THE NORTHERN TERRITORY OF AUSTRALIA

Copy No. 1

CONFIDENTIAL

CABINET DECISION

NO. 379

Submission No.: 326

Title: ALLIGATOR RIVERS REGIONAL TOWN

Cabinet -

(a) noted the report on the regional town at Attachment A to the Submission and directed the following Departments to advise -

  (i) Housing Commission/Public Service Commissioner to develop policy regarding Government accommodation and standards, and provision of Commonwealth accommodation in the town;

  (ii) Industrial Development in consultation with the Territory Parks and Wildlife Commission, to develop policies regarding provision of tourist facilities in the region;

  (iii) Law to examine the situation of the Town Planning Ordinance in regard to the town;

  (iv) Law to develop possible terms for a head lease for the town;

(b) endorsed the proposed town plan arrangement subject to discussions on detail to be held between interested parties, with possibly minor amendments;

(c) approved a letter to the Director of National Parks and Wildlife requesting a meeting to discuss not only the town plan, but the terms for the head lease for the town and proposed park management controls including tourism. There should be provision for direct discussions by the Department of Mines and Energy on those aspects of the plan of management directly relating to mining development, including future exploration;

(d) endorsed the concept of a Statutory Authority (under Northern Territory Legislation) to construct the town, and requested the Department of Law to draft, as a matter of urgency, guidelines for the legislation in consultation with other appropriate departments. This will enable the initiative to be taken in discussions to be held with the mining companies in formulating heads of agreement;

(M.R. FINGER),
Secretary to Cabinet.
15.8.78

.../2

THE NORTHERN TERRITORY OF AUSTRALIA

Copy No. 1

CONFIDENTIAL

CABINET DECISION

NO. 379

2.

Submission No.: 326

Title: ALLIGATOR RIVERS REGIONAL TOWN

(e) approved in principle the concept of management of the town through an elected advisory body, leading eventually to some form of local or community government; and

(f) endorsed action seeking representation of the Northern Territory Government at all negotiations on Northern Territory aspects of uranium mining in the Territory.

(M.R. FINGER),
Secretary to Cabinet.

15.8.78

CONFIDENTIAL

THE NORTHERN TERRITORY OF AUSTRALIA

CONFIDENTIAL

Copy No. 1

FOR CABINET

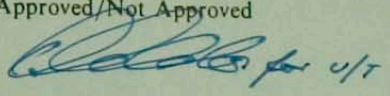
SUBMISSION No. 326

Title:	Alligator Rivers Regional Town.
Cabinet Member	Mr.P.A.E.Everingham, Chief Minister.
Purpose:	Progress report on development of the proposed town.
Relation to existing policy:	Cabinet Decision No.342 of 5 July,1978.
Timing/ legislative priority:	This submission requested within 28 days of Decision 342.
Announcement of decision, tabling, etc.:	N.A.
Action required before announcement:	Correspondence and discussions with other bodies
Staffing implications, numbers and costs, etc.:	Not yet developed.
Total cost:	N.A. at this stage.

CONFIDENTIAL

90252—2/78

CONFIDENTIAL

Comment by Director of Finance:	Representatives of the Territory Government at every stage of development of the Uranium Province must be directed that no approval of any arrangement involving the expenditure of money can be anticipated unless there has been prior agreement as to that expenditure between the Commonwealth and the Territory Governments.
Signed:	Approved/~~Not Approved~~ 
Date:	2/8/78
Comment by Public Service Commissioner:	
Signed:	Approved/Not Approved
Date:	

CONFIDENTIAL

ALLIGATOR RIVERS REGIONAL TOWN

Comment by Director of Finance:	
	Approved/Not Approved
Signed:	
Date:	
Comment by Public Service Commissioner:	No objection to recommendations. Cabinet however should note that significant staffing requirements can be expected.
	~~Approved/Not Approved~~
Signed:	for Public Service Commissioner
Date:	31/7/1978

MEMORANDUM

TO: CHIEF MINISTER
Through Director-General

DATE: 11.8.78

FROM: R.J. McARTHUR

14/8

REF:

RE: ALLIGATOR RIVERS REGIONAL TOWN

With reference to your proposed Cabinet Submission on the above, attached are comments by the Department of Transport and Works on the circulated draft.

The points raised in paragraph 2 will be assured if the Government obtains majority control of the Statutory Body formed to construct the town, and this aspect is covered in the Submission.

(R.J. McARTHUR)
Controller,
Special Development Projects

SECRETARY
DEPARTMENT OF TRANSPORT AND WORK
DARWIN.

11 August 1978

Director-General,
Department of the Chief Minister,
P.O. Box 4396,
DARWIN. N.T. 5794

11.00 am 11/8

Attention : Mr. R. J. McArthur

Dear Bob,

ALLIGATOR RIVERS REGIONAL TOWN

(Ref. your CS78/291 of 27 July)

We have examined the draft Cabinet Submission, and offer the following comments :

1. We endorse all of the recommendations.

2. Ref : Attachment A, page 4, "Construction Stage" paragraph 3.

   "The Northern Territory Government to handle construction through the Department of Transport and Works, ..."

We suggest that adoption of this principle would serve two purposes. It would :

(a) ensure that Territory consultants and contractors get their fair share of work, and

(b) ensure the Northern Territory Government's direct involvement in the Town from the early stages.

3. We are unable to comment on the Consultants' interim report on Advanced Design Study or the Town Plan as they were not included in the documents provided.

Yours sincerely,

for A. M. GREEN

ALLIGATOR RIVERS REGIONAL TOWN

1. BACKGROUND

Cabinet Submission No.296 informed Cabinet of the arrangements for financing, development and operation of the proposed Alligator Rivers Regional Township. As a result, Cabinet Decision No.342 of 5 July 1978 requested a revised report incorporating consideration of certain points raised.

The interim town plan and report has now been referred by the Director of National Parks and Wildlife (DNPW) for comment by the Northern Territory Government.

The Controller, Special Development Projects, has reported on the town plan (see Attachment 'A') and has raised certain issues.

The Minister for the Northern Territory has written to the Chief Minister outlining the functions suggested for a corporate body to develop the town.

2. CONSIDERATION OF ISSUES

(a) Comments on the points raised in Cabinet Decision No.342 are included in Attachment 'A'.

(b) The letter from the DNPW merely requested comments on the town plan. However the letter from Mr. Adermann included - "(4) Provision would be made for early consultation with other mining companies, the National Parks and Wildlife Service, the Northern Land Council and other authorities both in the planning and development of the town". The report at Attachment 'A' also suggests that more extensive consultation is necessary than a mere exchange of comments by letter. Therefore the DNPW should be asked to organise a full meeting of all interested parties to finalise details of the town plan.

.../4

CONFIDENTIAL

(c) Since the town will be located on Commonwealth land leased from the DNPW it appears that a statutory plan is not possible under the Northern Territory Ordinance. Hence the role of the Northern Territory Chief Planner in implementation of the plan needs clarification, and this is matter for reference to the Department of Law.

(d) Attachment 'A' indicates that proposed details of the head lease to the corporate body are not yet available. The proposed management controls in the Park are also of vital interest to the Government. Therefore closer and fuller consultation by the DNPW is necessary, in addition to above.

(e) Cabinet Submission No.296 proposed that financing and development of the town be carried out by a corporate body. As described in Attachment 'A', a meeting of officials considered several options for the structure of such a body and suggested that a Statutory Authority would be most appropriate. It would be vital the Government have the majority and final say on such an Authority, which should be established as soon as possible.

(f) The administration of the town after construction was also considered, and it was agreed that the town should be run not by the Statutory Authority, but by the normal Government agencies with provision for an elected advisory body - leading eventually to local government.

(g) Although the Commonwealth has kept the Government informed concerning the town, there has been limited consultation on other uranium issues. I have written to the Prime Minister, therefore, suggesting that the Government should be represented at meetings between the Commonwealth Uranium Task Group (officials) and other bodies, such as the NLC.

.../5

3. FINANCIAL CONSIDERATIONS

The letter from Mr. Adermann included - "5. The cost of basic infrastructure and utilities, e.g. land development, Roads, sewerage, water and power and of municipal and community welfare facilities would be met initially by the corporation and amortized through premiums on sub-leases of land and on a usage basis". (As shown in Cabinet Submission 296, Attachment B, the estimated cost of these facilities for a population of 3,500 is $35.94m, of which the Government share would be $5.57m.)

"6. As outlined in my letter of 13 June, the Northern Territory Government would meet the full cost of developing a social infrastructure, namely schools, hospital and police station (subject to the Commonwealth/ Northern Territory financial arrangements, with suitable provision for the Northern Territory to be re-imbursed for net expenditure incurred".

(Gross costs are estimated at $15.1m.)

"7. The Northern Territory Government and the various companies would each be responsible for the construction cost of its own houses and other facilities".

(Government costs estimated at $8.4m.)

The extent of the costs quoted above, and the possible share by the Northern Territory Government, should be regarded as indicative only for the purposes of this Submission. The costs are based on electricity being supplied by Ranger. Actual commitments are still to be determined in detail with the Commonwealth in accordance

with the Financial Arrangements.

4. CO-ORDINATION

A draft of this Submission was circulated to all departments. The Department of Industrial Development and the Territory Parks and Wildlife Commission are concerned that facilities be provided for visitors to the Park. The Department of Mines and Energy seeks provision for mineral exploration in the Park plan of management. The Department of Community Development supports the Submission and proposes a Standing Interdepartmental Committee to advise the Government on Uranium aspects. The Department of Law also supports the Submission. The Departments of Lands and Housing advise that Appendices 1 and 2 to 'Attachment A' are acceptable except for possible minor amendments. It wishes to see the Town Planning Board having an input to the corporate body and having responsibility for approving amendments to the Town Plan. This might be included in the agreement for the corporate body, subject to legal advice.

Comments were not received from the Department of Transport and Works at the due time of lodgement of this Submission.

5. LEGISLATION

If a Statutory Authority is agreed to for construction of the town, further discussions will be necessary with

the Commonwealth and the mining companies. A separate Submission seeking approval for legislation will then be presented in due course.

6. RECOMMENDATIONS

I recommend that Cabinet:

(a) Take note of the report on the regional town at Attachment 'A' and direct the following Departments to advise:

(i) Lands and Housing to develop policy regarding Government accommodation and standards, and provision of Commonwealth accommodation in the town;

(ii) Industrial Development in consultation with the Territory Parks and Wildlife Commission, to develop policies regarding provision of tourist facilities in the region;

(iii) Law to examine the situation of the Chief Planner in regard to the town;

(iv) Law to develop possible terms for a head lease for the town.

(b) Endorse the proposed town plan arrangement subject to discussions on detail to be held between interested parties, with possibly minor amendments.

(c) Approve a letter to the Director of National Parks and Wildlife requesting a meeting to discuss not

only the town plan, but the terms for the head lease for the town and proposed park management controls including tourism. There should be provision for direct discussions by the Department of Mines and Energy on those aspects of the plan of management directly relating to mining development, including future exploration.

(d) Endorse the concept of a Statutory Authority (under Northern Territory Legislation) to construct the town, and request the Department of Law to draft, as a matter of urgency, guidelines for the legislation in consultation with other appropriate departments. This will enable the initiative to be taken in discussions to be held with the mining companies in formulating heads of agreement.

(e) Approve in principle the concept of management of the town through an elected advisory body, leading eventually to some form of local or community government.

(f) Endorse my action seeking representation of the Northern Territory Government at all negotiations on Northern Territory aspects of uranium mining in the Territory.

CONFIDENTIAL

ATTACHMENT A.

SUBMISSION NO...

ALLIGATOR RIVERS REGIONAL TOWN.

1. INTRODUCTION.

The purpose of this report is to inform Cabinet of the current situation regarding the proposed town in the Alligator Rivers Region, and some other aspects of uranium development. The points raised by Decision No.342 are included. Cabinet may wish to evaluate progress and to form views, which perhaps might be injected into any meetings concerning uranium development in the Territory. At this advanced stage in the Ranger negotiations it could be important that any misgivings of the Government should be raised.

2. THE TOWN PLAN.

As the town will be located within the National Park, on a lease provided by the Director of National Parks and Wildlife (DNPW) and subject to the Park's plan of management, the Town Plan is the responsibility of the DNPW. He has engaged consultants, A.A.Heath and Partners (through the Department of the Northern Territory (DNT) which has in turn consulted the Chief Planner of the Northern Territory Department of Lands and Housing).

The plan of management (incorporating the Town Plan) will be placed on public display for comment after the National Park has been declared. The timing of this declaration is subject to the present negotiations with the Northern Land Council (NLC).

The consultant's interim report on the Advanced Design Study, a copy of which is attached as Appendix 1, is supported by the DNT and the DNPW. The DNPW has sought comments from the Northern Territory Government.

The final stage of the study is expected to be available by mid-August. This will bring the town plan to the stage where it can be handed over for major design work, to the appropriate body (see below).

