Baldivis Tailings Pond Rehabilitation Project and Effluent Management System Upgrade

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Western Mining Corporation Limited
Proposed changes to environmental conditions

Report and recommendation
of the Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia
Bulletin 767
December 1994

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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 a proposed change to environmental conditions set by the Minister for the Environment in May 1991.

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 report.

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 contents of the assessment report or 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
12th Floor, Dumas House
2 Havelock Street
WEST PERTH WA 6005

CLOSING DATE

Your appeal (with the $10 fee) must reach the Minister's office no later than 5.00 pm on 23 December 1994.

Environmental Impact Assessment (EIA)

Process Timelines in weeks

Date	Timeline commences after receipt of full details of proposal from the proponent	Time (weeks)
23/9/94	Proponent Document Released for Public Comment	2
14/10/94	Public Comment Period Closed	3
2/11/94	Issues Raised During Public Comment Period Summarised by EPA and forwarded to the Proponent	2
10/11/94	Proponent's response to issues raised received	1
	EPA reported to the Minister for the Environment	4

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Summary and recommendation

Western Mining Corporation Limited (WMC) operates the Kwinana Nickel Refinery (KNR). Liquid effluent from the refinery is discharged into a lined tailings pond at Baldivis. In 1979 the pond was found to be leaking, leading to contamination of the groundwater beneath the site.

In January 1991 the Environmental Protection Authority (EPA) assessed (Bulletin 489) a Consultative Environmental Review (AGC Consulting Group Pty Ltd, 1990) for the Baldivis Tailings Pond Rehabilitation Project and Effluent Management System Upgrade, which outlined the proposed strategy by WMC to resolve the groundwater contamination problem at the tailings pond. The proponent's specific objectives were to dewater and rehabilitate the tailings pond; to increase recovery of contaminated groundwater; to construct a new double lined effluent disposal pond structure and to upgrade the existing wastewater treatment plant to handle liquid effluent from the refinery, tailings pond and contaminated groundwater. Environmental Conditions for the rehabilitation project were issued by the Minister for the Environment in May 1991.

The works associated with the Baldivis tailings pond and effluent management system upgrade programme were substantially completed in January 1994 when the upgraded reverse osmosis plant was commissioned.

During the final phase of the works programme it became apparent that KNR would not be in a position to meet all the commitments made in the CER. These commitments (7 and 9 of the Proponent's Commitments attached to the Minister's Statement of 30 May 1991) relate to the discharge of effluent to the existing tailings pond, and the dewatering of the existing tailings pond respectively.

Western Mining Corporation Limited (1994) has now written to the Minister for the Environment outlining intended changes to the original proposal. Although the KNR intends to meet all the commitments made in the CER it is seeking more time to meet these two commitments. In addition to the changes to commitments 7 and 9, WMC has proposed a revised set of the original commitments (Section 7) to supersede the original commitments (Appendix 1). Commitments which have been fully met have been deleted and some additional commitments made.

The Minister for the Environment has requested that the EPA review these proposed changes to the original proposal, and report to him, in accordance with Section 46 of the Environmental Protection Act.

Recommendation Number	Summary of recommendation of the Environmental Protection Authority
1	The EPA recommends that the proposal could proceed subject to the EPA's recommendations in this assessment report; and the proponent's commitments.

1. Introduction and background

The proponent, Western Mining Corporation (WMC) Limited, operates a nickel refinery at Kwinana, 40 kilometres south of Perth. The refining process involves oxidation of nickel concentrate from the WMC Kalgoorlie Nickel Smelter, in an ammonia solution. Since 1969, solid residue and liquid effluent from the refinery have been discharged to a 30 hectare lined tailings pond at Millar Road, Baldivis, 7 km south-east of the refinery (Figure 1).

The polythene membrane lined tailings pond was constructed in a sand depression above a limestone base. In March 1979, leakage of ammonium sulphate was detected near the base of the aquifer below the site.

In 1979 WMC commenced recovery of contaminated groundwater through recovery bores and return of contaminated groundwater to the tailings pond. In 1981 WMC installed a reverse osmosis treatment plant at the refinery to remove ammonium sulphate from extracted groundwater and to allow re-use of recovered water in the refinery.

Since 1985, solid residue has not been discharged to the tailings pond at Baldivis but has been returned to the mine site for disposal.

In 1989, monitoring and performance data indicated that the tailings pond was still leaking and containment of contaminated groundwater was still unsatisfactory. In addition, concerns were noted for the protection of Lake Cooloongup as well as surrounding vegetation. Hence a Consultative Environmental Review (CER) was prepared by the proponent to address these issues. The proponent's specific objectives were to: dewater and rehabilitate the tailings pond; increase recovery of contaminated groundwater; construct a new double lined effluent disposal pond structure and to upgrade the existing wastewater treatment plant to handle liquid effluent from the refinery, tailings pond and contaminated groundwater.

In January 1991 the Environmental Protection Authority (EPA) released its report and recommendations (Bulletin 489) on the CER (AGC Consulting Group Pty Ltd, 1990). Environmental Conditions for the rehabilitation project were issued by the Minister for the Environment on May 30, 1991.

In January 1994 the works associated with the Baldivis tailings pond and effluent management system upgrade programme were substantially completed, at which time the upgraded reverse osmosis plant was commissioned.

During the final phase of the works programme it became apparent that KNR would not be in a position to meet all the commitments made in the CER. These commitments (7 and 9 of the Proponent's Commitments attached to the Minister's Statement of 30 May 1991, Appendix 1) relate to the discharge of effluent to the existing tailings pond, and the dewatering of the existing tailings pond respectively.

Commitment 7 stated that, "The proponent will cease discharging effluent to the existing tailings pond as soon as the proposed new effluent pond structure and upgraded effluent treatment plant are commissioned. Construction and commissioning of the new effluent pond structure and upgraded effluent treatment plant will be carried out as soon as possible after all statutory approvals have been granted, and will be to the satisfaction of the EPA".

Commitment 9 stated that, "The proponent will commence to dewater the existing leaking tailings pond immediately after cessation of effluent disposal and at the time of commissioning the new effluent pond structure. Dewatering will be carried out as quickly as is practical and to the satisfaction of the EPA. The recovered water will be treated or disposed of to the satisfaction of the EPA".

The inability of WMC to fulfil these commitments arose because of significant technical difficulties with the operation of the reverse osmosis treatment plant. Recovery of tailings pond liquor ceased in May 1994 due to the presence of algae fouling the membranes of the reverse osmosis treatment plant. Some strategic groundwater recovery bores have also been switched off due to the fouling of reverse osmosis membranes from natural organics and ferrous iron.

