

# **LUDMILLA CREEK CANALS OR CONSERVATION?**



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Today, Community Work students from Darwin Community College released a report on a survey carried out to assess opinions of both the residents adjacent to the proposed Redco Canal Scheme for Ludmilla Creek and the present users of Ludmilla Creek.

The survey revealed that local residents are already making considerable use of the Ludmilla Creek area and there was substantial awareness of the proposal to create canals in the creek area.

71% of people surveyed were opposed to the scheme and only 21% in favour with 8% undecided.

The student's conclusions are:

- There will be a considerable advantage in style of living for those citizens who can afford the price of a block fronting onto a canal.
- There will be employment created if the scheme goes ahead, but most, if not all, of this employment would be created wherever the housing was built.
- The canal scheme will require considerable public money to be spent just to allow it to go ahead, e.g. the resiting of the sewerage works, traffic solutions, health and educational facilities.
- There will be a high public expenditure needed to maintain this development, upkeep of lock, bund walls, public space, dredging channel, monitoring the cleanliness of the lake, etc.
- There is going to be a considerable loss to the poorest citizens living in the area, in particular they will lose a major part of the fish, crab and prawn areas and they will lose an important hunting and bushwalking area.
- The proposed scheme could exacerbate any storm surge problems.
- There could be health and ecological difficulties created by the scheme.
- The scheme will cause increased social problems in the adjacent areas, noise, traffic, competition for health and educational services.

For further information or copies of the report contact John Tomlinson on 816671 or 844277.

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Supplementary Reports:	Sewerage
	Storm Surge
	Schools and creches
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	Questionnaires

Students in the 4th semester of the Associate Diploma of Community Work at Darwin Community College recently surveyed the residents whose land adjoins the proposed Redco Canal Scheme for Ludmilla Creek. They also interviewed a sample of users of the Creek and the residents of Kulaluk and Bagot Communities. The attached data plus initial analysis is being released at this time because the issue has become one of public concern and the Developer has asked for these initial reports. In order to place the study of the proposed scheme into context preliminary studies of the social and environmental impact are also supplied.

The reasons the Redco scheme was selected for study was that it was a major development project, estimated to cost \$30 million, it could provide an additional housing and recreational asset, or it could result in considerable environmental damage, it could cause major social difficulties, and it was yet another proposed development affecting land owned by Aborigines.

The number of completed questionnaires is as follows:

Bagot	25
Kulaluk	23
Fishermen	36
Ludmilla/Fannie Bay	
Residents	71
<hr/>	
Total number of completed questionnaires	155

In order to get a thorough appreciation of the issues the class has spoken with the developer, politicians, environmentalists, a city councillor, has visited the sewerage works, toured the creek, and discussed issues with public servants and council employees who have expertise in the matters under investigation.

Everyone at Kulaluk, 84% of the Bagot sample, and 70% of other respondents had been to Ludmilla Creek. This figure rose to 96% for Bagot and 72% for other residents when respondents were asked if other people in their house used the creek. 44% of Bagot people, 25% of the Kulaluk sample, 70% of other residents, and 58% of the people who used the creek had been there at least once in the previous month. This shows a tremendously high usage rate particularly when it is considered that the peak use of the creek is during the prawn season which has not commenced yet. This high usage rate is confirmed by Question 2(c). The most frequently stated reason for using Ludmilla Creek was to catch fish, crabs, then prawns and swimming. 40% of respondents have been using the Creek for more than 5 years.

#### Knowledge of scheme

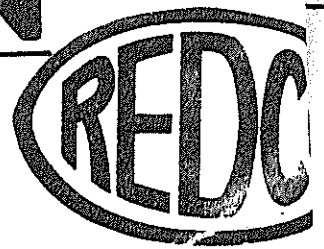
92% of Kulaluk respondents, 64% of Bagot and 68% of the other residents sampled knew something about the proposed scheme, only 43% of the user respondents had heard about the scheme. This indicates a very high awareness rate amongst the people who live near by.

#### Land Values

76% of other residents and 96% of Kulaluk residents thought that the canal development would raise the value of their block. This obviously was not regarded by many residents as necessarily a good thing; those paying rent were concerned that added value would raise rents and house owners were concerned about increased rate charges being levied because of the increase in value.