It is intended that, following receipt of comments from the Government and from Ranger, the DNPW will organise a "workshop" for thorough discussion and the opportunity to study the final plan before it is placed on public display as part of the management plan.

.../2

The final plan at present being prepared is based on the attached general area plan (Appendix 2) which will be altered as follows:

- The police station complex will be moved N.W. to the corner of the main connector road across from the Service Trades Area.
- A lawn cemetery is to be located in a suitable area.
- The Aboriginal residential area opposite the hospital may be relocated. An officer of the National Parks and Wildlife Service will visit the town site with members of the NLC to select an area.

It may be noted that the name of the town has already been gazetted (29.8.74) as Jabiru.

The Chief Planner has been approached for his comments on Appendices 1 and 2, but he has expressed concern at his role in the planning for this town.

3. POINTS ON THE TOWN PLAN RAISED IN CABINET DECISION NO.342.

(a) The possibility of including representation of local communities on the corporate body will be examined during the negotiations (see below).

(b) (i) Single people will have three options at Jabiru under the present plan, all of which were costed:
- Hostel accommodation.
- Two persons sharing a flat/townhouse.
- Four or five sharing a house specially designed to cater for this situation.

For single officers of the Public Service these options could be widened to include single flats if necessary. However this is a policy decision that will have to be made which could affect the standards now in force for the Public Service in the rest of the Territory.

(ii) The standard of housing for public servants, such as provision of air-conditioning, is again a matter of policy which could affect those standards presently in force throughout the Territory. Air-conditioning for the town as a whole is not envisaged at present,

.../3

but pressures could well devolve on the corporate body for this from the mining companies.

(c) For the purposes of preliminary costing the policy adopted for the single people was covered by the options in (b) above. Married couples would be in flats/townhouses or in 3 b.r. houses. No provision was made for 2 b.r. houses, for either married couples or single persons.

(d) An area will be available in the industrial area for a works depot and storage facility (P.21 of Appendix 1).

(e) Excluding the facilities at the school, two ovals and a soccer field are proposed for a population of 3,500. In the exercise carried out based on a population of 1,400, it was assumed that one oval would be sufficient.

(f) The Aboriginal residential areas will have the basic services provided at the same time as the town, and will be connected when required. This will be cheaper and less inconvenient method than supplying the services at a later date.

(g) The construction workers accommodation site is to be converted to a permanent "mobile home" area as construction winds down, but as it now seems more and more likely that sequential development will take place to at least some extent, there will be a need for some of the construction camp to remain until all building ceases. It is understood that the head lease for the town site will stipulate that no permanent resident will be allowed to live in any constructio camp facility after alternative facilities become available, and a time limit of four or five years could well be placed on the camp. The permanent mobile homes will be the personal property of the mine employees and other employees who nominate to live in that style. No temporary accommodation using mobile homes or caravans will be permitted.

(h) The town as outlined in the Interim Report will cater for a population of up to 4,500 persons. The Fox Report recommends that the population be restricted to 3,500 and the DNPW has stipulated that no reference be made to any population larger than that. However the last paragraph on page 1 of Appendix 1 mentions the flexibility of the plan to "allow for any choice or change in Federal policy at some future date".

.../4

In addition to points (b) and (c), there will be a need for agreement on housing Commonwealth Public Servants.

4. ADMINISTRATIVE ARRANGEMENTS.

The Commonwealth Government has requested the Attorney-General's Department to prepare a draft structure arrangement for a corporate body, involving the Northern Territory Government and Ranger with provision for other mining companies as they develop. It is understood that at this stage a company incorporated under the Companies Ordinance is envisaged, rather than a Statutory Body to be set up under special legislation.

Discussions were held on 17 July with the Departments of Treasury, Law, Transport and Works, and Community Development, and the following options were suggested:

Construction Stage.

- Body Corporate formed under the Companies Ordinance.
- A Statutory Body formed under new Territory legislation.
- The Northern Territory Government to handle construction through the Department of Transport and Works, acting as agent for the companies. Agreements would be drawn up to cover this.

As all the mining companies are seeking representation on the body from the start, it was agreed in the discussions that a Statutory Body would be the most desireable method. This would mean that the funds would be publically accountable, and any dispute which arose would be settled by the Minister to whom the Body would answer. Control of the Body must remain with the Government.

Town Management.

- Continue with the Body Corporate.
- Continue with the Statutory Body.
- Form a new Statutory Body or Body Corporate.
- Run by the Government (Department of Community Development)
- Form Local Government Body under Local Government Ordinance, amended if necessary.

.../5

As the first three options would mean that functions such as Health, Education and Police would be under the control of the Body formed it was suggested that the Town should be run by the Government with provisions for Local Government at a later stage. Local involvement in the early stages could be through an Advisory Council using elected residents. The mining companies will probably want direct representation on the governing body.

As a matter of comment the Advisory Council is not seen to include members nominated from the NLC, since the town area is not Aboriginal land, nor the DNPW since he will have ample control through his plan of management and the head lease.

This raises the point that the proposed conditions on the head lease are not yet formulated, which is undesirable since if the conditions are unacceptable further time could be lost through negotiations. It is suggested that some preliminary negotiations with the DNPW could be commenced, but it is essential that the Statutory Body for construction be established as a matter of urgency to complete all negotiations.

5. POSSIBLE CONTROLS TO BE INCLUDED IN THE PARK MANAGEMENT PLAN

During discussions held with officers of the Australian National Parks and Wildlife Service over the last six months, and from examination of Appendices 1 & 2, it is evident that the following controls are likely to be included as part of the plan of management. It is not known at present what has or has not been included in the plan of management, but it is suspected that strong restrictions will be imposed on both residents and visitors to the area. Reports to date are somewhat conflicting but the following might be expected:

- Accommodation in the town will be "closed" to everyone except permanent residents. Accommodation will not be available to visitors without a permit. This policy is in accordance with a Fox recommendation accepted by the Federal Government.
- A new road will be built from the Arnhem Highway east of the South Alligator River, through Woolwonga Reserve to the Jim Jim Road about a kilometre west of the town. The purpose of the new road is conjectured to prevent tourists coming in contact with the town and mine sites. It is understood that where this road intersects the Jim Jim Road there will be located the Park Headquarters and control point, a Research Station and a training centre with temporary accommodation for trainees. All this would be outside the town lease as presently shown on Appendix 2, and therefore outside of town management control.
- The lease area to be provided to the corporate body appears to be only about a third of the land set aside for the town from Aboriginal Land Grants. The Australian National Parks and Wildlife Service have stated that this can always be expanded if required, but how difficult this will be is a matter for conjecture at this stage. The reason given for the restricted lease is to prevent unapproved expansion of the town. However as the town is covered by the management plan and the National Parks Act, no building outside of the approved town plan can take place without the approval of the DNPW. It is therefore an unnecessary precaution and it would be desirable to have the lease given for that total area exempted from Aboriginal Land.
- It is expected that tourists will be allowed to use the town facilities for souvenirs, food, fuel, etc., as the population can only benefit from such contacts.

.../7

6. MEETINGS ON URANIUM DEVELOPMENT.

The agenda for these meetings between the Commonwealth and other parties is not known, but in the absence of any public statements to the contrary it is conjectured that agreement is still being sought this month on the following issues:

- Memorandum of Understanding and the legal agreement between Atomic Energy Commission and the Ranger Joint Venturers.
- Authority for Ranger under Section 41 of the Atomic Energy Act.
- Amendments to Ordinances and Regulations to cater for the environmental requirements for Ranger.
- Agreement between NLC and Commonwealth to allow Ranger to proceed.
- Agreement between NLC and DNPW for leasing Aboriginal Land for National Park.
- Whether the mining of Nabarlek, Jabiluka and Koongarra should be carried out under Northern Territory Ordinances, and any amendment required to cater for "prescribed minerals".
- Arrangements for a responsible body for continuous supervision of miners, residents in the area and other people as required after they have left the area and after mining has ceased, for effects of radon exposure.

7. OTHER ISSUES

- It appears possible that Ranger might be given approval to commence in August/September 1978. However it appears from the National Parks and Wildlife Conservation Act that the town as part of the plan of management, may not commence until the plan has been approved by Parliament, which could mean a delay of at least six months. On the other hand, discussion with the DPNW indicates that he could allow initial works to commence beforehand.
- Whilst uranium has been retained as a Commonwealth function,

the development will take place in the Territory, will affect Territorians and will have a direct effect on the future economy of the Territory. Therefore it is recommended that the Northern Territory Government seek to have representation at meetings held between the Commonwealth Government, mining companies and the Northern Land Council.

8. CONCLUSIONS

1. It is recommended that the views of Cabinet be sought on the following:
   - The latest Town Plan arrangement, with a recommendation for endorsement.
   - The options concerning the "corporate body" (desirable to have these views before officials meet with Attorney-General's Department), with a recommendation for a Statutory Authority.
   - The plan of management controls; bearing in mind that the comments above are based on heresay and deduction, and any firm action or submission must await the actual plan. Recommend that full consultation be requested before the plan is published.
2. The Government in its reply to the DNPW, with comments on the Town Plan, to outline its involvement in the construction of the town and the need for consultation at all times between DNPW and the Government regarding the Plan.
3. It is recommended that the Government seek representation, at the very least observer status, at meetings of officials on uranium and the town. Judging by previous attitudes the

.../9

NLC and some Commonwealth Government Departments might object. The alternative is to seek regular Government to Government briefing and consultation on the major issues.

The office of the Controller
of Special Development Projects.

8 August 1978

CONFIDENTIAL

APPENDIX 1 TO ATTACHMENT A

SUBMISSION NO...

JABIRU

Advanced Design Study

Interim Report

A.A. HEATH & PARTNERS PTY LTD

PLANNING CONSULTANTS & ENVIRONMENTAL SCIENTISTS

A MEMBER OF THE CAMERON McNAMARA & PARTNERS CONSULTANT GROUP

JABIRU
NEW TOWN

Advanced Design Study
Interim Report

A.A.Heath & Partners Pty Ltd
Planning & Environmental Consultants
131 Leichhardt Street, Brisbane, Qld. 4000

Contents

1. Introduction

The development of the new town of Jabiru is an integral part in the development of the uranium reserves west of Arnhem Land and is intended to be established in compatible terms with Kakadu National Park.

In February 1972 the Department of National Development commissioned a regional study of the Alligator Rivers Region of the Northern Territory. The consultants were required to assess the likely development of the region, assess the basic infrastructure and requirements for this development and assess the benefits likely to arise from a regional centre and the provision of common servites and facilities. The subsequent report which was produced summarised the findings of the study and presented conclusions, estimates and recommendations for further studies

In June 1973 a further study was undertaken for the Cities Commission and was concerned with the development of a first stage design for a regional centre incorporating an outline plan for the growth structure of the town and bringing together the planning for land use, utilities systems, transportation and conservation of lands not required for intensive or urban use, and providing an urban framework within which detailed planning could take place.

The current study is a culmination of the previous investig ation and planning studies and includes a revision of existing conceptual plans to incorporate revised criteria adopted from the Fox Report and included in the Federal Government's policies as set out in the series of papers issued in 1977 under the title, "Uranium-Australia's Decision".

For Jabiru, the precept has been established that the basic workforce will be that engaged in the uranium mining and with few exceptions, all other activities will be regarded as service functions to the former. Accordingly, the revised design plan has been prepared to accommodate a population of 3 500 persons and structured in such a way as to facilitate orderly and compact growth but retain flexibility in spatial land use dispostion to allow for any choice or change in Federal policy at some future date.

The plan provides for single as well as family accommodation and incorporates the central commercial and office core, school facilities, passive and active recreation, planning for public utilities and town support facilities. Planning for the initial development of the town incorporates a site for housing the construction workforce under conditions which will enable gradual integration with the town by sequential use.

Although this study is primarily a planning and design exercise, sufficient detail will be presented in the last segment of the study to enable the field survey, structural elements, civil works and construction to be designed and implemented with the minimum of delay and aid in the easy transfer from a construction-oriented town to a permanent operational town.

NOTE

This Interim Report is presented as a support document to the Stage 2 revision and re-design segment of the Study. A more comprehensive examination will be made of the functional infrastructure of the town in Stage 3 covering the detailed planning and full environmental assessment.

2. Design Criteria

2.1 TOWN SIZE

The design population of 3 500 persons will be accommodated in two residential sections and an area for town house development. The workforce will be housed in a "mobile home" camp complex during the initial development stage of the town.

Land use disposition has been designed so that the living areas are located convenient to the town centre and accessible to the school and the recreation area with the minimum of conflict with vehicular traffic.

2.2 POPULATION STRUCTURE

The permanent staff projections for year 5 total between 960, for a low projection, and 1 130, for a high projection, which can be expanded through family size figures to a population ranging from approximately 2 564 persons to a high of 3 027 persons.

The assumptions made are that 70% of the employees will be married and that a further 70% of these will have a family. A family unit of four was adopted.

