Ord River hydro-electric project

Argyle Diamond Mines Pty Limited

Report and recommendations
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 615
March, 1992

THE PURPOSE OF THIS REPORT

This report contains the Environmental Protection Authority's environmental assessment and recommendations to the Minister for the Environment on the environmental acceptability of the proposal.

Immediately following the release of the report there is a 14-day period when anyone may appeal to the Minister against the Environmental Protection Authority's recommendations.

After the appeal period, and determination of any appeals, the Minister consults with the other relevant ministers and agencies and then issues his decision about whether the proposal may or may not proceed. The Minister also announces the legally binding environmental conditions which might apply to any approval.

APPEALS

If you disagree with any of the assessment report recommendations you may appeal in writing to the Minister for the Environment outlining the environmental reasons for your concern and enclosing the appeal fee of $10.

It is important that you clearly indicate the part of the report you disagree with and the reasons for your concern so that the grounds of your appeal can be properly considered by the Minister for the Environment.

ADDRESS

Hon Minister for the Environment
18th Floor, Allendale Square
77 St George's Terrace
PERTH WA 6000

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 p.m. on 3 April, 1992.

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Summary and recommendations

Argyle Diamond Mines Pty Limited proposes to build a hydro-electric generating station next to the Ord River Dam to supply electricity to its diamond mine 120km to the south. In order to supply electricity to the mine site, Argyle Diamond Mines Pty Limited plans to construct and operate the hydro-electric station with 40MW capacity, construct a weir in the existing spillway to increase the storage capacity of Lake Argyle, and construct and maintain a 132kV overhead transmission line from the hydro-electric station to the mine site.

Several environmental issues have been raised by this proposal. The principal matter of environmental concern is that the preferred transmission line route would traverse the proposed Carr Boyd National Park. This raises issues of protection of the proposed park from physical incursions and degradation, as well as protection of the fauna and flora, the wilderness aspects and the visual amenity. The alternatives such as taking the transmission line under Lake Argyle for much of the route, or of undergrounding the line through Coolamon Pocket were discussed by the proponent. Undergrounding, or putting the cable underwater, while visually an attractive option appears to be potentially more damaging to the environment, with the need for blasting, additional structures, and more difficult maintenance. It is therefore proposed to accept the preferred transmission line route with assurances from the proponent as regards management. This includes progressive rehabilitation, rolling rather than clearing of vegetation, and careful siting of the line to minimise visual intrusion,

The sensitivity of the proposed Carr Boyd National Park was acknowledged and the proponent has made a commitment to liaise with the Department of Conservation and Land Management to determine the specific location within the proposed route easement in order to minimise disturbance to landscape or visual amenity. The proponent has also reported that liaison has taken place, and will continue to take place with Aboriginal people and communities.

The Environmental Protection Authority notes that the proponent has made commitments to liaise with the Department of Conservation and Land Management with regard to the transmission line route through the proposed National Park, and to conduct an induction programme to promote environmental awareness among employees and contractors. The Environmental Protection Authority considers that the proponent also should extend this liaison to the authority in whom the land is currently vested.

A second major category of concerns were those which dealt with effects on the Ord River system itself. There were concerns that by raising the level of the spillway through the construction of a weir in the existing Spillway Creek, additional areas would be inundated. There were concerns that the project would decrease the amount of water available for other users, especially during the construction phase of the coffer dam required to provide a de-watered site for the building of the power generating station itself. There were also concerns that the introduction of the project would alter the pattern of waterflows along the whole Ord River system, from the head waters of Lake Argyle to the mouth of the Ord River at Cambridge Gulf.

With respect to other users of the water, the Authority accepts the position stated by the Water Authority of Western Australia that: "While ADM are the proponents of the project, they will be constructing and operating the project under a joint operating agreement with the Water Authority. The Water Authority will still retain overall responsibility for the security of the structures and for ongoing operation and maintenance of the dam and for ensuring that the rights of other water users are not eroded."

These were the principal issues raised by the 37 submissions received, although there were others as well. These are addressed in Section 4.

The Environmental Protection Authority concludes that this project is environmentally acceptable, subject to the commitments made by the proponent and the recommendations made in this report.

Recommendations

Recommendation 1

The Environmental Protection Authority concludes that the proposal to build and operate a hydro-electric power station at the Ord River Dam and transmit power from this station to the Argyle Diamond mine site as described in the Public Environmental Review and modified following submissions and discussions is environmentally acceptable.

In reaching this conclusion, the Authority identified the main environmental factor to be considered was that the transmission line route would pass through the proposed Carr Boyd National Park. Other factors to be considered included the effects of the construction of the power station (including the timing of the building of the coffer dam), the effects of raising the spillway, and the effects of the construction of the transmission line, including access tracks, effects on vegetation, visual amenity and concerns of specific relevance to Aborigines. Any major changes in the regime of the Ord River system also required consideration.

The Environmental Protection Authority considers that these and other issues have been addressed by studies and environmental management commitments given by the proponent or by the Authority's recommendations in this report. Accordingly, the Environmental Protection Authority recommends that the proposal could proceed subject to:

- the proponent's commitments; and
- the Authority's recommendations in this report.

Recommendation 2

The Environmental Protection Authority recommends that during the construction of the power line the proponent should take such management measures as are necessary to avoid the introduction of potentially harmful species, including contamination by water-borne declared plant seeds to the satisfaction of the Environmental Protection Authority upon advice from the Agriculture Protection Board.

Recommendation 3

The Environmental Protection Authority recommends that the location of each borrow pit and quarry should be approved by the Water Authority of Western Australia and the Shire of Wyndham-East Kimberley prior to the commencement of earthworks at that location.

The rehabilitation of all quarries and borrow pits should be to the satisfaction of the Environmental Protection Authority on advice from the Water Authority of Western Australia and and Shire of Wyndham East Kimberley.

Recommendation 4

The Environmental Protection Authority recommends that not less than six months before the closure of the mine, the proponent should refer to the Environmental Protection Authority a programme to remove the transmission line and rehabilitate the transmission line easement, or alternative proposals for its further use.

1. Introduction

Argyle Diamond Mines Pty Limited (ADM) proposes to build a hydro-electric power generating station next to the Ord River Dam approximately 75km from Kununurra in the East Kimberley area of Western Australia, to supply electricity to the Argyle Diamond Mine some 120km to the south. To supply electricity to the mine site, Argyle Diamond Mines Pty Limited plans to build and operate the hydro-electric station with 40MW capacity, construct a weir in the existing spillway to increase the storage capacity of Lake Argyle, and construct and maintain a 132kV overhead transmission line from the hydro-electric station to the mine site. Electricity at the mine is currently generated by a 28MW diesel-fired power station, which, if the hydro-electric project does not proceed, is expected to expand to 40MW by the mid 1990s.

This report outlines the proposal, the environmental concerns which the Environmental Protection Authority and others have raised, the proposed mitigation or management of those issues, some details on the public review and assessments made of the proposals, commitments by the proponent, and recommendations to the Minister for the Environment outlining the Authority's views on the ways in which this project can be carried out in an environmentally acceptable way.

The current proposal was originally submitted to the Environmental Protection Authority in April 1990 by CRA Business Services Development (WA). In February 1991, responsibility for the project was transferred to Argyle Diamond Mines Pty Limited. The Environmental Protection Authority decided to assess the proposal under Part IV of the Environmental Protection Act, at the level of Public Environmental Review (PER). The document was released for an eight-week public review period from 14 October 1991 to 9 December 1991. Thirty seven submissions were received.

2. Historical background

The idea of using the Ord River Dam for hydro electric generation has been part of many plans and studies since its inception.

Under the terms of the Western Australian Government (Ord River Irrigation) Act (No 50 of 1968) provision was made for

"The construction of a dam on the Ord River which shall consist of.....
(b) an uncontrolled spillway and incidental works associated therewith;
(c) River diversion and outlet conduits together with incidental works associated therewith, to incorporate all necessary provision for the later installation of a hydro-electric generating station of an installed capacity of about 30,000 kilowatts..."

Following a request from the Prime Minister, the Northern Territory Electricity Commission and the State Energy Commission of Western Australia (SECWA) did a feasibility study in 1979 which became the subject of an Environmental Review and Management Programme (ERMP) and subsequently was reported on in EPA's Bulletin 82 in 1980, and found to be environmentally acceptable. This proposal included a 60MW hydro electric generating station, (compared to the present 40MW), and involved raising the height of the spillway by 6m. It was concluded that "the spillway modification will not markedly alter the regime of Lake Argyle: what it will do in effect is to divert water from the spillway to flow through the turbines instead." Transmission lines to Darwin and the East Kimberley were not included in the studies with this assessment. The proposal did not proceed.

Under the terms of the Diamond (Ashton Joint Venture) Agreement (No 108 of 1981), the Ashton Joint Venture (AJV) was required to conduct a feasibility study with the State Energy Commission "...with a view to the establishment of hydro electric generation works on the Ord River and distribution works to supply inter alia the Argyle mining area..."

