The use of offsets in EIAs as a way of mitigating the uncertainties associated with cumulative impacts of major resource proposals in the north west of Western Australia

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Abstract

The use of offsets as a counterbalance to unavoidable impacts of development has been used as part of environmental protection for nearly 20 years. The Western Australian EPA, the peak environmental agency, has developed an offsets policy based on the notion no net loss of critical assets. The paper discusses the application of that policy through EIAs of some recent major resource related proposals planned for the north of WA. A unique feature of the application of this policy was emerged which is the notion of 'offsets for uncertainty'. This has emerged because of the inherent environmental uncertainty associated with many of the major resources proposals. Two types of uncertainty offsets have been identified: a 'residual risk' offset where an offset to is provided as part of the approval in recognition of the residual risk associated with the proposal; and a 'banked' offset, which is an offset to be 'cashed in' in the event that negative environmental impacts occur. To illustrate these types of offsets the Gorgon proposal to extract and process natural gas from the Gorgon and Jansz gas fields is discussed in detail.

Introduction

The use of offsets as a counterbalance to unavoidable impacts of development proposals (also called compensatory habitat, ecological compensation, environmental compensation and mitigation banks) has been used for nearly 20 years in the United States, Canada (Harper and Quigley 2005) and the UK (Morris, Alonso et al. 2006) but is a fairly recent policy tool in Australia (Gibbons and Lindenmayer 2007). It is normally applied to achieve a 'no net loss' (NNL) outcome involving both no loss of total area and function of the asset to be impacted.

The peak environmental agency in Western Australia (WA), the Environmental Protection Authority (EPA), has recently adopted an offsets policy to apply to certain new proposal undergoing EIA (EPA 2006; EPA 2008). This paper examines the use of offsets by the EPA in the environmental assessment of some recent major resource related proposals planned for the north of WA. It begins with a discussion of the policy and three important features not usually found in other offset policies, one of which is unique: the notion of 'offsets for uncertainty'.

The next section gives some important background information about WA and the resources boom important to understanding the rest of the paper

The WA EPA and EIA

The WA EPA is the peak environmental agency in WA, being a five person board with a full time chairman. It is supported by staff from the State Government agency, the Department of Environment and Conservation (DEC). It carries out the main part of EIA but it is not the final decision maker. The EPA makes recommendations to the Minister for the environment on the environmental acceptability of proposals and what, if any, conditions should apply. The Minister makes the final decision on the proposal and sets the environmental conditions to apply should the proposal receive approval. The EPA is also responsible for setting policies that apply to the EIA process.

The EPA's Offsets policy

The current EPA policy (EPA 2006) establishes eight broad principles in applying offsets:

- Environmental offsets should only be considered after all other reasonable attempts to mitigate adverse impacts have been exhausted;
- An environmental offset package should address both direct offsets and 'contributing' offsets;
- Offsets should be 'like for like or better';
- If there is a risk that the offset could fail, then the offset ratio should be greater than 1:1;
- The process to determine and assess the offset should be "robust, consistent and transparent";
- Offsets must meet statutory requirements;

- Offsets must be “clearly defines, transparent and enforceable”; and
- The offset must be long lasting in delivering the benefit.

The policy and its application have three special features not normally found in the use of offsets elsewhere. Firstly, it is not a strict NNL policy, but requires that an offset be provided only where the environmental asset to be impacted is considered ‘critical’. These are assets where the cumulative loss to-date has exceeded a critical level and further loss would be considered unacceptable. Critical assets include:

- Conservation Reserves;
- Significant wetlands;
- Threatened ecological communities; and
- Certain benthic habitats especially coral.

The EPA is currently developing a policy that would better define what it considers to be critical assets.

The EPA has a general presumption against significant impacts on critical assets and offsets can only be considered where the impact on the critical asset is less than significant. However, as noted earlier, the Minister, not the EPA, gives the final approval in EIA, and there has been at least one occasion where the EPA considered that a proposal could have significant impact of some critical assets, recommended against it, but the Minister approved the proposal subject to further considerable offsets (see the Gorgon proposal below).

The second feature is that the EPA has set an “aspirational goal” for offsets that they should achieve a net environmental benefit: that is, an offset should contain a ‘direct offset’ which is the counterbalance to the impacts of the proposal (no loss of environmental value), and a ‘contributing offset’ which are other complementary actions or activities which would provide the actual net benefit. This goes beyond the NNL principle, but it should be noted that it is applied only where ‘critical’ assets are involved.