The figures in the following Table being attained in about the fifth year from the commencement of operations of the Ranger mine.

It has been assumed also that about 70% of the family units (totalling between 668 and 789) would require dwelling accommodation. This gives a requirement of between 470 and 555 houses.

Of the remaining 30% (totalling between 200 and 235 and representing family units without children) the requirement for houses as against flats or town houses is assumed as an equal demand. Therefore the remaining 200 to 235 family units would require from 100 to 118 houses and the same number of flats or town houses.

POPULATION CALCULATIONS BASED ON WORKERS

	Ranger Uranium Mines P/L	Pancon. Mining Ltd.	Noranda Australia Limited	Government and Private
Workforce	330-480	360	80-100	190
70% married	230-336	250	55-70	133
70% of married with a family	160-236 families	175 families	40-50 families	93 families
family size	4	4	4	4
family numbers	640-944*	700*	160-200*	372*
30% of married with no family	70-100 families	75 families	15-20 families	40 families
family size	2	2	2	2
family numbers	140-200*	150*	30-40*	80*
30% single	100-144*	110*	25-30*	57*
TOTAL	880-1288*	960*	215-270*	509*

TOTAL (approximately) High 3 027
Low 2 564

The single people (approximtaely 290 to 340), representing about 30% of the workforce, will be accommodated in houses, flats or town houses, and the hostel. It is assumed that the distribution will be biased towards housing accommodation. Using the high projection and with four persons sharing a house a further 42 houses could be needed. On this basis, the town house or flat need is likely to be 30 units with two sharing while the hostel accommodation could be 110 persons.

The summation of this is that the perceived requirement for accommodation types would be:

- dwellings 609 to 755
- town houses or flats 118 to 148
- hostel beds 110

Closely related to the population numbers are the anticipated school enrolments. Based on educational needs at Nhulunbuy, the Department of Education has estimated a student population of 1 000. This would be made up of 120 pre-school students, 640 primary students, 180 students in the years 8 to 10 and 50 students in years 11 and 12.

These figures are similar to those attained in Moranbah[1] in Central Queensland in its seventh year. (Developed by Utah Development Company to serve the Goonyella and Peak Downs coal mines).

A minimum site area of ten hectares was required, the area of the site proposed meets this requirement.

2.3 RESIDENTIAL AREAS

As studies[2] of housing types, and housing preferences, in remote areas show a preference for detached houses over the various forms of multiple housing, the detached single family dwelling has been adopted as the basic housing unit.

The single family dwelling will also be used to accommodate up to four or five single persons in preference to an exclusive provision of hostel accommodation.

Hostel accommodation will be provided, but on a limited scale, and located close to the town centre.

The physical form of the residential areas reflects the pattern of development which people have previously had as they come to like that to which they have become accustomed. Makale, Holloway & Associates have reported, in respect of remote towns, that ".... many of the resident have strong emotional attachments to the type of housing that they were used to outside the Territories and these bring with them well-formed perferences or often prejudices in favour of a particular type of accommodation".[3]

2.4 VISUAL AMENITY IN RESIDENTIAL SECTIONS

The roads are curved in gentle sweeps so that sight distances are always adequate. The inability to see completely to the end of the road prevents monotony and allows slight off-setting of houses on allotments so that they present a staggered appearance rather than the regimented effect which predominates on a straight road.

---

1. Pascoe B. "A Young Town for Young People" Telegraph, Brisbane, 13 July 1977.
2. Redding P.J.R. "Kambalda Case Study-Part 1, Living in Kambalda Australian Unesco Seminar 1973, Man & the Environment.
3. Makale, Holloway & Associates Ltd., "Planning Report and Development Plan of Norman Wells, Northwest Territories", 1970.

All footways should be paved to assist in the prevention of soil erosion as all the soils of the town site are susceptible to erosion when disturbed. Consequences of such erosion include a serious siltation of the storm water system. Footpaths should be a min. 0.75 metre wide and should adjoin the back of the street channel so that aesthetically, the kerb and channel and the path form one unit. Paths to the bicycle and pedestrian ways should be concrete paved 1.5 metres wide to allow bicycles to pass.

Kerbs should be low-backed type so that they will not cause damage to motor vehicles and also allow bicycles and prams etc., to easily cross them. Where kerbs and channels are not required for stormwater drainage they will be omitted and the road paving finished with concrete edging only.

Colour of the road pavement will depend on the stone that is available but if possible black, heat accumulating surfacings should be avoided.

Underground electricity reticulation will be of very great importance in maintaining a satisfactory visual environment

Street lighting should be on steel poles set well back from the kerb so that they will not be damaged by or damage motor vehicles. In this position they will also be less obtrusive and may be painted a colour to blend with the background. Street and pathway lighting should be designed primarily for pedestrians as it should not be necessary to provide a high level of lighting intensity along roads. At pathways however, lighting should ensure that there are no dark areas. At the ends of culs-de-sac and where bicycle-pedestrian paths adjoin roads, steel or concrete bollards should be erected to prevent access to the pathways system except by maintenance vehicles.

On allotments facing collector roads, fencing should be provided for the whole allotment to provide against increased danger to children from passing vehicles. On other roads fencing could initially be confined to the side and the rear of properties leaving the front yards un-fenced so that an open appearance is presented in the smaller streets. This however should not be regarded as inflexible as studies elsewhere[1] have shown that attitudes to open front yards vary within the community. Front fencing for the safe enclosure of children and property, a functional approach, is preferred by many people, who place a value on privacy, and should not be prevented purely on the grounds of visual amenity.

1. Stockbridge M.E., Gordon B., Nowicki R., and Peterson N., Dominance of Giants - a Shire of Roebourne Study Department of Social Work, University of Western Australia 1976, p.208.

It is important that the range of colours permitted on residential buildings be restricted to a limited range, preferably colours that reflect heat but be not so bright as to be glarey, and be harmonious with the colours of the natural vegetation. Examples of such colours would be beige, straw colours and very pale browns. This restriction of colour is important because of form, mass and proportions of houses will vary considerably, and if unchecked, will present a most ragged and haphazard street scene. The control of colour, because it is the factor that registers most immediately to the senses, is a most important control. Examples of such control on colour, both conscious and traditional, are the traditional white buildings of the Greek Islands, the earth tones used in Hawaii, the restricted colours at the Mt. Ommaney cluster homes in Brisbane and the uniform colour scheme used throughout the University of Western Australia.

2.5 RESIDENTIAL ALLOTMENTS

The general run of house lots has been set at 33 m x 25 m (825 sq.m). This larger size allotment has been chosen having regard to the tropical climate where houses tend to be open and therefore privacy of sight and sound are hard to maintain and the best control is provided by distance. The allotments are large enough to allow siting of houses on the blocks to be governed by the distance apart between houses rather than the traditional method of setting specific distances for houses to be set back from front and side alignments. The opportunity should be taken to site the houses so that they are in the best positions as regards privacy from house to house. In a tropical situation this privacy between houses is far more important than privacy between house and street. Larger allotments also allow easier penetration of breezes through residential areas where there is greater space between buildings.

A road pattern has been designed so that allotments may, in the majority of cases, provide for the locating of a house having its long axis through east-west, and it is recommended that only minor deviations be undertaken from this ideal as C.S.I.R.O. research shows plainly that heat loads increase dramatically with deviation from this axis. In this regard however, each block needs to be considered on its merits as the direction of the prevailing breeze can, and does, modify the climate on individual blocks and in certain cases it may be preferable for the building to have a major room directly facing the prevailing dry season winds.

The majority of allotments have convenient access to a system of walking and bicycle pathways providing safe travel for school children and for pedestrians to community facilities and within the residential sections.

There is a perceived pattern of movement to the school and, while not to the same extent, there is a pattern of movement to the town centre. In this latter case, the movement will be both pedestrian and vehicular.

Where appropriate, rear allotments have been provided as these have been found to be popular where fronting onto pathway systems, especially as in the manner provided here where the system widens to form play grounds. It is also economical to provide this type of allotment and gives a variety of choice of domestic living style.

A proportion of above average sized allotments has also been provided in order to cater for the larger family dwellings. It has been found in other new North Australian towns that it has become necessary to make provision for a relatively high proportion of four bedroom houses.

Provision has been made for town house/flat development located conveniently to major facilities but other larger lots, for the construction of town houses, can be obtained by the amalgamation of a number of residential lots.

In the general residential sections, the creation of completely segregated enclaves of housing type or style should be avoided. This is to prevent one section of the town being branded as better or worse than any other section. What is desirable is the development of all classes of houses in all areas in small groups and not a complete scatter.

The resulting areas will then be distinctive enough to attract middle-class residents but with the whole community sharing the community social amenities.

2.6 INDUSTRIAL AREA

This estate is down wind of the town while still being convenient to it. Entry to the estate is from the Arnhem Highway via the main access road.

2.7 TOWN CENTRE

The town centre location has been moved a little to the north-east from the previous proposals so as to provide a better disposition of land use and balanced town development. In this position it will still be the visual and social centre for the town. The site has an important visual relationship to Mt. Brockman and the Arnhem escarpment which in most places is not seen because of the all prevading bush.

In this position the residential areas can each progress together from their initial settlements through to full development without altering the focus of that development upon the town centre.

The town centre is on a high ridge and includes police, hospital and civic functions. The site has the best micro-climate and the location permits extension without dust generated by that work being carried over the remainder of the town by the prevailing dry season south-easterlies.

2.8 HOSPITAL

The health service is to comprise a community health centre in the town centre complex with an outpatient facility. The inpatient facility is in close proximity and has a connection to the main access road for emergency ambulance entry.

Car parking for health vehicles, ambulances etc. as well as public parking for the hospital is incorporated in the town centre parking plan. The site, on the elevated ridge will enjoy good views and micro-climate including breezes.

Its proximity to the collector road offers excellent access, it will be convenient to residents and will not be subject to dust nuisance from future construction stages

Residential accommodation associated with the hospital and health facilities is provided adjacent to the hospital. This location will enable advantage to be taken of the town's community facilities and is close to the social and commercial hub of the town centre.

Expansion of the hospital, to almost double its planned size if necessary, is allowed for in the allocation of land areas. This expansion can take place without disruption to any access ways or car parking areas.

2.9 TOWN TIP

A sanitary landfill tip site of an area of 10 hectares and 2.5 kilometres from the town is recommended. It is north east of the town and on the road to the sewage treatment works. It is located such that it is not visible from the town and is away from the direction of prevailing winds.

2.10 SEWAGE TREATMENT PLANT

This is located north of the Arnhem Highway and north east of the town. Refer Appendix A.

2.11 GOLF COURSE

A nine hole 2 500 metre golf course is planned on a 30 hectare site.

The site is on the south-west side of the town, south of the approach road and east of the Jim Jim Road.

The golf club house and sports club complex have been combined as a site which is on the same low ridge passing through the town centre. The site has the same locational advantages as the town centre due to its elevation and aspect.

2.12 FUNERAL FACILITIES

Having regard to the Arnhem Highway connection between Jabiru and Darwin and the relatively short travel time involved, it is not proposed to make provision for a cemetery. It is possible that a small crematorium and memorial area may eventuate and this could be accommodated in association with the mortician's premises in the service trades area.

2.13 COMMUNICATIONS

All land allocations have been made for Telecom including an elevated site for two way radio communication requirements for the police and other users, together with provision for other installations.

One such provision is for the Trunk Radio Relay Mast some 70 m high adjacent to the Exchange in the town centre. From an aesthetic viewpoint this facility would be better located in a less obtrusive position. However, there are significant financial constraints involved and any site relocation would be dependent on availability of funds. Given suitable design treatment compatible in scale to the surrounding structures, this tower could be tolerated in the position indicated.

2.14 THE LAKE

The lake referred to in the initial Feasibility Study and again in the Design Study - Stage 1 will remain in its planned position.

The maintenance of its water level and the requirements for make-up water are referred to in the above report.

2.15 EDUCATION

The site of the school, which is slightly more than ten hectares in area, is that opposite the town centre which gives good pedestrian access to the residential districts as well as the recreation area between these two districts.

3. Review of Policies

The items of policy and the management plan for the Kakadu National Park that relate to environmental aspects of the town design are summarised below.

3.1 PARK INFORMATION CENTRE

A small administration office consisting of visitor information centre, etc. will be required in the Town Centre office accommodation complex.

3.2 STAFF AND STAFF ACCOMMODATION

The Australian National Parks and Wildlife Service would like some Park staff to live in the town to avoid family/social problems. As yet they have no clear indication on the proportion of single staff to married staff, but they are interested in the mining companies figure of around 70% married.

3.3 ABORIGINAL STAFF

It is proposed that a significant proportion of the A.N.P.W.S. staff will be Aborigines and that this proportion will increase as the number of staff increases.

3.4 STAFF FROM JABIRU

It is expected that women from the town will be available for staff positions at the A.N.P.W.S. headquarters. The number should build up to 10 over the first 5 years.