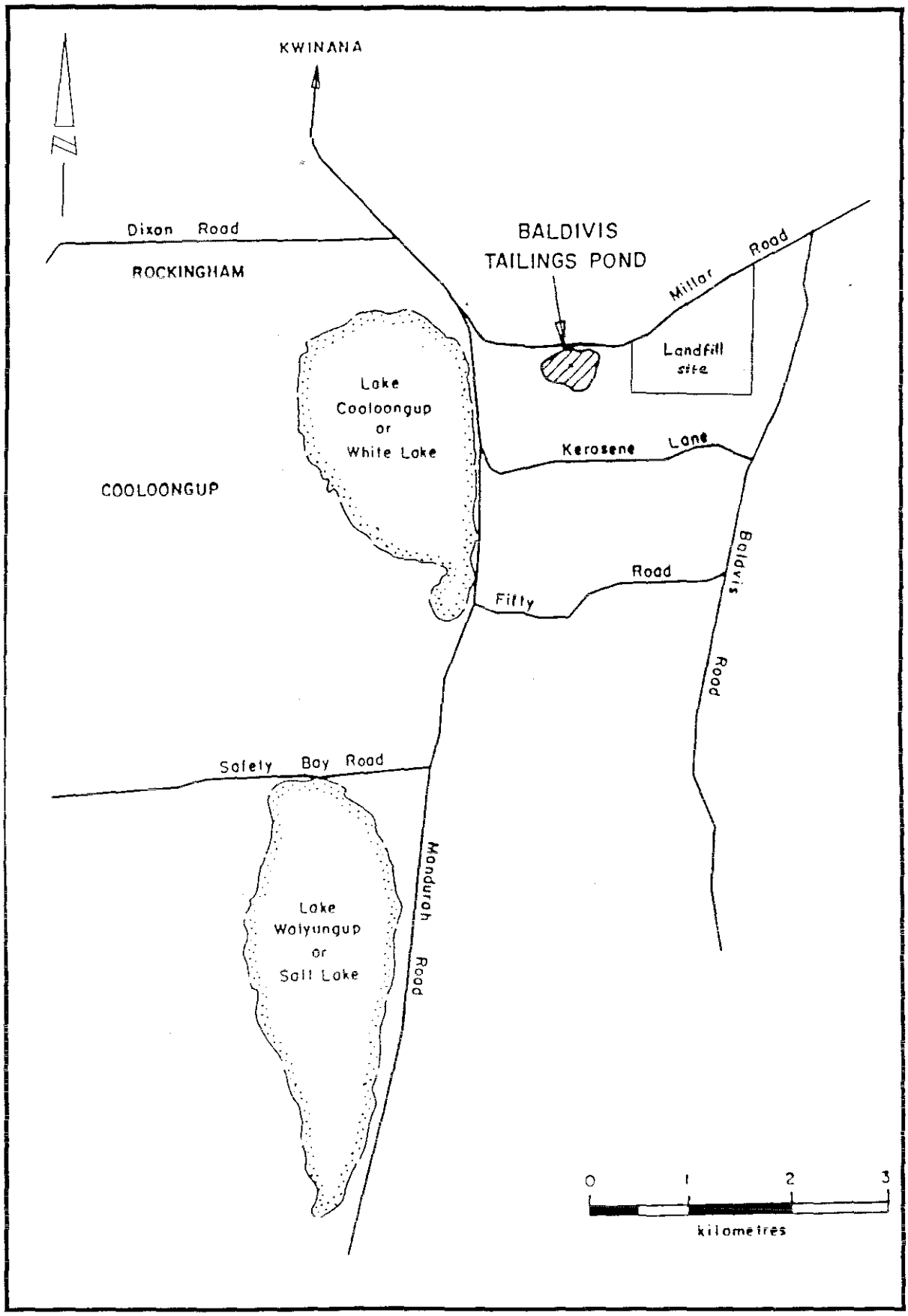

Figure 1: Tailings pond locality plan

Western Mining Corporation Limited (1994) has now written to the Minister for the Environment outlining intended changes to the original proposal. Although the KNR intends to meet all the commitments made in the CER, it is seeking more time to meet these two commitments.

In addition to the changes to commitments 7 and 9, WMC has proposed a revised set of commitments (Section 7) to supersede the original commitments (Appendix 1). Commitments which have been fully met have been deleted and some additional commitments made.

The Minister for the Environment has requested that the EPA review these proposed changes to the original proposal, and report to him, in accordance with Section 46 of the Environmental Protection Act. This report fulfils that request.

2. Summary description of proposal

2.1 The proposal

In order to overcome the membrane fouling problems encountered in the present reverse osmosis treatment plant, and fulfil its commitments, the proponent has proposed the installation of a continuous microfiltration (CMF) pre-treatment plant to remove the foulants in the tailings pond liquor and groundwater, prior to treatment through the existing reverse osmosis plant.

It is proposed that the refinery effluent, tailings pond liquor and recovered groundwater will be blended in the lined staging pond at Baldivis prior to feeding to the CMF plant. The filtrate from the CMF plant will be returned to the refinery site and treated in the existing reverse osmosis circuit.

In addition to the CMF plant, WMC is reviewing current remedial plans, as well as short and long term options, which may be implemented to ensure that adverse effects which may result from the delay to the remedial programme, are minimised.

WMC believes the review of the project is most appropriate in order to meet its commitments regarding:

- protection of Lake Cooloongup and fringing vegetation;
- tackling the source of the groundwater contamination (ie the tailings pond); and
- recovering the groundwater contaminants.

To achieve this a works and study programme has already commenced and consists of the following:

- a study of the hydrogeology and environmental impacts on Lake Cooloongup undertaken by the CSIRO Water Division (WA);
- a water treatment and water/effluent management study undertaken by Sinclair Knight Merz;
- an investigation of groundwater contamination beneath the Kwinana Nickel Refinery site, with the objective to providing recovery options for remediation. This study is to be undertaken by Dames and Moore; and
- installation of additional bunding and process containment paving to prevent oil and particulates from entering plant effluent streams.

2.2 Revised proponent's commitments and timing

The proponent has submitted a revised list of commitments (Section 7) to supersede all previous commitments stated in the CER (Appendix 1). The original commitments have been revised to reflect events since the CER was assessed in 1991.

The proposed changes to the commitments are environmentally insignificant and do not change the intent of the original commitments. A comparison of proposed and existing commitments, by statement number, is given in Appendix 2.

