Argyle Diamond Mine Alluvial Mining Project

Argyle Diamond Mines Pty Ltd

Report and Recommendations
of the
Environmental Protection Authority

Environmental Protection Authority
Perth Western Australia
Bulletin 389 June 1989

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i SUMMARY AND RECOMMENDATIONS

Argyle Diamond Mines Pty Ltd (ADM) has submitted a proposal to recommence the mining of alluvial diamonds from Smoke and Limestone Creeks within its Argyle mining lease. Details of the proposal were submitted to the Authority in a Notice of Intent.

The project is expected to process about 5 million tonnes of gravels for a return of approximately 5.3 million carats, over a period of three years, beginning about July 1989.

Mining would be in stages, beginning upstream and moving progressively downwards. The existing alluvial treatment plant would be used, with minor modifications. Tailings would be disposed of into the existing dam which is immediately north of the alluvial treatment plant.

Rehabilitation of the mined areas would use improved techniques developed over areas rehabilitated after the original alluvial mining. It would follow closely after mining of each area has been completed. Monitoring would be regular and remedial work would be undertaken, if necessary, in consultation with Mines Department and the Environmental Protection Authority.

The large area of disturbance (155 ha) is a concern because of the potential for increased soil erosion. However, the proponent has demonstrated successful rehabilitation of most areas formerly mined (ie Upper Smoke Creek area and the less clayey parts of Limestone Creek alluvial areas), and more recent trials in difficult clayey areas using coarse rock mulch have proven effective. Given moderate rainfalls the proposed rehabilitation programmes are expected to be successful.

The fringing riverine vegetation on Smoke Creek will be progressively replaced as mining moves downstream. This area is not expected to create any problem as regrowth in the past has been effective and rapid. The creek channel will follow the low ground contours after mining, so that it will meander aesthetically, as it does currently.

Management of the oversize dump will be assisted by minimising the number of active faces, thus enabling revegetation to occur from the west end in a progressive manner.

The Authority has concluded that the proposed mining of alluvial deposits, although extending over a large area, will not result in unacceptable environmental impacts provided the commitments made by ADM are kept.

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal described in the Notice of Intent as subsequently revised, is environmentally acceptable and recommends that it could proceed subject to the environmental commitments made by the proponent in their revised Notice of Intent and the recommendations in this report.

RECOMMENDATION 2

The Authority recommends that approval to proceed should be subject to firm undertakings by the proponent to effectively rehabilitate and manage previously mined alluvial areas to the satisfaction of the Mines Department.

RECOMMENDATION 3

The Authority recommends that the proponent undertake ongoing management and rehabilitation of the site to the satisfaction of the Department of Mines following consultation with the Western Australian Water Authority and the Environmental Protection Authority.

1. INTRODUCTION

Argyle Diamond Mines Pty Ltd (ADM) proposes to mine and process additional deposits held within its existing Argyle leases.

Clause 10 of the Diamond (Ashton Joint Venture) Agreement Act 1981 requires ADM to submit proposals when intending to significantly expand or otherwise vary their activities beyond those specified in previously approved proposals. As the mining operations at Argyle are subject to the Diamond (Ashton Joint Venture) Agreement Act 1981, all proposals (including management programmes) are subject to the satisfaction of the Department of Resources Development.

The leases are located on 'Lissadel' Pastoral Lease 110 km SW of Kununurra in the East Kimberley region (see Map 1).

In December 1988 ADM Notified the Department of Resources Development (DRD) of their intention to recommence alluvials mining on Smoke Creek and Limestone Creek. The proposal was referred to the Environmental Protection Authority which decided to assess it under Part IV of the Environmental Protection Act, at the level of Notice of Intent.

The original document, submitted in March 1989 left a number of issues unclear and the Environmental Protection Authority referred these back to ADM for further details. A revised document from the proponent was received in May 1989.

2. PROJECT DESCRIPTION

2.1 AIMS

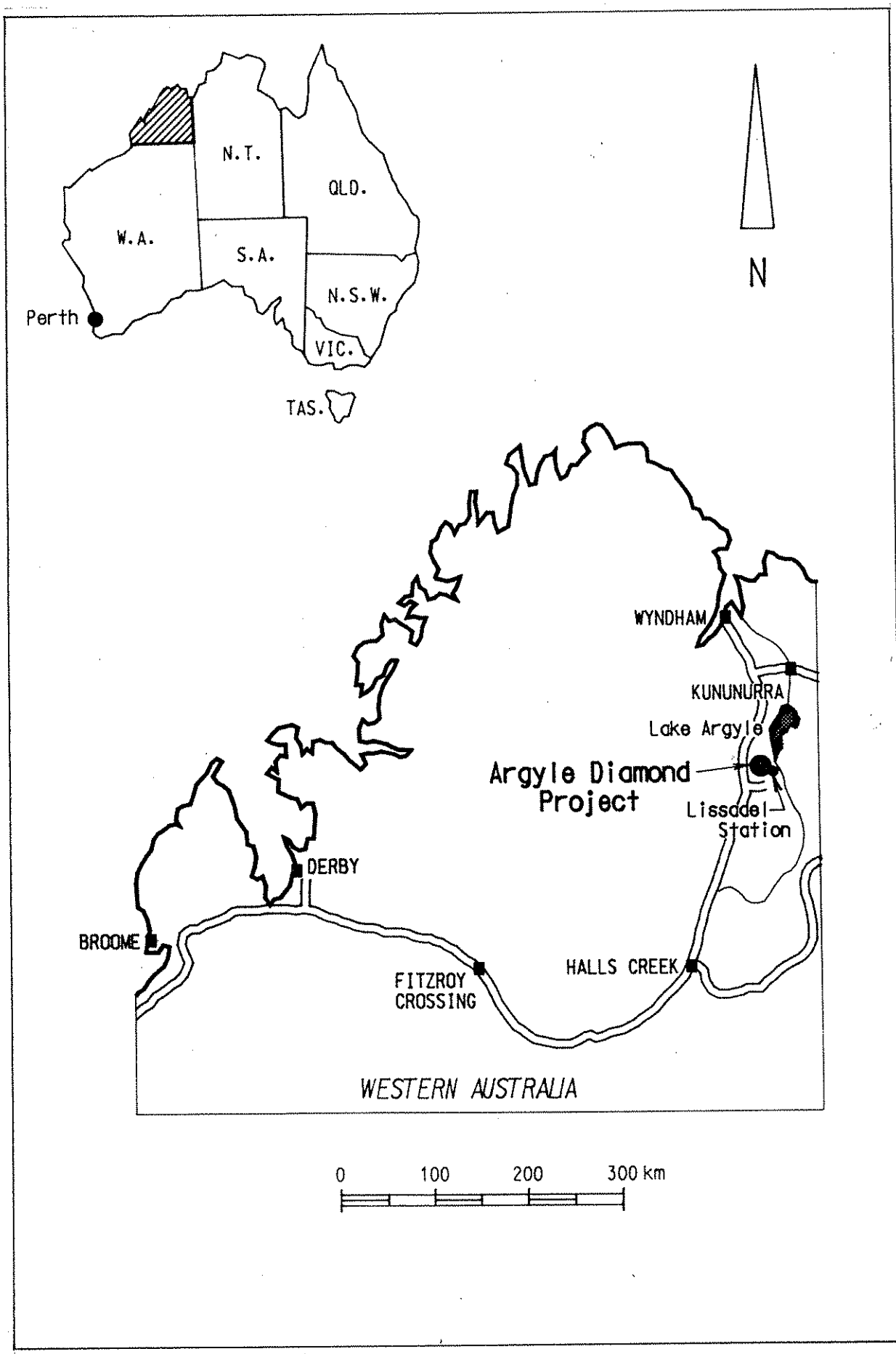
The proposal encompasses the mining and processing of approximately 5 million tonnes of alluvials over 36 months beginning later in 1989, within several areas on Smoke Creek and Limestone Creek adjacent to and downstream from previously mined deposits (Map 2). Mining and rehabilitation schedules are included as Appendix II. The total area disturbed by this mining is expected to be 155 ha, for the recovery of about 5.3 million carats of diamonds.