3.5 ITINERANT ABORIGINES

There is a general desire to avoid the possibility that any sort of fringe settlement might occur near the town. However, because of the many unknowns in this new situation, the Northern Land Council could wish to see provision made for special living areas for Aborigines, should these become desirable.

Accordingly, two sites of approximately 7-8 ha have been identified for this purpose on the northern side of the town access road. One site has been nominated at a convenient distance from the hospital so as to facilitate visitations to relatives.

3.6 TRAINING PROGRAM FOR RESIDENTS

A.N.P.W.S. will conduct training courses to be run by a European training officer or a highly educated Aborigine. They expect an agreement to take such a course will be part of the conditions of employment for all mine workers and others in the town. It will probably include guided tours provided by the A.N.P.W.S.

3.7 TOWN BUFFER AREA

A.N.P.W.S. expect that the town buffer area will have an area of 69 km^2. They base this on a statement from the Survey Office, Canberra made on 9th March, 1978.

3.8 TOWN LEASE AREA

Within the general 69 sq. km "town buffer area", it is proposed to establish a "town lease area" defined by a boundary as indicated on the General Area Plan (Plan No.1) and identified by co-ordinates. This area encompasses sufficient land to the east and the north to contain trunk stormwater and sewerage reticulation, treatment works, effluent discharge reserve and refuse disposal area.

3.9 MAGELA CREEK

A.N.P.W.S. have a general policy of regarding Magela Creek as a controlled catchment for any pollution from mining and the town. Baroalba Creek catchment is to be protected to the maximum extent possible. Given that the Magela catchment is to be used, the locations for the treatment and disposal of sewage and the landfill sanitary dump have been nominated. These facilities will be placed at an acceptable distance and direction from the town.

3.10 DISPOSAL OF SEWAGE EFFLUENT

A.N.P.W.S. believe that land disposal (irrigation) of secondary treated sewage effluent can be effectively used in the town area during the dry season. Treated effluent should not be used as dry weather make-up water for the proposed lake in the town. To avoid the possibility of lake water eutrophication only town water would be used.

3.11 FIRE POLICY

The buffer zone will be subject to prescribed burning every year but in a mosiac pattern spread over at least the first half of the dry season. This will be done by Aboriginal rangers using the traditional (and quite elaborate) system of burning known to the Aborigines. This fire policy for the buffer zone will be integrated with the fire management plan for the adjoining areas of park.

3.12 VISITORS ACCOMMODATION IN JABIRU

The management plan for the park will propose visitor accommodation facilities in the town for town visitors. Use of these will be strictly by advance reservation, and for a limited period only.

3.13 ORNAMENTAL PLANTS

Plants for rehabilitation and/or beautification will be provided from a nursery established in the town. Species provided will be approved by the Director of National Parks and Wildlife and will so far as possible be restricted to local species. No plants will be brought into the area without the written permission of the Director which will only be granted if it can be shown that no threat is posed to the natural environment and that the introduction of other plants is justified.

3.14 WATER PIPELINE

For the location of the 40 km length of water pipeline from the bore fields near the South Alligator River, it is possible that an archaeologist will have to survey the pipeline route. This may be necessary to avoid sacred areas or artefact sites. An easement will be required over the route of the pipeline and the pipes will be laid underground.

3.15 LITTER TRAP-PITS

To prevent trash from being carried by stormwater drainage into Magela Creek, A.N.P.W.S. propose the use of trap-pits. They will be using these on any of their own "built-up" areas elsewhere in the Park.

3.16 DOMESTIC PETS

The A.N.P.W.S. propose that desexed dogs will be the only pets brought into or kept in the town. They will be registered and will be kept under control at all times. They will not be allowed outside the town unless they are being transported beyond the park boundaries and owners of dogs will be required to deposit a bond on bringing in a dog which will be refundable in full on the death or removal of the animal. Humane facilities will be provided for the destruction of unwanted dogs and a pound for dogs found wandering in the town area will be established in the industrial area.

3.17 FISH FOR TOWN LAKE

A.N.P.W.S. suggest that the town lake could be stocked with local species of fish.

3.18 SUMMARY

The Australian National Parks and Wildlife Service has accepted the Jabiru town as playing a most important role in their management plan for operating the Kakadu Park. The A.N.P.W.S. also accepts the functional operation of the town provided that any pollution and disturbance is confined to the Magela Creek system.

4. Environmental Criteria

4.1 TOWN SITE

An important general policy in the management plan for the Kakadu National Park is that any major areas of disturbance and sources of pollution should be confined within the catchment of Magela Creek to the maximum extent possible. The location of the town and ancillary services such as sewerage and road access meets this requirement.

Disturbance of the soil and vegetation should be kept to the minimum feasible and clearing should take place as close as practicable to the time when construction begins.

One important aspect of this policy is that any changes in design of the town, now or in the future, should not involve any activity that expands the town in a south-westerly direction towards the Baroalba Creek catchment.

4.2 BUFFER AREA

The southern edge of the town buffer area extends to the watershed divide between the Magela Creek system and the Nourlangie Creek system. Baroalba Creek is the tributary of Nourlangie Creek that lies closest to the town and this creek contains a number of rare species of animals. Consequently the outer edge of the Buffer Area where it adjoins the catchment of Baroalba Creek should be carefully controlled to avoid any deleterious effects to this catchment.

The majority of the Buffer Area should be managed for controlled burning as a part of a burning management plan for the adjoining areas of the National Park. It may be desirable for reasons of safety and aesthetics to manage the Buffer Area inside the Town Lease Area under different treatment from the rest of the buffer area. In terms of its function as a firebreak around the town, the boundary of this Buffer Area or Park Strip needs to be a minimum of 200 metres from any town development. Along the side of the town nearest Baroalba Creek this boundary should be set as the absolute outer limit for any activity by townspeople.

The use of trail-bikes or 4 W.D. vehicles in the Buffer Area should be forbidden.

4.3 RANGER STATION AND STAFF HOUSING

If the A.N.P.W.S. decides to have a ranger station near the town with some staff resident in the town, this should assist greatly in the problem of harmonizing the existence of the town with the operation of the National Park around it. It will also add some element of social mix to the population of the town. Such a mixing of park staff within the town would also assist in an acceptably mild form of continuing education over park use for the townspeople after they have completed the initial training course that will be required for all residents.

The type of residences required for park staff in the first year could be permanent dwellings together with some temporary dwellings for families and temporary units for single staff.

Over a five year period the permanent family accommodation units could increase with temporary family type accommodation gradually phasing out after the first two years. Similarly the number of permanent units for single staff would increase with the temporary units being phased out.

4.4 SEWERAGE

As recommended in the assessment supplied by the Department of Construction, Darwin (Appendix A) the sewerage treatment works should be of the activated sludge type with final chlorination. The works should be located north-east of the town and north-west of the Airstrip. Discharge of treated effluent should be to Magela Creek during the wet season after Magela Creek has begun to flow and through irrigation of park areas in the town during the dry season.

4.5 SOLID WASTES

A landfill dump will be needed at least for the early years. To minimise the spread of such activities this landfill dump should be located close to the sewerage works. Before dumping commences the topsoil should be removed and stored nearby for use in covering the dump. The dump should be operated on a basis of a first covering with 10 cm of fill at the end of each day of dumping. This procedure is the standard method for dealing with putrescible wastes in many Australian cities.

To give some idea of the area required for a landfill dump the average quantity of solid wastes produced may approach 2 kg per person per day. This includes the full range of normal wastes from food scraps to non-putrescible materials. In terms of volume, each household could produce an average of about 1 cubic metre per week.

Allowing for compaction of say 50% of the material dumped, each week 1 000 households would require a landfill area of 1/10th of 1 hectare filled to a depth of 0.5 metres. Thus in one year 1 000 households could require a landfill area of 0.5 hectares filled and compacted to a depth of 5 metres. These estimates do not allow for the depth of soil to cover each fill.

Consideration needs to be given to the provision of an alternative or supplementary system of disposal by means of an industrial incinerator of adequate capacity to handle daily waste. Factors relating to this facility will be dealt with in the final report.

There is a need to obtain a clear understanding as to whether or not a site for town refuse will be available in due course (say 3-5 years after mining commences) within the open-cut or overburden dumps of Ranger mine. If this is to become available it will greatly reduce the area needed for a landfill dump during the early years of the town's existence.

The site for the disposal of liquid wastes should be close to but not necessarily alongside, the main landfill dump. Any wastes of a toxic nature will be removed from the Park.

4.6 EROSION CONTROL

Careful attention to this matter will be needed from the first day of construction activity on the town site. The alternative will be severe gully erosion within and around the town site within 2 years. Appendix B sets out guidelines and a prescription for contractors which should be a part of all contract specifications involving disturbance of the soil surface. This prescription has been approved by the Officer in Charge, Soil Conservation, Darwin.

None of the native grasses are known to be suitable for use in such work. It should be noted that the introduced species to be used have been chosen with regard to the problem of possible escape from the town area. None of these species will flourish in the Alligator Rivers area in the absence of nitrogen fertiliser. Pangola grass does not set seed; the hybrid sorghum is bred in such a way that plants growing from its seed are of poor size and vigour. Bahia grass may persist for a short period on the fringes of waterholes but would be drowned by flood waters in the next wet season.

4.7 ARNHEM HIGHWAY

In addition to normal traffic on the Arnhem Highway it is expected that it will have to carry a large number of transport vehicles to supply ore processing facilities. To produce 1 000 tonnes of yellowcake up to 25 000 tonnes of reagent and fuel etc. could be required. This will involve a heavy concentration of road transports using the Arnhem Highway for the return trip to Darwin. For this and other traffic there may be the need to review the carrying capacity of the Arnhem Highway and examine means by which road safety can be optimised.

5. Town Centre and Industrial Estate

5.1 DESIGN OBJECTIVES

The town centre is the hub of the commercial, administrative, educational, cultural and social activity of the town and the region.

In this region, climate is difficult and shelter is always necessary and welcomed. This town, like many other towns with an origin in mining, needs to overcome the frequently held attitude that mining towns are temporary.

Careful attention has been given to the convenience of the users of the centre. Distances are short from the outermost carpark to the centre. Shopping and other activities within the centre may be carried out safe from motor vehicles. Government offices are grouped together for day-to-day convenience and to assist in the interchange of information and ideas between departments and between Government and public.

The centre is planned to serve both day and night so that it is useful and busy for as much of the day as possible. After the ordinary activities of the day, the centre and its carparking area can be used for recreational pursuits, drama and cinema, club meeting rooms, and the like.

The design aim has been to satisfy the following:-

1. The provision of shade from the sun and protection from the rain. The creation of a town centre fitting to the scale of the whole town on the outside, and to human scale on the inside.

2. To convey the drama that should be associated with the vitality of the hub of a town, and also cater for such routine things as economical stormwater drainage, electricity reticulation and air conditionin

3. The internal public areas particularly should not be so large as to destroy the sense of activity and life but not too small to make movement inconvenient.

4. The centre should within itself be sufficiently flexible in its fabric to be changed to meet changing needs.

5. Parts of the public spaces need to be able to be temporarily enclosed to enable, for example, a charge to be made for entry to a charity function.

6. The centre should be simple in expression on the outside and provide contrasts of colour, light, intricacy, form and texture internally.

7. The centre should open up views to the only significant scale physical feature of the landscape - Mt. Brockman and the adjoining escarpment.

It is expected that all shops and offices will be air-conditioned.

5.2 VEHICLE PARKING

Where permitted by other considerations, the areas between car parking bays are planted with shade trees in an attempt to reduce the extremely high temperatures that occur inside parked motor cars in tropical areas.

Special areas have been set aside for the parking of large trucks as, although these vehicles should be deterred from staying in the immediate vicinity of the town centre once the purpose of the visit is accomplished, it can be expected that it would be extremely difficult to police such a requirement.

5.3 TOWN SERVICE TRADES AREA

A Town Service Trade Area has been provided to the northern side of the town centre to provide for petrol filling station, hardware supplies, appliance repair workshops, motor showrooms, used car and caravan yard, public utilities other than generating works, funeral premises and other service trades including light industrial activities not having a detrimental affect on the amenity of the locality and where goods are manufactured for sale on site or where goods, appliances and small machinery are serviced or repaired.

5.4 INDUSTRIAL LAND USE PROVISIONS

Land use requirements for industrial land have been provided and would accommodate works depot, municipal depot, general workshops, warehouses, bus depot, trucking station, fuel storage, builders yards, Telecom line depot, dog pound etc.

6. Housing and Accommodation

6.1 GENERAL

Some imaginative measures have previously been adopted to overcome environment difficulties which residents in the tropics must face but these have often been found to be costly. The solutions adopted often take the form of direct confrontations with the environment, such as whole-house refrigerated air conditioning with small concer shown for the consequent high costs of installation and running. Opportunities to exploit natural conditions are passed over in many cases. Reduction of heat loads through correct orientation, selection of roof colour, and mutual shading in building complexes have sometimes been ignored.