The emergence of ‘offsets for uncertainty’

The third feature for the EPA’s offsets policy is one that has emerged through practice rather than design, and involves the notion of ‘offsets for uncertainty’. These offsets for uncertainty have emerged in response to the inherent environmental uncertainty associated with many of the major resources proposals planned for the north of WA. This paper gives particular attention to these offsets.

The environmental, socioeconomic background to this study

The mainland of WA and the offshore waters are rich in mineral (mostly iron ore) and hydrocarbon (mainly natural gas) resources which have traditionally been extracted and exported to markets in South East Asia, mostly Japan. In more recent years, the booming economies of China and India have lead to a surge of interest in these resources. Figure 1 shows the growth in the exports of iron since 1980, and the recent boom in exports since 2004 is obvious. Figure 2 shows the volumes of gas in the three key basins off the north coast of WA compared to the total reserves in the rest of Australia.

A particular problem in assessing the impacts of many of these proposals has been the lack of relevant environmental data. WA is Australia's largest state in area, making up about a third of the mainland and is 2,525,500 square kilometres in size (about a quarter the size of Canada). Of the 2.1 million people that live in WA, about 80% in and around the capital city Perth (approx. 1.6 million). The majority of the rest live in coastal cities, mostly in the southern half of the State (see Figure 3).

This is well illustrated when comparing the scientific work done on Cockburn Sound (a natural embayment 30 km south of Perth), and the Pilbara-Kimberly marine environment. Cockburn Sound is the most heavily used marine area in WA, and is subject to a range of environmental pressures. Since 1960, 136 publications and small reports on Cockburn Sound have been produced, whereas the marine and coastal areas of the north of WA have been poorly studied. For example, the marine waters and beaches in the area are important for several marine turtle species but there has been less than ten studies carried out on these species, most of those are in the north-eastern area of Australia rather than the Pilbara-Kimberly area. The first significant study of Flatback turtle in WA waters was carried out in 2004, and this was part of the EIA for a major LNG proposal (Gorgon, see below). That study found that the beaches adjacent to the proposal LNG plant were significant for Flatback turtle nesting, with around 15% of the known female population of Flatback turtles found in WA nesting at these two beaches.

In the absence of this baseline data it is difficult to accurately determine the environmental impacts of individual proposals let alone cumulative impacts. The levels of uncertainly associated with many of these proposals are significant.

Proposals considered

Nine (9) proposals and subsequent EIAs were included for analysis. These proposals and their known environmental impacts are summarised in Table 1.

Table 1: Proposal description and predicted significant environmental impacts

Proposal name	**Year of EIA**	**Location, Description**	**Key predicted environmental impacts**
Iron ore mine, processing and export at Cape Preston	2002	Development of an iron ore mine (44.8 mtpa), downstream processing or the ore, and development of a port for exporting the ore at Cape Preston.	Construction of port facilities involving up to 4.5 million cubic metres of dredge spoil. Clearing of 1916 ha of native vegetation.
Dampier Port Expansion and Dredging - Dampier Port Authority	2003	Improvement and extension of the current wharf facilities; dredging for the deepening and widening of existing shipping basin and access channel.	dredging and disposal of up to 4.5 million cubic metres of sediments
Fortescue Metals Pilbara Iron Ore Infrastructure Project	2005	Construct a port facility at Anderson Point in Port Hedland, and construct a 345 km railway from the port to the mine.	Construction of port facilities involving up to 3.3 million cubic metres of dredge spoil. Clearing of 3,100 ha of native vegetation 1,800 ha permanently cleared. Loss of around 109 ha of mangrove habitat
Gorgon Gas Development Barrow Island Nature Reserve	2006/07	Extract, pipe, liquefy and export 10 million tonnes per annum of natural gas from the Greater Gorgon and Jansz gas fields. LNG processing to take place on Barrow Island.	Construction of port facilities involving up to 7.5 million cubic metres of dredge spoil. Loss of 23.2 ha of coral. Clearing of 300 ha of native vegetation
Dredging Program Dampier Port Upgrade	2006	Dredging program by Hamersley Iron for maintenance and increase port capacity for increased iron ore exports.	Up to 3.4 million cubic metres of dredge spoil.
Materials Stockpiling and Handling Facilities, Cape Preston	2006	Expanding and upgrading existing stockpiling area and associated infrastructure, to handling iron ore.	Clearing of 20 ha of native vegetation.
Mt Gibson Iron Ore Mine and Infrastructure Project	2006	Mine and process iron ore; construction of a pipeline to transport the magnetite slurry to Geraldton Port for export. 13 million tonnes of hematite and 230 million tonnes of magnetite.	Clearing of 970 ha of native vegetation, including 14% and 55% of the known population of two DRF species
Dredging Program Cape Lambert Port Upgrade	2007	Dredging program by Robe River Iron for maintenance and increase port capacity.	Up to 2.5 million cubic metres of dredge spoil.
Maxima 3D Marine Seismic Survey – Scott Reef	April 2007	Seismic survey (for hydrocarbons) of 340 sq km around Scott Reef	
Pluto LNG Development, Burrup Peninsula	2006/07	Develop the Pluto gas field, 190 kilometres north-west of Dampier (off-shore) process and export LNG at Burrup peninsula (16 million tonnes per annum of LNG).	Construction of port facilities involving up to 14 million cubic metres of dredge spoil. Between 1.3 and 30ha of coral lost. Clearing of 119 ha of native vegetation. 85 of the 1490 ancient Aboriginal rock panels to be re-located