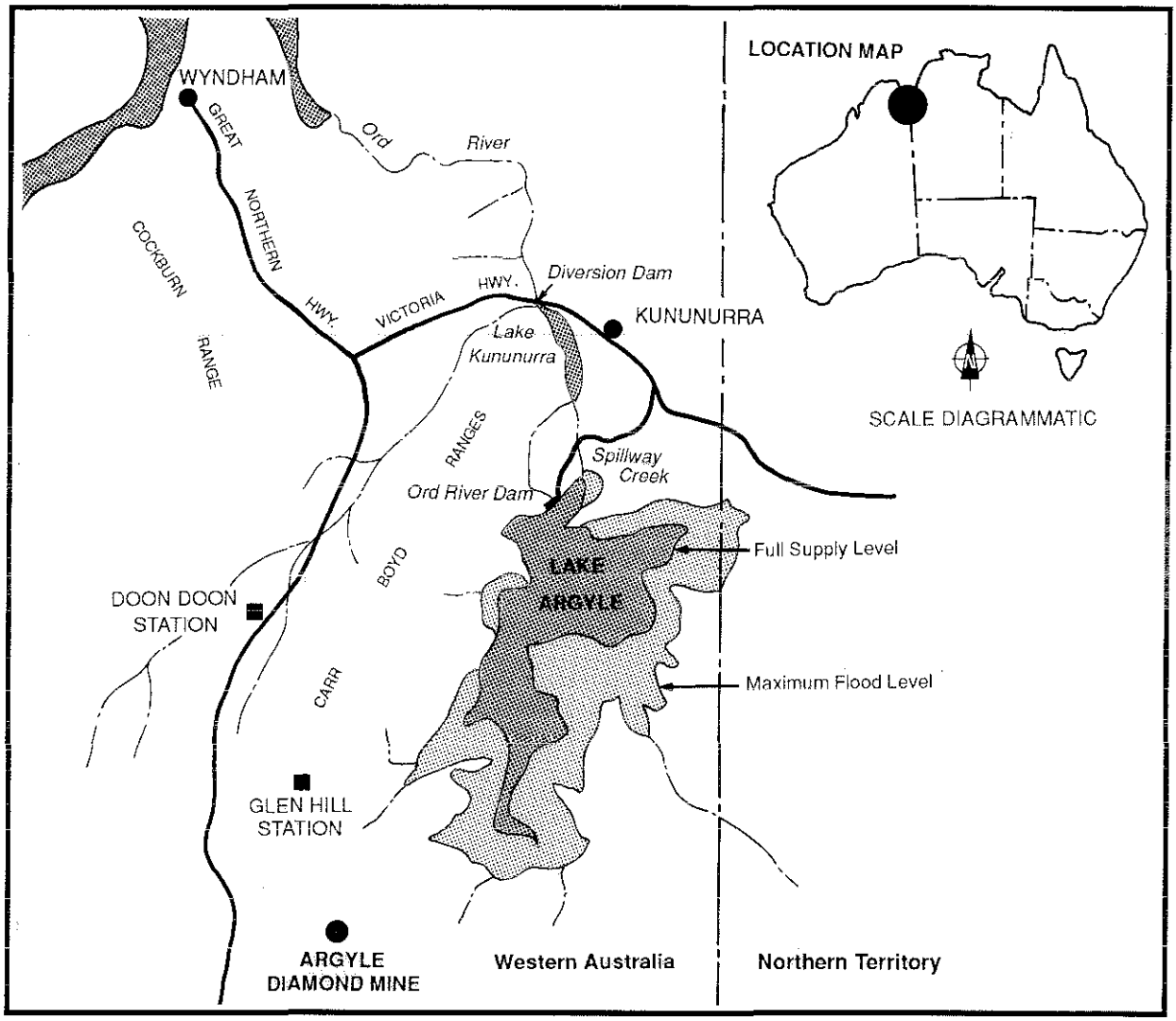

Figure 1: Location of the project (Source: PER)

This study was carried out in 1982, but the project did not proceed. Another study by the Argyle partners in 1986 was found not to be economically viable for the production at that time.

A 1983 amendment to the Company's Agreement Act[1] with the State included a clause that "...the Joint Venturers shall upon request by the State at any time or times before 31st December, 1988 enter into negotiations with the State Energy Commission view to the establishment on terms and conditions to be agreed between the State Energy Commission and the Joint Venturers of hydro electric generation works on the Ord River and distribution works to supply, *inter alia* the Argyle mining area and any relevant town at the Argyle mining area.." However, this was not acted upon.

Following an increase in production, and increases in expected costs of diesel generation, CRA Business Services Development (WA) put forward a proposal to the Authority in April of 1990. There have been some subsequent changes, including change of proponent to Argyle Diamond Mines. The current project being assessed is now the culmination of studies carried out by the proponents and their consultants, discussions with the Environmental Protection Authority and other interested parties including Government and private agencies and individuals, and has resulted in the development proposals as outlined in the PER document and responses to submissions.

[1] Diamond (Ashton Joint Venture) Agreement Amendment Act 1983

3. The proposal

The proposal involves the construction and operation of a hydro-electric power generation facility next to the main dam on the Ord River, using facilities established during initial dam construction for such a purpose. When the dam wall was built, two tunnels were built to allow for provision and control of irrigation water, and the possibility of utilising waters from Lake Argyle to generate electricity. The hydro-electric generating station would be built at the downstream "toe" of the dam. Two turbines would be installed with a combined generating capacity of 40MW at a lake level of 82m AHD or greater. While the majority of the structures would be below 'datum ground level', the superstructure, transformers and switching station would be above this level. To de-water the site, a temporary coffer dam would be built some 100m downstream of the irrigation outlet, and would incorporate culverts to allow water through during this period. Some concerns have been expressed about the timing of coffer dam construction, in the context of water availability to other users.

It is proposed to transmit the power thus generated to the Argyle diamond mine site by construction of a 132kV line, 120km long, using hollow concrete or steel support poles. After consideration of several alternative routes, it was decided to take the transmission line along the route indicated on Figure 2. Undergrounding of part or all of the line was deemed impractical in the terrain through which it would pass and, the proponent claimed, likely to be more environmentally damaging than overhead lines.

To improve the storage efficiency, and increase the water head for power generation, it is proposed to build a weir in the existing Spillway Creek, about 6m high. It should be noted that this will not mean a corresponding increase in the inundation levels of Lake Argyle. In response to concerns expressed in submissions on the PER document, the proponent noted "No land is likely to be inundated by raising the level of the spillway that has not been inundated in the past. Figure 3 of the PER indicates that, generally, the level of Lake Argyle with the project will be less than it has been without the project. The maximum level recorded is 96.8m which is more than 6m above the proposed new spillway level.

It is not expected that the Maximum Probable Flood level ("MPF") of the dam (110.8m) will change as a result of either the spillway weir or the hydro-electric station."

Studies done in 1979-1980 for the State Energy Commission also referred to the raising of the Spillway level by 6m and that this would not affect the full supply level of the lake or alter its existing regime. The Environmental Protection Authority (Bulletin 82) found this earlier project to be environmentally acceptable, and noted: "The spillway modifications will not markedly alter the regime of Lake Argyle: what it will do in effect is to divert water from the spillway to flow through the turbines instead. The project is designed to use this water and not to affect the Dam's agricultural irrigation water supply potential."

The life of the hydro-electric project is expected to exceed the life of the present diamond mine. At the end of the "mine-life" period, it will be essential for the proponent to remove the transmission line, or return to the Environmental Protection Authority with proposals for its further use.

4. Environmental issues and their management

Several environmental issues have been raised by this proposal. The principal matter of environmental concern is that the proposed transmission line route will traverse the proposed Carr Boyd National Park. This raises issues of protection of the park from physical incursions and degradation, as well as protection of the fauna and flora, the wilderness aspects and the visual amenity.

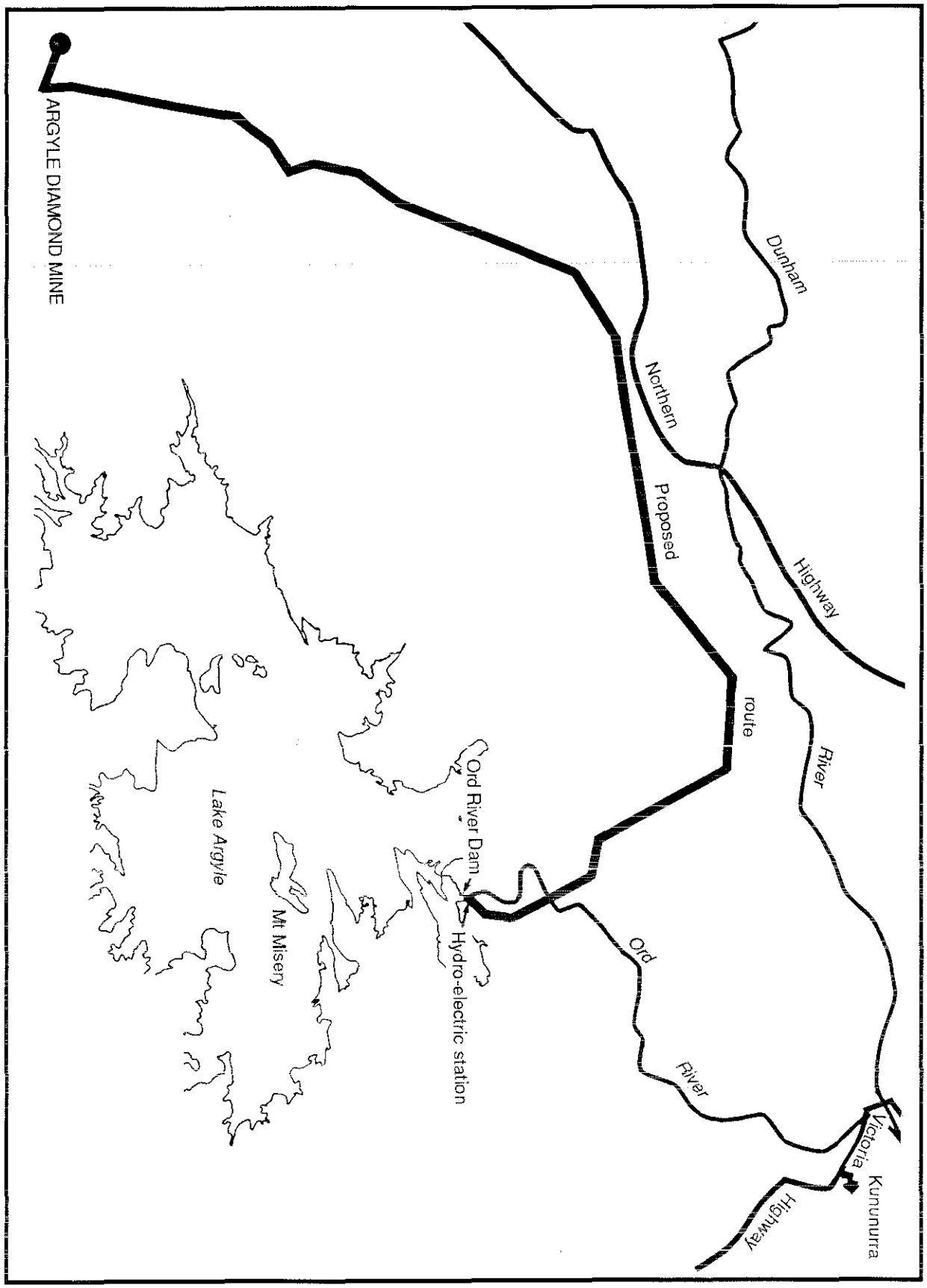

Figure 2: Proposed transmission line route (Source: PER)

A second major category of concerns were those which dealt with effects on the Ord River system itself. These related less to fringing vegetation and faunal habitats than to several water-related issues. Potential environmental problems were identified in relation to perceived changes in the patterns of water flows along the whole Ord River system, from the headwaters of Lake Argyle down both the Spillway Creek and the Ord River main channel to Lake Kununurra and the Diversion Dam, and below that, all the way to the mouth of the Ord River at Cambridge Gulf. These concerns were expressed in terms of the amount of water and the changes in patterns of water flows.