By comparing communities the most successful aspects of each type of development can be identified. It may not always be possible to incorporate these into proposed designs, but the mere recognition that they have been successful provides a firmer basis for the selection of alternatives where necessary. One obvious deficiency in some tropical towns is the absence of wide eaves on houses on the sides which are exposed to direct sunlight for long periods. This is particularly important during the dry season.

Other aspects to be considered are the means by which energy conservation can be maximised by the use of insulation, tinted glass windows and solar panels on the roof for water heating.

Generally, houses should all meet the higher of Northern Territory building standards with all houses being provided with some form of cooling. Other matters which will need to be considered include site planning for optimum aspect, the provision of covered space or breezeway outdoor living areas, house design to facilitate cross ventilation and whether to incorporate ceiling fans with partial air conditioning. This latter option can be successfully used by the installation of a relatively small air conditioning unit with short optional ducting to either the living or the sleeping area.

It is difficult to recognise and anticipate all the practical, social and psychological needs of a future population of a town which has yet to be built. This difficulty is often compounded by the fact that the needs of the community form only part of a much wider scene which also involves the development and construction phase and in most cases decisions must be taken in accordance with a stringent time schedule.

It is reasonable to assume that a remote mining community should be organised along conventional lines when it is of such size and nature as to make it practical for the community to enjoy the same freedom of action and to assume the same responsibilities as those in more settled areas. This is not just a matter of size, as such things as the stability of a population and the relativity between single workers and family groups are also relevant

6.2 SINGLE FAMILY DWELLINGS

828 residential allotments are provided in the design which would include some sites for town houses or flats. At the initial stage for the development of the town and subject to the orderly provision of services, allotments could be made up of the part of the south-western residential section and the part of the north-eastern residential section. These two areas are complet sewerage design areas. It is important however, that construction within the residential section commence, as far as possible, on the south-eastern side and work towards the north-west to avoid dust nuisance.

Socially, it may be undesirable to raise any artificial barriers to the integration of the various categories of townspeople. For this reason, there could be an advantage in mingling government housing with company housing and mining housing with other mining housing rather than having separate estates by employer category. Similarly, it may not be advisable for residential areas to be allocated according to the employee's hierarchy in a particular company although some grouping, so that common interests can be shared by neighbours, appears to be advisable.

Deviation from house siting with the longitudinal axis east-west may be permitted where the micro-climate or some special circumstances warrants it. Too rigid an adherence to the east-west axis can result in monotony, but this will be alleviated to some extent by the fact that the streets have been designed to off-set houses, one against the other.

It is recommended that all of the 4 bedroom houses have 2 car accommodation and that 25% of the 3 bedroom houses have 2 car spaces, with the remainder having 1 car space. All town houses and flats should have car spaces at the rate of one per housing unit.

Those houses that are designed with accommodation for only one car should wherever possible be designed so that an additional garage or car-port may be added.

Town housing may prove to be acceptable in this town where many of the inhabitants are shift-workers and many work long hours and are not inclined to take an interest in gardening. Careful designs will be necessary to obviate problems of noise and privacy.

It is recommended that both the houses on the ground and high-set houses be erected in the proportions of about half each so as to provide the widest range of choice. The consultants have not found sufficient evidence to support the discontinued use of high-set houses. There is still strong preference by many people for this style of housing in a tropical climate.

Houses elevated on columns should have the ground floor areas paved so they may be used for play areas and family recreation. Houses constructed on the ground should have covered verandahs of similar size to the ground floor space of the elevated houses. All houses should be insect-screened.

It is recommended that air conditioning be installed in one room of the house, preferably the family room, and that ducting be incorporated so that the conditioning may be used in a bedroom in the evening. In this way air conditioning costs will be kept within a reasonable limit and provision made to escape the rigours of the most trying days. It is recommended that investigations be carried out to examine the feasibility of setting the conditioners to maintain about 24°C rather than the normal 20°C. This higher temperature may lessen thermal shock, still provide comfortable living conditions and be less of an inhibitor to outside social contact.

The extent of the air conditioning of houses that is desirable is not resolved. It has been argued that full air conditioning is a basic human commodity[1] and should be provided. In contrast with this it has been reported that full air conditioning encourages the women to stay indoors and this increases their isolation and their heat reaction when they do go out.[2,3]

It is recommended that all bedrooms except those air conditioned and all non-air conditioned living spaces be fitted with ceiling fans. Kitchens however should be fitted with exhaust fans. Where eastern-western walls are of masonry they should be completely shaded by trellises

1. Agius, J. Report on Workshop on Proposed Regional Centre for the Alligator Rivers Region of the Northern Territory, June 1973, Cities Commission, Appendix F p.6.
2. Pilbara Study Group (1974). The Pilbara Study. Australian Government Publishing Service, Canberra App. 9-1 p.5.
3. White. E. (1973). "Women in the Pilbara". The Good Neighbour Council of W.A. Perth.

or screening, as the heat absorbed by these walls during the day is re-radiated in the evenings into the building. Such protection is not necessary in timber walls as they have low heat storage capacity.

6.3 TOWN HOUSING AND HOSTEL

Separate areas have been set aside for single accommodation and a proportion of town housing sufficient to provide for the needs of the community to an advanced stage of the town's development.

Because of the greater movement of people and vehicles in and out of flats and hostel, they should be located on the perimeter collector roads.

Vehicle garaging in town houses, flats and hostel should be in separate buildings so that noise and headlights from motor cars do not disturb tenants, and these garage buildings should be connected to the main building by covered ways. Where the garages (or carports) are located in positions where the play of headlights on the accommodation buildings is unavoidable, screening should be provided.

The maximum density of flat buildings should be about 1 housing unit to 300 sq.m and sites should be selected accordingly.

In the smaller town houses, vehicle garaging at a rate of 1 vehicle per house should be provided adjoining the house and accessible from the house under cover. There should be a clear division between parts of the site that clearly 'belong' to a particular unit. Each house should be entirely self-contained and masonry walls are recommended between in the interests of privacy. The walls should be extended into the yards and the overhangs of the roof made greater than usual in an attempt to prevent noise passing from one unit to another. Town houses should be placed on allotments having a size not less than 400 sq m per house.

6.4 CONSTRUCTION VILLAGE

From the first stage of the Town development, temporary accommodation will be required, primarily for mines construction workers and town construction workers.

Mines construction workers should be housed by their employers at or near the site of the mines and away from the town. Contracts with mines construction companies should include the requirement that all temporary accommodation for construction workforce be removed on completion of contract.

Erection of temporary accommodation without adequate control could lead to unsatisfactory residential conditions and to avoid this we make the following recommendations.

1. Mines construction workers should be housed at the mines away from the town.

2. Town construction workers should be housed in a construction village in a special section provided which is gradually made over to permanent use as a future residential area.

3. Mines operational staff and government employees should be housed from the very start in permanent residences.

Experience in other parts of the Northern Territory suggests that building construction workers will be housed partly in truly mobile caravans and partly in mobile homes without wheels. As the caravans and mobile homes of the construction workers are used as semi-permanent dwellings, they are usually of large size. On this account, the majority of the total caravan sites should be sufficiently large to accommodate units up to 12.2 (40 ft) long and have sites of 97.6 sq.m (12.2 x 8 m). Standard sites recommended to be 73.6 sq.m (9.2 m x 8 m).

Amenities blocks should be provided on the basis of one block to ten caravan sites. Amenities blocks should contain showers, toilets, laundry facilities including ironing facilities.

Each site should have its own connection to sewerage (for household wastes), electricity and town water. Electricity mains should be sized to cater for the demand created by air conditioners in all caravans.

7. Road Design and Pedestrian Mobility

7.1 TRAFFIC MOVEMENT

Except for extremely short journeys, there would, because of the hot sun, be little inclination to walk. Motor vehicles will be the primary means of making both long and short journeys about the town - journeys to work and recreation, shopping trips, and carriage of goods.

While acknowledging this climatic influence on pedestrian movement, path systems have been included in the design of the town for shorter journeys (particularly for children) e.g. walk to school and shops. These paths will be suitable for bicycle riders, and shelters should be provided in the larger areas to give refuge from the sun and rain.

We continue to recommend that where possible, buses should transport miners to and from work. This would reduce traffic volumes, road maintenance and the potential number of road accidents. It also leaves cars available to housewives for shopping and reduces need for shopping bus services.

If bus transport to and from work is not provided the road network will need to cater for a high proportion of external job-trips in the initial stages of town growth It will be capable of development to handle a growing proportion of internal job-trips as numbers of private and government workers increase. Within the pattern formed by the regional trunk roads, the transportation network concept is a hierarchy of roads serving specific functions.

7.2 THE MAIN CONNECTOR ROAD

The main connector road is intended to swing off the Arnhem Highway to the west and provide an approach to the town for vehicles travelling from the direction of Darwin. The alignment of this road to the west is yet to be established and will be subject to survey and engineering investigation. The road continues through the town to connect the Arnhem Highway north of the town and will provide the principal access for industrial, transport and mining traffic.

It is recommended that this road be located within a 30 metre road reserve, which will provide for future upgrading of the road to four lanes.

The alignments of this road should provide for vehicle speeds in excess of 100 kph but we recommend that speeds be limited to 75 kph.

The connector road should be designated as a limited access road, as all access to building and other sites is intended to be afforded from secondary roads.

This road is located on the leeward side of the urban area to minimise any fallout of dust created from traffic on unsealed shoulders of the pavement. Parking should be prohibited.

A buffer zone of minimum width 50 m is proposed along each side of the reservation to reduce the effects of the traffic (dust and noise) using this road and to provide screening of adjoining uses from motorists.

7.3 RESIDENTIAL COLLECTOR ROADS

The principle recommended in the Stage 1 Design Study for the creation of discrete residential areas, bounded by, but not traversed by collector roads, has been incorporated in the detailed design.

The collector roads are the second order roads performing a traffic collector function and will form the link between the local roads internal to the residential areas and the connector road.

These roads are recommended to have sealed carriageways in 25 m reservations, and have curves of not less than 180 m. It is intended that these roads be limited to 60 kph speeds. All intersections have been designed as 3 way junctions at right angles.

Collector roads will also provide access to some individual sites and to school, town centre areas and sporting facilities.

7.4 OTHER COLLECTOR ROADS

Roads to town centre and in the industrial area will be of similar standards of design to the residential collector roads.

Kerb parking should be prohibited in these areas, and conveniently located off-street parking provisions have been incorporated to cater for vehicles parked in connection with the functions of the central areas, including the community facilities.

The main collector road serving the town centre has been designed so as not to introduce any conflict with pedestrian movement in the residential section of the town, particularly with regard to the revised school location.

The roads of the industrial area have single access only to the main town connector road. The vehicular separation of the industrial area and the town centre from the remainder of the town should make the movement of vehicle traffic through residential road systems totally unnecessary.

7.5 LOCAL ROADS

A system of short loop roads and culs-de-sac has been designed to provide access to sites within the residential areas. All these roads are recommended to have sealed pavements.

Loop roads have reservations of 20 m and culs-de-sac of 16.5 m. These roads should be speed-controlled to 45 kph to minimise danger and disturbance to the residential areas.

The road pattern provides for subdivisional design which permits the majority of buildings to be sited facing north/south.

7.6 INTERSECTION DESIGN

The junctions between the main connector road and collector roads will be the major intersections in the road network, and are designed as 90° 3 way junctions

The junction between the main connector road with the Jim Jim Road and the Arnhem Highway, to the north, are also three way junctions.

Other points of access to the main connector road, e.g. from the drive-in theatre and the industrial area, are three way junctions. These points of intersection are away from the two main junctions to ensure smooth and safe traffic operation.

Traffic volumes will not be high. The greatest generator, the drive-in theatre, is positioned to give access to the residential area via both residential access roads.

7.7 TRAVEL PATTERNS

The detail design of the town road pattern is aimed at providing a separation between the heavy vehicles (trucks, buses etc.), serving the town centre, and industrial estates, and the local private traffic.

Industrial and warehousing uses which will generate heavy-vehicle traffic are located in the industrial estate, positioned between the Arnhem Highway and the town centre. The industrial roads have single access only to the main connector road. Provision for the parking of a number of articulated vehicles has been included near the town centre.

The location of the town centre offers direct access from the main connector road for heavy vehicles arriving or departing from the town. The town centre precinct is located about 1.5 km from the alignment of the Arnhem Highway.

The superior standards of alignment and direct routing of the main connector road and the collectors around the town centre are intended to provide more suitable and convenient routes for heavy vehicles. The residential areas will provide no through road routes which could attract 'short-cut' or 'by-pass' traffic.

The road pattern in the residential area is designed to provide safe, convenient and direct access to the town centre and main connector road through the hierarchy of road types previously described. The collector roads and loop roads provide access between and within the residential areas respectively.

Movement from the residential areas to the town centre is fairly direct along obvious routes with no extraneous traffic directed to the residential areas.