Additional areas are under consideration downstream pending feasibility studies; these will be the subject of later Notices of Intent if mining is proposed.

2.2 MINING METHOD

ADM intends to use the same method as for the original alluvial operation until and unless a better long-term method can be established. A hydraulic excavator is used with a front end loader to transfer the ore to 40 t trucks for transport to the plant. If a change in the method is contemplated the proponent will formally notify the Authority so that an assessment of the proposal can be made.

At Smoke Creek the deposits will be mined to a maximum depth of 4 m, with an average of 2.7 m, while in the Limestone Creek areas the maximum depth will be 1.5 m.



Map 1. Location Plan.

2.3 TAILINGS DISPOSAL

Tailings will be deposited into the existing tailings dam immediately north of the alluvial treatment plant (Fig 2). The volume over the three year period will be 1.2 million m^3 (an average of 40% by volume of the total alluvial plant feed), which will be accommodated within the existing capacity of about 2.8 million m^3. This volume is based on a beaching slope of 1.16^o over the area of the tailings disposal and a settling density of 1.47 for the slimes.

2.4 OVERSIZE DISPOSAL

Some of the oversize fraction will be used as mulch and rip-rap during rehabilitation, but the remainder will be dumped on the area previously established for the earlier alluvial operation. About 1.5 million tonnes (of the total of 5 million) will be emplaced so as to extend a pre-existing low-lying ridge eastwards. This configuration will help to reduce visual impacts. Rehabilitation will occur progressively from the western end as the dump advances. This point was not made clear in the original document.

2.5 STAFFING AND EDUCATION

Thirty one ADM employees will be required to operate the alluvial treatment plant, while 23 contractors will be responsible for the mining and transport of the alluvial feed to the plant.

All employees and contractors are required to attend a site induction programme in which the proponent's environmental protection policies are outlined. All except about six personnel, who will commute from Kununurra, will work on the standard fly-in fly-out basis to Perth. This was originally an issue of concern as it was not known if the contract personnel would be commuting or using their own vehicles.

2.6 REHABILITATION

Past attempts at rehabilitation have in some areas not been satisfactory to the Environmental Protection Authority. Consequently, the Authority sought firm commitments from ADM for effective rehabilitation of these areas, as well as proposed mining areas.

ADM recognises that there are two important components of rehabilitation, these being long-term stability, and aesthetics. Its policy is to use, wherever possible, native species of vegetation. In order to establish a quick-growing, protective ground cover it will be practice to sow grasses, Acacias, Cassias and Sorghum. Eucalypts will be planted out as seedlings.

An improvement over the previous methods is that topsoil will be stripped up to one month prior to mining and progressively replaced within one month of the completion of mining. (see Appendix II). This will help to maintain the viability of the soil and assist in more rapid rehabilitation. In addition, all cleared vegetation will be windrowed and returned to the mined areas. The effect will be twofold: it will reduce the potential for soil erosion; and it will recycle organic matter.