On the amount of water, concerns were expressed on the one hand that there would be insufficient water for other users such as irrigators, tour operators, recreational and professional fishers, pastoralists and so on. This was also expressed as a water use conflict, and apprehension that the hydro-electric project would "take" water from other users. On the other hand, there was concern that there could be flooding of previously dry areas, to the detriment of miners, pastoralists, Aboriginal communities and Aboriginal sites, and to the detriment of, or at least marked alteration to fringing vegetation and habitats. These concerns were expressed by a diversity of submitters, with particular interests in different sections of the Ord River system, from backwater effects at the headwaters of Lake Argyle, through to effects on the lower Ord River.

Several ecological and social issues were raised by submissions received by the Authority following the release of the PER document on 14 October 1991. These included concerns over and requests for further information on:

- Route of the transmission line
- Landscape and wilderness aspects
- Timing of the coffer-dam construction
- Use of explosives, fire risks, electro-magnetic radiation
- Raising the spillway
- Changes in water flow patterns
- Conflicts over water use
- Fauna, flora, wildlife
- Decommissioning
- Issues of specific concern to Aborigines
- Recreation
- Employment

Responses were sought from the proponent on all of the above issues. The full text of this response is at Appendix 3.

4.1. Environmental management

The proponent has made several environmental management commitments in the PER document, and subsequently expanded on issues of concern expressed in the submissions. These appear in Appendices 1 and 3 respectively. This section of the report seeks to outline key issues of concern which were expressed to the Environmental Protection Authority, and the assessment by the Authority of the responses of the proponent and any further recommendations which the Authority believes to be necessary. The first category of issues deals with the proposal to take the transmission line through the Carr Boyd National Park, and the issues, therefore, which relate to the transmission line route. The second category deals with Ord River system concerns, such as the timing of coffer dam construction, the raising of the spillway, and changes to the patterns of water flow. Concerns here relate to the amount of water and to the regime or pattern of water flows. Finally, other issues of concern to submitters

are outlined. These issues are social, economic, philosophical or a mixture of all three, and some of them are beyond the scope of this environmental assessment.

4.1.1 Impacts on proposed Carr Boyd National Park

Additional information was sought on other options available for the project other than putting the transmission line through the proposed Carr Boyd National Park. These were incorporated into the PER document, and further information was also provided following the receipt of submissions. The full text of the response is at Appendix 3. Alternative routes which would not have traversed the Carr Boyd Range and proposed National Park through Coolamon Pocket were considered, but not found to be viable economically, or, in some cases, environmentally sound.

Essentially, the sensitivity of the area has been acknowledged, and the proposed route will be slightly re-aligned to reduce its visibility from the hydro-electric station up to the ridge, at the request of the Water Authority of Western Australia. The Department of Conservation and Land Management will be invited to participate in determining the exact route through Coolamon Pocket.

The Environmental Protection Authority notes that the proponent has made commitments to liaise with the Department of Conservation and Land Management with regard to the transmission line route through the proposed National Park, and to conduct an induction programme to promote environmental awareness among employees and contractors. The Authority considers that the proponent also should extend this liaison to the authority in whom the land is currently vested.

Removal of vegetation will be kept to a minimum, and as the construction of each section of the transmission line is completed, disturbances or damage will be rehabilitated.

Poles used will be hollow concrete or steel; no wooden poles will be used for the transmission line.

Aboriginal sites surveys conducted have indicated that there will be no such sites along the transmission route. The proponent has indicated that if any sites were to be subsequently identified during construction, the alignment of the transmission line would be changed to avoid that area.

Neither employees nor contractors will be permitted to bring animals into the construction camps and areas, and a commitment has been made that "An induction programme will be conducted during construction and operation to promote environmental awareness amongst employees and contractors." However, it will be necessary for the proponents, their contractors and employees to liaise with the Agriculture Protection Board to ensure that no pest species are inadvertently introduced. Vehicles, machinery and other equipment may need to be inspected and possibly washed down, depending on their origin, and all measures designed to protect the area from potentially harmful species will need to be undertaken. This applies to land-based plants, as well as a need to minimise the risks of water-borne declared plant seed contamination.

Recommendation 2

The Environmental Protection Authority recommends that during the construction of the power line the proponent should take such management measures as are necessary to avoid the introduction of potentially harmful species, including contamination by water-borne declared plant seeds to the satisfaction of the Environmental Protection Authority upon advice from the Agriculture Protection Board.

4.1.2 Transmission line route

The possibilities of taking the transmission line under Lake Argyle for much of the route, or, alternately, of undergrounding the line through Coolamon Pocket were discussed with the proponent. Undergrounding, or putting the cable underwater, while visually more attractive appear to be potentially more damaging to the environment, with the need for blasting, additional structures and more difficult maintenance. The Authority therefore accepts that these options are not clearly environmentally preferable to the proposed option, given the commitments made by the proponent as regards management. These include progressive rehabilitation, rolling rather than clearing of vegetation, careful siting of the line to minimise visual intrusion, and an invitation to the Department of Conservation and Land Management to participate in determining the exact route through Coolamon Pocket.

Another issue raised was protection of fauna and flora along the proposed route. Apart from the damage which may be caused by the actual construction of the transmission line, concern was expressed that access ways may criss-cross the landscape and that this would be damaging in itself, but would also provide additional access to other potential intrusions. The Department of Conservation and Land Management has yet to draw up a full park management plan, and so any additional diversity of access tracks could present an environmental concern. However, the proponent has indicated that there will be no permanent access tracks to the transmission line, and that such tracks created during construction will be progressively rehabilitated. Normal inspections are expected to be by helicopter rather than by driving along the route.

Specifically, there was also concern over the effect of the transmission line on waterbirds which may collide with the line, and on two poorly known species from the area, *Eucalyptus ordensis* and *Brachychiton tuberculatus*, which may be in the path of the transmission line.

On both issues the proponent has indicated its awareness of the issues. It is intended to increase ground clearance over permanent water to minimise impacts on waterbirds, and if river users report an increase in waterbird mortality due to transmission line strikes, Argyle Diamond Mines Pty Limited will examine the possibility of increasing line visibility for waterbirds by the use of coloured markers.

The two plant species mentioned are listed by the Department of Conservation and Land Management as being Priority Two and Three respectively in the current list of Declared Rare and Priority Flora. Argyle Diamond Mines Pty Limited has indicated that although no plants of these species have been recorded during botanical surveys of the area, surveyors will be provided with sets of colour photographs, and told to note, flag and photograph any plants which resemble these species. They have additionally given an assurance that populations of any flagged plants which are confirmed as being significant species will be protected.

Concern was expressed also that the transmission line would increase fire risks, especially during storms and cyclones, and that the poles themselves would present an environmental hazard, in their construction, especially if explosives were to be used. Again, if they were to fall, during cyclones or storms, additional fire risks could be created, and vegetation damaged.

The proponent has indicated an awareness of the issues, and has indicated fire risk management strategies, and appropriate safeguards in the use of explosives. The proposed rehabilitation of areas damaged during construction has already been noted.

The transmission line was also seen as potentially creating an electro-magnetic radiation hazard for those people and communities along the route, especially the Aboriginal people at Glen Hill. On the issue of electro-magnetic radiation, it may be noted that the construction and operating standards of the transmission line will be set according to guidelines of the State Energy Commission of Western Australia, in accordance with International Radiation Protection Association criteria. It is expected that the transmission line alignment will be some 250 m to the east of the Glen Hill community living areas. The Environmental Protection Authority is guided in this matter by advice from the Health Department of Western Australia.

Another concern was that the selection of the route through the area surrounding the dam and around the Lake Argyle Village should be made with a view to minimising the visual impact on

key vistas in the area. The Water Authority, which has responsibility for and operates the Ord River Dam facility would like to be involved in the final route selection, and has discussed this with Argyle Diamond Mines Pty Limited and its consultants. Similarly, the Water Authority has indicated that the location of the fire fighting tank suggested by Argyle Diamond Mines Pty Limited is being reviewed to ensure that it does not visually detract from the vistas around the dam.

4.1.3 Timing of coffer dam construction

The timing of the construction of the coffer dam, and the subsequent stopping, or diminution of water flow from Lake Argyle down the Ord River to Lake Kununurra was raised as a major concern by many. In particular, it was felt that other water users, principally tourist operators, but also irrigators would be disadvantaged. The length of time during which it was expected there would be no flow (three weeks) was a concern as well as when that no-flow period would be. The intention of the proponent is to build the coffer dam early in the dry season (May to September), but submitters requested that this be changed to early wet season (October to April).