Figure 1: Growth in the exports of iron from WA since 1980

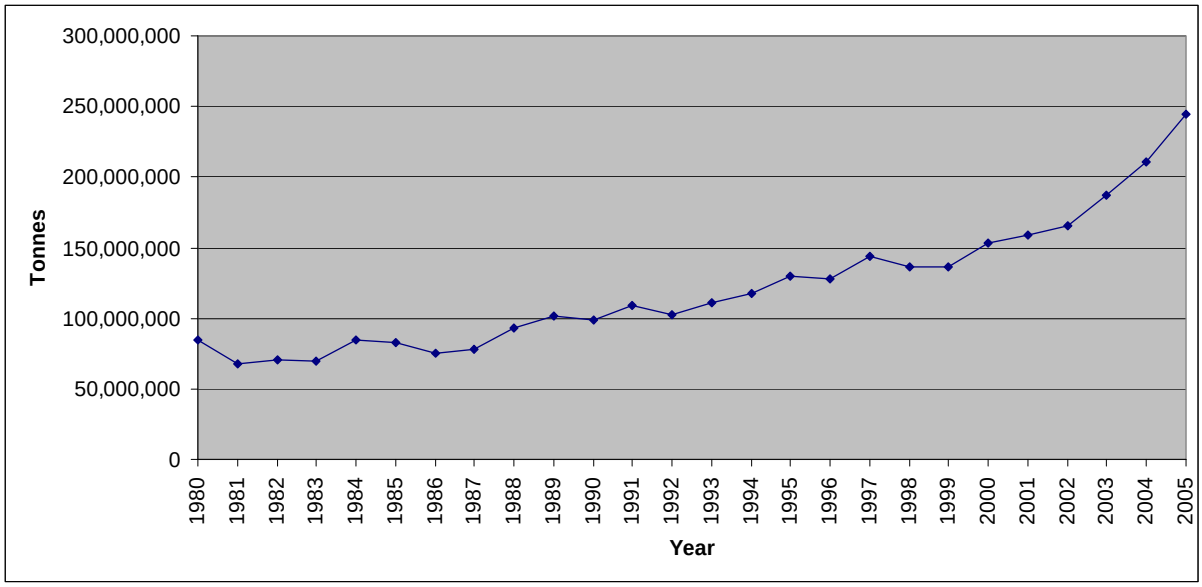


Figure 2: Volumes of gas in