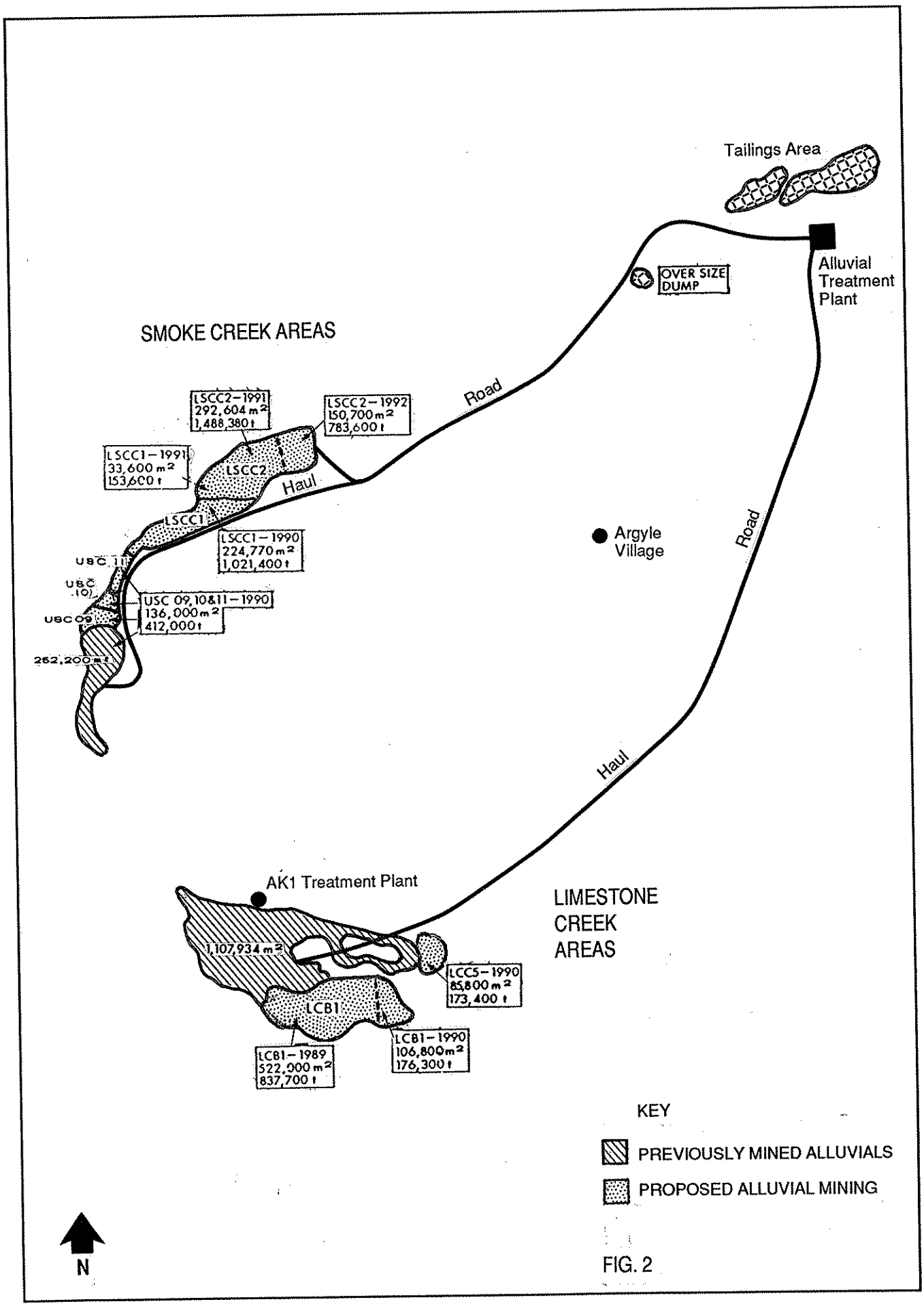

Tailings Area
Alluvial Treatment Plant
OVER SIZE DUMP
SMOKE CREEK AREAS
LSCC2–1991
292,604 m²
1,488,380 t
LSCC2–1992
150,700 m²
783,600 t
LSCC1–1991
33,600 m²
153,600 t
LSCC2
Haul
Road
LSCC1
LSCC1–1990
224,770 m²
1,021,400 t
USC 11
USC 10
USC 09
USC 09,10&11–1990
136,000 m²
412,000 t
262,200 m²
Argyle Village
Road
Haul
AK1 Treatment Plant
LIMESTONE CREEK AREAS
1,107,934 m²
LCC5–1990
85,800 m²
173,400 t
LCB1
LCB1–1990
106,800 m²
176,300 t
LCB1–1989
522,000 m²
837,700 t
KEY
PREVIOUSLY MINED ALLUVIALS
PROPOSED ALLUVIAL MINING
N

FIG. 2

2.6.1 LIMESTONE CREEK DEPOSITS

The ground profile in the 1985 mined area had two defined "bedrock" material types:

- high clay, low stone content; and

- clay plus stones and pebbles.

The latter areas have proved to be amenable to rehabilitation and the proposed mining areas are expected to be of this type. Proposed treatment will be:

. grading to conform with surroundings, with the deliberate creation of depressions in order to increase water retention;

. areas of low granular content will be top dressed with coarse reject material (+ 0.8 mm) from the alluvial treatment plant;

. drainage ditches will be excavated with 1% gradient, which will direct run-off into the major creek systems at non-erosive speeds;

. areas between ditches will be contour ripped to a depth of 0.5 m; and

. supermix 'A' fertiliser will be applied at the rate of 150 kg/ha and the area will be sown and planted as discussed above.

2.6.2 SMOKE CREEK DEPOSITS

The depth of mining will be greater here than at Limestone Creek (up to 4 m versus only 1.5 m) and "bedrock" is basaltic clay. This material has recolonised in the past following rehabilitation. Treatment will be similar to that for Limestone Creek except that because of the narrow and steep sided valley concentrating run-off, the main drainage channel will be deepened to contain most flow events to this route. This will help to protect new vegetation on the levee banks from flood damage and will reduce sediment loss from the area. Reject oversize material from the process plant will be returned to the main channel as rip-rap to help reduce erosion.

2.7 MONITORING

Erosion control will continue to be monitored via the existing stream gauging stations on Gap and Limestone Creeks downstream of the proposed mine area on Limestone Creek.

The existing gauging station on Smoke Creek is situated within the area to be mined and will need to be relocated further downstream. Alternative sites will be assessed for their suitability.

Vegetation profiles in adjacent undisturbed areas are used as controls for assessment of the success of rehabilitation. Areas that have achieved, or will achieve >60% of their original vegetation density are regarded as being successful. Regular monitoring will be done visually and quantitatively, the latter being carried out annually immediately after the wet season, and remedial work will follow if necessary. ADM has undertaken to develop strategies for problem areas in close consultation with staff at the Mines Department and the Environmental Protection Authority.

2.8 INFRASTRUCTURE

The original alluvial treatment plant will be used. Minor modifications to suppress dust are the only planned changes to this plant.

