeline placement should be informed by benthic habitat mapping and avoid, wherever possible, features that may represent important feeding areas for marine turtles. (The benthic environment of the pipeline corridor was not characterised and therefore the relative importance of habitat within this area remains unknown) 4. Seismic and pile-driving operations should occur, wherever possible, outside the known periods of whale migration to reduce impacts of displacement or behavioural change. (These species are sensitive to underwater noise and may be affected by masking when in the vicinity of the FPSO facility, which can inhibit communication, feeding and awareness of vessel traffic.) High energy acoustic impacts are likely to increase mortality of small fish species and zooplankton close to the FPSO and to impact marine mammals and turtles by local displacement and by interfering with communication, feeding and potentially navigation 5. Minimising the level of contamination in discharge waters. (The greatest concern is linked to the effects of produced water as alkyl phenols and polyaromatic hydrocarbons from produced water accumulate in fish and invertebrates.)	• Survey results to date have been thoroughly analysed to inform engineering design and this has not identified any unusual features on the seafloor that may be unidentified underwater cultural heritage issues. • ConocoPhillips is committed to undertaking further targeted surveys to determine the optimum route for the gas export pipeline. These surveys will involve the characterisation of seabed features along the gas export pipeline route, including the identification of any maritime heritage that may be of high cultural significance. • If any features of potential interest are identified during these subsequent surveys, ConocoPhillips will provide the results of these surveys to the Department of Tourism and Culture. **Migratory and marine threatened species** **Item 2:** • The importance of the flatback and olive ridley turtle internesting biologically important internesting areas / habitat critical to the survival is recognised and considered throughout the OPP (Section 5 Description of the environment and Section 6 Evaluation of environmental impacts and risks). • ConocoPhillips recognises that the Northern Territory olive ridley turtle stock is significant as the last major remaining olive ridley turtle stock in south-east Asia, and the Tiwi Islands and surrounding nearshore waters contain important nesting and internesting habitat for this stock, as defined in the Recovery Plan for Marine Turtles in Australia (the Recovery Plan) (DoEE 2017). • At the time of publishing the original OPP for public comment, two factors influenced the spatial extent of the dry gas export pipeline corridor as presented: a. The independent review of the Commonwealth Marine Reserves (CMR) Network had recommended that part of the Oceanic Shoals CMR (currently a multiple use zone) be revised to include a habitat protection zone on the eastern side of the CMR. This introduced uncertainty as to whether the project would be able to gain approvals to install the gas export pipeline in that area if the review's recommendations were adopted (the Management Plans are currently being revised following a public comment period). Consequently, a pipeline corridor that provided the option to install part of the pipeline within the now proposed habitat protection zone, or completely outside of the proposed habitat protection zone was included in the original OPP. b. The spatial extent of the corridor included in the original OPP was based on the level of project engineering available at that time and did overlap a small area of the olive ridley turtle internesting area defined in the Recovery Plan (DoEE 2017). • In the period between publication of the OPP for public comment and re-submission of the OPP for acceptance by NOPSEMA, information derived from additional field surveys and engineering studies became available. ConocoPhillips considered the new information, including in the context of the olive ridley turtle internesting BIA and the comments raised in public comment submissions. Consequently, potential pipeline routes that would have overlapped the internesting BIA for olive ridley turtles nesting on the Tiwi Islands were removed as options. • Shortly after submission to NOPSEMA for stage two assessment of acceptability the DoEE released spatial data for (draft) habitat critical to the survival of olive ridley and flatback turtles, via the Conservation Values Atlas. The internesting habitat critical to the survival of flatback turtles and olive ridley turtles is 60 km and 20 km respectively, surrounding the Tiwi Islands.	**Migratory and marine threatened species** The following text has been included in the revised OPP as a key Management Control: *Dredging activities/trenching activities for the gas export pipeline installation (if required) will occur outside the peak flatback (June to September) and olive ridley (April to August) turtle internesting period when within the internesting habitat critical to the survival of these species.* Given the fact that 'habitat critical to the survival of a species' is provided specific consideration in the Recovery Plan for Marine Turtles in Australia (DoEE 2017a) which is a statutory instrument under the EPBC Act, the impact assessment presented in Section 6 of the OPP has been updated to explicitly use the internesting habitat critical to the survival of flatback and olive ridley turtles as the point of reference to inform the potential risk and impact conclusions. The relevant impact assessment text has been amended as follows: Seabed disturbance – direct impacts *Disturbance of the seabed is not anticipated to significantly affect mobile marine fauna, such as marine mammals, marine reptiles, fish and sharks/rays. The majority of these species are generally present within the water column and are not solely reliant on benthic habitat (Section 5.6). The area of seabed to be disturbed within the project area also represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively, in which individuals may rest on the seabed between nesting events. However, as outlined above, the actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). Taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles.* *Additionally, although some loss of marine turtle foraging habitat is likely to occur as a result of the installation of the gas export pipeline on the seabed, such foraging habitat is widely represented in the region and any loss is expected to be negligible. Environmental, geophysical and bathymetric*