In response to this concern, the proponent indicated that the coffer dam construction was essential to the further development of the project, and therefore would need to begin as soon as feasible. However, it was also noted that the Water Authority which will retain control over water use in the Ord River system intended to raise the levels of Lake Kununurra prior to coffer dam construction, and so would be able to meet the needs of irrigators during the three week construction period. Also, that the ultimate decision on when the flow from Lake Argyle could be suspended for three weeks would remain with the Water Authority.

The Water Authority of Western Australia has also indicated that it was advising some tourist operators on alternative temporary sites for use during the coffer dam construction.

The Water Authority has indicated that while Argyle Diamond Mines Pty Limited is the project proponent, the project will be constructed and operated under a joint operating agreement with the Water Authority. The Water Authority will also retain overall responsibility for the security of structures and the ongoing operation and maintenance of the dam, as well as for ensuring the rights of other water users are protected. Negotiations between the Water Authority of Western Australia and Argyle Diamond Mines are continuing regarding details of the joint operating agreement.

One of the major sources of concern with an early dry season construction period has been that tour boat operators may not have enough water flow to navigate between Lake Kununurra and the main Ord River Dam on Lake Argyle. The Water Authority has pointed out that the temporary cessation of flow has been a common practice in the normal operations of the Ord River scheme, and would not be expected to cause any unusual environmental effects. The Water Authority also notes that care has always been taken to ensure that the users of the water continue to be supplied. The Environmental Protection Authority concludes that there will not be detrimental ecological effects from the cessation of water flow for the three weeks of the coffer dam construction.

With respect to other users of the water, the Authority accepts the position stated by the Water Authority of Western Australia that: "While ADM are the proponents of the project, they will be constructing and operating the project under a joint operating agreement with the Water Authority. The Water Authority will still retain overall responsibility for the security of the structures and for ongoing operation and maintenance of the dam and for ensuring that the rights of other water users are not eroded."

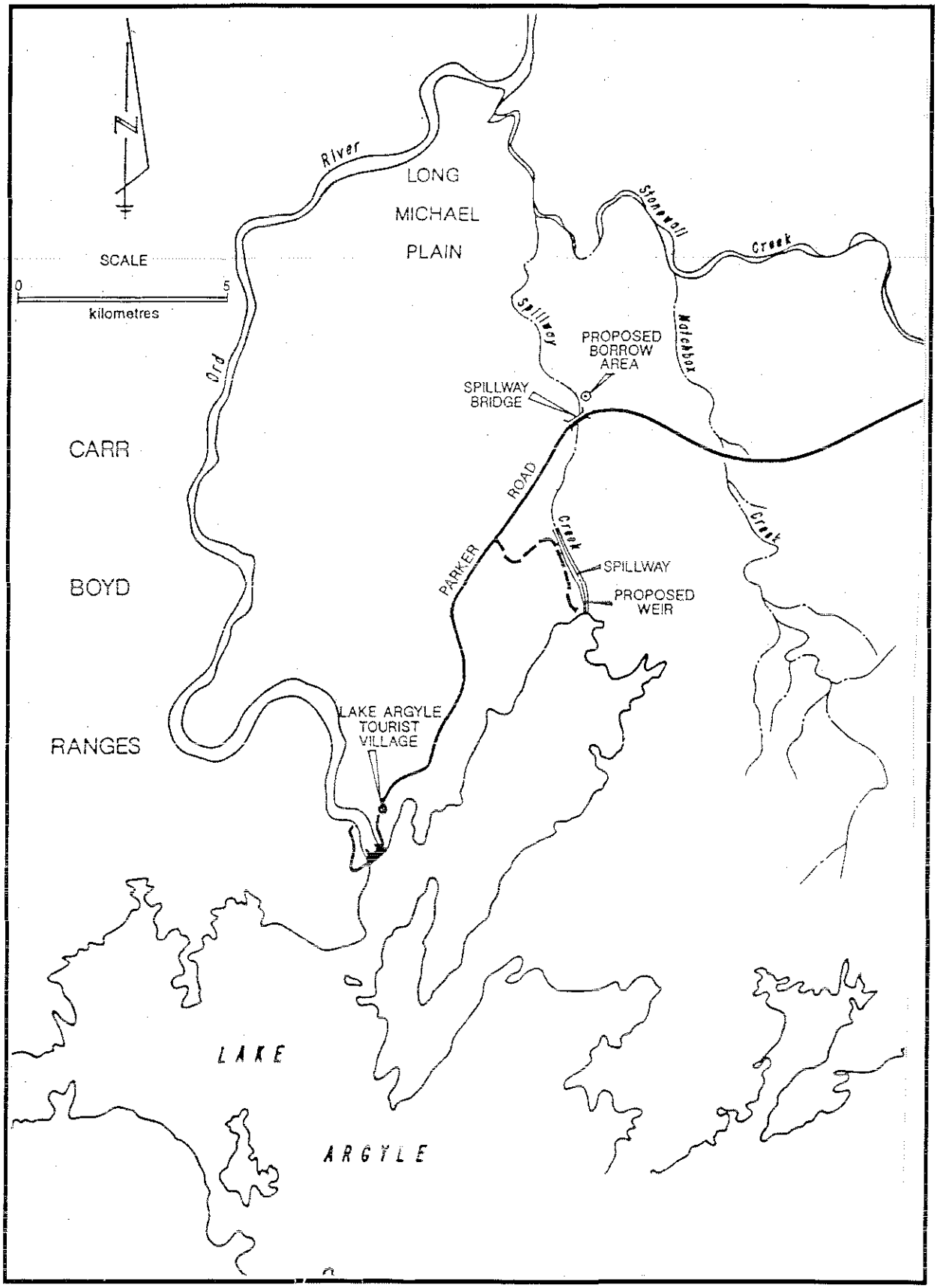

Figure 3. Ord River system: Lake Argyle, Spillway Creek (Source: PER)

4.1.4 Raising the spillway

Considerable concern was expressed by several submitters that inserting a weir in Spillway Creek, thereby raising the level of the Spillway by 6m would result in major inundations around the edges of Lake Argyle; that the presence of the weir may affect fish migrations into Lake Argyle; and that the weir would, by reducing water flows in Spillway Creek, diminish the recreation values of the creek.

As indicated in the proposal description (Section 3), Lake Argyle is not expected to be raised such that additional areas would be inundated. The response by Argyle Diamond Mines Pty Limited to the question of inundation was as follows: "No land is likely to be inundated by raising the level of the spillway that has not been inundated in the past. Figure 3 of the PER indicates that, generally, the level of Lake Argyle with the project will be less than it has been without the project. The maximum water level recorded is 96.8m which is more than 6m above the proposed new spillway level."

The Water Authority has noted that the size of the weir in the spillway was selected to ensure that it has no appreciable impact on flood water levels in the reservoir and that the flood security of the reservoir is not reduced.

The Water Authority of Western Australia has indicated that parts of the existing quarry area may not be safe to be used for works areas, and that some review may need to be made of the source for aggregates and backfill. Pits along Spillway Creek would need to be rehabilitated once the work has been completed. The Water Authority has indicated that alternative sources may be available. The Environmental Protection Authority concludes that the proponent should liaise with the Water Authority on the location, management and rehabilitation of quarry and borrow pit areas, inasmuch as they impact upon the dam, Spillway Creek, Lake Argyle Village, and surrounds.

Recommendation 3

The Environmental Protection Authority recommends that the location of each borrow pit and quarry should be approved by the Water Authority of Western Australia and the Shire of Wyndham-East Kimberley prior to the commencement of earthworks at that location.

The rehabilitation of all quarries and borrow pits should be to the satisfaction of the Environmental Protection Authority on advice from the Water Authority of Western Australia and and Shire of Wyndham East Kimberley.

While the weir in Spillway Creek will act as a barrier to fish migrating upstream into Lake Argyle, the diversion dam already provides a fish barrier, and there is no evidence of fish presently using Spillway Creek for upstream migration. It may be noted that the issue of fish in the waters of the Ord River system has been considered for some time, certainly before this proposal for a hydro-electric station on the Ord was mooted. The Water Authority of Western Australia and the Department of Fisheries have had, and maintain an interest in this. To date, no successful 'fish ladders' for barramundi have been constructed in Australia, but further work on fish habitats and ecology is progressing. The raising of the spillway will not impede this work, nor affect the potential professional or recreational fishing in the area.

Spillway Creek is a popular recreational area, and concerns were expressed that its use may be diminished by the building of the weir. The proponent has noted that Spillway Creek did not flow for some two and a half years between July 1988 and February 1991. In terms of water regime, it is unlikely the project will have major impacts on water flows in the Spillway Creek which were not previously present. However, the Water Authority notes that some consideration is being given to incorporating an outlet in the weir to maintain a flow in Spillway Creek when the water levels are high enough. This would provide recreational and scenic advantages, and would not compromise the overall operation of the Spillway weir.

Water will still flow down Spillway Creek when the water level of Lake Argyle rises to 92.2 m AHD. In order to protect the channel floor and sides adjacent to the weir from erosion it is intended to build a concrete apron downstream of the weir, and along the sides of the channel adjacent to the weir. The Environmental Protection Authority concludes that the overall environmental effects of building the weir in the spillway are expected to be minimal.

4.1.5 Changes in water flows

Apart from concerns about inundations, and the overall availability of water for different purposes, the other types of concerns expressed referred to different patterns of water flows. The proponent has noted that whereas overall flows will be within the same parameters as in the past, it is expected that flows below the Diversion Dam will be more uniformly spread, and that flows along Spillway Creek will be less frequent than in the past. It is noted, however, that "Patterns of inundation are a function of the rate of drawdown, surface area, and volume of inflow, which in turn, is a function of rainfall in the catchment area. Patterns of inundation have never been documented and therefore we are unable to clearly describe any changes in inundation patterns. However, reference to Figure 3 in the PER suggests that there will be little change to patterns of inundation and consequently, there will be negligible effects on vegetation and wildlife." (see Appendix 3)

The original damming of the Ord River changed the ecology of the area considerably. In the past decade there have been some additional changes, largely due to the increased water use as further horticultural and other potential of the area are recognised and utilised. The proposal to build and operate the hydro-electric station on the Ord is not expected to cause major changes to water flow patterns. If anything, a regime more akin to that which operated before the past decade of increased use is expected to be "the norm". The parameters within which the system is expected to operate will remain the same, and the Water Authority remains committed to the provision of water supplies to all users.