No new roads will be required and there is no additional infrastructure required to supply power for the project.

To ensure continuity of water to the treatment plant the take-off point will be relocated to immediately downstream of the booster pumps. This will involve laying 900 m of water pipe parallel to the existing pipeline.

3. EXISTING ENVIRONMENT

The mine is located on a pastoral lease on 'Lissadel' Station in the East Kimberley region, about 20 km upstream (south) from Lake Argyle.

The climate is tropical monsoon, with a distinct dry winter and wetter summers.

At Limestone Creek the vegetation is low tree and curly spinifex savannah, common to flat open areas, and is developed on granitic clays and rocks. The Smoke Creek area is more confined and consists of riverine vegetation, fringed with a levee - terrace upper story tree complex. Several species of grasses are also common.

Because of the pronounced topography of the minesite rainfall is generally channelled via well defined drainage systems and erosion can become a problem on overgrazed or un-rehabilitated areas.

Data obtained from the original ERMP (Ashton Joint Venture, ERMP, Argyle Diamond Project, Dames & Moore 1982) indicate there are no rare or endangered species of flora and fauna known from the proposed mining areas.

The company has stated that no known aboriginal sites will be disturbed by operations associated with this proposal.

4. ENVIRONMENTAL ISSUES

Important issues for consideration are seen to be:

. the large area of disturbance (155 ha), including destruction of fringing riverine vegetation in Smoke Creek;

. the consequent potential for soil erosion, leading to poor productivity of the alluvial flats and increased sediment loadings into Lake Argyle; and

. management of the oversize fraction dump.

As a consequence of concerns in relation to these issues, the Authority asked ADM to clarify several areas of their rehabilitation programmes. These were:

- the criteria for quantitative measurement of success;

- size of areas previously mined which are considered to have been successfully rehabilitated;

- the size of areas which have not been successfully rehabilitated, and details of the timing and content of remedial measures;

- the stages and timing of rehabilitation programmes for areas proposed for mining;

- the proponent's policy on the use of exotic versus native species to revegetate areas.

An early concern raised with the company was that the course of Smoke Creek might be engineered so as to run straight, in the form of a deep ditch. When this point was raised ADM clarified their intention to leave a meandering stream course which will be "sensitive and complimentary to the existing surrounds".

Also, it was noted that cattle straying into newly planted rehabilitation areas were inflicting severe damage, and a firm undertaking was sought from ADM to restrict their access. Control of cattle will be achieved by the use of appropriate fencing to keep them out of areas undergoing rehabilitation.

The proponents' advice via their subsequent document has addressed all the issues raised.

ADM recognises the problems with rehabilitation of predominantly clay areas in the former Limestone Creek alluvial mining areas, and is confident that small scale trials using coarser rock mulch have overcome these. It is intended to return the oversize (> 0.8 mm) fraction to potentially problematic clayey areas after it has passed through the alluvial plant.

Rehabilitation of the oversize dump will be effected by progressively revegetating faces from the west end of the dump, while the active slopes are developed eastwards.

The Authority considers that the revised Notice of Intent has adequately addressed all issues and as a result, makes the following recommendations:

RECOMMENDATION 1

The Environmental Protection Authority concludes that the proposal described in the Notice of Intent as subsequently revised, is environmentally acceptable and recommends that it could proceed subject to the environmental commitments made by the proponent in their revised Notice of Intent and the recommendations in this report.

RECOMMENDATION 2

The Authority recommends that approval to proceed should be subject to firm undertakings by the proponent to effectively rehabilitate and manage previously mined alluvial areas to the satisfaction of the Mines Department.

RECOMMENDATION 3

The Authority recommends that the proponent undertake ongoing management and rehabilitation of the site to the satisfaction of the Department of Mines, following consultation with the Western Australian Water Authority and the Environmental Protection Authority.

5. CONCLUSION

Although the proposed mining area is substantial the impacts should be acceptable, provided that the new techniques in hand for rehabilitation of clayey areas are successful, and that stabilisation and revegetation of the oversize dump will be progressively undertaken.

The Authority is confident that with ADM's commitment to monitoring, management, and consultation with Government agencies any problems which arise will be effectively dealt with.

APPENDIX 1

LIST OF ENVIRONMENTAL COMMITMENTS

LIST OF ENVIRONMENTAL COMMITMENTS

1. No significant new infrastructure will be constructed (power, plant, roads).

2. Fine tailings will be disposed of into the existing dam.

3. Top soil will be removed up to one month prior to mining of an area and replaced up to one month after mining of the area is completed.

4. Vegetation will be windrowed from areas to be mined, and replaced with the topsoil after mining.

5. The land after mining will be graded to integrate with surrounding landforms, with water-retaining depressions.

6. Clayey areas will be top dressed with stony material (+ 0.8 mm) from the alluvial treatment plant.

7. Drainage ditches with 1% fall will be dug to direct run-off into the main creek systems.

8. The area between drainage ditches will be contour ripped to a minimum depth of 0.5 m.

9. If newly mined areas are contributing excessive sediments to the creeks ADM will consult with the relevant Government authorities and construct remedial earthworks.

10. Rehabilitation will include fertilising with Supermix 'A' at the rate of 150 kg/ha and sowing with quick growing native and introduced plant species, followed by eucalypts.

11. At Smoke Creek the main drainage channel will be deepened and to protect emerging vegetation on the banks from flood damage some of the oversize material from the process plant will be returned as rip-rap to the main channel to help reduce erosion.

12. The stream gauging station on Smoke Creek will be relocated to a suitable site downstream.

13. The proponent undertakes to protect all known aboriginal sites from mining.

14. ADM will work in close consultation with the Department of Mines and the Environmental Protection Authority to develop effective remedial strategies if areas prove problematic to rehabilitate.

15. The Smoke Creek channel will be realigned after mining to allow a meandering aspect that will be sensitive to the existing surrounds.