	• The internesting habitat critical to the survival of olive ridley turtles covers a much greater spatial extent than the internesting BIA, which is restricted to a 20 km buffer from the high-density nesting beaches on the north-west coast of the Tiwi Islands. • In parallel to NOPSEMA assessment for acceptability, ConocoPhillips continued to progress gas export pipeline route engineering and consequently was able to rule out several potential routes based on consideration and evaluation of a range of factors, including feasibility and the potential for environmental impacts. This has resulted in a refined gas export pipeline corridor that provides the best option for the project, including minimising potential environmental impacts (refer Table 4.10 from the OPP for a comparative assessment of the pipeline corridor alternatives). However, based on the evaluation, the pipeline corridor cannot avoid the internesting habitat critical to the survival of flatback and olive ridley turtles, but the corridor has been reduced as much as possible (prior to final pipeline routing studies) and now only overlaps approximately 3.7% and 3.2% of the total internesting habitat critical to the survival of these species, respectively. • The actual area of seabed within the internesting habitat critical to the survival for flatback and olive ridley turtles that will be directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). • Given the small overlap of the gas export pipeline corridor with internesting habitat critical to the survival of olive ridley turtles (3.2%) and the short duration of time pipelay activities are expected to take to complete within the internesting habitat critical to survival for the species (approximately 1 – 2 months), ConocoPhillips is not proposing to avoid pipelay activities within this area, either completely or temporally. • While the refinement of the gas export pipeline corridor cannot avoid the habitat critical to the survival of flatback and olive ridley turtles, it does avoid the internesting BIA for olive ridley turtles and with no pipelay installation activities to occur within the olive ridley internesting BIA at any time, including during peak nesting and hatchling emergence periods for this species (April to September). • Although the pipeline corridor does overlap internesting habitat critical to the survival of flatback and olive ridley turtles, undertaking pipeline installation activities within this area during anytime of the year is considered consistent with the objectives and requirements of the Recovery Plan for Marine Turtles. Demonstration of alignment with the objectives and requirements of the Recovery Plan for Marine Turtles in relation to project activities are provided in the revised OPP, including seabed disturbance (Table 6-14) and light emissions (Table6-30). • Taking into account the outcomes of a professional review by Pendoley (2017; (Appendix Q of the OPP), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles, the 30 m depth contour is considered to encompass the vast majority of the area within which flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). Those studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, as the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles are > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep)	*surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. Therefore, the physical presence of the gas export pipeline is not expected to adversely impact on biologically important behaviours or biologically important habitat, including habitat critical to the survival of marine turtles.* Seabed disturbance – indirect impacts *There is potential for a small portion of internesting habitat critical to the survival of flatback and olive ridley turtles to be affected by increased sedimentation/turbidity as seabed intervention works for the gas export pipeline may be required within the internesting habitat critical to the survival of these species. The potential loss or reduction in quality of habitat may temporarily reduce available foraging and internesting habitats available for marine turtles. In the context of indirect impacts, potential marine turtle habitat may be lost indirectly through an increase in localised turbidity in the water column.* *There is likely to be temporary indirect impacts on potential foraging habitat in the immediate vicinity of the pipeline installation activities. The majority of the benthic habitats within the pipeline corridor are expected to be characterised by filter feeders and burrowers/crinoids, with a substantial portion of the area supporting no benthic habitat (as summarised previously in Section 5.5.2.2). These habitats are well represented elsewhere within the region, with foraging grounds for flatback and olive ridley turtles represented across the wider Timor Sea (Figure 5-18). The area that may be indirectly affected is also not known to support biologically important foraging grounds for flatback or olive ridley turtles (Figure 5-18). Environmental, geophysical and bathymetric surveys have not indicated the presence of any unique or limiting benthic foraging habitat for marine turtles within the gas export pipeline corridor. In addition, the area has naturally high levels of turbidity and periodic severe events associated with cyclones. Flatback and olive ridley turtles are known to naturally feed in turbid, shallow inshore waters. It is expected that sedimentation effects from seabed intervention activities will be localised in extent, commensurate with the nature of specific method(s) that will be further assessed as part of activity-specific EPs. In summary, there may be a temporary, localised, indirect impact on flatback and olive ridley turtles associated with the loss of benthos, resulting in a negligible temporary reduction in foraging habitat. However, individual turtles are expected to simply move to similar habitats that are well represented in the region, with no significant population level impacts predicted. Therefore, indirect impacts to foraging habitat are not expected to adversely impact on biologically important behaviours or habitat critical to the survival of marine turtles.* *Internesting habitat in the immediate vicinity of the pipeline installation activities may be impacted by sedimentation/turbidity, however, the potential impact is considered low due to the restricted spatial extent that could be impacted by sedimentation/turbidity and as other significant areas for internesting occur beyond the gas export pipeline corridor (Figure 5-18), i.e. the corridor only overlaps 3.7% and 3.2% of the internesting habitat critical to the survival of flatback and olive ridley turtles, respectively. Drawing on the comparable case studies described earlier in this section for similar pipeline intervention activities, the area of local disturbance may be expected to be in the order of several hundred metres (e.g. as described for the Macedon project, with separation buffer of up to 700 m from primary features) to several kilometres (e.g. as observed for Gorgon nearshore*

	occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat remaining outside the corridor and available for internesting turtles. • In summary, light from installation vessels, as well as direct and indirect impacts from seabed intervention techniques, are unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities and localised extent of any potential impacts. • ConocoPhillips considers that pipelay activities within the internesting habitat critical to the survival of flatback and olive ridley turtles will not have the effect of displacing females from nesting habitat, nor result in a likely increase in hatchling mortality, based on consideration of the following: *Seabed disturbance* Direct impacts: • The area of seabed to be disturbed within the project area represents a very small portion of the habitat available for these species. For example, the gas export pipeline corridor overlaps 1,192 km^2 (3.7%) and 255 km^2 (3.2%) of internesting habitat critical to the survival of flatback turtles and olive ridley turtles, respectively. • The actual area of seabed within the internesting area directly disturbed by the gas export pipeline will be significantly smaller (in the order of approximately < 0.0001% for flatback turtles and approximately < 0.0015% for olive ridley turtles). • The vast majority of suitable internesting habitat remains outside the gas export pipeline corridor and is available for internesting turtles, including water depths < 30 m deep, in which internesting turtles are known to rest in the days leading up to re-nesting. • Therefore, any direct impacts from seabed disturbance are highly unlikely to result in the displacement of nesting female flatback and olive ridley turtles. Indirect impacts: • Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat. • Gas export pipeline Installation activities, including seabed intervention techniques, within the internesting habitat critical to the survival of olive ridley turtles are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature. *Lighting* • The OPP stated that studies have shown that hatchling turtles may be affected by light produced up to 18 km from the nesting beach (Hodge et al. 2006). It should be noted that this reference relates to light emissions from a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels of light emissions than a typical pipelay vessel. • The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. Note that the pipe welding deck for	*trenching, with elevated turbidity observed within 2 km), depending on the nature of the activities and local seabed and oceanographic conditions at the time.* *Geophysical and bathymetric survey data have indicated that secondary stabilisation, such as dredging and trenching, is not required in the portion of the gas export pipeline corridor that overlaps the internesting habitat critical to the survival of flatback and olive ridley turtles. In this portion of the corridor seabed intervention techniques are expected be limited to span rectifications using concrete mattresses or grout bags, and rock berms. Therefore, any indirect impacts within the internesting habitat critical to the survival of flatback and olive ridley turtles are likely to be localised and temporary in nature (lasting a matter of days), and would not significantly reduce the amount of available habitat.* *The portion of internesting habitat critical to the survival of olive ridley turtles that is intersected by the gas export pipeline corridor is located off the west and south-west coast of Bathurst Island, where olive ridley turtles are known to nest only in low density numbers (Whiting et al. 2007a; Chatto and Baker 2008). This area is distant from the high-density nesting beaches on the north-west coast of Melville Island. Additionally, the pipeline corridor is located in water depths > 30 m where it overlaps with the internesting habitat critical to the survival of olive ridley turtles. As described above, studies have demonstrated that while turtles may be present in offshore waters with water depths of up to 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. It is therefore expected that internesting olive ridley turtles would only be transiting within, or in the vicinity of, the gas export pipeline corridor in very low numbers. The gas export pipeline corridor overlaps only approximately 3.2% of the internesting habitat critical to the survival of olive ridley turtles, meaning the vast majority of the internesting habitat critical to the survival of the species would not be impacted and would be available for any potentially displaced individual internesting olive ridley turtles to use. Installation activities, including seabed intervention techniques, are expected to take approximately one to two months to complete for this portion of the pipeline, indicating that any indirect impacts to internesting habitat critical to the survival of olive ridley turtles would be short-term and temporary in nature. Therefore, indirect impacts from gas export pipeline installation activities within the internesting habitat critical to the survival of olive ridley turtles will not prevent any biologically important behaviours from occurring.* *Turtles are not deemed to be physiologically affected by an increase in suspended sediments associated with sediment-generating activities (DSD 2010). As part of the INPEX Ichthys project nearshore environmental monitoring program, an analysis of observed patterns of distribution and abundance of turtles and dugongs around Darwin Harbour and surrounding nearshore waters before and after dredging operations concluded that, "…while spatial and temporal variation has been observed in the distribution and abundance of turtles and dugongs over the duration of the program, on the balance of evidence these differences appear most likely due to natural variation. As such, following the completion of the Dredging Phase of monitoring, there is no indication of any major changes to turtle or dugong populations in the Darwin region as a result of dredging activities" (Cardno 2014). This observation supports the impact conclusion that population level impacts are not expected, including if dredging were required in the event*