Concerns that there would be too much water (inundations) at the headwaters of Lake Argyle, or not enough water throughout the system do not appear justified. The Water Authority has indicated that it will endeavour to make those adjustments necessary to cause minimum disruptions to other water users, although it is not possible to achieve optimal conditions for all users at all times.

On the question of resolution of conflicts over access to water use, both the proponent and the Water Authority note that operating rules will be established between them, and that the Water Authority of Western Australia is and will remain ultimately responsible for ensuring adequate water for use by all users. It may be useful for a consultative committee of water users to be established by the Water Authority, to provide them with detailed information of concerns by water users. This may formalise the situation and allow members of the local community to have direct access to the Water Authority decision makers. It may also provide a vehicle for communication whereby the Water Authority and Argyle Diamond Mines Pty Limited can advise those with an interest in water use and availability of the intended project and its progress, allowing mutual understanding and accommodation of requirements.

4.1.6 Aboriginal concerns

Aboriginal communities and organisations expressed concerns regarding the project outlining many of the environmental concerns which have been dealt with above.

In addition, concerns were expressed about possible disturbances to and destruction of Aboriginal sites. The proponent has indicated that formal consultations, site visits, archaeological and anthropology surveys have been undertaken and that "the proposed development at the Ord River dam and the location of the proposed transmission line have been approved by the Aboriginal people concerned."

The Environmental Protection Authority has drawn the proponent's attention to the requirements of the relevant Aboriginal Heritage legislation. While submissions raised concerns

over impacts on Aboriginal sites, the Environmental Protection Authority notes that it is the responsibility of the Department of Aboriginal Sites to consider such impacts under the terms of its legislation.

Argyle Diamond Mines Pty Limited has further indicated that when selecting the final transmission line route in detail, there will be further liaison with the relevant Aboriginal people. Any sites found will be avoided.

Additional concerns were expressed about the effects of blasting, however Argyle Diamond Mines Pty Limited has advised that not only will blasting be reduced as far as possible, but that it will be carried out in accordance with statutory requirements, and that landholders will be advised in advance. It seems essential that a similar liaison be maintained with Aboriginal communities, organisations and individuals who can "speak for" the areas to be affected. The proponent has indicated in commitments made in the PER that "A continual programme of liaison and consultation will be carried out with the Doon Doon, Glen Hill and other relevant local communities during the construction phase of the project."

4.1.7 Decommissioning

The PER document stated that "A decommissioning programme for the Ord River Hydro-electric project cannot be developed with certainty at this time....At an appropriate time, prior to the cessation of mining, Argyle Diamond Mines Pty Limited will liaise with SECWA and WAWA on relative alternative uses for the power and associated infrastructure..."

Additional information was sought from ADM. The full text of the response to submission is at Appendix 3. Specifically, the company has indicated that if there is no further use for the transmission line when Argyle Diamond Mines Pty Limited ceases mining, the line will be removed and any areas disturbed as a result of that removal will be rehabilitated. The spillway weir will remain in place.

As the life of the hydro-electric project is expected to exceed the life of the present diamond mine, the Environmental Protection Authority believes that if, at the end of the mine life the power line is not removed, the proponent should return to the Authority with any future plans for its use or modification.

Recommendation 4

The Environmental Protection Authority recommends that not less than six months before the closure of the mine, the proponent should refer to the Environmental Protection Authority a programme to remove the transmission line and rehabilitate the transmission line easement, or alternative proposals for its further use.

4.1.8 Social and other issues

Several other social issues were raised, including recreational uses of the Ord River system, and whether the new facilities would enhance or detract from existing recreational and scenic areas and activities. Other issues raised have concerned the safety and integrity of roads and bridges, and the need to maintain appropriate liaison with the Shire of Wyndham-East Kimberley and the Main Roads Department.

The Environmental Protection Authority considers that the proponent should liaise with the Main Roads Department and the Shire of Wyndham-East Kimberley regarding the safety and integrity of roads, bridges and proposed traffic during construction.

Submissions also raised the importance of air safety considerations of the transmission line, both at the mine site itself, where Argyle Diamond Mines Pty Limited maintain a licensed aerodrome and have responsibility to maintain Obstacle Limitation Surfaces in accordance with the requirements of the Civil Aviation Authority, and the issue of line visibility and safety with regard to helicopters and light planes, including aerial mustering aircraft. The Environmental Protection Authority considers these issues are adequately dealt with by the proponent adhering to Civil Aviation Authority requirements.

Another concern raised was the question of employment of contractors and any additional employees who may be required as a result of the proposal. The Environmental Protection Authority is concerned that construction camps are designed to deal adequately with such matters as effluent disposal, and that employees and contractors behave in such a way so as not to negatively affect the environment. A commitment has been made indicating that camp sites will be subject to environmental management guidelines and employees will be appropriately inducted. (See Appendix 1). In this regard, the ban on the use of private vehicles along the transmission route, and the ban on domestic pets is supported. It will be necessary for the proponent to maintain liaison with the Department of Conservation and Land Management with regard to management guidelines for the proposed National Park, and to ensure that contractors and employees meet the requirements of those guidelines.

The question of numbers employed, and the source of those employees can potentially have significant social impacts but the Authority considers these can be acceptably managed by Argyle Diamond Mines Pty Limited in cooperation with the Department of State Development, and other agencies having jurisdiction in various aspects of employment and contracting.

6. Summary and conclusions

A proposal to construct a facility which will be publicly visible, over a considerable range of country, will involve something as significant as the Ord River and the dam on Lake Argyle, and will traverse environmentally important and sensitive land designated for a National Park, is likely to arouse considerable public interest.

From information contained in the PER document, and discussions with Argyle Diamond Mines and other interested agencies, organisations, and individuals, the Environmental Protection Authority concludes that this project is environmentally acceptable, subject to the commitments made by the proponent, and the recommendations made in this report.

Whereas the Environmental Protection Authority has assessed the environmental impacts and management strategies to ameliorate or avoid these impacts, the Authority can not address, for example, economic, planning, or specifically Aboriginal issues and concerns. These are the responsibility of other agencies.

Appendix 1

Proponent's environmental management commitments

MANAGEMENT COMMITMENTS

ADM is committed to a programme of environmental management and protection. This programme is detailed in Section 7 and specific commitments to environmental management and protection are as follows:

1. The environmental management programme and associated works will be carried out to the satisfaction of the EPA on advice from WAWA and SECWA and in accordance with practices relevant at the time.

2. ADM is committed to a rehabilitation programme of areas disturbed during project construction. Rehabilitation works will be designed on a site-specific basis and will generally include, where appropriate, soil erosion control works, surface re-shaping, drainage control, surface stabilization, and habitat restoration.

3. A continual programme of liaison and consultation will be carried out with the Doon Doon, Glen Hill and other relevant local communities during the construction phase of the project. In addition, ADM will control the movement of the workforce on pastoral leases and the use of off-road vehicles by project personnel for recreational purposes will not be permitted during construction of the power line. Contractors will be advised of their obligations under the Western Australian Aboriginal Heritage Act 1972-1980.

4. Blasting, when necessary, will be restricted to daylight hours.

5. The construction site will be cleaned up by the contractor prior to leaving the site. All construction and industrial waste will be removed to a waste disposal site that will be selected, designed, and operated in accordance with standard waste disposal practices.

6. ADM will require all contractors to comply with statutory regulations for the control of noise in the workplace.

7. During the construction period, there will be periods of heavy traffic use on various sections of roads in and around the dam and spillway area. Traffic management and control will be undertaken at all times during these periods by the project managers.

8. All vehicles used in construction of the transmission line will be equipped with fire extinguishers and knap-sack sprays in case of accidental fire.

9. Explosives will only be used for foundation preparation where ground conditions do not permit drilling or augering.

10. All foundation holes will be kept covered prior to pole erection to prevent injury to stock or native fauna.

11. Sites for laydown areas will be selected so that disturbance to the environment is minimised.

12. Each construction camp for the transmission line will be sited to ensure that there will be no impacts on ground or surface water resources.

13. The Department of Conservation and Land Management will be invited to participate in final route selection through Coolamon Pocket. In addition, ADM is committed to sound construction management principles for the powerline, which, together with design, will minimise visual impacts. ADM will discuss with station managers, the aspect of transmission line visibility in relation to aerial mustering.

14. At an appropriate time, ADM will liaise with SECWA and WAWA on relative alternative uses for the power and associated infrastructure. In addition, ADM will advise the EPA of ongoing uses for the power line.

15. An induction programme will be conducted during construction and operation to promote environmental awareness amongst employees and contractors.

Appendix 2

Submissions received and issues raised

Submissions

The PER document was released for public submissions on 14 October 1991, with an eight week submission period, closing on 9 December 1991.

Thirty-seven submissions were received. Twenty-one of these submissions were from Government Departments and agencies at Local, State and Federal level. Of the remaining sixteen submissions, three were from Conservation groups, and two from Aboriginal organisations.

Some of the issues raised in the submissions were not of an environmental nature, or represented general statement which did not relate directly to the proposal.

Where the issues raised had not been sufficiently explained in the PER document or required further information or explanation, these were discussed with the proponents and an issues list drawn up for their further comment. This issues list letter is reproduced below, and the responses appear in Appendix 3. The second issues list, appended here, was provided by the Social Impact Unit. Responses to these questions are also in Appendix 3.