The proposed commitments also contain additional commitments which relate to the provision of regular reports relating to the works programme and studies as detailed in Section 2.1 (proposed commitment 4) and the submission of a monitoring programme (proposed commitments 28 and 29).

It is proposed that the current monitoring programme will be revised in line with the results of the hydrogeological and environmental impact study on Lake Cooloongup undertaken by the CSIRO Water Division (WA). The proposed monitoring programme is scheduled to be submitted to the Department of Environmental Protection by the end of February 1995 (Cousins, L., [Western Mining Corporation], *pers. comm.*, 1994).

Original proponent's commitments 7 and 9 are now proposed to be replaced by revised commitments 7, 8 and 9 (Section 7). These revised commitments also stipulate the timeframe for the rehabilitation of the tailings pond.

> **Commitment 7** (of Minister's Statement dated 30 May 1991)
>
> The proponent will cease discharging effluent to the existing tailings pond as soon as the proposed new effluent pond structure and upgraded effluent treatment plant are commissioned. Construction and commissioning of the new effluent pond structure and upgraded effluent treatment plant will be carried out as soon as possible after all statutory approvals have been granted, and will be to the satisfaction of the EPA.

Replaced by:

> **Revised commitment 7**
>
> The proponent will cease discharging plant effluent into the tailings pond by 30 June 1995.

and

> **Revised commitment 8**
>
> Treatment (as defined in the revised commitments, Section 7) and disposal of the effluent will be carried out to the satisfaction of the EPA.

These revised commitments reflect the fact that the construction and commissioning of the new effluent pond structure has been completed.

> **Commitment 9** (of Ministers Statement dated 30 May 1991)
>
> The proponent will commence to dewater the existing leaking tailings pond immediately after cessation of effluent disposal and at the time of commissioning the new effluent pond structure. Dewatering will be carried out as quickly as is practical and to the satisfaction of the EPA. The recovered water will be treated or disposed of to the satisfaction of the EPA.

Replaced by

> **Revised commitment 9**
>
> The proponent will commence to dewater the tailings pond as soon as practical after the commissioning of the CMF pretreatment plant and no later than 30 June 1995. The dewatering and subsequent treatment and disposal of the pond liquor will be carried out to the satisfaction of the EPA.

3. Environmental impact assessment process

This proposal was referred to the EPA in September 1994, and has been assessed under the provisions of Part IV (Section 46) of the Environmental Protection Act 1986. The assessment for this proposal follows the *Environmental impact assessment administrative procedures* (Department of Environmental Protection, 1993).

The Department of Environmental Protection (which administers the environmental impact assessment process for the EPA) reviewed all submissions made on this proposal and prepared a list of environmental issues raised in submissions. A list of submitters is provided in Appendix 4. The WMC has provided a response to the environmental issues raised in submissions (Appendix 3), and a consolidated list of revised environmental management commitments for the Baldivis tailings pond (Section 7).

Limitation

This evaluation has been undertaken using information currently available. The information has been provided by the proponent through preparation of the environmental review document by Department of Environmental Protection officers utilising their own expertise and reference material, by utilising experience and information from other State Government agencies, and by contribution from Environmental Protection Authority members. The Environmental Protection Authority recognises that further studies and research may affect the conclusions.

4. Evaluation

The Environmental Protection Authority's objective is to protect Lake Cooloongup and the fringing vegetation and maintain the beneficial use of the groundwater in the area. These objectives are the same as those stated in the EPA's assessment of the original CER (Bulletin 489, January 1991).

The Department of Environmental Protection (DEP), on behalf of the EPA, sought comment from State Government Authorities, Local Government Authorities, community groups and individuals who provided submissions during the assessment of the original CER.

4.1 Advice from State Government Agencies

Advice from the Geological Survey of Western Australia (a division of the Department of Minerals and Energy) supported the amendments to the rehabilitation project. The submission stated that, "The changes to the original CER are considered acceptable on hydrogeological grounds, particularly the proposed studies to determine the nature of the movement of contamination and groundwater discharge to Lake Cooloongup, and the development of a groundwater remediation programme for the Kwinana Nickel Refinery".

Advice from the Department of Resources Development stated, "Whilst WMC has not been able to fully accommodate commitments 7 and 9 of the Ministerial Conditions issued by the Minister for the Environment in May 1991, it has demonstrated its determination to achieve compliance by June 1995. The extension of time sought in fulfilling these commitments would not appear unreasonable in the context of the new technology being trialed and the studies being commissioned to meet the environmental objectives. Accordingly, the company's position is supported".

The Water Authority of Western Australia (WAWA) advised that it had no objection to the changes proposed to the tailings pond rehabilitation programme and effluent system upgrade. The WAWA concluded that, "The Water Authority should be kept informed of progress with the upgrade of the effluent management system, pond rehabilitation and contaminated groundwater recovery", and, "...we consider water related conditions should be inserted in WMC's DEP licence".

4.2 Advice from Local Government Authorities

Advice was sought from the Town of Kwinana and the City of Rockingham. The nickel refinery is situated in the Town of Kwinana and the tailings pond at Baldivis, in the City of Rockingham. Lake Cooloongup is also in the City of Rockingham.

The Kwinana Town Council supported the KNR's commitments to rehabilitate the Baldivis tailings pond area and decontaminate groundwater. The submission states, "Council

acknowledges the technical problems currently faced by the company and support their continued commitment to rehabilitation as outlined in their supporting documentation".

The City of Rockingham had no objections to the changes to the original proposal. However, the City of Rockingham did ask for information on areas of interest to the Council. These are discussed below, under issues raised in submissions.

4.3 Issues raised in submissions

The main issues raised in submissions related to the effects of groundwater extraction; the operation of the proposed CMF plant; Lake Cooloongup, and stormwater management.

The City of Rockingham sought further information relating to "the effect of the groundwater extraction on the movement of groundwater under the Council's landfill facility in Millar Road, and ... the effects on the plume movement in relation to the landfill facility?"

Submissions sought details on the operation of the CMF plant. The submissions noted that the backwash containing solids from the CMF plant was proposed to be returned to the staging pond, and asked, "As these solids are not proposed to be removed from the treatment circuit, will they cause further problems in the treatment systems downstream of the staging pond?" Other questions related to the percentage of solids contained in the backwash and the removal and disposal of the solids.

The submission relating to Lake Cooloongup asked for the ratio of extracted groundwater (for treatment) in relation to the total groundwater flux from the Baldivis site towards Lake Cooloongup.