	modern pipelay vessels (such as the Castorone, which recently laid the gas export pipeline for the Ichthys development) is typically encased within the vessel structure, reducing light spill to the marine environment when compared to vessel where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically well lit for operational safety. Cranes are typically the highest point on pipelay vessels. External lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision. • The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point. The pipelay vessel will be directly visible at this distance. Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), the highest point of the vessel will be directly visible from the shoreline out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels. • The temporary presence of the pipelay vessels in the area will not significantly increase the volume of existing vessel traffic in the area. The area west and south-west of the Tiwi Islands is subject to considerable vessel traffic. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system (CTS) indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor. These are typically commercial vessels (e.g. container vessels, tankers etc.) moving to and from ports throughout southeast Asia. Vessel traffic of this nature has been operating in the region for decades. *Nesting turtles* • Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area. • There is no evidence that suggests internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat. Therefore, the displacement of nesting females from preferred nesting habitats or from the biologically important internesting area is considered highly unlikely. *Hatchlings* • Artificial light from coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest: o Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and	*that the final pipeline route is located outside (to the east) of the Oceanic Shoals marine park.* *Therefore, any potential indirect impacts to internesting habitat critical to the survival of flatback and olive ridley turtles, and/or to interesting females, are expected to be short term at any one area and localised, with only a small number of individuals being affected and the potential to impact nesting behaviour is also considered low.* *To further address potential impacts and risks to the marine environment associated with installation of the gas export pipeline, further engineering and field studies will be undertaken as the project design progresses. Detailed management controls to address sedimentation/turbidity will also be further evaluated and defined as part of the development and implementation of the gas export pipeline installation EP.* Light emissions *The gas export pipeline corridor is located closer to the Tiwi Islands (approximately 6 km at the closest point), however, there are no permanent light sources associated with this subsea infrastructure. Project vessels will be the only project-related light source within the gas export pipeline corridor during installation, planned operational maintenance and decommissioning activities.* *The pipeline corridor lies approximately 6 km from Bathurst Island at the closest point and a pipelay vessel would be directly visible at this distance. The pipelay vessel will be lit at night to provide a safe working environment and to comply with relevant maritime navigation requirements. The pipe welding deck for modern pipelay vessels is typically encased within the vessel structure, reducing light spill to the marine environment when compared to vessels where the welding deck is open. Other areas of the vessel such as cranes and ramps (e.g. pipeline 'stinger') are typically lit for operational safety. Cranes are typically the highest point on pipelay vessels. External lighting on working vessels is often reduced (while maintaining a safe working environment) to promote bridge crew night vision.* *Assuming a pipelay vessel height of 65 m (based on the highest point on the pipelay vessel Castorone, one of the largest pipelay vessels currently in commission), line of sight calculations have estimated that the highest point of the vessel will be directly visible from the vessel out to approximately 29 km. It is important to note that this is associated with lighting on the crane, with such lighting often being reduced compared to other enclosed sources of lighting on pipelay vessels.* *As outlined above, modelling of light density levels for a drill rig showed that light reduced to levels comparable with a quarter moon to full moon night sky (0.01–0.1 Lux) within 1.2 km, with light density levels equivalent to a moonless clear night sky and a quarter moon sky (< 0.01 Lux) predicted within 12.6 km (Woodside 2014). Given that light emissions from pipelay vessels are more representative of point sources and drill rigs (as opposed to large industrial facilities), it is considered that the pipelay vessel will appear as relatively small lit object on the water's horizon. Any diffuse light glow emitted from the vessel is expected to be minimal on the Tiwi Islands coastline and largely insignificant as it would be comparable to the light level on a moonless clear night sky and a quarter moon sky. It is also expected that the temporary presence of the pipelay vessels in the area will not significantly increase the volume of vessel traffic that operates in the area. Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking*