Mr M J Erickson
Argyle Diamond Mines Pty Ltd
Private Bag no 11, Post Office
West Perth 6005

Your ref:
Our ref: 91/79 53075
Enquiries: Ms K Wilson

Dear Mr Erickson

ORD RIVER HYDRO-ELECTRIC PROJECT

Thank you for your letter of 6 January regarding Argyle Diamond Mines' proposal for the above project.

I have outlined the key issues arising from the public review period of your PER document, and forward these to you hoping they are sufficiently specific to enable you to address. If there are any queries, perhaps these could be discussed when you meet with officers of the Authority next week.

The issues raised in the submissions have been grouped under ten headings for convenience.

1. Route

What are the environmental concerns with Option A? Could these be realistically managed? There is not sufficient information on the environmental problems with going under the Lake. What about an underwater route with an overhead line from the Lake to the Mine?

Could the powerline be 'undergrounded' through the Carr Boyd proposed National Park? What would be the environmental problems? How could these be ameliorated?

2. Landscape and Wilderness Aspects and Impacts

More information is requested on landscape and wilderness aspects and impacts, especially in relation to the proposed Carr Boyd National Park. Concerns have been expressed that the landscape will be seriously diminished by the powerline, and that vegetation and wildlife habitats will be destroyed over both the proposed route, and the access to it. That these impacts will take place in a proposed National Park has raised additional concerns. It is important, therefore, to acknowledge the greater sensitivity of this area.

Whereas progressive rehabilitation is mentioned in the PER document, what will this involve?

Environmental
Protection Authority

1 Mount Street, Perth
Western Australia 6000
Telephone (091) 222 7000
Facsimile (091) 322 1598

What has been done to minimise visual impacts through this area? Has a 'seen area' survey been done? Will it ? Have the Department of Conservation and Land Management and their landscape experts/architects been involved in choosing the actual alignment? Will they be?

Will tracks need to be graded to each pole site? Has the access to pole sites for construction been adequately explored in terms of vegetation, Aboriginal sites, visual amenity? Will these tracks be permanent? If not,what rehabilitation is proposed? How will wider access along these tracks be discouraged? Has 'dog-leg' access tracking been considered to make them less visible, and less easily accessible?

What management commitments are given regarding protection against the introduction of potentially harmful plants and animals, and the eradication and control of any which may be in the area or introduced to it by Argyle Diamond Mines or its contractors?

3. Explosives/ Fire Risks/ Electro-magnetic Radiation

What will be the extent of explosives use? How will the impacts be minimised?

What contingency plans are in place for managing increased fire risks? From vehicles, from fallen poles during cyclones or from lightning strikes, for instance?

How close to Glen Hill living areas will the transmission lines be? What consideration has been given to the effects of electro-magnetic radiation?

4. Aboriginal and Site Issues

Assurances have been given that the proposed development at the Ord River Dam and the location of the proposed transmission line "have been approved by the Aboriginal people concerned".

What information is available on the existence or otherwise of Aboriginal ethnographic or archaeological sites along the proposed access and construction tracks? And on land likely to be inundated by raising the level of the spillway by 6 metres.

5. Timing of Coffer Dam Construction and Consequent Water Level Reductions

Considerable concern has been expressed about the proposed timing of the coffer dam construction and the consequent water level reductions.

What effects will this have on levels in Lake Kununurra? Or fish stocks? On the Ord River below the Diversion Dam? On the tidal areas around the mouth of the Ord? On vegetation? On fauna? From submissions it seems clear these environmental impacts could be significant. How will they be ameliorated or avoided?

There have been numerous alternative suggestions - all of them relate to construction of the coffer dam during the Wet season (October to April) rather than during the Dry season (May to September) because of the adverse effects of reduced water flows on other water users. Comment is sought.

6. Changes in Water Flow Patterns

What changes will there be in the patterns of inundation both during construction and operation, and what will the environmental effects of this be? What effects on vegetation? On wildlife? (including waterbirds)

What consequences will there be on the lower Ord and tidal areas as the Ord River flows to Cambridge Gulf?

What consequences will there be for water flowing from the Diversion Dam?
What effects on vegetation? on Irrigation? on erosion of river banks? on fish stocks? Will there be increased agricultural chemical run-off?

More information is requested on water flows from Lake Argyle and the Spillway through to Cambridge Gulf. The information that the limits of water changes are within historical levels does not give adequate information on the effects of the changes in patterns and durations.

For instance, the creation of Lake Argyle and the operation of the dam to date have created a riverine environment very different from the previous annual flooding pattern, but stable with much greater riparian vegetation. Will the new regime of water management maintain this environment, or change it to a new stable state?

7. Raising the Spillway

More information is sought on the effects of raising the Spillway. Will there be impacts on Aboriginal sites or on other miners/pastoralists/landholders in the area as a result of extra inundation areas at the headwaters of Lake Argyle? Or elsewhere behind the spillway?

What is proposed with regard to land inundation areas, especially after the spillway has been raised, but before the hydro-power station is operational?

Will there be effects on recreational or commercial fishers, or on their access?

Has consideration been given to
i) putting a temporary plug in the spillway before coffer dam construction to increase water retention? and/or
ii) an outlet being incorporated in the spillway to maintain some flow in the Spillway Creek during construction?

8. Water Use Conflicts

More information is sought on the resolution of potential water use conflicts between Argyle Diamond Mines Pty Ltd and other water users?

One submission noted a 'rumour' that the Ord River "would not flow for three years during the construction stage" What are the scenarios for flow from beneath the Diversion Dam and from the Spillway?

9. Flora/Fauna/Wildlife

Additional information is sought regarding fauna and flora surveys already carried out or proposed. Further information is sought on impacts on waterfowl.

Will there be a monitoring program for environmental effects, in particular as regards waterbird mortality?

There is a need to identify and protect Eucalyptus ordensis and Brachychiton tuberculatus. What has been/will be done?

10. De-Commissioning.

Further information is sought on the options and negotiations/decisions to date regarding the future of the power station , transmission line and spillway weir after the end of the expected life of the mine.

Commitments are sought from Argyle Diamond Mines Pty Ltd that if the installations are not transferred to or on-sold to another agency, that ADM will ensure that adequate decommissioning and rehabilitation takes place.

I also enclose a copy of issues raised by the Social Impact Unit ,some of which overlap the above. I look forward to receiving detailed responses from you on all the matters raised by the Authority and by the SIU as a result of submissions following the release of your PER document.

The issues can be further clarified at the meeting which has been proposed for 22 January 1992 at 1 Mount Street (7th Floor Conference Room) at 3pm, or by contacting Ms Katrin Wilson at the Authority.

Yours sincerely

Bruce Kennedy
A/DIRECTOR
EVALUATION DIVISION

15 January 1992

Enc

issues140192kwi

ARGYLE DIAMOND MINES JOINT VENTURE
ORD RIVER HYDRO-ELECTRIC PROJECT

QUESTIONS FROM SUBMISSIONS

Water Flows

Concern was expressed about adverse economic impacts due to water flow restrictions during the construction period. Issues included impact on landowners, effects on tour operators and "rumours" that the river may not flow for up to three years. Information on water flow to the Cambridge Gulf was requested and there were numerous requests for construction to begin in the off-peak farm and tourist season, with concerns that some community members may be forced out of business.

How ~~Who~~ will the proposal effect water flows from the spillway to Cambridge Gulf?

Can construction take place in the off-peak farming and tourist season between October and April? If not, why not?

Recreation

The area below the diversion dam is a popular venue for recreational fishing and other activities which may be impacted in the short and longer term. The upstream migration of fish from below the spillway will be impeded periodically leading to significant increases in fish stocks. Submissions foreshadow that this could cause increased recreational fishing activities in the area below the spillway.

What specific impacts are likely to occur on existing fishing and other recreational activities below the diversion dam? How will the company manage these impacts?

What measures will the company take to ensure the safety of future recreational fishing persons below the spillway?

Aboriginal Heritage

Concerns were raised that site surveys commissioned by the proponent were not available. The PER did not address the possible impact on aboriginal sites of the construction site and associated works for the hydro-electricity facility; the construction camps; construction and maintenance access tracks for the transmission towers; and, places affected by the raising of the water level of the lake. The impact on adjacent sites of significance from explosives was of concern as was the impact on flora and fauna in terms of its relationship to traditional and contemporary Aboriginal use. Diagrammatic plans showing the location of each tower, all access tracks and each construction camp site were requested.

What are the impacts on Aboriginal sites of the hydro-electric plant; transmission lines; construction camps; construction and maintenance tracks for the transmission towers; rising dam water levels; and, possible effects on adjacent sites resulting from the use of explosives.

Will the company provide plans to Aboriginal communities showing all construction camps and proposed construction and maintenance tracks for the transmission lines and will ADM release the Aboriginal site survey reports?

What impact will changes to flora and fauna have in terms of its relationship to traditional and contemporary Aboriginal use?

What impacts will occur on current and proposed aboriginal communities in the area?

Public Safety

Submissions questioned the safety of the dam for the hydro plant and its ability to accommodate large floods. There was concern that the spillway weir could exacerbate flooding.

How will flood control be affected by the weir and associated changes in operation of the dam?

Security of Water Supply

During periods of drought water supply could become critical and there could be a conflict between the need to continue to feed the hydro-electric station and the retention of water for the irrigators.

In periods of water shortage, how will the needs of irrigators be balanced against those of the hydro-electric station?

Bow River Mine

Concern was expressed about the effect of the proposal on the Bow River mine and the flow-on impact on Kununurra should the Bow River mine be adversely effected through excessive inundation. Insufficient data is provided in the PER on peak levels of construction workforce, length of employment and number of local appointments.

How will the proponent ensure that the Bow River mine will not be affected by the proposal?

Has the proponent prepared an assessment of the net effect on short-term and long-term employment in the region as a result of the proposed hydro-electric scheme?

Employment

The proposal suggests that the project will employ up to 200 people during construction and approximately 18 people in an ongoing capacity.

Where will the labour be sourced?

How will the company ensure that local people will benefit from the employment opportunities?

Electromagnetic Radiation

Concern was expressed about the effects of electromagnetic radiation from transmission lines.