the three key basins off the north coast of WA

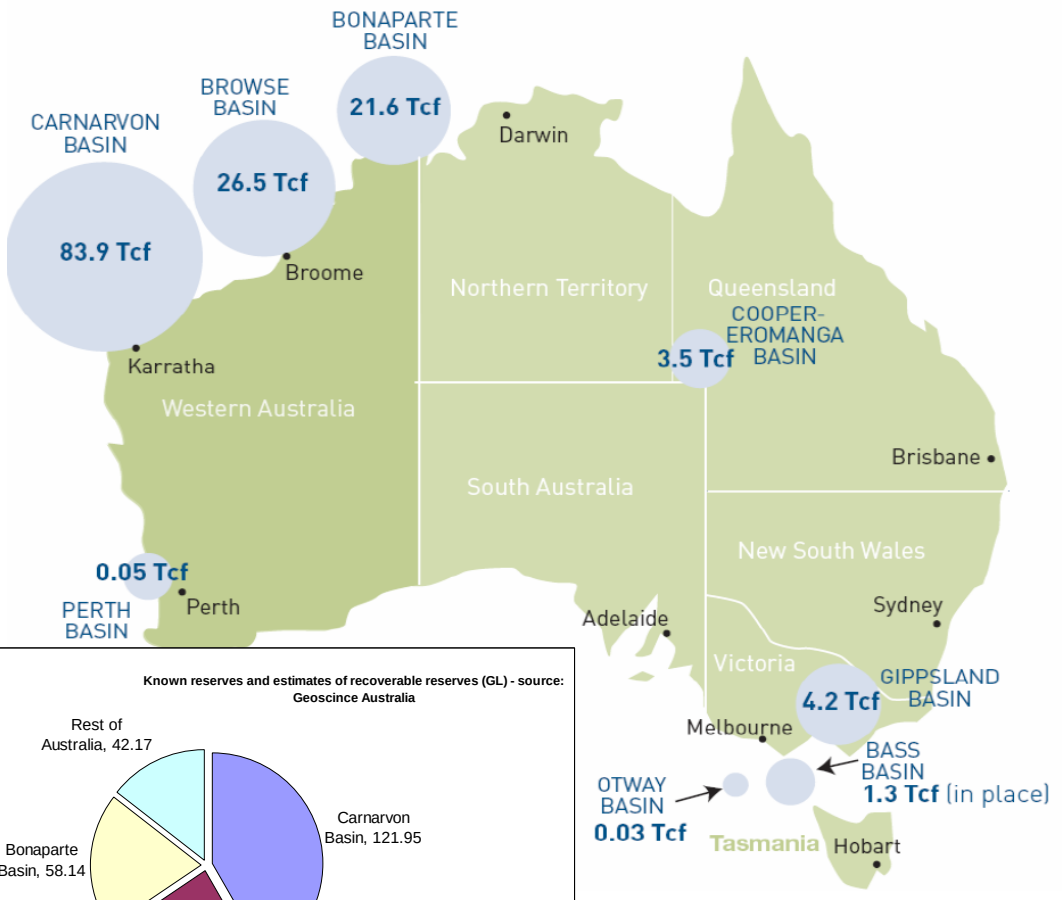
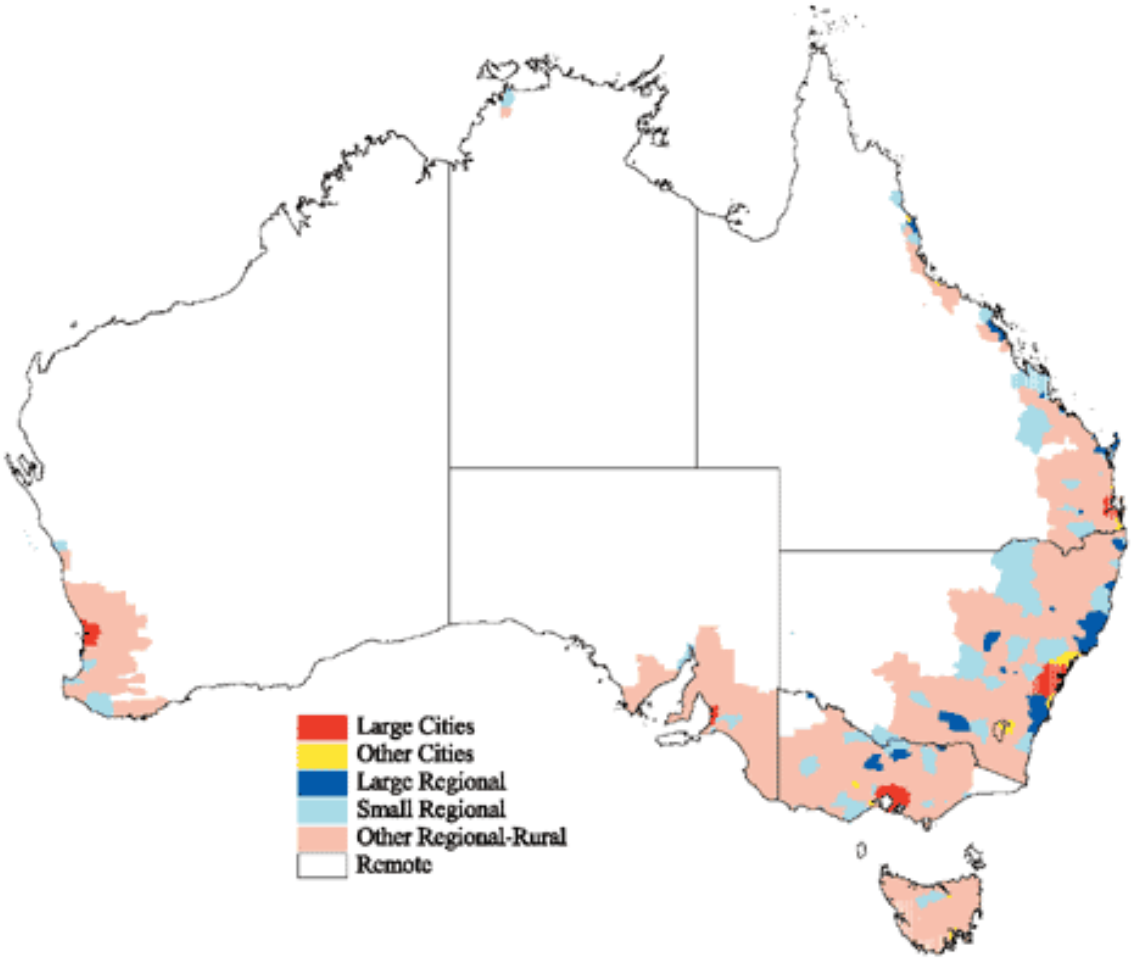