16. It is company policy to use native species for revegetation programmes, wherever possible.

17. Inspections of areas under rehabilitation will be made annually, if not more frequently.

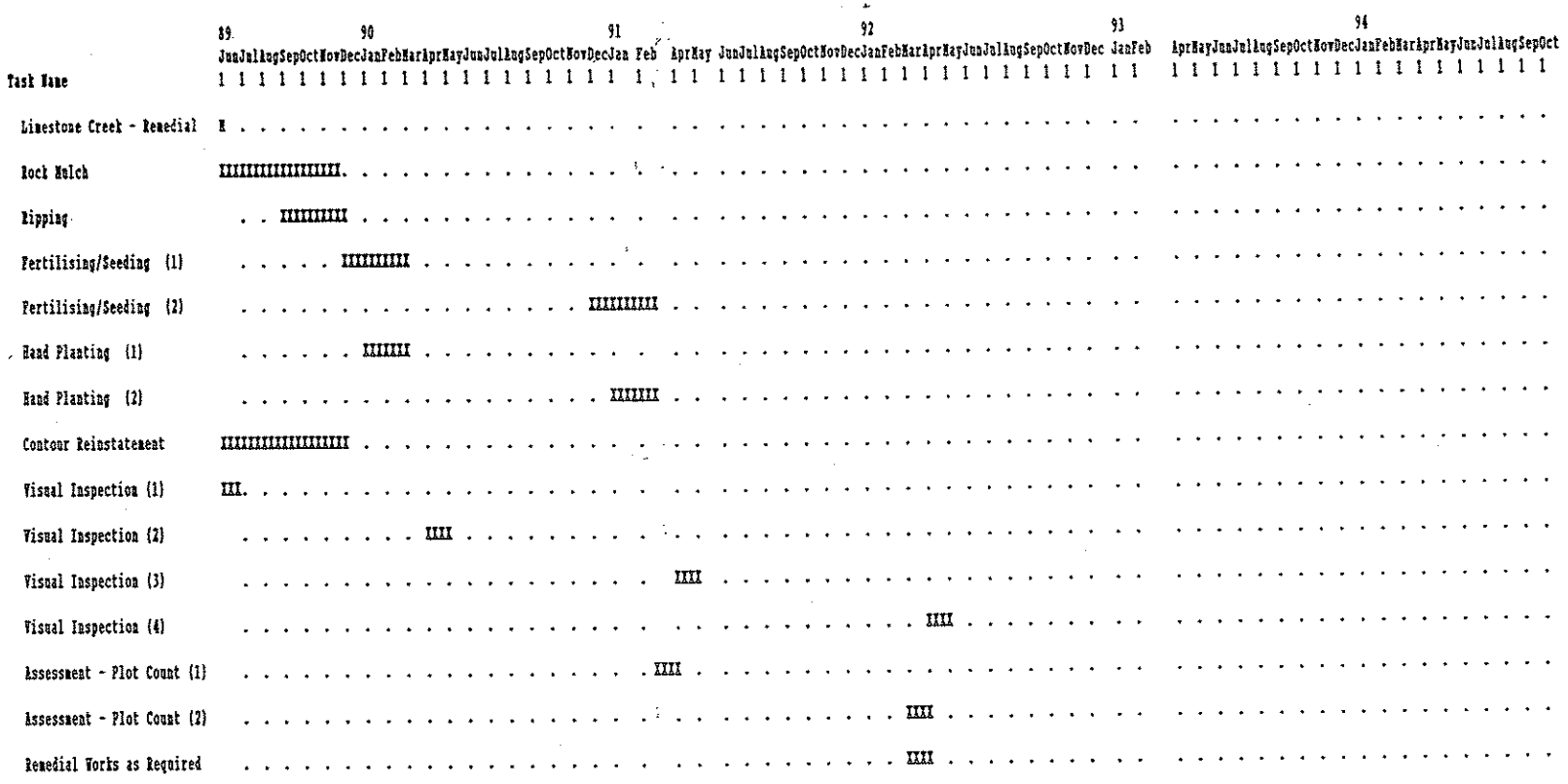
18. Fencing around areas under rehabilitation will be upgraded in order to effectively keep out cattle.

19. Mining, processing and environmental works will be annually reported.

20. The above list is additional to the ongoing commitments which relate to ADM's activities, as outlined in the company's previous reports.