One submission related to stormwater management, including the disposal of stormwater run-off from the nickel refinery to the Baldivis tailings pond and the diversion of uncontaminated stormwater runoff to more acceptable (and less costly) disposal methods (eg stormwater sumps). The proponent was asked to comment on a proposed stormwater management strategy. This proposal involved the storage of contaminated stormwater on-site at the nickel refinery followed by direct feeding into the reverse osmosis plant, instead of occupying volume at the Baldivis site.

4.4 Proponent's response to public submissions

In response to questions raised by the City of Rockingham, the proponent commented that, "Groundwater extraction will have negligible impact on the movement of groundwater under the adjacent landfill in Millar road. Movements of the plume will also have negligible impact as the water table is located significantly below the bottom of the landfill facility. Regional groundwater occurs in a generally westerly direction away from the landfill towards Lake Cooloongup".

In response to questions raised relating to the operation of the CMF plant, the proponent responded that, "...the backwash from the CMF will initially be returned to the staging pond to enable the recovery programme to be actioned. It was also indicated (in the proposal) that options for long term management of the solids would be required to be investigated. The preferred option is the construction of a small sludge pond (with weir) on the edge of the existing tailings pond, but on top of the membrane liner".

The percentage of solids in the backwash was stated as 0.5 to 1.0 per cent and would not impact on the effective volume of the system. The response further stated (proponent's response 2.4, Appendix 3) that, "The solids will be removed manually and deposited with the existing residue in the tailings pond. After removal of all the liquor from the tailings pond, the residues will be sealed as proposed in the Consultative Environmental Review and in a manner acceptable to the EPA".

The proponent's complete response to issues raised in submissions is given in Appendix 3.

4.5 Evaluation of revised proponent's commitments

The proposed revised commitments do not change the intent of the original commitments. The commitments have been revised to reflect the installation and commissioning of the new effluent pond structure. Since the commissioning of the new effluent pond structure, Environmental Condition 5 (relating to commencement of the project within five years); commitment 12 (upgrading of the wastewater treatment plant); commitment 16 (construction of the new effluent pond structure) and commitment 30 (submission and implementation of a monitoring programme), have been fulfilled.

The proposed revised commitments (Section 7) also contain additional commitments which relate to the provision of regular reports relating to the works programme and studies detailed in Section 2.1 (proposed commitment 4) and the submission of a revised monitoring programme (proposed commitment 28 and 29).

5. Discussion and synthesis

The Environmental Protection Authority considers that the proposed amendments to commitments 7 and 9 of the Proponent's Commitments attached to the Minister's Statement of 30 May 1991 (Appendix 1) are acceptable.

The proposed revised commitments, to supersede the previous commitments, do not change the intent of the original commitments, and are acceptable.

These revised commitments also contain acceptable additional commitments which relate to the provision of regular reports relating to the works and study programme and the submission of a monitoring programme.

6. EPA's conclusions and recommendation

After consulting with all relevant levels of the community, no advice, technical or otherwise, was presented to the EPA which would suggest that the proposed changes to Environmental Conditions could not proceed.

The Environmental Protection Authority concludes that the proposed changes to Environmental Conditions are acceptable.

Recommendation 1

The Environmental Protection Authority concludes that the proposal by Western Mining Corporation to amend Commitments 7 and 9 for the Baldivis tailings pond rehabilitation project and effluent management system upgrade is acceptable and could proceed.

To achieve the intent of Commitments 7 and 9, involves the installation of a Continuous Microfiltration (CMF) plant to pre-treat tailings pond liquor and recovered groundwater prior to treatment in the existing reverse osmosis circuit.

The Environmental Protection Authority believes that its objectives, to protect Lake Cooloongup and the fringing vegetation and maintain the beneficial use of the groundwater in the area, are adequately addressed by the revised commitments made by the proponent (Section 7), the proponent's response to issues raised in public submissions (Appendix 3) and the Environmental Protection Authority's recommendations in this report.

The proponent has also requested other changes to the original commitments (Appendix 1). These amendments are acceptable as they do not change the intent of the original commitments.

Accordingly the EPA recommends that the proposal could proceed subject to the EPA's recommendations in this assessment report; and the proponent's commitments.

The issue of ongoing environmental performance could be addressed through the inclusion of conditions and procedures which require the proponent to prepare periodic "Progress and Compliance Reports". These reports would provide the EPA with an up to date view of the project status and compliance with environmental conditions. Such reports would be publicly available and could be used to demonstrate the proponent's commitment to the environmental issues. The procedures define clear protocols for the on-going assessment of the project.

7. Recommended amended environmental conditions

The above recommendation could be given effect through an amendment to the Minister's Statement on the original proposal, issued on 30 May 1991 (Appendix 1).

Accordingly the EPA concludes that the environmental conditions within the Ministerial Statement, set on 30 May April 1991, should be amended as follows:

STATEMENT TO AMEND CONDITIONS APPLYING TO A PROPOSAL (PURSUANT TO THE PROVISIONS OF SECTION 46 OF THE ENVIRONMENTAL PROTECTION ACT 1986)

PROPOSAL:	BALDIVIS TAILINGS POND REHABILITATION PROJECT AND EFFLUENT MANAGEMENT SYSTEM UPGRADE (323/903)
CURRENT PROPONENT:	WESTERN MINING CORPORATION
CONDITIONS SET ON:	30 MAY 1991

The implementation of this proposal is now subject to the following conditions which replace all previous conditions:

1 Proponent Commitments

The proponent has made a number of environmental management commitments in order to protect the environment.

1-1 In implementing the proposal (including the documented modifications of August 1994), the proponent shall fulfil the relevant environmental management commitments made in documentation on the Baldivis Tailings Pond Rehabilitation Project and Effluent Management System Upgrade in August 1994, reported on in Environmental Protection Authority Bulletin 767; in the Consultative Environmental Review; and published in Environmental Protection Authority Bulletin 489 as Appendix 1; provided that the commitments are not inconsistent with the conditions or procedures contained in this statement.

A schedule of environmental management commitments (December 1994) which will be audited by the Department of Environmental Protection is attached.

2 Implementation

Changes to the proposal which are not substantial may be carried out with the approval of the Minister for the Environment.

2-1 Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines, on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3 Decommissioning

3-1 The proponent shall carry out decommissioning of the project, removal of the plant and installations and rehabilitation of the site and its environs.

3-2 At least six months prior to decommissioning, the proponent shall prepare a (final) decommissioning and rehabilitation plan to achieve the objectives of condition 3-1.

3-3 The proponent shall implement the plan required by condition 3-2 to achieve the objectives of condition 3-1.