Figure 3: Population distribution in Australia (Source: Australia State of Environment report - http://www.environment.gov.au/soe/2001/publications/theme-reports/settlements/index.html



History of the application of the EPA's offsets policy and emergence of 'offsets of uncertainty'

Appendix 1 has a table that summarises the offsets outcomes for each of the nine proposals. It lists only the expected 'critical' environmental impacts and the relevant (if any) offsets required. It does not contain any significant but non-critical impacts. For example, Table 1 shows that the Fortescue Metals project will involve the initial loss of 3,100 ha and native, only 1,300 of which will be rehabilitated. This vegetation is not considered 'critical' and no like-for-like offset to counterbalance this loss was required. Instead, the proponent has agreed to fund a PhD research project for three years examining the flora of the region. This highlights the point made earlier that the EPA offsets policy is not based on a strict NNL principle.

Of the nine proposals, only four had known direct impacts on critical assets. This involved impacts on:

- Coral (2),
- Mangroves (1),
- Terrestrial vegetation (1),
- Ancient Aboriginal rock panels (1),
- An area of a nature reserve (1), and
- Declared Rare Flora species (1).

In all cases direct offsets were not possible, and a range of contributing offsets was required. This will be illustrated when considering the two of the case studies below. In all cases, the EIA identified uncertainty

about the nature and extent of impacts on at least one critical asset, where there was residual risk that environmental impacts could be unacceptable. These involved:

- Unknown additional loss of coral loss because of impacts of dredging (sediment plume) – 4;
- Possible introduction of weeds/pest to nature reserve – 1;
- Possible additional impacts on marine turtles – 2;
- Possible extinction of certain species, notably
    - Subterranean fauna species – 2;
    - Terrestrial flora – 1;
    - Terrestrial fauna – 1.

The emergence of these uncertain impacts re-enforces the point made earlier about the lack of environmental base-line data available against which to assess these proposals.