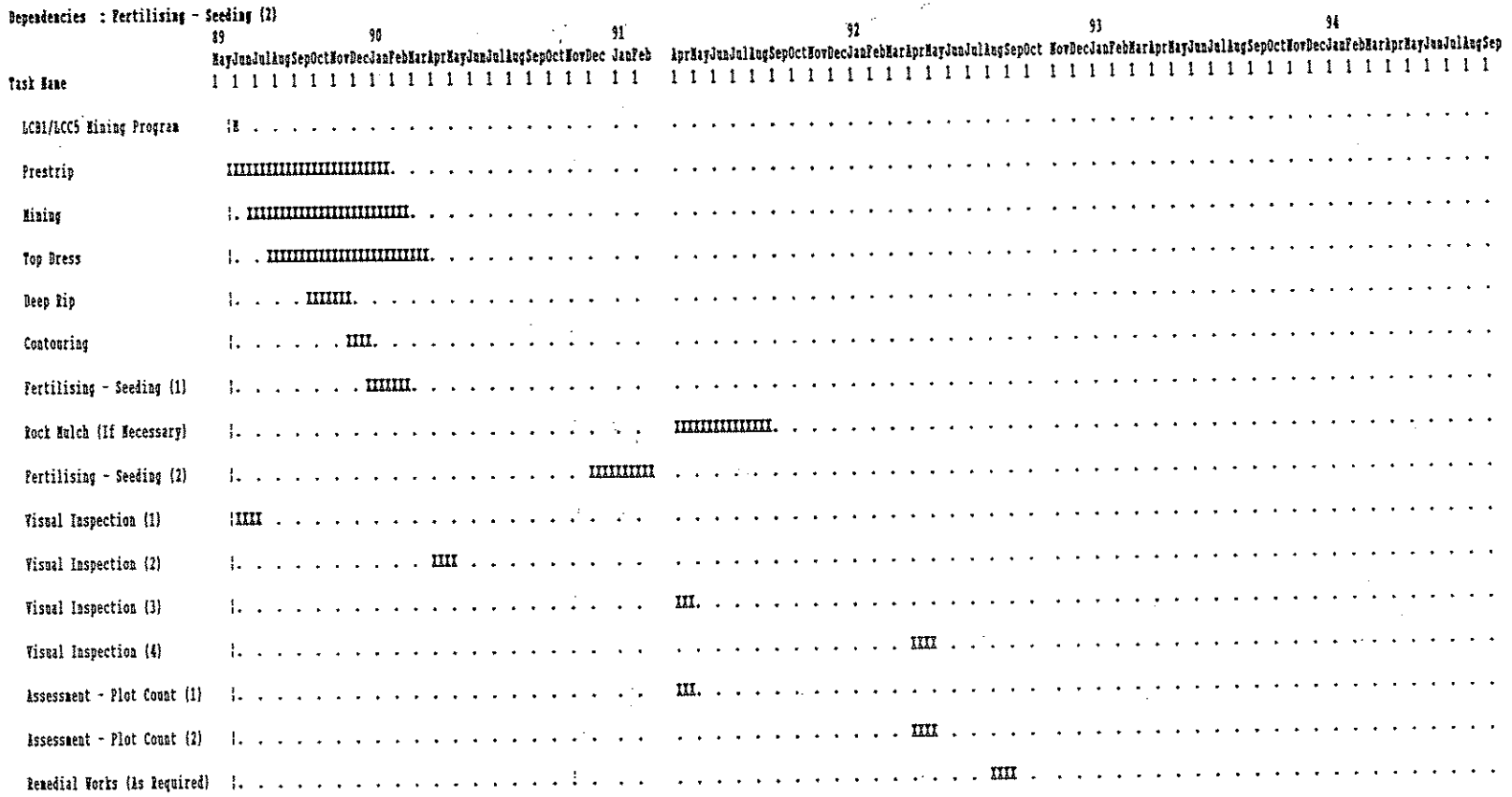
APPENDIX 2

MINING AND REHABILITATION SCHEDULES



TIME LINE Gantt Chart Report, Strip 1

Limestone Ck - remedial



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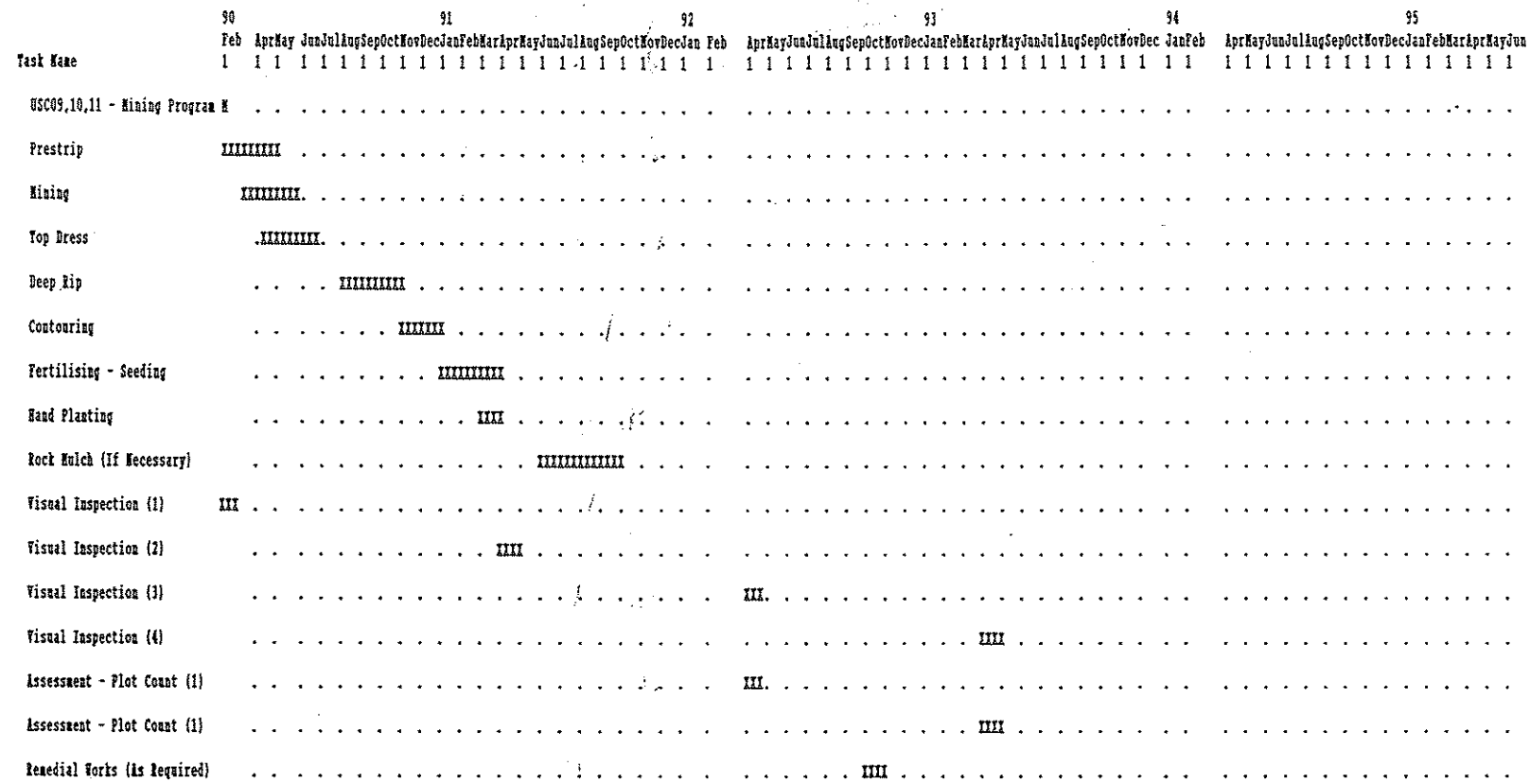
LCB-1 / LCC-5
Mining,
Fertilising, Seeding