What will be the effects of electromagnetic radiation from the transmission lines?

Compensation

Concern was expressed about compensation rights and options of landowners who have facilities installed on their property.

How will landowners be compensated for the use of land for transmission lines?

Appendix 3

Responses to issues raised

Response to Issues raised by EPA

1. ROUTE

1.1 Environmental Concerns with Option A

Option A is the option of locating the transmission line along the bottom of Lake Argyle and then overland to the mine.

Environmental concerns regarding this option arise from the need to bury the cable in a trench cut into natural ground lying below the sediment deposited in the lake. The two main issues are fluctuating water levels and natural ground conditions.

Sediments deposited in the lake vary in depth and particle size depending on water levels at the time of inflow. The sediments are highly erodible and do not provide a suitable foundation for an oil-filled transmission cable.

The length of cable to be buried below Lake Argyle would be approximately 60 km. This length is based on the surface area of the lake at the probable maximum flood level of 110 m AHD. The trench into which the cable would be laid would be cut into natural ground and this process would involve a high level of disturbance to the bottom sediments. A dredging type operation, and blasting in areas of rock would contribute significantly to sediment becoming suspended and moving downstream towards the dam. Localised fish kills could be expected from blasting operations.

An underwater cable would require sealing at specially designed structures at each end of the cable. Each structure would resemble a small substation with overhead gantries, isolators, and oil reservoirs and monitoring equipment. In addition, a length of 60 km under water would require sub-surface reservoirs for oil expansion and replenishment of oil lost by leakage. The risks of an oil seep into Lake Argyle cannot be discounted and the presence of this risk enhances the potential for a significant environmental impact.

1.2 Underground Route For Powerline

A requirement to bury the powerline through the proposed Carr Boyd Ranges National Park is in direct conflict with the design philosophy of the proponent. This is to minimise route disturbance and not to introduce a visible scar into the landscape.

Location of the powerline underground through Coolamon Pocket would require the following operations:

* clearing the route of all vegetation and top soil;
* trenching and trench preparation;
* cable laying
* back filling and re-spreading of top soil; and
* construction of erosion control works.

Characterisation of sub-surface material through Coolamon Pocket has not been carried out at this time and operations outlined above would represent a worst-case scenario. However, assuming a single cable laying operation could be conducted utilising a large crawler tractor, mounted with cable-laying equipment, the disturbance to the surface would still result in a clearly defined surface scar running the length of Coolamon Pocket.

There would also be problems associated with soil erosion. Coolamon Pocket is not flat lying, but is gently saucer shaped in cross section. This surface morphology results in a distinct drainage pattern from the northern and southern boundaries towards a westerly flowing drainage line. This defined drainage system, highly erodible duplex soils, and high intensity summer rainfall all combine to enhance the potential for accelerated soil erosion along the trench. The severity of the resultant erosion would be a function of the cable-laying method, but even using the system above, surface disturbance will pre-dispose the area to accelerated soil erosion.

In addition to first order issues such as site disturbance, a defined scar, and soil erosion potential, there is also the problem of cable life expectancy. If a trench is required because of site conditions, then some form of cable blanket, such as sand, would be required

to prevent damage by rock floaters moving and settling against the cable over time. The stockpiling and introduction of sand to the trench would further increase total site disturbance and enhance the potential for a long-term scar to remain.

Of serious concern in the Kimberley region is the problem of termites destroying cable insulation. As this problem currently exists, an underground cable would require protection and this would in turn require the use of a pitch-filled cable and reservoirs. Alternatively a copper-sheathed cable could be used but this would require careful laying and hence the use of a prepared trench.

2. LANDSCAPE AND WILDERNESS ASPECTS AND IMPACTS

2.1 Carr Boyd National Park

We acknowledge the sensitivity of this section of the transmission line route. At the request of the Water Authority of Western Australia ("WAWA"), we have agreed to slightly re-align the route of the transmission line from the hydro-electric station up to the ridge to make the line less visible from the various viewing points.

We believe that the landscape will not be seriously diminished and that vegetation and wildlife habitats will not be destroyed. As far as is possible, vegetation will be rolled, not cleared, along a 3 m wide strip along the centre line of the transmission line easement. As stated in the PER, poles will be delivered to their locations on trollies towed by a rubber-tyred tractor. The ease of access to the park and risk of environmental impacts will not be increased by the construction and operation of the transmission line.

2.2 Progressive Rehabilitation

During construction of the transmission line, as each section of the line is completed it will be rehabilitated. This will include measures to prevent soil erosion, minimise surface run off and enhance vegetation regrowth.

2.3 Visual Impacts

The proposed route follows valleys where possible so that the line will not be visible from outside the valleys. In addition, from within a valley, the line will be seen against a solid background of

hills and mountains. The Kimberley landscape has a great capacity to absorb visual intrusion and it is proposed to minimise intrusion by careful management of any construction activities that could result in a permanent scar on the landscape.

A 'seen area' survey has not yet been done. The Department of Conservation and Land Management will be invited to participate when the exact route of the transmission line through Coolamon pocket is determined.

2.4 Pole Sites

It is not our intention to grade tracks to pole sites. However it is expected that, in some places, it will be necessary. The amount of grading will be kept to a minimum for cost, as well as for environmental reasons. The exact route for the transmission line and pole locations cannot be determined until a detailed engineering survey is carried out.

Any Aboriginal sites identified will be avoided by a change in alignment of the transmission line.

There will be no permanently graded tracks so "dog legging" will be unnecessary. The region will be no more accessible with the project in place.

No specific action will be taken to protect against the introduction of potentially harmful plants as it is considered unnecessary. During the construction period, employees and contractors will not be permitted to bring animals into the construction camps and sites as stated in section 3.4.2 of the PER.

3. EXPLOSIVES/FIRE RISKS/ELECTRIC AND MAGNETIC FIELDS

3.1 Explosives

The extent of the use of explosives use will depend on ground conditions at each pole site. Blasting will be reduced as far as possible. Explosives will be used in accordance with statutory requirements and landholders will be advised of blasting in advance.

3.2 Increased Fire Risks

All vehicles involved in construction of the transmission line will be equipped with fire extinguishers and knap-sack sprays.

There is a fire danger if trees or flying debris come in contact with the power lines. This danger will be minimised by routine trimming of tall trees within the service easement and maintenance of the line. There are very few trees, if any, along the route which approach the proposed height of the transmission line. Debris, flying at the height of the transmission line, is most likely during cyclone periods. The vegetation is also likely to be damp at these times so the fire danger is low.

3.3 Electric and Magnetic Fields

The debate on health effects of electric and magnetic fields has yet to be decided. While data are gradually being accumulated, evidence of direct health effects is inconclusive, but is being monitored by the World Health Organisation (WHO) and the International Radiation Protection Association (IRPA).

Regardless of current research efforts, the construction and operating standards of the transmission line will be set by the State Energy Commission of Western Australia("SECWA"). SECWA has adopted interim guidelines established by IRPA and approved by the Australian National Health and Medical Research Council. The recommended limits as established by IRPA for 50 Hz electric and magnetic fields in areas with public access are as follows:

	Electric field (kV/m)	Magnetic flux density (milli tesla)
Up to 24 hours per day	5	0.1
A few hours per day	10	1.0

For a 132 kV single circuit line under a normal load and at a horizontal distance of 20 m from the centre line, the magnetic flux density would be expected to be less than 0.001 milli tesla and the electric field intensity would be expected to be approximately 0.1 kV/m. Both levels are well below the WHO standard for 24 hour exposure.

At the present time, the exact alignment of the transmission line in the vicinity of Glen hill Community is not known but it is expected to pass approximately 250 m east of the community. At this distance, magnetic and electric field intensity from the 132 kV transmission line would probably be too small to be measured, despite highly sensitive instrumentation. At this distance, background levels could be considerably higher than those generated by the transmission line.

4. ABORIGINAL AND SITE ISSUES

4.1 Aboriginal Sites

Surveys were carried out by G. Quartermaine for the Snowy Mountains Engineering Corporation and by R. O'Connor for CRA Business Development. These indicated that, although there are some archeological sites in the areas around the transmission line route, none of the sites will be affected by construction of the power line. The sites are all surface artefact scatters and were classified as minor sites of low archaeological significance because of their small size, low number of artefacts and lack of stratigraphic potential.

4.2 Inundation

No land is likely to be inundated by raising the level of the spillway that has not been inundated in the past. Figure 3 of the PER indicates that, generally, the level of Lake Argyle with the project will be less than it has been without the project. The maximum water level recorded is 96.8 m which is more than 6 m above the proposed new spillway level.

It is not expected that the Maximum Probable Flood level ("MPF") of the dam (110.8m) will change as a result of either the spillway weir or the hydro-electric station.

5. TIMING OF COFFER DAM CONSTRUCTION

5.1 Effect on Levels in Lake Kununurra

WAWA intends to raise the level of Lake Kununurra before construction of the coffer dam. The water level will fall during the proposed three week period of construction but WAWA will continue to release water from the Diversion Dam, during the period

5.2 Effect on Fish Stocks

The effect on fish stocks is impossible to predict with any accuracy. No data are available on the river ecosystem prior to construction of the Ord River Dam and no studies have been carried out since the dam was completed. In the past, lake Kununurra has been drained as a method of weed control. Any resulting adverse impacts from this temporary cessation of flow have never been documented. It is stated that the river will revert to a series of pools during construction of the coffer dam and any adverse impacts on fish stocks will be temporary only.

5.3 Effect on the Ord River Below the Diversion Dam

It is again pointed out that WAWA is responsible for water management in Lake Argyle and Lake Kununurra, and releases from the Diversion Dam. The period of construction will be approximately three weeks and this temporary reduction in flow is not expected to adversely affect flows in the Ord River below the Diversion Dam.