The EPA response to this was iterative. For the first two proposals (both involving possible additional loss of coral) the proponents were required to monitor and report the impacts of dredging on the coral and some additional management measures were required. It maybe that the EPA was of the view that the residual risk to coral was low, or that it wasn't sure how to apply the offsets policy in the face of this uncertainty. However, when the next proposal was assessed, the EPA went a step further. The residual risk related to the possible loss of additional mangrove habitat and so the proponent was required to not only monitor impacts but develop early warning triggers of mangrove health. These were meant to be real measures of mangroves health rather than measures of actual damage to mangroves, and when these measures reach a certain pre-agreed level, additional management measures would be 'triggered' to ensure actual additional loss of mangrove does not occur. This is a typically adaptive management approach, but is based on the residual risk being low enough that there is a high level of confidence that additional management measures can be put in place to prevent further loss.

The Gorgon gas proposal provided some unique issues during the EIA process which caused to the EPA and the Minister to rethink how to deal with the uncertain impacts and residual risk. The use of offsets became a useful way to address these issues.

The Gorgon proposal

The Gorgon proposal is a joint venture between three companies (Chevron, Shell and ExxonMobil) to extract natural gas from the Gorgon and Jansz gas fields (10 million tonnes per annum) about 160 km off the north-west coast of WA, and to construct a liquefied natural gas processing complex on Barrow Island along with infrastructure to allow export of the LNG. It has a proposed life span of at least 60 years. This proposal has been highly contentious, largely because Barrow Island is a class A nature reserve, and the island and surrounding waters have significant conservation values. Barrow Island has been used since the 1960s for oil production operation and whilst production is declining it is expected to continue for another 15-20 years. Notwithstanding this, the island's conservation status is significant and the island remains largely free of invasive species, unlike other islands in the region.

The key environmental issues for both the construction and operational phases are:

- A dredging program involving 7.5 million cubic metres of dredge spoil and the subsequent loss of 23.2 ha of coral;
- Clearing of 300 ha of 'critical' native vegetation;
- Risk of invasive species invasion and the requirement for a comprehensive quarantine program;
- Possible impacts on two beaches significant for nesting of Flatback turtles;
- Impact of certain fauna species; and
- The Gorgon gas contains 15% carbon dioxide, and this is to be extracted and injected underground on Barrow Island in formations from which oil has been extracted.

The project caused considerable debate in the community, as much because of the uncertainty of the nature and extent of some of the potential impacts, including:

- The extent of the dredge plume and, therefore, the actual extent of coral loss;

- The level of risk the any invasion species could be introduced and subsequently became established on the island;
- How the Flatback turtle population of the region would be affected through potential disruption to female nesting and hatchings survival rates;
- Possible extinction of four subterranean taxa and one terrestrial taxa species only found within the development site; and
- Likely success of the carbon dioxide injection programme (risk of failure).

The final approval package included some significant offsets for the direct impacts:

- $40 million to a Net Conservation Benefit Fund for conservation works on other sites; and
- Funding for a permanent Department of Environment and Conservation (DEC) presence on the Island to oversee that Project's impacts on island and marine conservation - $1 million a year during the construction, and $750,000 before and after.

These can be seen as an offset for being in a nature reserve and for the loss of the 300 ha of vegetation. It was, however, the responses to the residual risk (uncertain impacts) that was of particular interests here.

The debate over the how much coral would actually be impacted by the dredging programme was and remains intense. In recognition of the uncertainty, the proponent drew up a significant adaptive management response, but the details of which won't be expanded upon here. The responses to two of the issues - risk of invasion species establishment on the island and the uncertainty over impacts on the Flatback turtle population in the region - are more relevant to the discussion here.

On the invasion species issue, the proponent was not only required to design and implement and quarantine management plan, but was also required to provide the following offsets:

- $10 million to fund a 12-year Threatened Species Translocation and Reintroduction Program for certain species from Barrow Island to other islands in the region; and
- A financial guarantee of $10 million to cover the costs for eradicating any non-indigenous species (invasion species) that may established on Barrow Island because of the project

With respect to the possible impacts on the Flatback turtle population in the region, the proponent was required to produce and implement and management plan and to monitor the population using the island looking for possible negative impacts. Further, the proponent was also required to provide the following offsets:

- A $32.5 million 30-year program of providing added protection to the North West Flatback Turtle population in areas away from Barrow Island; and
- In the event that monitoring demonstrates that the proposal is having a significant adverse impact on the Flatback turtle the proponent is required to carry out actions to improve recruitment to the turtle population, the total cost of these actions not to exceed $5 million.