IIIII Detail Task ##### Summary Task M Milestone
xxIII (Started) =### (Started) ››› Conflict
III-- (Slack) ###-- (Slack) ..III Resource delay

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TIME LINE Gantt Chart Report, Strip 1

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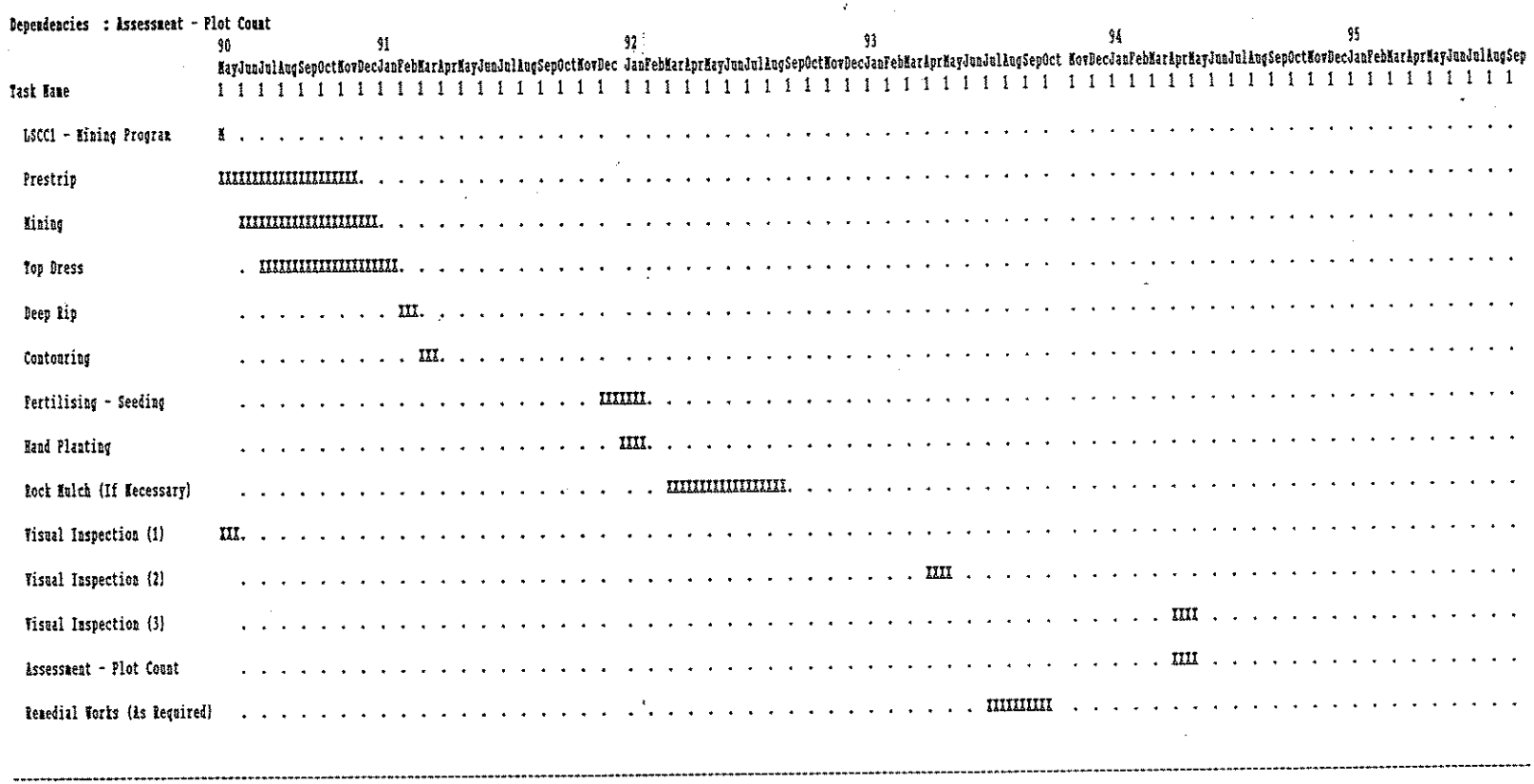
Mining