	○ Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources. • Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995). • Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean. • Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, flatback hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017). • Thums et al. (2016) demonstrated that hatchling turtles in the sea are attracted to artificial lights, however the influence on turtle behaviour was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however the orientation did not result in disorientation. • The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. • Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated while within the vicinity of the acoustic tag array. • It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at the closest possible point within the pipeline corridor; at this distance, the illumination perceived by hatchling turtles on the nearest beaches on Bathurst Island with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky. • The risk of hatchlings becoming trapped in a light pool in proximity to the pipelay vessel is low given: pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary; while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will	*system indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor (Figure 5-26). These are typically commercial vessels (e.g. container vessels, tankers, etc.) moving to and from ports throughout south-east Asia. During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area.* *Light impacts to internesting flatback and olive ridley turtles are of particular relevance to this impact assessment, given the fact that the pipeline corridor intersects internesting habitat critical to the survival of flatback and olive ridley turtles (Figure 5-14). The percentage proportion of the internesting habitat critical to the survival of flatback and olive ridley turtles that is intersected by the gas export pipeline corridor is 3.7% and 3.2%, respectively. However, the actual area likely to be affected by light emissions during pipeline installation at any one time will be considerably smaller given the reality that the area of disturbance will be based on a vessel slowly moving along a defined pipeline route. There is no evidence, published or anecdotal to suggest internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat (Pendoley 2017; Appendix Q, Witherington and Martin 2003). Light spill is likely to be localised to within a few kilometres of the pipeline installation activity, and the internesting turtle population are exposed to existing light spill from shipping activities using the area between the gas export pipeline corridor and the Tiwi Islands as a channel for entry/exit to Darwin Harbour (Figure 5-26). The number of internesting turtles potentially exposed to the pipeline operations over a 6–12 month period during installation is low given the peak internesting period (June to September for flatbacks and April to August for olive ridley) is a subset of the installation period.* *As discussed in Section 6.4.3, taking into account the outcomes of a professional review by Pendoley (2017; Appendix Q), as well as a number of other studies investigating internesting behaviours of flatback and olive ridley turtles (Section 5.6.3), the 30 m depth contour is considered to encompass the vast majority of the area that flatback and olive ridley turtles would undertake internesting activities (i.e. resting on the seabed), with the existing 24 nm (44.5 km) Contiguous Zone Boundary encompassing the extent (waters up to 55 m deep) that internesting turtles are likely to extend to (Pendoley 2017). These studies have demonstrated that while turtles may be present in offshore waters with water depths of up 55 m during the internesting period, they are typically freely moving through these areas before they return to shallow waters (less than 30 m deep and typically shallower than 10 m) to rest in the days leading up to re-nesting activity. The area in which internesting behaviours occur (i.e. resting in waters less than 30 m deep prior to re-nesting) does not intersect the gas export pipeline corridor, with the minimum water depths for the portion of the corridor that overlaps internesting habitat critical to the survival of marine turtles being > 30 m deep. The broader area that is traversed by internesting turtles (i.e. waters up to 55 m deep) occupies a portion of the gas export pipeline corridor, with the vast majority of suitable internesting habitat and remaining outside the corridor and available for internesting turtles. In summary, light from installation vessels is unlikely to have a significant effect on individual internesting marine turtles transiting the area given the relatively short-term nature of the activities (approximately 6–12 months).*

	reduce the opportunity for individuals to intercept or pool around a vessel; hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents; and hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low. **References** Department of the Environment (DoEE). 2017. (Final) The Recovery Plan for Marine Turtles in Australia. Department of the Environment and Energy, Canberra, Australian Capital Territory. Harewood, A. and Horrocks, J.A. 2008. Impacts of coastal development on hawksbill hatchling survival and swimming success during the initial offshore migration. 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Competitive interactions between artificial lighting and natural cues during seafinding by hatchling marine turtles. Biological Conservation 121: 311–316. Witherington, B.E. and Martin, R.E. 2003. Understanding, assessing and resolving light-pollution problems on sea turtle nesting beaches. Florida Marine Research Institute Technical Report TR-2 3rd	*Studies in other areas have shown that artificial lighting may affect the location that nesting turtles emerge to the beach, the success of nest construction, whether nesting is abandoned, and the seaward return of adults (Salmon et al. 1995, Salmon and Witherington 1995). Studies of nesting inhibition of female turtles have demonstrated a clear effect of direct lighting on turtle nesting beaches, with artificial lighting appearing to deter females from leaving the water (Witherington and Martin 2000). The source of lighting in such studies has typically been from residential and industrial development overlapping the coastline, rather than offshore from nesting beaches. The potential for nesting female turtles to be inhibited by artificial light emissions from a pipelay vessel is low when considering the distance of the light source from the beach and observed behavioural responses elsewhere, and the fact that turtles continue to successfully nest on the Tiwi Islands in the presence of light from existing vessel traffic in the area.