Interestingly, the proponent is of the view that its quarantine program will be rigorous enough to avoid any invasion species to establish on the island, and that the proposal can be managed so that it will not impact adversely on the Flatback turtle population. The proponent does, however, acknowledge the residual risk associated with each issue. Consequently, the first offset for each issue can be seen as a 'residual risk' offset in that it is provided not because an adverse impact is expected, but because there is a real and recognised risk that adverse impacts could occur. The second offsets for each issue can be seen as 'banked' offsets as they will only be called on in the event that monitoring show adverse impacts have occurred. Together these types of offset can be seen as 'offsets for uncertainty' rather than direct offset. This is clearly a new approach of the EPA in response to the project's uncertainty, which goes beyond that previously adopted, and marks a significant shift in the implementation of its offset policy.

Offsets post-Gorgon

Several proposals were assessed by the EPA subsequent to the Gorgon proposal, most of which either did not have such significant uncertainty associated with them or were of a much smaller scale. Consequently, they were not subject to significant 'offsets for uncertainty'. The next major proposal with significant uncertainty was another LNG proposal, the Pluto LNG Development, Burrup Peninsula. This involved the extraction of gas from the Pluto gas field, 190 kilometres north-west of Dampier and processing and export LNG at Burrup peninsula (16 million tonnes per annum of LNG). This proposal has received world wide attention

because the Burrup Peninsula contains around 500,000 ancient rock art (petroglyphs), some more than 10,000 years old (Bird and Hallam 2006). The Friends of Australian Rock Art claim that some the early work could be as old as 30,000 years. The processing plant site for the Pluto proposal contains 1490 rock panels, 85 of which are to be relocated because they are within the actual disturbance footprint.

The key area of environmental uncertainty for the proposal is the extent of coral lost because to the dredge plume. Dredging is required for the port facilities and to allow ship access to the port, with around 14 million cubic metres of dredge spoil produced. 1.3 ha of coral will be lost because they are within the dredge channel, but up to an additional 30 ha could be lost because of the sediment plume. As an offset for the loss of 1.3 ha of coral, the proponent is required to fund research and monitoring work in nearby Dampier Archipelago Marine Park at $760,000 per year to a total of $3.8m. The proponent is also required to fund a study on better management of dredging impacts on corals, total cost is $6.2m. This latter offset can be seen as an offset for uncertainty (a residual risk offset) as it is required irrespective of the actual loss of coral. No banked offset is required in the event that coral loss exceeds 1.3 ha.

Conclusion

This paper has argued that two new types of offset have been used in response to the uncertainty associated with some major resource projects proposed for the north west of WA. They have been described as 'offsets for uncertainty'. The first type of offset is a 'residual risk' offset, which is provided not because adverse impacts are expected but in recognition of the residual risk associated with the proposal. The second type is a 'banked' offset, which is an offset that would be 'cashed in' only in the event that negative environmental impacts occur. In support of this offset, the proponent is required to carry out environmental monitoring to look for negative impacts, and if any occur and these impacts cannot be mitigated through adaptive management, then the offset is called upon commensurate with the monitored impacts.

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Appendix 1: Summary of the offsets outcome for each proposal