The residential areas are linked beside the school while the school is convenient to the students residences.

By providing bus transport to work for the mines workforce, two benefits would result : a minimisation of journey-to-work traffic generated by this group, and an increased proportion of families with the use of a motor vehicle for recreation, social activities and shopping during working hours.

7.8 PEDESTRIAN MOVEMENT

A system of linear open spaces has been incorporated in the detail design of the town to provide the alternative travel systems for pedestrians and cyclists.

Pathways incorporated in these open space corridors will have gentle grades, and in many areas follow the site contours.

The minimum width of the corridors is 5 metres, sufficient to provide access for maintenance vehicles. The open space areas vary irregularly in width to provide opportunities to create interest by landscaping, variation in view and vista, and to provide local play space for young children. Larger areas should have shelters for shade and rest during play and walking.

Because of the highly erodible nature of the soil, it will be necessary to provide sealed pathways to eliminate erosion. These paths should be of width to permit cyclist and pedestrian traffic.

The pathway system is oriented towards the school site, to provide both children and adults a pleasant and more sociable journey to the community facilities and activities Connections provide access to the school site and major public open space areas to improve the safety of the system especially for unaccompanied children.

Other major pathways are envisaged linking the town centre to the lakeside recreation areas.

Pedestrian movement within the town centre will be entirely traffic-free. While the car parking adjacent to the main buildings is intended for use by the other community facilities in the centre, these uses are set within the town garden area and are free from through traffic or parking vehicles.

8. Social and Recreation Facilities

8.1 GENERAL

Activities within the town will fall into three basic groups:-

1. the housing areas
2. service activities (e.g. shopping, school, hospital, etc.)
3. recreational facilities.

In a town of this size, the formal service and recreational facilities can and should be located together in the town centre. It is essential that the town centre be the principal focus of town life and it should offer as diverse a range of attractions as possible. Individually, shops or a club or a hall will have little impact; grouped, they will provide a range of opportunity and a diversity of activity creating a sense of liveliness and variety that will bring about an identification with the town centre.

Identification with the town through its centre will bring about a sense of pride and eventually a stability of work-force which will be of considerable value. The success of the town as seen by the residents and outsiders will be measured by the ability to establish a vital core and it is for this reason that all major non-residential activities should be concentrated in this area.

Recreational requirements can be divided into three main groups:-

1. active sports areas
2. parks for restful enjoyment
3. natural areas away from the town.

The requirements of group 1 would be met by planning adequate facilities within the town lease area boundary. These will progressively take the form of a golf course, bowling greens, tennis courts, cricket ovals, etc.

The requirements of group 2 would again be met within the town lease area boundary in suitable locations and developing those sites to fulfil the purpose of quite enjoyment.

The requirements of group 3 will be met by areas away from the town site which may comprise specific and developed picnic areas properly established with appropriate facilities to encourage their controlled use.

Because of the isolation of the new town due to its geographical location, recreational facilities such as this are considered to be a most important element of the development. It is also considered most important that the haphazard use of the surrounding area to the town be prevented in order to eliminate the possibility of adversely affecting the environment. It is therefore suggested that a road pattern be constructed to link all chosen recreational areas and that a map and photo-mosaic showing these details be permanently displayed at the town centre.

While the location of sports and recreational facilities within the town should be carefully planned and provided, the development of some facilities could evolve through self interest and involvement of the residents themselves. The building of these facilities on a voluntary basis will go a long way to ensuring their success.

8.2 VISUAL AMENITY

The natural features of the site have been utilised to provide natural and man-made recreational areas. The prominence and beauty of the Mt. Brockman escarpment face has been opened to view - forming a link between the proposed national park and the town.

The visual impact of a lake water feature will enhance the vistas which open up from the elevated sections of the town. The lake in turn, will provide a facility for small boat sailing and, subject to purification methods, an additional opportunity for swimming.

8.3 FACILITIES

Care has been taken to create safe access to facilities, particularly those which will be utilised by children. The pedestrian/bicycle pathway network will help to discourage traffic congestion at points of activity and will allow a greater and safer degree of enjoyment by children and adults.

A wide range of recreational facilities has been provided to cater for the basic demands of the population of the new town. Recreational activities are such that they will complement the range of social, educational and health facilities which form an integral part of the infrastructu which is to be established.

8.4 ACTIVE RECREATION

The provision of active recreational facilities will emerge in the form of various sports. These could include indoor bowling, lawn bowls, night tennis, volley ball, chess squares in the town centre, hobbies building, swimming and wading pools, football, hockey, cricket, basketball and subsequently, a golf course. The latter could become an important facility which should be provided as early as possible, it is in a location away from the town so that players and others have a feeling of 'somewhere to go'.

8.5 PASSIVE RECREATION

The less active facilities for leisure will be utilised by both visitors and residents. The extent to which provision is made will make a significant impact on the image of the town.

The town park will be the main central amenity but this also will form part of an open space system extending into the residential areas and the peripheral open space.

The system of pedestrian movement is directed to all places of congregation besides providing direct accessible open space in the houses that follow its course. All circulation routes within this open space system should be carefully articulated and landscaped to provide the pedestrian with as much visual variety as is possible.

In the more expansive areas where the open space spines widen, provision should be made for fun-play sculpture for pre-teen children and playgrounds for early teenagers. In the larger recreational areas, future facilities can be provided for more formal activities within easy walking distance of all homes and intermediate or minor focal points of community social interaction.

9. Landscaping

9.1 GENERAL

The site is relatively flat and has a medium density of vegetation of which only a small portion could be regarded as ornamental. It has shallow and very erodible soil and a climate which alternates from a hot dry season to a prolonged wet season.

Because of these conditions, traditional landscape methods would only have a limited application. Plant selection must of necessity be restricted to local species which are known to be reliable in this situation.

Mr. Justice Fox states in the conclusions to Chapter 12 of the second report (ref. 3) "It will be necessary for the town to be one of high amenity". It is therefore desirable that the town be a green town i.e. a town where landscaped and planted public areas together with private property be provided with enough water in the dry season to maintain a generally green appearance.

9.2 WHITE ANT INFESTATION

Shade is an all important amenity in a tropical environment. Unfortunately few tree species which are native to the town area have any value as shade trees. Furthermore existing trees become riddled with white ants at an early age. If white ant infestation can be controlled some Northern Territory species of eucalypts and melalueca can be cultivated as attractive ornamental trees.

9.3 CLEARING

Clearing carried on within the town site should be carefully controlled and should not be subject to wholesale levelling and clearing as building work proceeds. The denudation of town sites prior to the commencement of building projects considerably increases the problem of controlling local dust and erosion, although the preservation of trees at considerable cost which must ultimately be removed to allow house construction should be avoided. Existing trees which are to be preserved should be located in places which make their retention sensible and should be marked and fully protected before earthworks commence.

Planning and developing a town under these circumstances is not a simple exercise but recognition of the need to provide the best possible environmental conditions from the outset of development will ultimately create a desirable level of domestic amenity and clearly show the result of careful and imaginative town and environmental planning.

9.4 BOUNDARIES

Permanent green-belt type boundaries should be defined around the town site at an early stage as well as ensuring that areas defined for future development are also fully protected.

As most of the low lying areas are subject to inundation during the wet seasons, the most appropriate method of defining boundaries would be with belts of dense planting in the valleys below the 20 metre contours. The dominant vegetation types in them are Pandanus and Broad-leafed Paperbark *(Melalueca quinquenervia)*. Both of these species can be readily propagated inexpensively and could then be closely planted to form a fairly impenetratable surround to the township, leaving an open stretch of valley to allow for water flow in the wet season.

9.5 THE TOWN

All enquiries indicate that in isolated towns in Australia there is a consistent desire 'for green towns'. The contrast of well kept public gardens and the all surrounding 'bush' appears to be a very significant factor in the lives of the inhabitants. On this basis, fairly high expenditures on open town spaces are justified.

Landscaping is an integral part of the planning and development of the urban areas. Landscape design should aim to isolate small sections of existing vegetation where it can be examined in detail. It has considerable interest and beauty but in the vastness of the surrounding country it is too monotonous to invite attention.

The major landscape elements should therefore comprise the approach roads, central town park, recreation complex, lake area, green-belt and the various treatments associated with the school, hospital, mobile village, and the industrial area.

As far as practicable all of the public open spaces should be linked so that a network of greenery permeates the township, thereby providing a pleasant means of access to all areas. To some extent, these pedestrian ways could also provide a recreational facility such as jogging or cycling.

Ideally, all parkland should have its own road frontage but where this is neither economical nor practical, the fullest advantage should be taken of access and view.

9.6 TOWN PARK

This park is centrally situated and associated with the town centre. It will need to be made as attractive as possible so that it may become a place of interest for the residents. Screening of the car park boundaries and shade trees as a lead in from the park would be a necessary feature. As well as being associated with the Shopping centre, the park could become the social focus for a variety of community interests such as open-air concerts, childrens play and public meetings. The setting of the ornamental portion could be gradually improved with sculpture, flower beds, paths and fountains.

Adequate car parking space is essential for each of these functions with well defined separation with shrub and tree plantings.

The local lawn grass *(Paspalum notatum)* should be planted and irrigated over the whole area of the park. The existing grades would be suitable as they slope to the adjoining road, thereby providing good runoff.

9.7 RECREATION AREA

The optimum Sportsground provision has been made for football and circket fields, hockey, basketball, tennis courts, and childrens play. Local preferences may well determine the allocation of space and the emphasis on particular activities. In line with current "Top End" practice, football is played the year round using the same field for Rugby League during the Dry Season and Australian Rules during the Wet. Cricket could be given a separate ground and provided with a "synthetic" wicket.

During the early stages of the town's growth, major spectator sport is unlikely to be significant and should not necessitate the provision of oval fencing.

There should however, be a provision for dressing sheds, toilets, seats, drinking fountains, litter-bins and adequate car parks. The latter should be designed in such a way that cars will not be able to drive over the playing fields.

9.8 GOLF COURSE

The site selected is on flat to very gently sloping wash slopes of not more than about 2% having gravelly sandy to loamy soils on laterite. The land carries the typical mixed-eucalypt woodland and mixed-scrub vegetation.

Under natural conditions of minimum disturbance the soils on the site have a low erosion potential mainly because of the protective ground cover vegetation.

Removal of ground cover by burning or grazing, disturbance of the surface by earthworks or excessive traffic can induce severe erosion of the bare soil by combined rain-drop impact and surface run off. This can be critical at the onset of the wet season before the growth flush of ground cover vegetation can stabilise an area disturbed during the dry season.

As it is normal practice to maintain a good ground cover on a golf course and prevent activities that would disturb the surface it is unlikely that erosion will ever be a problem once the course is established.

Soils on the proposed site are of the type that would improve with standard management practices and should respond particularly well if they were irrigated with treated sewage effluent. When established the ground cover and a policy of minimum surface disturbance should reduce erosion potential to an acceptable low level. Establishment of ground cover is discussed in Appendix B.

9.9 THE LAKE

An appropriate landscape for the lake area would be large scale undulating grassland with bold clumps of trees in dense groves and groups of Pandanus. The latter could be obtained by transplanting some of the existing palms which would otherwise be destroyed by inundation. These could be cut down to abt.1m and transplanted with a back hoe or similar machine.

Cars should be restricted, but provided with convenient access to Picnic and Bar-B-Q locations and childrens areas. Tree groupings would also need to be protected from vehicular traffic. Closely planted groves of trees will prevent shoreline travel.

9.10 SCHOOL GROUNDS

It is intended that the school site in its central location will provide a landscaped feature linked to the residential area by walking or cycling paths. Provision has been made for the usual play areas and sports fields, with the balance area landscaped in a manner which is not only agreeable in appearance but also provides an educational value in terms of botany and the fauna that is associated with the trees and shrubs indigenous to the area. Landscape appreciation and an acquaintance with ecology can thus be encouraged at this basic educational level.

9.11 INDUSTRIAL AREA

Generally, only a minimum of landscaping need be provided in this area but a dense wide buffer of natural planting should be provided between the industrial complex and the Town approach road.

Controls should be exercised over the development of industrial buildings to achieve a landscaped treatment for the frontages.

The incorporation of rest areas for mid-day out-door meals and a small recreation space for the younger or more active workers, would be a desirable feature within the area.

10. Future Community

10.1 THE TOWN

This town will have its origins in a construction work-force housed in temporary accommodation.

From these beginnings will grow a human settlement which will operate as a highly complex system comprising a whole range of technological and communications sub-systems

From this collectivity of people, occupying a common territory, sharing a common life and interacting within a local institutional complex[2] will emerge a community.[3]

The intention of the creators of the town must be to assist in the development of strategies for manipulation of the environment in such a way that the people will be happy to regard this resultant community as their "home town".[4]

Many studies have been or are being undertaken to assess the expectations and aspirations of the residents of these remote towns, the results of the available studies have been taken into account in the preparation of the revised design incorporated in this report.