4 Proponent

These conditions legally apply to the nominated proponent.

4-1 No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

5 Compliance Auditing

In order to ensure that environmental conditions and commitments are met, an audit system is required.

5-1 The proponent, in consultation with the Department of Environmental Protection, shall prepare an Audit Programme, which includes requirements for the preparation of periodic Compliance Reports.

5-2 The proponent shall subsequently implement the Audit Programme required by condition 5-1.

Procedure

The Department of Environmental Protection is responsible for verifying compliance with the conditions contained in this statement, with the exception of conditions stating that the proponent shall meet the requirements of either the Minister for the Environment or any other public authority.
If the Department of Environmental Protection, other public authority or proponent is in dispute concerning compliance with the conditions contained in this statement, that dispute will be determined by the Minister for the Environment.

Proponent's Commitments

Schedule of environmental management commitments

General Commitments

1 The groundwater contamination resulting from the tailings pond will be rectified as specified in the CER and subsequent documentation assessed by the EPA.

2 All facilities which are used to hold contaminated materials associated with polluted groundwater recovery or polluted effluent/slurry or solid waste disposal (at the Refinery and Baldivis sites) will be so designed so as to contain spillage.

3 The proponent will modify its contaminated groundwater recovery programme and its tailings pond management procedures, if it cannot meet licence conditions placed on it by EPA.

4 The proponent will provide regular reports to the EPA, or as directed by the EPA, on the progress and results of studies by the independent consultants for the project.

5 The proponent will implement as appropriate any plans necessary to meet its environmental objectives.

6 The proponent will continue to transport solid tailings residues, resulting from its Kwinana nickel operations back to the Kambalda minesite and this will be done to the satisfaction of the EPA and the Health Department. If the proponent were to change this practice and dispose of this solid waste elsewhere, it would only do so after first obtaining approval from the EPA.

Tailings Pond

7 The proponent will cease discharging plant effluent into the tailings pond by 30 June 1995.

8 Treatment and disposal of the effluent will be carried out to the satisfaction of the EPA.

9 The proponent will commence to dewater the tailings pond as soon as practical after the commissioning of the CMF pretreatment plant and no later than 30 June 1995. The dewatering and subsequent treatment and disposal of the pond liquor will be carried out to the satisfaction of the EPA.

10 The proponent will, at least six months prior to completing the dewatering of the tailings pond, prepare a decommissioning and rehabilitation plan for review and approval by the EPA.

11 Rehabilitation of the existing tailings pond site will be carried out to the satisfaction of the EPA, Health Department, Water Authority, the Department of State Development and any other relevant agency.

12 During the dewatering and rehabilitation programmes the associated environmental management plans will be modified as deemed necessary and where practical to minimise the impact of pollution on the environmental surrounds.

Waste Water Treatment Plant

13 The proponent will operate, manage and monitor the performance of the waste water treatment plant so that waste recovery can be continually optimised.

14 The proponent will maintain the waste water treatment plant to a level which will enable processing of contaminated groundwater at the treatment rates indicated in the CER (and subsequent documentation). The proponent will undertake further upgrading of the waste water treatment plant if treatment of the contaminated groundwater is not progressing at a satisfactory rate.

15 The proponent will continue to investigate new technology and improvements to improve its waste water treatment plant to optimise recovery of pollutants.

16 All operations at the treatment plant will be designed and operated to contain all spillages and contaminated run off within the site boundaries .

17 The proponent will manage the disposal of any solids from the treatment plant to prevent contamination of the environment.

Evaporation Cells

18 The evaporation cells will be operated and managed to the satisfaction of the EPA, Water Authority, the Health Department and any other relevant statutory agency.

19 To ensure that the final salt residue in the evaporation cells conforms to predicted specifications for future management, the chloride bleed effluent composition and discharge rates, will be monitored.

20 If the quality or quantity of chloride bleed effluent does not conform to specifications the effluent will be retreated or otherwise disposed of in an acceptable manner.

21 Salt residues building up in the evaporation cells over the lifetime of the cells will be managed to the satisfaction of the EPA and Health Department.

22 Seepage rates from the evaporation cells will be monitored and any leakage from the structure will be immediately notified to the EPA.

23 The proponent will take immediate action to recover leakage and repair the structure.

24 The proponent will, at least six months prior to dewatering the evaporation cells prepare a decommissioning and rehabilitation plan for review and approval by the EPA.

25 When decommissioning, the proponent will cease discharge to and dewater the evaporation cells. The recovered water will be evaporated or treated and disposed of in an acceptable manner.

26 Rehabilitation of the evaporation cell site will be carried out to the satisfaction of the EPA, Health Department, Water Authority and other relevant agencies.

27 During rehabilitation, the evaporation cell site will be stabilised to prevent leakage subsequently occurring even during periods of high rainfall. This stabilisation will be carried out to the satisfaction of the EPA and the Water Authority.

Monitoring and Reporting

28 Throughout the life of the project, the proponent will maintain and implement an Environmental Monitoring Programme.

29 The monitoring programme will be submitted to the EPA for approval and will include:

- groundwater monitoring bores and locations
- land transects for vegetation monitoring

- monitoring for protection of Lake Cooloongup
- frequency and time of monitoring
- reporting times to the EPA

30 All samples taken in the monitoring programme will be analysed in a laboratory acceptable to the EPA.

31 The proponent will monitor all pipelines running between the Refinery and Baldivis for integrity.

32 In the case of spillage to the environment resulting from effluent pipeline failure, the proponent will immediately inform the EPA of such spillage, immediately clean up the leakage and as soon as possible remediate any environmental impact.

33 The proponent will monitor and control insects and weeds around the tailings pond and evaporation cells to the satisfaction of the EPA, the Health Department and the City of Rockingham.

34 The proponent will monitor and ensure that the tailings pond and evaporation cells are fenced so as to avoid public access at all times.

35 The proponent will monitor the evaporation cells seepage rates.

36 If the EPA identifies an environmental impact on Lake Cooloongup or surrounding areas resulting from contaminated groundwater generated by the proponent, the proponent will undertake remedial action to the requirements of the EPA.

37 The proponent will submit regular reports to the EPA or as directed by the EPA. The report will include:

- Advice to the EPA on the fulfilment or otherwise of any Ministerial Conditions and Commitments given for the project which may have been achieved or had impact during the reporting period.

- Operating and recovery performance data for the treatment plant.

- Disposal and distribution, including volumes and composition, of all:

  (a) Refinery effluent streams
  (b) Treatment plant streams

  within the refinery site as well as to the Baldivis site.