Proposal name and year of EIA	Known critical environmental impacts	Offset	Uncertain and unknown critical environmental impacts	Offset, including any monitoring to identify 'critical' impacts
Iron ore mine, processing and export at cape Preston: 2002	None	N/A	Possible loss of subterranean fauna species (extinction) because of reduced watertable caused by de-watering	Monitoring programme to measure impacts. No banked offset is impacts result.
Dampier Port Expansion: 2003	None		Unknown area of coral indirectly lost or put under stress because of sediment plume.	Coral survey within Port Area, and monitoring programme to identify any impacts on coral. No banked offset is impacts result.
Fortescue Metals Pilbara Iron Ore and Infrastructure Project: 2005.	Loss of around 109 ha of mangrove habitat (considered critical) for port, 14.8 ha of which is close canopy with 94.4 ha open mudflats with scattered other species.	Rehabilitation of around 0.8 to 1 ha of mangroves. Re-contouring of some disturbed areas to facilitate mangrove re-colonisation. Fund an environmental study of mangroves in area – mapping, assess condition of mangroves, and monitor iron ore dust deposition.	Possible indirect impacts on remaining mangroves.	Mangrove monitoring program. Development of early warning triggers of mangrove health and additional management measures that would be initiated to ensure loss of mangrove is within predicted limits.
Gorgon Gas Development Barrow Island Nature Reserve: 2006	Effective loss of an area of a class A Nature Reserve Loss of 23.2 ha of coral; Clearing of 300 ha of vegetation; Gorgon gas around 15% CO_2 – significant volume produced;	Initial $40 million fund as "Net Conservation Benefit". High level dredging management including expert panel; High level quarantine management including expert panel; $10m over 10 years for threatened species translocation to other islands program Reservoir CO_2 capture and storage required	Actual area of coral lost subject to some uncertainty; Impact of flatback turtles uncertain– beach near processing plant significant for turtle nesting; Exotic species invasion and spread (weeds and fauna); Potential extinction of four subterranean taxa and one terrestrial taxa - known only from the development site;	$2.5m to fund government auditing dredging and expert panel to advise on dredging. Interim coral health triggers established with subsequent management actions required even suspend dredging Monitoring turtle population and up to $5m for turtle population enhancement actions should monitoring show impacts on turtle population; establish turtle expert panel. $32.5m over 30 years for NW flatback turtle protection program; $10m 'bond' to cover any cost of exotic species eradication; High level Quarantine Management System and expert panel Continue survey until 5 taxa are found outside the site.
Dredging Program Dampier Port Upgrade: 2006	None expected.	N/A	No direct loss of coral but uncertainty if any coral will be lost indirectly (turbidity and sedimentation); Concern dredging could impact on coral spawning, in particular the dredging will continue during the likely minor spring spawning event.	Undertake research into coral recovery following disturbance, including reproductive processes and larval settlement; Undertake research into relative importance of the spring spawning event
Materials Stockpiling and Handling Facilities, Cape Preston: 2006	None	N/A	Significance of beach for turtle nesting uncertain and data available of limited value.	Carry out study to establish baseline usage of beach by turtles; ongoing monitoring of beach for turtles; establish triggers (changes to turtle usage of beach) for additional management action

Proposal name and year of assessment	Known critical environmental impacts	Offset	Uncertain and unknown critical environmental impacts	Offset
Mt Gibson Iron Ore Mine and Infrastructure Project: 2006	Two flora species - *Darwinia masonii*, the recently discovered *Lepidosperma sp*. Mt Gibson only found on this BIF. Like tio be threatened ecological community. 15% of *D. masonii* and 47% of *Lepidosperma sp*. Mt Gibson would be lost	Government to take action to conserve (reserve) the remaining populations of both species. Adequate management resources provided to DEC to ensure that threatening processes on the remaining plant populations are mitigated. Proponent to develop Research and Recovery Plans for two species.	Some possibility that two species could be found elsewhere other than this BIFs (would reduce risk to species)	More surveys to determine actual extent of two species beyond Mt Gibson.
Dredging Program Cape Lambert Port Upgrade: 2007	None	N/A	Uncertain impacts of coral spawning – significant impact would be seen as critical	Monitoring programme; setting of spawning success criteria as triggers for additional dredging management measures
Pluto LNG Development, Burrup Peninsula: 2006 & 2007	Direct loss of about 1.3ha of coral because of dredging and up to another 30ha lost through indirect impacts (sediment plume etc) – significant coral loss as cumulative loss >10% NOTE: Loss of around 119 ha of high value (not critical)vegetation; 85 of the 1490 ancient Aboriginal rock panels on the site are within the development footprint	DEC funded for research and monitoring work in Dampier Archipelago Marine Park – $3.8m - $760,000 pa . Rehabilitation of some degraded areas outside the area ($70,000 establishment cost, $30,000 per year for 5 years (construction) and an agreed sum for on-going phase Fund DEC to do flora studies or poorly known species - $250,000. Study of likely links between past human us of the site and the botanic resources there.	Extent of loss of coral due to indirect impacts of dredging. Some concern that snail species found on site and whose habitat would be lost is endemic to site only.	Establish dredge management group; Establishing three levels of management triggers in terms of % net averaged coral mortality of monitoring sites with different management responses. Do pre and post dredging coral surveys to determine actual impacts Study on better management of dredging impacts on corals – $6.2m. Genetic study of snail species to address taxonomic issue - $100,000.