The physical form is, however, only a potential environment since it simply provides possibilities or cures for social behaviour. The effective or total environment is the product of these physical patterns plus the behaviour of the people who will use them and that will vary according to their social background and their way of life : to what sociologists, in their technical language, call social structure and culture.[5] There will be strong forces of social division as have emerged in other centres. These then question the attaining of a "homogenity of living conditions" as a planning objective.

1. - Living Way Out, C.S.I.R.O., Division of Building Research 1972.
2. Martin J.I., "Suburbia, Community and Network" in Australian Society, a Sociological Introduction. Second Edition ed. Davis A.F. & Enid S. Cheshire 1970.
3. Bell, C. and Newby, H. Community Studies George Allen & Unwin, London (1971).
4. - Living Way out Op.Cit.
5. Brady M, Planning for People. Bedford Square Press, London 1969. p.21.

Marked differences in the quality of housing between company and non-company employees should be avoided. The result of differing standards is a social schism with resentment towards company personnel, the whole question of which is the cause of grave concern in other similar communities.

10.2 NEW RESIDENTS

This town is unique, in terms of remote settlements, in that it is or will be located within a National Park.

There is a requirement of limited or controlled access to the National Park, the proximity to Aboriginal sites, and limitation on vehicular movement in the wet season, and this information must be conveyed to new residents.

It is therefore recommended that a "Park Welcome" or other suitably named handbook be available for all residents. Additional information could include a town road directory, availability of health and other similar services, details of the types of Aboriginal sites and artefacts existing in the area and the need for their preservation. Finally, there could be included an updated list of community organisations, their meeting place and the names of people to contact.

10.3 RESIDENT PARTICIPATION

It is envisaged that this town will initially be run by some form of Town Management Board which will control the project through the developing years. This Board could find that it may benefit from liaison with some resident representation in the form of an advisory committee or committees, the representatives of which would include as wide a range of residents as possible. Advisory Committees have been used in the development of new towns, e.g. Hamersley Iron, and their usefulness has been recognised.[1]

In the new town, the problem arises of means of channelling community requests to either the respective companies or the Government. This can be done on an ad hoc basis or through the advisory committee as previously suggested In this regard, the committee would provide a readymade vehicle with the added advantage that it is neither wholly Government nor wholly one single company and has elected representatives of the community playing a significant role.

1. Stockbridge M.E., *et.al.*, Op. Cit p.206.

10.4 "AT-RISK" GROUPS

Certain groups within the community will be at higher than normal risk to develop psychiatric and physical ill-health. These groups have been identified and studied.[1]

There is need for planning the social life of children, teenagers, single adults and women.

The young (3 to 10 years) children need adventure playgrounds in preference to roaming the area.

The town centre should contain a social club or centre an a coffee shop while private housing requires outdoor living spaces.

10.5 ALLEVIATION OF PROBLEM AREAS

Perhaps the most difficult problem to be faced is the prevention of the development of dependency relations by fostering self-help and other forms of free enterprise independence.

The management group is usually the first contact a newcomer and his family has with the town. Consequently, its public relations function is highly important. But since it is also both a managing and to some extent a policing group, it faces the usual difficulties in being accepted, trusted, and relied upon as an objective helpful body.

The kinds of recommendations that emerge from studies of contacts between management and community are relatively simple and the development of independent groups should be encouraged as early as possible. This can be done through company officers being active in setting up sports and other clubs and then withdrawing gradually from office. More difficult is encouraging the townspeople to form community groups or to foster collaboration over community facilities instead of expecting management to provide.

---

1. Burvill P.W: "Health and the Environment in Isolated New Towns" Australian UNESCO Seminar 1973 Vol.1 p.27.

Every company or corporation has some kinds of policy with respect to human relations. Both experience and a change in climate of society have made it necessary for mining companies to go far beyond policies that treat an employee as if he were an "object". Their policies and involvement in setting up and running a new town have to take into account the existence of the subtle influences of a social structure - the community - and explicitly or implicitly have to make provision for "social health", for satisfaction with living rather than only with the conditions of work.

Given such broad humane policies, it follows that the job of establishing, running, and developing a town requires a good deal of knowledge of the sociological make-up and attitudes of the people who will be residents.

Bibliography

Alterman R. The intervention of values in the planning process, University of Manitoba, Department of City Planning 1970. (Unpublished thesis).

Anon. "A Better Life Up North" Ecos C.S.I.R.O. Environmental Research 2, Sept. 1974.

Anon (1972). Living Way Out. Report prepared by the C.S.I.R.O. Division of Building Research.

Brealey T.B., Living in Remote Communities in Tropical Australia Explanatory Study. Report T.B. 27-1 C.S.I.R.O. Division of Building Research, Victoria (1972).

Brealey T.B. & Newton P.W. "The Case for Centralisation" in Mining Review, July 1977.

Broady Maurice, Planning for People Bedford Square Press, London (1969).

Brodie-Hall L.C. & Oliver J.B., Kambalda Case Study Australian UNESCO Seminar "Man & Environment" (1973).

Cities Commission, Report on Workshop on Proposed Regional Centre for the Alligator Rivers Region of the Northern Territory June 1973.

Cameron, McNamara & Partners & Heathwood Willis & Partners. Alligator Rivers, Feasibility Study for a New Regional Centr Dept. of National Development, 1972.

Ellson I.G. Case Study - Shay Gap, Australian UNESCO Seminar "Man & Environment" (1973).

A.A. Heath & Partners & Willis Heathwood & Partners. Alligator Rivers N.T. Regional Town Project, Design Study - Stage 1. Cities Commission 1973.

Martin, J.I. "Suburbia, Community & Network" in Australian Socie a Sociological Introduction. Second edition ed. Daves A.F. & Enid S., Cheshire 1970.

Reading P.J.R., Kambalda Case Study - Part 1, Living in Kambalda Australian UNESCO Seminar "Man & Environment" 1973.

Stockbridge M.E., Gordon B., Nowicki R & Peterson N. Dominance of Giants - a Shire of Roebourne Study Department of Social Work, University of Western Australia 1976.

DEPARTMENT OF CONSTRUCTION, DARWIN N.T.

ALLIGATOR RIVER'S REGIONAL CENTRE

Sewage Treatment Plant Location

It is considered that the sewage treatment plant should be located at least 2 000 ft from the boundaries of the housing subdivisions and be also located in the NW-SE prevailing wind corridor such that these winds will clear the town. This would place the site to the NE of the town.

Choice of Plant

The choice of plant depends to some extent on the reuse of effluent.

The cheapest form of treatment has been, in the N.T., sewage lagoons. These give slight odour, high quality treatment and with a minimum detention period of 30 days a detention long enough to cover the life cycles of pathogenic bacteria and viruses. The plants are very economical to run.

The effluent however has a very large population of algae and may cause problems in reuse directly for agricultural use. As there is large evaporation from the lagoons the T.D.S. often appreciates considerably to make it too brackish for irrigation under tight soil conditions. Removal of the algae can be costly. If chlorination was insisted upon before reuse (as would be likely it would be necessary to remove the algae which can protect the bacteria from the action of the chlorine.

Another type of treatment which would be considered would be an activated sludge plant (or a form of it). This gives a high quality treatment and would be suitable for reuse with chlorination for irrigation. It would be clear enough to not cause any trouble in irrigation equipment and the T.D.S. would increase only by about 300 ppm over the original water. The health aspects would however rely very heavily on the efficiency of chlorination as the effluent without chlorination would have a high bacteria level.

Because there is some risk to public health due to the possibility of inefficient chlorination, this type of effluent should not be used where there is risk of infection of wounds e.g., sportsfields It should be suitable for tree and shrub irrigation, golf courses. and bowling greens. Additional treatment e.g. filtration effluent, would remove most of the dangers to public health.

Use of Effluent for Make-up Water to Lake

The two problems in using effluent as make-up water are public health risk and supply of nutrients.

As stated previously there would not be much public health risk if effluent were filtered and chlorinated.

The supply of nutrients would however, encourage algael and other plant growths in the lake. It is not possible to predict the extent of this algael and other growths. In this circumstance, I do not think it would affect the aesthetics but may make some areas difficult for water sports (sailing, canoeing) by the greater incidence of large plants.

Removal of nutrients is possible but costly and make-up from the water supply or separate bores should be much cheaper.

Disposal of Effluent

The situation of Jabiru is a common one in the Northern Territory i.e. disposal to water courses which are dry for part of the year. The practise is to evaporate the effluent during the dry and discharge effluent only during the wet. Sufficient land is available for this practice at Jabiru. An alternative method where land is partially available for evaporation is to hold the effluent for several weeks and discharge the whole of the holding area quickly. This intermittent discharge enables the effluent to dry up quickly in the water courses before there is a chance of mosquito breeding. Continuous discharge is to be avoided no matter how pure because of the mosquito breeding problem. Mosquito breeding in lagoons can be readily controlled.

Conclusions

1. Sewerage treatment should be located to NE of the town.

2. The treatment should be of the activated sludge type filtered and chlorinated and reused for irrigation (depending on economics also).

3. Sewage plant effluent should <u>not</u> be used for make-up water to the lake.

4. Evaporation basins should be installed to evaporate the effluent during the dry and discharge to Magela Creek only when there is sufficient run of river.

GUIDELINES AND PRESCRIPTION FOR GRASS ESTABLISHMENT IN AREAS DISTURBED BY ENGINEERING WORKS

1. INTRODUCTION

The objective is to obtain a complete cover of plant material as quickly as possible. This is achieved by planting, fertilizing, watering and mowing the area in a sequence which requires attention to timing and continued maintenance. The sequence passes through several phases with varying intensities of activity. Therefore the overall control of the activities should be planned to ensure the sequence can be maintained. It takes a minimum of 12 weeks to get a regrassed area to a state which can be considered self-maintaining.

There are two basic stages in the process. These are:

(a) A cover crop that gives substantial leafy cover to reduce raindrop impact and a first measure of root binding within 2 to 3 weeks of germinating. For this purpose an annual crop is used, for wet season planting.

(b) A perennial coarse grass with runners which can grow rapidly, spread under the cover crop and then take over the main function as cover and binding.

2. LIMITATIONS

Success in grassing will be moderated by the weather conditions. Extreme heat or excessive rain will obviously limit success. Therefore wet season plantings should incorporate a cover crop to provide a measure of protection to the soil surface as quickly as possible; that is the season will dictate the actual planting mix used. Alternatively the use of specialised "hydromulch" may reduce the risks of establishment failure, especially on particularly erosion prone areas such as steep batters.

These guidelines have been prepared for application to the Jabiru township area and should not be applied uncritically elsewhere.

It is recommended that the maximum area started in treatmen at any one time should be less than 0.5 hectare. This limitation relates particularly to the need to water the sown area to aid establishment and growth of the grasses. However, it is recommended that regrassing be initiated immediately engineering activities are completed in a

particular area, irrespective of the month of the year, to assist in minimising the dust nuisance problem.

All operations should be undertaken with normal agricultural or landscaping type machinery with the possible exception of topsoil stripping. The use of wheeled tractors will limit compaction of the newly spread soils and ensure more reliable distribution of seed, fertilizers and other chemicals by use of calibrated machinery.

It is recommended that at least the initial planting operations be planned and supervised by a Soil Conservation Officer of the N.T.P.S. Darwin.

3. TOPSOIL

As only dryland areas are to be disturbed by engineering work, topsoil may be stripped from the area to a depth of 10 cm. To ensure adequate supplies of topsoil for re-grassing operations, it is preferable to strip all of the area that is to be disturbed, excavated or covered with fill and not just the area to be excavated.

The pre-stripping clearing need not remove all vegetation, though it will assist later spreading of the soil if no roots, branches and the like in excess of 5 cm diameter and 10 cm length are present. Thus grasses and shrubs up to 2.0 m in height may be left in the topsoil at the operators option.

This topsoil should be stockpiled away from drainage lines and areas where it may be subject to wetting by groundwater The maximum time for storage of topsoil should be not more than 6 months.

Chemical testing of topsoil is not necessary since the types and quantities of fertilizer recommended will provide adequate nutrition for the grasses specified. It should be recognised that most soils in this area are of low fertility status (see Story, *et.al.*, 1976).

It is assumed that imported topsoil will not be available at Jabiru because it is surrounded by National Park. Most of the soils of the area are of adequate depth, though of low fertility status, and so there is little advantage to be gained in importing soil to a particular site.

4. SUBSOIL

Where the surface to be spread with topsoil has been compacted by the passage of construction equipment, the surface should be scarified to a depth of 10 cm before spreading the topsoil.

Installation of any buried utility service should preferably take place prior to the spreading of topsoil.

5. SOIL SPREADING

If a layer of topsoil is to be placed on the prepared surface of the areas to be grassed, this layer should be at least 10 cm thick and conform to the design profile of the area. The area topsoiled at any one time preferably should not exceed 0.5 hectare.