- All monitoring data as proposed in the Environmental Monitoring Programme.

- Seepage rates of the evaporation cells.

Definitions:

1. CMF Plant
   Continuous microfiltration plant.

2. Waste Water Treatment Plant
   Infrastructure associated with the CMF pretreatment, nano filtration and reverse osmosis plants.

3. Tailings Pond

Old pond previously used for storage of tailings residue and plant effluent and which is now considered for dewatering and rehabilitation.

4. Evaporation Cells
   New facilities to accept and evaporate chloride bleed effluent from the reverse osmosis plant as per CER (dated September 1990).

5. Plant Effluent
   Waste liquor from the nickel operations at the refinery.

6. Chloride Bleed Effluent
   Waste liquor from the reverse osmosis section of the treatment plant.

7. Pond Liquor
   Liquor in the tailings pond.

8. Rehabilitation
   Site decommissioning after dewatering the tailings pond or other evaporative storage.

8. References

AGC Consulting Group Pty Ltd (1990), "Tailings Pond Rehabilitation and Effluent Management System Upgrade - Consultative Environmental Review".

Environmental Protection Authority (1991), "Tailings Pond Rehabilitation and Effluent Management System Upgrade, Baldivis", Report and Recommendations of the Environmental Protection Authority", Bulletin 489. Environmental Protection Authority, Western Australia.

Environmental Protection Authority (1993), "Environmental Impact Assessment - Administrative Procedures", Environmental Protection Authority, Western Australia.

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Appendix 1

Minister's statement of 31 May 1991 including the proponent's commitments

Ass # 323

Bull # 489

State # 144

WESTERN AUSTRALIA

MINISTER FOR THE ENVIRONMENT

STATEMENT THAT A PROPOSAL MAY BE IMPLEMENTED (PURSUANT TO THE PROVISIONS OF THE ENVIRONMENTAL PROTECTION ACT 1986)

Tailings pond rehabilitation project and effluent management system upgrade, Baldivis

Western Mining Corporation Ltd

This proposal may be implemented subject to the following conditions:

1. In implementing the proposal, the proponent shall fulfil the commitments (which are not inconsistent with the conditions or procedures contained in this statement) made in the Consultative Environmental Review and in responses to issues raised during the assessment (A copy of the commitments is attached).

2. Subject to these conditions, the manner of detailed implementation of the proposal shall conform in substance with that set out in any designs, specifications, plans or other technical material submitted by the proponent to the Environmental Protection Authority with the proposal. Where, in the course of that detailed implementation, the proponent seeks to change those designs, specifications, plans or other technical material in any way that the Minister for the Environment determines on the advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

3. The proponent shall be responsible for decommissioning the upgraded effluent management system and rehabilitating its site and environs, to the satisfaction of the Environmental Protection Authority. At least six months prior to cessation of operation of the upgraded effluent management system, the proponent shall prepare and subsequently implement a decommissioning and rehabilitation plan, to the satisfaction of the Environmental Protection Authority.

4. No transfer of ownership, control or management of the project which would give rise to a need for the replacement of the proponent shall take place until the Minister for the Environment has advised the proponent that approval has been given for the nomination of a replacement proponent. Any request for the exercise of that power of the Minister shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the project in accordance with the conditions and procedures set out in the statement.

Published on

31 MAY 1991

5. If the proponent has not substantially commenced the project within five years of the date of this statement then the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment shall determine any question as to whether the project has been substantially commenced. Any application to extend the period of five years referred to in this condition shall be made before the expiration of that period, to the Minister for the Environment by way of a request for a change in the condition under Section 46 of the Environmental Protection Act. (On expiration of the five year period, further consideration of the proposal can only occur following a new referral to the Environmental Protection Authority).

Bob Pearce, MLA
MINISTER FOR THE ENVIRONMENT

30 MAY 1991

TAILINGS POND REHABILITATION PROJECT AND EFFLUENT MANAGEMENT SYSTEM UPGRADE, BALDIVIS

PROPONENT'S COMMITMENTS

The proponent, Western Mining Corporation Limited (WMC) has provided the following commitments to the Environmental Protection Authority in the CER on its Tailings Pond Rehabilitation Project at Baldivis and Effluent Management System Upgrade at Baldivis and Kwinana.

General Commitments

(1) The proponent will adhere to the proposals as described in the CER and as assessed by the Environmental Protection Authority and will fulfil the commitments made therein and summarized below.

(2) The groundwater pollution resulting from the leaking tailings pond will be rectified as specified in the CER, to the satisfaction of all relevant Government agencies' including the following -

- EPA;
- Water Authority of WA;
- Department of Conservation and Land Management; and
- Mines Department.

(3) The proposed new effluent pond structure will be constructed, operated and managed to the satisfaction of -

- EPA;
- Water Authority of WA;
- Mines Department; and
- The Health Department.

(4) The proposed liquid, slurry and solid waste management practices will be carried out, where relevant, to the satisfaction of -

- Environmental Protection Authority;
- Water Authority of WA;
- Mines Department;
- The Health Department.

(5) If the EPA identifies an environmental impact on Lake Cooloongup or surrounding area resulting from polluted groundwater generated by the proponent, the proponent will take all reasonable remedial action to the satisfaction of the EPA and all other relevant Government agencies.

Existing Tailings Pond

(6) The environmental management programme will be modified where practicable to reduce the impact of pollution on the environment to the satisfaction of the EPA.

(7) The proponent will cease discharging effluent to the existing tailings pond as soon as the proposed new effluent pond structure and upgraded effluent treatment plant are commissioned. Construction and commissioning of the new effluent pond structure and upgraded effluent treatment plant will be carried out as soon as possible after all statutory approvals have been granted, and will be to the satisfaction of the EPA.

(8) The proponent will, at least six months prior to decommissioning the existing tailings pond, prepare a decommissioning and rehabilitation plan to the satisfaction of the EPA.

(9) The proponent will commence to dewater the existing leaking tailings pond immediately after cessation of effluent disposal and at the time of commissioning the new effluent pond structure. Dewatering will be carried out as quickly as is practical and to the satisfaction of the EPA. The recovered water will be treated or disposed of to the satisfaction of the EPA.

(10) Rehabilitation of the existing tailings pond site will be carried out to the satisfaction of the EPA, Health Department, Water Authority, the Department of State Development and any other relevant agency.

(11) During rehabilitation, the leaking tailings pond will be stabilized to minimize leakage as far as possible, even during periods of high rainfall, and this will be done to the satisfaction of the EPA and the Water Authority of Western Australia.