* *The primary light sensitive receptors in the gas export pipeline corridor of particular relevance are hatchling flatback and olive ridley turtles located on the shores of the Tiwi Islands. Hatchlings emerging from the sand locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon and away from elevated silhouettes of dunes and/or vegetation bordering the beach on the landward side (Limpus 1971, Salmon et al. 1992, Limpus and Kamrowski 2013, Pendoley and Kamrowski 2016). Artificial light from onshore coastal developments has been demonstrated to cause disorientation of hatchling turtles during the post-hatching movements (Lorne and Salmon 2007, Salmon 2003, Tuxbury and Salmon 2005). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest:* • *Misorientation – misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean; and* • *Disorientation – disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources.* *Turtles disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington 1995).* *While some studies have shown hatchling orientation to be disrupted by light produced at distances of up to 18 km from the nesting beach this has been from large onshore coastal industrial facilities (Hodge et al. 2007 in Pendoley 2017), not offshore sources. Other studies have demonstrated that diffuse light glow from these light sources does not cause hatchling disorientation beyond 4.8 km from the light source (Limpus 2006) and individual lights as point sources have been reported to disorient hatchling turtles up to a few hundred metres (Limpus 2006). The impact observed by Hodge et al. (2007) (cited in Pendoley 2017) was limited to misorientation, with hatchling turtles taking a slightly longer path to reach the sea. The light source was a large industrial installation (the Boyne Island alumina smelter), which is considerably larger and has much higher levels and intensity of light emissions than a typical pipelay vessel. While the work of Hodge et al. (2007) provides evidence of potential impacts of artificial light from large industrial facilities on hatchling turtle behaviour, caution should be used in making inferences about light sources that differ in nature and scale.*

	Edition Revised, Florida Department of Environmental Protection, Tequesta, Florida, United States of America. **Item 3:** • As outlined in the OPP, the benthic habitats within the gas export pipeline corridor have been investigated in recent years during separate field studies led by Geoscience Australia (Przeslawski et al. 2014), ConocoPhillips (Jacobs 2016) and the Australian Institute of Marine Science (AIMS) (Heyward et al 2017). Section 5.5.2.2 of the OPP provides an overview of how AIMS used the available data to develop a spatial predictive benthic habitat model to map the benthic habitats of the Oceanic Shoals Commonwealth Marine Reserve (Radford and Puotinen 2016 - see Figure 5-7 of the OPP), and then how AIMS used the additional benthic habitat data collected by ConocoPhillips and AIMS to extend the spatial extent of the habitat model to cover the entire extent of both the pipeline corridor and the Barossa offshore development area (see **Figure 5-8** of the OPP). • Section 5.5.2.2 also identifies that the benthic communities that occur within the pipeline corridor are predominantly filter feeders and abiotic areas that support no benthic habitat with small areas of macroalgae and hard corals, gorgonians, alcynon and Halimeda. These habitats types are represented both within the pipeline corridor and surrounding area. • While the gas export pipeline corridor published in the OPP did intersect biologically important internesting areas for flatback and olive ridley turtles (now revised to not overlap the olive ridley interesting area), it does not intersect any biologically important areas identified as foraging/feeding areas for marine turtles. • Marine turtles forage predominantly on shallow benthic habitats containing seagrass and/or algae, and inshore seagrass beds, with benthic habitats at shoals and banks providing important foraging grounds. Based on the benthic habitats expected to occur within the pipeline corridor, it is considered unlikely that the pipeline will significantly affect these preferred feeding areas. • In addition, given the small area of seabed that would be directly disturbed by the placement of the pipeline, it is highly unlikely that the project will significantly impact the availability of feeding areas available to marine turtles. Therefore, the risk to the turtle feeding habitat is considered very low, and the existing management controls proposed are appropriate given the project context and manage the risk to acceptable levels. • ConocoPhillips is committed to undertaking further targeted field survey effort to supplement the understanding of the benthic habitats in the gas export pipeline corridor, as part of the process of informing the selection of a final pipeline route. An additional field survey has recently been completed AIMS (October 2017) and the data collected during that survey are being analysed. The information derived from this survey will inform future pipeline route selection and will allow a robust assessment of the representativeness of habitats that may be disturbed by the installation of the pipeline compared to the broader region. This will then inform the impact assessment for future Environment Plans to be developed for the project. **Item 4:** • ConocoPhillips considers that seasonal restriction of seismic and pile driving activities is not warranted or appropriate. • As detailed in the OPP, impacts to cetaceans at a population level from underwater noise generated by the project is considered highly unlikely given the Barossa offshore development area does not contain any regionally significant feeding, breeding, aggregation areas or migration corridors for marine mammals including those referenced in the submission.	*Based on the range at which a typical pipelay vessel may be visible, vessels in the majority of the pipelay corridor will not be directly observable from the shore. In the event hatchling turtles from nests on the Tiwi Islands became oriented toward light emissions from the pipelay vessels, it is unlikely that this behavioural response would prevent hatchlings reaching the sea given the pipeline corridor is directly west of the Tiwi Islands. Light-induced impacts on hatchlings turtles between exiting the nest and reaching the sea (e.g. dehydration, exhaustion and predation by terrestrial predators) would be highly unlikely to be increased compared to if the pipelay vessel was absent. Given the source of the light is seaward of the nesting beach, it would be highly unlikely to disorientate hatchlings to a degree that would reduce their ability to locate and orientate towards the ocean.