TIME LINE Gantt Chart Report, Strip 1

LSCC-1
Assessment, Mining

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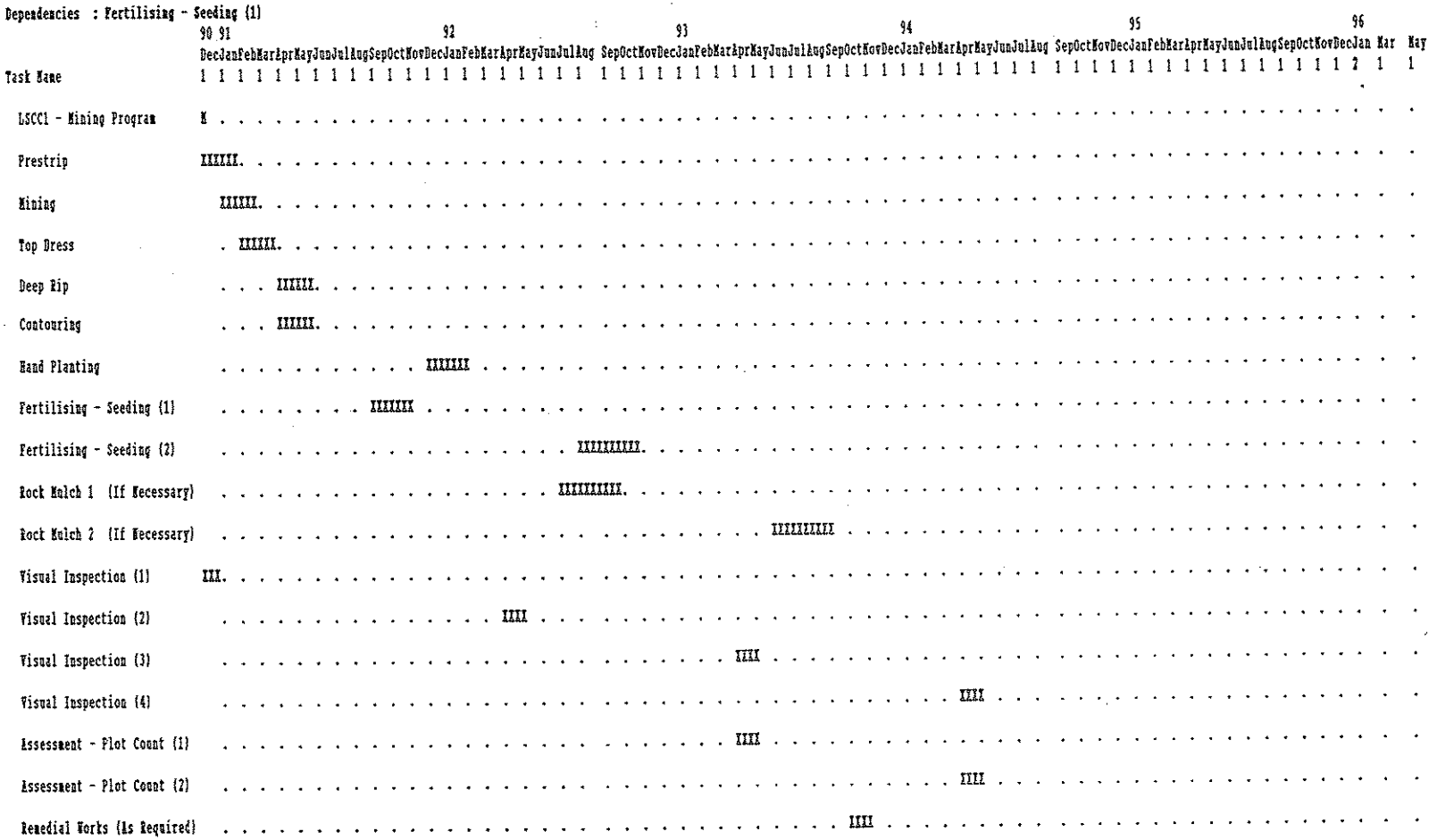

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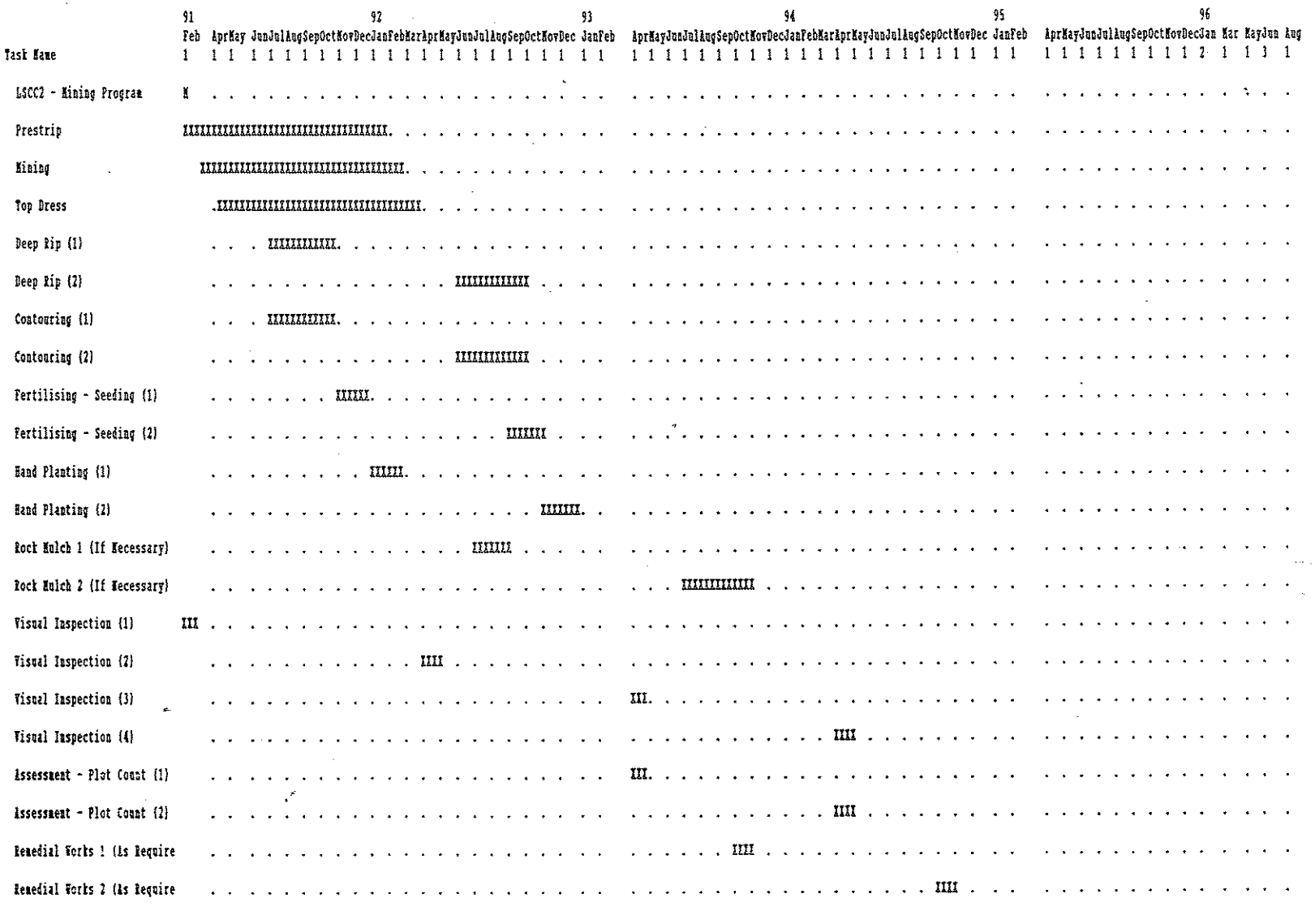
TIME LINE Gantt Chart Report, Strip 1

L5CC-1
Seeding
Mining



TIME LINE Gantt Chart Report, Strip 1

LSCC-2. Mining