Upgrading of Wastewater Treatment Plant

(12) The proponent will upgrade its reverse osmosis wastewater treatment plant to a level which will enable processing of contaminated groundwater at the treatment rates indicated in the CER. The proponent will undertake further upgrading of the wastewater treatment plant if treatment of the contaminated groundwater is not progressing at a reasonable rate to the satisfaction of the EPA.

(13) The proponent will operate and manage its wastewater treatment plant to the satisfaction of the EPA.

(14) The proponent will monitor the performance of its wastewater treatment plant so that waste recovery can be continually optimized, and this will be done to the satisfaction of the EPA.

(15) The proponent will continue to investigate new technology and improvements to improve its wastewater treatment plant to optimize recovery of pollutants and this will be done to the reasonable satisfaction of EPA.

New Effluent Pond Structure: Construction and Management

(16) The proposed new effluent pond structure will be constructed to the satisfaction of the EPA, Water Authority and the Health Department and any other relevant statutory agency.

(17) The proposed new effluent pond structure will be operated and managed to the satisfaction of the EPA, Water Authority, the Health Department and any other relevant statutory agency.

New Effluent Pond Structure: Effluent and Slurry

(18) To ensure that the final residue in the new effluent pond structure conforms to predicted specifications for future management, the plant effluent, slurry and solid residue quality and discharge rates, will be monitored to the satisfaction of the EPA. If the quality or quantity of effluent does not conform to predicted specifications and is unacceptable to the EPA, the effluent will be retreated or otherwise disposed of to EPA's satisfaction.

New Effluent Pond Structure: Leakage

(19) If leakage were detected from the proposed new effluent pond structure, EPA will be notified immediately. The proponent will take immediate action to recover leakage and mend the leak and this will be done to the satisfaction of the EPA.

New Effluent Pond Structure: Solids Buildup

(20) Solid residues building up in the new effluent pond structure over the lifetime of the ponds would be managed to the satisfaction of the EPA and Health Department.

New Effluent Pond Structure: Decommissioning and Rehabilitation

(21) The proponent will be responsible for decommissioning the new effluent pond structure and rehabilitating the site to the satisfaction of the EPA.

(22) The proponent will, at least six months prior to decommissioning the new effluent pond structure, prepare a decommissioning and rehabilitation plan to the satisfaction of the EPA.

(23) Upon decommissioning, the proponent will cease discharge to and dewater the new pond structure. This will be carried out to the satisfaction of the EPA. The recovered water, if any, will be evaporated or treated and disposed of, to the satisfaction of the EPA.

(24) Rehabilitation of the new effluent pond structure site will be carried out to the satisfaction of the EPA, Health Department, Water Authority and any other relevant agency.

(25) During rehabilitation, the new effluent pond structure will be stabilized to prevent leakage subsequently occurring even during periods of high rainfall. This stabilization will be carried out to the satisfaction of the EPA and the Water Authority.

Solid Waste Disposal From Gold Recovery Unit

(26) The proponent will continue to transport contaminated solid waste residues, resulting from its gold recovery unit, back to its Kambalda minesite and this will be done to the satisfaction of the EPA and the Health Department. If the proponent were to change this practice and dispose of this solid waste elsewhere, it would only do so after first obtaining approval from the EPA.

Spillage at Plant

(27) Any new operations at the existing plant will be designed and operated to contain any liquid spillages and contaminated runoff within the site boundaries to the satisfaction of the EPA.

Breakage of Effluent Pipeline

(28) In the case of spillage to the environment resulting from effluent pipeline failure, the proponent will immediately inform the EPA of such spillage, immediately clean up the leakage and as soon as possible remediate any environmental impact to the satisfaction of the EPA.

Storage Facilities for Contaminated Liquids and Solids in the Plant

(29) All new facilities which are used on site to hold contaminated materials associated with polluted groundwater recovery or polluted effluent/slurry or solid waste disposal will be so designed so as to contain spillage from entering the environment. The design of containment and recovery methods to be used will be to the satisfaction of the EPA.

Monitoring

(30) Prior to construction of the new effluent pond structure, the proponent will submit and subsequently implement a monitoring programme to the satisfaction of the EPA and the Water Authority.

The monitoring programme will include -

(30.1) · data outlining existing status of groundwater contamination so that a bench mark can be set to measure performance of recovery of polluted groundwater;

(30.2) · proposed sampling period to determine performance in recovery of polluted groundwater;

(30.3) · monitoring Cooloongup Lake environment for impacts;

(30.4) · parameters to be measured;

(30.5) · sampling sites and times and

(30.6) · reporting times to the EPA.

(31) All samples taken in the monitoring programme will be analysed in a laboratory acceptable to the EPA.

Security

(32) The proponent will ensure that the old and new tailings ponds are fenced so as to avoid public access at all times and that this will be done to the satisfaction of the EPA.

Other Commitments

(33) The proponent will control insects and weeds around the tailings ponds (evaporation ponds) to the satisfaction of the EPA, the Health Department and the City of Rockingham.

(34) The proponent will modify its polluted groundwater recovery programme and its tailings pond management procedures, if it cannot meet licence conditions placed on it by EPA. Such modifications will be to the satisfaction of the EPA.

(35) The proponent will not transfer ownership, control or management responsibility of groundwater cleanup, tailings ponds management, solid waste disposal or tailings dams rehabilitation without prior consultation and arrangements being made which are to the satisfaction of the EPA and The Hon. Minister for Environment.

General Reporting

(36) Reports will be provided to the EPA as directed by the EPA. Reporting will include advice to the EPA on the fulfilment of any Ministerial Conditions and Commitments given by the proponent at relevant project stages and of works approval and licencing conditions.

Appendix 2

Comparison of proposed and existing commitments, by statement number

Original Commitment Statement number (from Minister's Statement of 30 May 1991, Appendix 1)	Proposed Commitment Statement number	Comments
1		Addressed in recommended Environmental Condition 1
2	1	
3, 17	18	
4	6, 17	
5	36	
6	12	
7	7, 8	
8	10	
9	9	
10, 11	11	
12	14	
13, 14	13	
15	15	
16		Commitment fulfilled
18	19, 20	
19	22, 23	
20	21	
21		Addressed in recommended Environmental Condition 3
22	24	
23	25	
24	26	
25	27	
26	6	
27, 29	2	
28	32	
30		Commitment fulfilled
31	30	
32	34	
33	33	
34	3	
35		Addressed in recommended Environmental Condition 4
36	37	
	4, 5, 16, 28, 29, 31	Additional commitments

Appendix 3

Proponent's response to issues raised in submissions

ANSWERS TO DEPARTMENT OF ENVIRONMENTAL PROTECTION ON QUESTIONS ARISING FROM THE SUBMISSIONS RECEIVED ON THE WESTERN MINING CORPORATION'S PROPOSED SECTION 46 CHANGES TO ENVIRONMENTAL CONDITIONS

BALDIVIS REHABILITATION PROJECT

Q1. Effects of groundwater extraction

1.1 What is the effect of the groundwater extraction on the movement of groundwater under the adjacent landfill facility in Millar Road? What are the effects on the plume movement in relation to the landfill facility?