* *Once hatchlings enter the ocean, an internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann and Lohmann 1992, Stapput and Wiltschko 2005). Water movement has been shown to be an important influence on hatchling turtles, with hatchlings swimming directly towards oncoming waves (Lohmann et al. 1990, Lohmann and Lohmann 1992). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne and Salmon 2007, Harewood and Horrocks 2008), and over short distances of up to 150 m, hatchlings are more influenced by light than wave cues (i.e. the light cue overrode the wave cue at this distance). Once in the sea, hatchlings of most marine turtle species assume a pelagic life history phase. A notable exception is flatback turtle hatchlings, which do not have a pelagic phase, instead residing in coastal shallow waters on the continental shelf (Pendoley 2017).* *Hatchlings are not trapped indefinitely in light pools and eventually continue the migration offshore (Thums et al. 2013, 2016). However, they may be exposed to an increased risk of predation when trapped in light spill from vessels. Overnight observations of flatback turtle hatchlings trapped by the light spill from a pipelay barge moored approximately 10 km off the east coast of Barrow Island found hatchlings remained within the light spill in the lee of the barge all night until dawn when they swam away from the barge and were carried away by currents (K. Pendoley pers. comm. 2003). None of the monitored hatchlings were predated. These observations, together with experimental results that demonstrated the attraction of hatchlings to light at sea over 150 m (Thums et al. 2016), suggests that hatchlings carried by currents into the vicinity (estimated 500 m–1,000 m) of a pipelay barge can become trapped by light (Pendoley 2017). While hatchling turtles in the sea are attracted to artificial lights, the influence on turtle behavior and impact to hatchlings was considerably less compared to the effects of light on hatchlings on the shoreline. The results of this study indicated that hatchling turtles were misoriented towards artificial light once entering the sea, however, the misorientation did not result in disorientation. The presence of artificial light in the study did not prohibit hatchling turtles from migrating offshore, but did result in hatchling turtles spending a greater period during night hours in areas of the sea illuminated by artificial light compared to non-illuminated conditions. Thums et al. (2016) suggested that the increased time spent by hatchlings in artificially illuminated areas at sea may increase the risk of predation. Of the 40 hatchlings tagged during the study, Thums et al. (2016) suggested one may have been predated. It is of note that the artificial light source used in the study was intense (400 W metal halide light), directed towards the natal beach, and located approximately 200-300 m from the beach. This is not consistent with the potential light emitted from the pipelay vessel, which will be over 6 km from the nearest nesting beach at*

	• The noise assessment presented in the OPP demonstrates that any spatial and temporal scale of behavioural response effects would be limited to the localised area surrounding the FPSO facility. Any impacts from seismic (vertical seismic profiling of the development wells) and pile driving operations are expected to be short-term. • Therefore, the key management controls and supporting environmental performance outcomes included in the OPP are appropriate to manage the risk of underwater noise to acceptable levels. • The impact assessment within the OPP addresses the potential for mortality of small fish species and zooplankton and behavioural responses to marine turtles within very close proximity to the acoustic source during vertical seismic profiling (VSP conducted from the MODU) and pile driving (if required during FPSO mooring installation). • As stated within the OPP, expected sound levels emitted from the seismic source during VSP are expected to be approximately 190 dB re 1 µPa at 1 m which is well below the impulsive noise threshold for mortality and potential mortal injury for fish and plankton of 207 dB re 1 µPa (Table 6-20 of the OPP). • The OPP impact assessment concluded that given the expected sound levels and thresholds of marine fauna, there is the potential for behavioural change responses to marine mammals, marine reptiles and fish in close proximity to the VSP source (within hundreds of metres). The Barossa offshore development area and immediate surrounds do not contain any significant feeding, breeding or aggregation areas for marine mammals and reptiles. Therefore, there is likely to be a limited abundance of individuals present in the area at any time with individuals likely to be traversing through the area • ConocoPhillips considers that the impact assessment and conclusion within the OPP remains valid for fish and plankton in relation to potential impacts from VSP. • The impact assessment for pile driving underwater noise acknowledges that mortality of fish and plankton may be possible within close proximity to the FPSO. Table 6-21 of the OPP provides the modeled distances for the mortality/potential for mortal injury threshold for fish form underwater pile driving noise as ranging from 0.20 to 0.34 km from the noise source. • For marine turtles, the OPP stated that underwater noise emissions generated from pile driving activities were predicted to cause behavioural responses or injury within approximately 14.4 km and 0.2 km, respectively (Table 6-21 of the OPP). Considering the open ocean location of the Barossa offshore development area and significant distance to internesting habitat critical to the survival of marine turtles and shoals/banks, only individual turtles may be affected as they transit the area. No impacts at a population level are anticipated. • No changes to the OPP are proposed. **Item 5:** • ConocoPhillips recognises that planned discharges associated with operational offshore oil and gas projects may contain trace amounts of chemicals. • Operational discharges in the Barossa offshore development area will not impact the nearest shoals and banks in the region which support a diverse and varied range of benthic/fish communities. • ConocoPhillips acknowledges that the FPSO facility will provide artificial reef habitat and has the potential to support colonising and aggregating species, such as benthic primary producers and fish species, over time. However, this is not considered to affect the overall assessment of potential impacts and risks associated with operational discharges in the Barossa offshore development area.	