Due allowance should be made for some compaction of the spread topsoil as a result of later traffic in watering, planting, fertilizing and the like. In areas to be lain with turf, allowance should be made, in establishing the desired profile, for the 3 cm thickness of the turf-sod.

6. SEEDING

The seed mixture to be planted should vary with the seasons.

In the dry season of May to September (inclusive), the following should be sown at the stated rates:

Bahia grass *(Paspalum notatum)* at 10 kg/ha
Pangola grass *(Digitaria decumbens)* as vegetative sprigs.

In the wet season of October to April (inclusive), the following should be sown at the stated rates:

Dwarf Sorghum *(Sorghum vulgare)* (hybrid) at 4 kg/ha
Bahia grass *(Paspalum notatum)* at 10 kg/ha
Pangola grass *(Digitaria decumbens)* as vegetative sprigs.

"Certified" seed should be used to prevent unintentional introduction of weeds. Seed bags and labels should be retained for inspection. Seed should not be stored on site as it is most desirable to plant the seed as soon as it is delivered from the seed merchant.

Planting of the seed will vary with the type of implement available.

(a) Use of a fertilizer/seed drill with a separate box for grass seed.

The Bahia grass seed should be sown *on the surface*. The seed of the cover crop used in the wet season should be drilled in to a depth of 2.5 to 5 cm. The fertilizer should be drilled in to a depth of 2.5 to 5 cm. A fertilizer/seed drill with a separate box for grass seed would enable all of these things to be done in a single pass of the machine. A light covering harrow or chain should be attached to the back of the drill. If no grass seed box is available the fine seed should be broadcast by hand and this should be done after the fertilizer and cover crop are sown.

(b) Use of a tail mounted spinner for broadcasting.

Because of the different weight of the fertilizer, cover crop seed (if sown), and grass seeds they are thrown to different widths if put through a spinner together. This results in ribbons of land receiving no seed. Thus if a spinner is used it will be necessary to make several passes; one with the fertilizer, one with the cover seed in the wet season, and one with the Bahia grass seed. A light covering harrow or chain should be used after the final pass to cover the seed.

Immediately the seeding and fertilizing is completed the Pangola grass should be sprigged into the soil surface. This should be done carefully to ensure plant root material - soil contact and at centres such that no more than 15 cm of bare soil is between sprigs in any row with rows 0.6 metres apart. The rows should be along the contour i.e. across the slope. The sprigs should be planted out within 24 hours of being cut from nursery stock.

Planting on particularly erosion prone areas such as steep batters should be done in passes parallel to the contour, especially when using the seed drill. However, it may be desirable in some instances to turf such steep batters or apply the seed and fertilizer in "hydromulch".

The species selected for this protective planting have been chosen on the basis of known ability to mitigate erosion, adaptability to the Jabiru environment in managed condition but lack of persistence in unmanaged or in-the-wild conditions. For these reasons it is recommended that only these species be used and particularly that none of the species in the genus *Brachiaria* be used.

7. FERTILIZING

At sowing, a dressing of a mixed fertilizer of high analysi for nitrogen shall be applied. This should be a 10:5:5 analysis fertilizer or near equivalent in a standard commercial mixture such as Q11 or Fertica. It should be applied at a rate of 400 kg/ha.

Further dressings of the nitrogenous fertilizer Nitram should be applied at the rate of 100 kg/ha at 6 weeks, 10 weeks and 14 weeks after planting. In these instances the fertilizer should be broadcast before mowing of the grass. These maintenance fertilizer applications should b broadcast and watered into the soil.

Fertilizer bags and labels should be retained for inspectio Fertilizer should not be stored on site for more than 1 week.

Therefore the fertilizer programme is:

At sowing, mixed fertilizer (Q11)	400 kg/ha
At 6 weeks, nitrogen fertilizer (Nitram)	100 kg/ha
At 10 weeks, nitrogen fertilizer (Nitram)	100 kg/ha
At 14 weeks, nitrogen fertilizer (Nitram)	100 kg/ha

8. WATERING

Throughout this section the stated quantities of water applied should augment the natural rainfall of the precedin 48 hours (i.e. natural rainfall plus watering equals the amounts stated). In situations where the grassing of the works area does not have to lead to a lawn-like appearance, it may not be necessary to water the sown areas after the 10th week as stipulated in this programme.

The area to be sown should receive 25 mm of water, after the topsoil has been spread but within 48 hours before sowing of the grass seed and planting the sprigs.

Immediately after sowing, fertilizing and sprigging the area should again receive 25 mm of water.

In the following week the planted area should receive 25 mm every second day.

For the next 3 weeks the area planted should receive 25 mm on two occasions each week. For the next four weeks the area should receive 25 mm at least once a week.

It may be desirable to continue watering on an occasional basis such that if there is no rain for two weeks the established grass areas are watered. It will be necessary to water the area in the 14th week after planting to assist the infiltration of the fertilizer.

The watering can be done with any type of sprinkler. The quantity of water applied at each watering should be measured with the use of three or four rough rain gauges such as jam tins which are moved along with the sprinklers.

9. MOWING

The basic aim in the mowing programme is to encourage the sprawling growth of the grasses. This is done by progressively lowering the height of the cut. A normal tractor powered slasher will be adequate for the mowing operations until the grass cover is complete (probably at about 15 weeks) when a gang mower could be used. However, where a lawn appearance is not necessary in a particular situation, this programme of mowing may not be necessary after the third cut in the 12th week and this will lead to the dominance of the pangola grass.

There should be no mowing for 8 weeks after planting. The first cut should be at about 15 cm height above ground level.

The second cut should be during the 10th week at a height of 10 cm.

The third cut should be during the 12th week at a height of 10 cm.

All subsequent cuts should be at a height of 10 cm and no more frequently than once a week with the frequency governed by the growth and density of the grass cover.

All trash should be left where it falls at each time of cutting.

If lawn-like grass cover is required, the mowing height may be reduced but never to less than 5 cm above ground. The reduced mowing height will lead to the dominance of the Bahia grass.

10. TURFING

In particularly erosion prone areas such as steep batters it may be desirable to lay turf to obtain stability more quickly. Alternatively such areas could be "hydromulched" using the seed and fertilizer as specified for the normal plantings.

The area to be turfed should be watered within the 48 hours before the turf is laid so that it receives at least 25 mm.

Turfs of pangola grass should be cut such that they retain a root mass at least 2.5 cm thick. The area from which they are obtained should be weed-free and receive a watering of at least 25 mm within 24 hours before cutting.

The turf should be laid out within 24 hours of being cut. This time limitation and the preparatory work required may lead to the need to develop a turf-farm/nursery in the town area or at some nearby location to allow quick supply of turf and sprigs.

On slopes the line of the laying should parallel the contour of the slope.

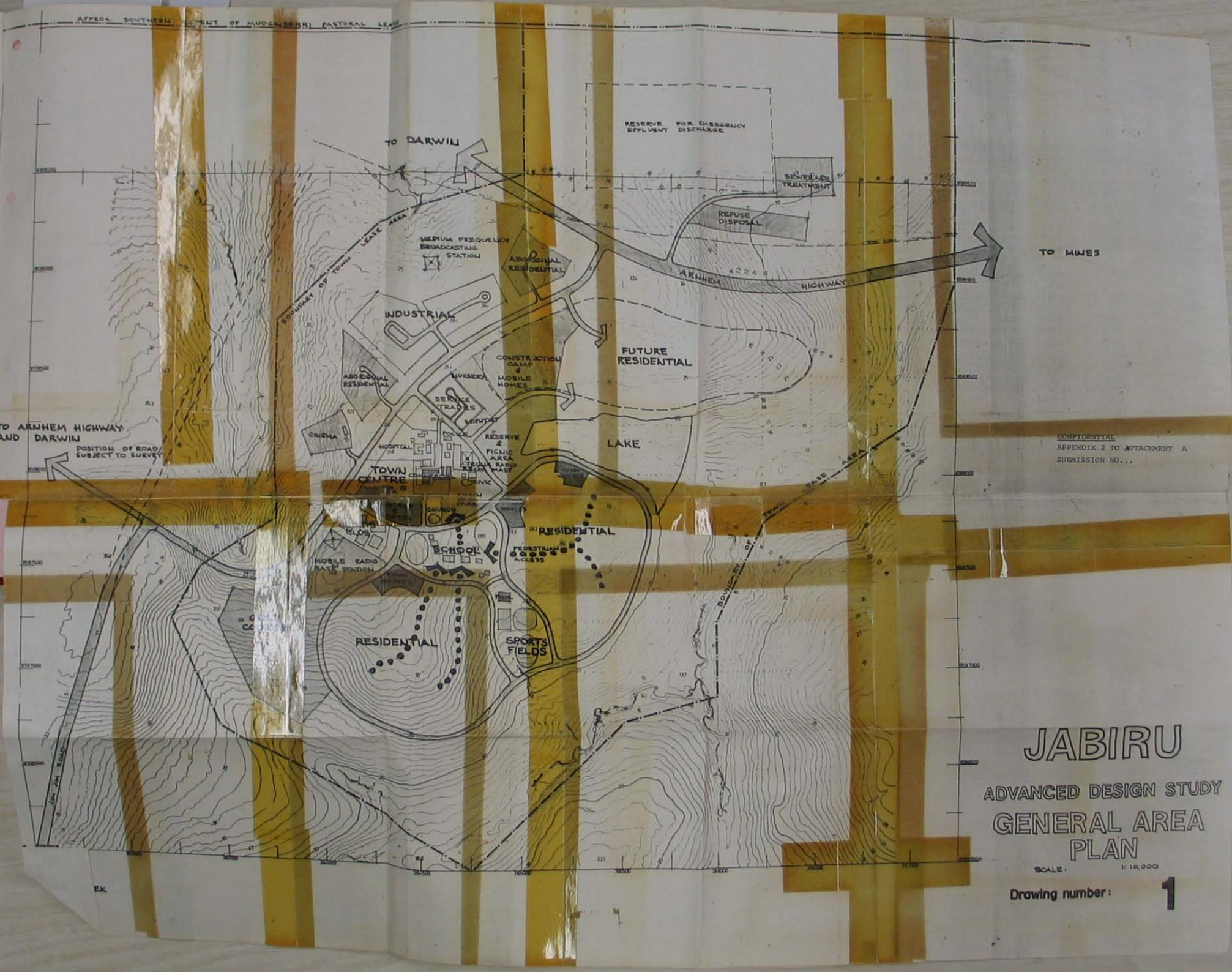
The newly laid turf should be watered immediately and be subject to the same watering programme as areas which are seed planted and sprigged.

The fertilizing programme used should also be the same as the seed planted areas, with the initial mixed fertilizer dressing being applied immediately after laying and prior to the first post-laying watering.

Mowing should not be attempted for 4 weeks and thereafter at a frequency not greater than once a week with that frequency governed by the growth of the grass. All mowing should be at a height of 10 cm, except where a lawn appearance is required which may be achieved with a cut height minimum of 5 cm.

SCHEDULE OF SITE AREAS

828 Residential allotments (av. 33 m x 24 m)	825 sq.
Police and court complex	1.5 ha
Hospital & Community Health	4.2 ha
Construction Village	12.0 ha
School facilities	12.6 ha
Supervising Scientist & Research	0.7 ha
Sports Club	4.0 ha
Golf Course (9 hole - 2 500 m)	30.0 ha
Radio Mast Stations - each	0.4 ha
Refuse Disposal Area	10.0 ha
Sewage Treatment Works	4.0 ha
Office Floor Area	2000 sq.m
Commercial Floor Area	4750 sq.m


APPROX SOUTHERN EXTENT OF MUDGINBERRI PASTORAL LEASE
RESERVE FOR EMERGENCY EFFLUENT DISCHARGE
TO DARWIN
SEWERAGE TREATMENT
REFUSE DISPOSAL
TO HWES
ARNHEM HIGHWAY
MEDIUM FREQUENCY BROADCASTING STATION
ABORIGINAL RESIDENTIAL
BOUNDARY OF TOWN LEASE AREA
INDUSTRIAL
FUTURE RESIDENTIAL
CONSTRUCTION CAMP & MOBILE HOMES
NURSERY
SERVICE TRADES
CENTRAL
CINEMA
HOSPITAL
POLICE
RESERVE & PICNIC AREA
TROPOSPHERIC RADIO BEAM MAST
LAKE
TOWN CENTRE
CIVIC
TOWN PARK
CHURCH
RESIDENTIAL
SCHOOL
PEDESTRIAN ACCESS
MOBILE RADIO BASE STATION
RESIDENTIAL
SPORTS FIELDS
TO ARNHEM HIGHWAY AND DARWIN
POSITION OF ROAD SUBJECT TO SURVEY
CONFIDENTIAL
APPENDIX 2 TO ATTACHMENT A
SUBMISSION NO...
JABIRU
ADVANCED DESIGN STUDY
GENERAL AREA PLAN
SCALE: 1:10,000
Drawing number: 1