A1. Effects of Groundwater Extraction:

1.1 Groundwater extraction will have negligible impact on the movement of groundwater under the adjacent landfill in Millar Road. Movements of the plume will also have negligible impact as the water table is located significantly below the bottom of the landfill facility. Regional groundwater flow occurs in a generally westerly direction away from the landfill towards Lake Cooloongup. The effect of extraction is to capture some of this throughflow and some recharge, both of which would otherwise have proceeded towards Lake Cooloongup. Because the transmissivity (ability to transmit water) of the aquifer is so large, effects on the water table are extremely small. Increasing the rate of extraction would decrease water levels beneath the landfill by millimetres or centimetres at the most (depending on the location of additional recovery bores). Decreasing the rate of extraction would increase the water levels, but not enough to bring the water table into contact with the bottom of the landfill.

The plume of contaminated groundwater has moved some distance towards the landfill, because the plume is more dense than the surrounding groundwater, and movement is driven by density differences. Recent modelling has shown that the current rate of movement is very slow. Most of the movement would have happened in the first months and years after the initial leak in 1979. Recent assessment of conductivity data has shown that the plume is indeed being recovered, at least in those areas where its density is greatest. Even if some of the plume were to move as far as the landfill, it would be many metres below the water table, which is well below the landfill.

*Q2. **Proposed Cross Flow Microfiltration plant***

2.1 The backwash containing solids from the Cross Flow Microfiltration plant are proposed to be returned to the staging pond. This backwash is likely to contain iron and organic materials which caused the original fouling problems. As these solids are not being removed from the treatment circuit, will the solids cause further problems in the treatment systems downstream of the staging pond?

2.2 What percentage of solids will be contained in the backwash?

2.3 Is there likely to be a build-up of solids in the staging pond over a period of time, thus reducing the effective volume of the pond?

2.4 How will solids in the staging pond be removed and how will they be disposed of?

A2. **Proposed Continuous Microfiltration (CMF) Plant:**

2.1 As stated in the document for the proposed Section 46 changes to environmental conditions, the backwash from the CMF will initially be returned to the staging pond to enable the recovery programme to be actioned. It was also indicated that options for long term management of the solids would be required to be investigated.

The preferred option currently being assessed is the construction of a small sludge pond (with weir) on the edge of the existing tailings pond, but on top of the membrane liner. The solids associated with the backwash will settle on the edge of the tailings pond allowing the liquor component to overflow into the main body of the tailings pond. If required, coagulants will be used to enhance settling of the solids.

The solids in the backwash will consist of materials that naturally occur in waters : iron,.algae and associated organics. These materials are similar to the materials that already exist in the tailings pond. The brown-coloured residue currently in the pond is precipitated iron.

As the tailings pond is dewatered, the entrained solids in the liquor feed stream to the CMF will naturally increase as the water level is lowered. This increase in solids will not impact on the percentage of solids in the CMF backwash nor downstream sections of the water treatment plant. However, the solids will necessitate an increase in the frequency of the actual backwash step of the operation.

2.2 The percentage of solids in the backwash is only 0.5 to 1.0%. The solids are very fine and hence block the filters rapidly before any substantial build up of material occurs.

2.3 The low level of solids and the fact that they can be easily removed from the staging pond will not impact on the effective volume of the system.

2.4 The solids will be removed manually and deposited with the existing residue in the tailings pond. After removal of all the liquor from the tailings pond, the residues will be sealed as proposed in the Consultative Environmental Review and in a manner acceptable to the EPA.

*Q3. **Lake Cooloongup***

3.1 What is the ratio of extracted groundwater (for treatment) in relation to the total groundwater flux from the Baldivis site towards Lake Cooloongup?

A3. **Lake Cooloongup:**

3.1 Currently it is difficult to estimate the ratio of extracted groundwater relative to the total groundwater flux towards Lake Cooloongup. However, such estimates will become available in January 1995 when studies currently being undertaken by CSIRO are due for completion.

Extraction to date is believed to be less than the natural recharge over the area of the plume. It is possible that extraction may be increased up to the rate of natural recharge. In that case, groundwater flow to Lake Cooloongup would be equal in magnitude to the flow of groundwater from east of the Baldivis tailings pond towards the pond. Extraction may be of the order of half of the natural throughflow.

In spite of this, there is no evidence that groundwater levels have significantly declined due to the extraction to date. This is probably due to the extremely high transmissivities in the aquifer. Furthermore, there is no evidence that the reduction in flow has had any negative impact on Lake Cooloongup. The natural variation in lake levels is controlled mainly by rainfall and evaporation, and natural groundwater inflows play a negligible role in controlling water levels.

*Q4. **Stormwater management***

4.1 Is stormwater run-off from the nickel refinery directed to the Baldivis tailings pond?

4.2 It is conceivable that stormwater volumes in winter may account for a large percentage of "effluent" going to the tailings pond. Are there any plans to divert uncontaminated stormwater runoff to more acceptable (and less costly) disposal methods (eg stormwater sumps)? Alternatively, contaminated stormwater could be stored on-site at the nickel refinery and fed directly into the nanofiltration and reverse osmosis plants instead of occupying volume at the Baldivis site. Could the company comment on this alternative?

A4. **Stormwater Management:**

4.1 Stormwater run off from the KNR site is currently sent to the Baldivis tailings pond.

4.2 In addition to the effluent upgrade project, KNR has also been addressing the civil works within the KNR site. A major component of the latter works programme has been to provide adequate plant bunding to ensure the separation of process materials from stormwater.

Clean water will be used for reticulation of gardens and other vegetated areas. However, any stormwater that is found to be contaminated with process material will be directly treated in the reverse osmosis plant.

Appendix 4

List of submitters

Department of Minerals and Energy — Geological Survey of Western Australia
Department of Resources Development
Water Authority of Western Australia
Town of Kwinana
City of Rockingham