*the closest possible point within the pipeline corridor. At this distance, the illumination perceived by hatchling turtles on the nearest beaches on the Tiwi Islands with be considerably less intense, comparable to the light level on a moonless clear night sky and a quarter moon sky, and therefore, is unlikely to have the same effect.* *The risk of trapping and possible increased risk of predation is greatest in the southern end of the pipeline corridor where it passes at its closest point to Bathurst Island off Cape Fourcroy. The risk of this occurring is considered relatively low when taking into account: the limited time the pipelay vessel and associated support vessel will be present at any one location off the west coast of the Tiwi Islands, the temporally restricted peak hatchling season (June – September for flatback turtles and April – August for olive ridley turtles), the low risk of hatchlings intersecting a small zone (approximately 500 m–1,000 m) around the pipelay vessel over which they might be influenced to orient towards the vessel lights, the currents in the area mean there is a low likelihood the hatchlings will be in slow moving water (< 0.5 knots) that would allow them to swim against a current towards the light source and then remain in the light, and the short (overnight) time frame the hatchlings could be trapped. Any hatchlings that do become trapped in the light spill from a vessel may be at risk from an increased risk of predation, however, the risk of this is likely reduced due to the distance offshore from predator rich inshore waters. The risk to the flatback and olive ridley turtle populations from the light spill during pipelay installation activities is therefore considered to be low and undetectable against normal population fluctuations.* *An assessment against the significance impact criteria in the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance is provided in Appendix Q. The installation of the Barossa gas export pipeline at any time of year is not expected to represent a significant risk to flatback and olive ridley turtles at a population level, taking into consideration:* • *the relatively short 6–12 month time frame of the pipeline installation is insignificant within the context of the long breeding period of marine turtles and so the time frame the breeding females are potentially exposed to the project is low* • *pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of internesting females or dispersing hatchlings to project related risk will be temporary.* • *the seasonally dispersed nesting behaviour reduces the risk of exposure to the entire breeding population* • *while migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel* • *hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents* • *hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and*

	• The OPP contains a commitment in the key management control which states that 'an environmental monitoring program (Section 7.2.3) and adaptive management framework (Section 7.3) will be applied to manage PFW and cooling water discharges.' • The OPP provides an outline of the environmental monitoring framework for the project, which includes: ○ monitoring of the environment in the area influenced by project activities ○ verification monitoring of the PFW discharge stream during operations to confirm compliance with the management controls ○ periodic testing of produced formation water discharges to characterise the discharge stream and inform triggers that are appropriate for the sensitivity of local organisms. ○ development of trigger actions to support implementation of the monitoring framework and used to inform and refine the monitoring parameters. • To minimise potential impacts, ConocoPhillips will also adopt an adaptive management framework to actively manage routine discharges throughout the life of the project. • Considering the management controls that will be implemented, and the fact that the area of influence is limited to open offshore waters, any residual (i.e. trace levels) of contaminants in the PFW discharges from the project are not expected to accumulate in fish and invertebrates and disturb reproductive/biological functions. No impacts at a population level are expected. • ConocoPhillips consider the management controls and supporting environmental performance outcomes defined in the current OPP are appropriate to manage the risk of operational discharges associated with the project to acceptable levels.	*will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low.* *In summary, the impact evaluation demonstrates that impacts to turtles from light during pipeline installation at any time of year are not anticipated to result in impacts at a population level, with the risk to the marine turtle populations from the proposed pipeline installation considered to be low and undetectable against normal population fluctuations. Determinable impacts at a population level from temporary and localised changes in internesting habitat critical to the survival of flatback and olive ridley turtles are not expected given the fact that the light emitted from project vessels will only affect turtles present within a small portion of the available internesting habitat critical to the survival of these species. With regard to potential impacts to hatchlings, individual female turtles also generally do not breed each year. For example, flatback turtles have been observed to breed at intervals between one to five years (mean of 2.7 years) (DoEE 2017d). Olive ridley turtles, however, differ to the other marine turtle species in that the majority (over 60%) of females nest every year (IUCN 2017). Taking this into account, the likelihood of population level impacts is further reduced as it is unlikely that the entire population will be nesting/internesting in any one season. The implementation of key management controls will provide for acceptable environmental outcomes, taking into account the short-term transient nature of effects during the pipeline activities.*