Below the Diversion Dam, at Kununurra, the Ord River subtends a catchment area of approximately 6000 km^2 and has a length of approximately 155 km to Adolphus Island in Cambridge Gulf. The presence of deeper pools, tributary inflow and tidal flows suggest that impacts in the lower reaches of the Ord River as a result of construction of the coffer dam would be negligible.

Argyle Diamond Mines Pty Limited ("ADM") established impact assessment criteria and defined impacts as either significant or not significant. Where an impact was defined as significant, an appropriate management strategy was developed to ameliorate the

impact or eliminate it completely. If an impact is not significant under the criteria established by ADM then specific management or amelioration programmes were not described in the PER.

5.4 Alternative Suggestions

The coffer dam construction is on the critical path of activities. For the project to proceed, construction of the coffer dam must begin as soon as environmental and joint venture approvals are received.

The period during which water will not be discharged during the coffer dam construction will ultimately be determined by WAWA which will maintain overall control over the use of water.

6. CHANGES IN WATER FLOW PATTERNS

6.1 Changes in Flow Patterns

Patterns of inundation are a function of the rate of drawdown, surface area, and volume of inflow, which in turn, is a function of rainfall in the catchment area. Patterns of inundation have never been documented and therefore we are unable to clearly describe any changes in inundation patterns. However, reference to Figure 3 in the PER suggests that there will be little change to patterns of inundation and consequently, there will be negligible effects on vegetation and wildlife.

6.2 Consequences on Lower Ord River and the Tidal Area to Cambridge Gulf

This issue is discussed in Section 5.3 above and it is again emphasised that with a catchment area of 6000 km^2 and a river length of 155 km below the Diversion Dam, any link between natural system perturbations and operation of the hydro-electric station would require prolonged and highly specific research just to establish a set of base-line data. During the wet season, it is normal for the Kimberley region to receive summer storms that track over the land surface at random. Such storms may create extensive runoff and flooding in drainage lines below the Diversion Dam thus creating significant differences in simple parameters such as runoff and sediment loads. Such an event has no relationship to upstream systems.

6.3 Water Flowing from the Diversion Dam

The proposed Ord Hydro-electric project will release water through the two generating turbines rather than water being released through the irrigation valves. The water so released will be at an average rate slightly higher than at present and accordingly, the new regime of water management will maintain the riparian vegetation environment.

Water releases from the Diversion Dam will be controlled by WAWA and not by ADM. There is no evidence to suggest that the status of the Ord River below the Diversion Dam will be altered by the project. WAWA should be consulted for its long-term water management plans for Lake Kununurra if additional information is required.

7. RAISING THE SPILLWAY

7.1 Effects on raising the spillway

No more information is readily available. There is not likely to be any extra inundation at the head waters of Lake Argyle (see 4.2).

7.2 Land inundation areas after the spillway is raised but before the hydro-electric power station is operational

ADM does not propose to take any action regarding inundation areas. The effects will not be different to what has occurred in the past.

7.3 Effects on recreational or commercial fishers

There will be no significant effects. It is true that the spillway weir will be a barrier to fish migrating upstream into Lake Argyle. However the Diversion Dam is already a barrier. There is no evidence that the fish stocks in Lake Argyle depend on fish being able to migrate to Lake Argyle through Spillway Creek. Spillway Creek did not flow for $2^1/_2$ years from July 1988 until February 1991.

7.4 Temporary Plug in Spillway

No consideration has been given to installing a temporary plug in the spillway. As construction will begin in the dry season in about mid 1992, it is unlikely that Spillway Creek will be flowing during the period of construction of the coffer dam.

7.5 Outlet in the Spillway

It is not intended to incorporate an outlet in the spillway as there is no need to maintain flow in Spillway Creek.

8. WATER USE CONFLICTS

8.1 Resolution of conflicts

Proposed operating rules will be agreed between ADM and WAWA which is responsible for ensuring adequate water for other users. There will be more water available for other users than there is at present because of the increase in the capacity of the dam. All water passing through the turbines will flow into Lake Kununurra as it does now.

8.2 Scenarios for flow from beneath Diversion Dam and from the Spillway

The PER states clearly that the reduction in flow during the construction of the coffer dam will be temporary and will last for up to three weeks only.

Flow beneath the Diversion Dam will be similar in annual volume to what has occurred in the past but will be more uniformly spread throughout the year.

With the spillway weir in place, Spillway Creek will only flow if the level in Lake Argyle is above 92.2 m AHD. From Figure 3 of the PER, it is apparent that flows along Spillway Creek will be less frequent than in past.

9. FLORA / FAUNA / WILDLIFE

9.1 Fauna

Flora and fauna surveys were carried out by Dr. A.S. Weston (flora) and Ninox Wildlife Consulting (fauna) and their reports are available if required.

The following extract is taken from the Ninox report:

'In a few restricted locations, the transmission line has the potential to affect waterbirds, but at these points the overall impact is liable to be minor. The Ord River is almost certainly a movement corridor for a wide range of waterbird species and at locations such as the proposed crossover point where the river is relatively narrow, a constricting effect is liable to occur, thus causing more birds to collide with transmission lines.'

Although the transmission line will have minimum ground clearances in compliance with SECWA and ESAA standards, the intention is to increase ground clearance to 11 m over permanent water to minimise impacts on waterbirds using the drainage line corridor.

The transmission line crossing over the Ord River is not accessible by road and a monitoring programme would be difficult to establish. However, if river users report an increase in waterbird mortality due to transmission line strikes, ADM will examine the possibility of increasing line visibility for waterbirds.

9.4 *Eucalyptus Ordensis* and *Brachychiton Tuberculatus*

According to the current, 21/11/91 CALM list of Declared Rare and Priority Flora, E. *ordensis* is a Priority Two species (poorly known, known from only one or few populations, in urgent need of further survey and with at least some populations not believed to be under immediate threat) and B. *tuberculatus* is a Priority Three species (poorly known, known from several populations, in need of further survey and with at least some populations not believed to be under immediate threat).

Weston (1991) states that E. *ordensis,* an undescribed species, probably occurs near the project area. Neither B. *tuberculatus* nor its habitats have been found in or near the project area.

Eucalyptus ordensis and *Brachychiton tuberculatus*, which are both distinctive plants were looked for during botanical surveys of the project area, but neither species was identified in the project area, although the latter species was found near Kununurra.

This and other recorded locations for the *Brachychiton* are, apparently, well north of the project area and in types of habitats not occurring in the project area.

The eucalypt is, apparently, a very restricted species, recorded several kilometres west of the proposed transmission line route near the Great Northern Highway between Gap Bore and MacPhee's Well (about 67 km south of the Kununurra-Wyndham road), probably wholly or mainly on steep granitic and, possibly, quartzitic slopes with at least a few trees of E. *confluens* and E. *brevifolia*. The proposed transmission line route is on a geologically different substrate.

Prior to surveying the transmission line route, surveyors will be given sets of colour photographs and specimens of these two species and other significant plant species and will be told to note, flag and photograph any plants they see which resemble these significant species. Populations of any flagged plants which botanists confirm as being significant species will be more prominently flagged to be protected from disturbance.

10. DE-COMMISSIONING

10.1 Hydro-electric Station

No negotiations have been conducted, or decisions made, regarding the future of the hydro-electric station following the completion of mining at Argyle. However, as stated in the PER it will be available for other purposes, for example to supply power to Kununurra.

10.2 Transmission Line

If there is no further use for the transmission line when ADM ceases mining, it will be removed at the time of decommissioning the mine.
Any areas disturbed as a result of removal of the transmission line or associated infrastructure will be rehabilitated on a site-specific basis. In general terms, rehabilitation may involve erosion control works, measures to stabilise the surface and revegetation where appropriate.

10.3 Spillway Weir

The spillway weir will remain in place. This will increase the capacity of Lake Argyle and make the supply of water to users even more secure.

11. ISSUES RAISED BY SOCIAL IMPACT UNIT

11.1 Water Flows

This issue has been discussed in the preceding sections.

11.2 Recreation

This issue has been discussed in the preceding sections. It is not ADM's responsibility to implement measures to ensure the safety of people fishing below the spillway.

11.3 Aboriginal Heritage

The PER addressed the possible impact on Aboriginal sites on pages 56 and 57.

As stated in the PER, when selecting the transmission line route, ADM will liaise with the relevant Aboriginal people in order to avoid areas of cultural significance. Diagrammatic plans showing the location of each tower, access tracks and construction camp sites will not be available until a detailed engineering survey is conducted. In view of the above, we do not intend to make these available.

ADM will not release the Aboriginal site survey reports. These reports contain information and diagrams which some Aboriginal people may not wish to be made public.

There will be no significant changes to flora and fauna. Consequently there will be no impact on traditional and contemporary Aboriginal use.

There will be no significant impact on current Aboriginal communities in the area. We are not aware of other 'proposed' communities.

11.4 Public Safety

There is no risk to the safety of the dam nor to its ability to accommodate large floods. Raising the spillway weir will not exacerbate flooding.

11.5 Security of water Supply

This issue has been addressed in section 8

11.6 Bow River Mine

The effects of inundation have been addressed in section 4.2. There will be no increase in the risk to the Bow River mine compared to the present.

11.7 Employment

ADM has not prepared a detailed assessment of the net effect on short-term and long-term employment in the region as a result of the hydro-electric project.

It is not possible at present, nor we believe necessary, to provide additional information on peak levels of the construction workforce, length of employment and number of local appointments. This information will only be available when contractors submit tenders.

During the construction period it will be the sole responsibility of the major contractors to appoint their own employees. ADM believes that local people will benefit from the employment opportunities. The contractors will be under the same obligations as the Argyle Diamond Mines Joint Venturers to use, as far as possible, labour available within Western Australia as specified in Clause 12 of the Diamond (Argyle Diamond Mines Joint Venture) Agreement Act 1981-1983

11.8 Electro-magnetic Radiation

This issue is discussed in section 3.3.

11.9 Compensation

The transmission line passes through crown land and pastoral leases. It will not affect the value or use of the land through which it passes. Therefore compensation is not applicable.