# **EAST-HAVEN**

(Fannie Bay / Ludmilla)



## **residential & recreational development proposal**







Prepared by -

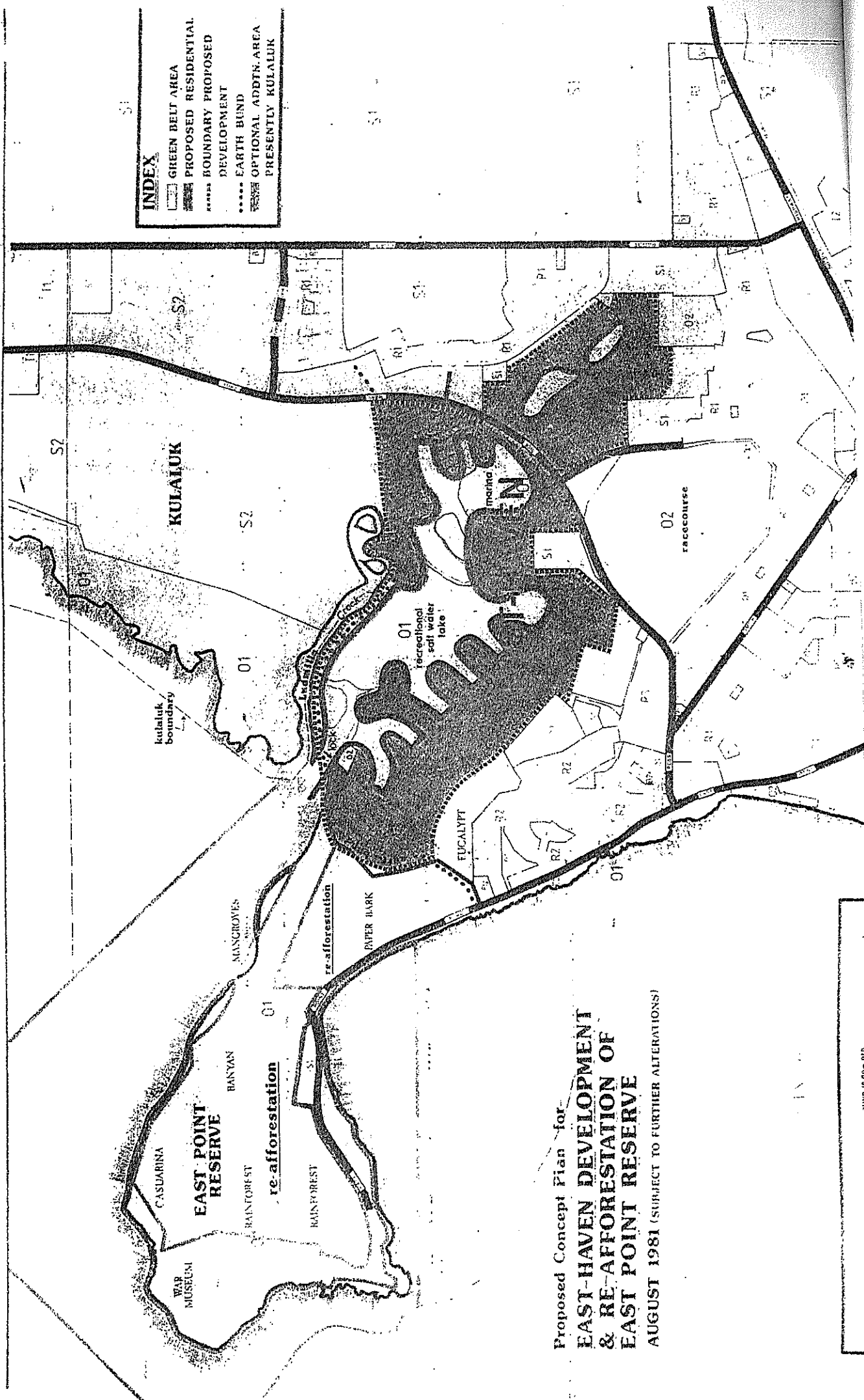
Real Estate Development Corp. Pty.  
20th August, 1981.

### **Development Benefits**

- A huge deep salt water lake providing a relatively safe environment for childrens aquatic sports plus boat storage and launching facilities, public beaches, parklands and recreational amenities.
- A major new residential suburb of a style and appeal unsurpassed in urban Darwin - close to the sea and to the inner city area with its existing employment and recreational facilities.
- Re-afforestation of the East Point peninsula with Rain-forest, Banyon, Casuarina, Paper Bark and Eucalypt forests - in accordance with the East Point Reserve Trustees recently completed management plan.
- \* Re-development of a badly degenerated, polluted inner city area into an attractive suburb with extensive recreational facilities.
- \* Elimination of present Sewerage Treatment Plant odours and major pollution problems.
- \* Employment during development stage and construction of homes. Possibility of long term employment for Kulaluk community on parkland maintenance and manufacture of adobe bricks.
- \* Tourist attraction of lake and ancillary facilities.
- \* Aquatic sports facilities, fishing and safe anchorage for smaller boats.

# INDEX

-  GREEN BELT AREA
-  PROPOSED RESIDENTIAL DEVELOPMENT
-  BOUNDARY PROPOSED DEVELOPMENT
-  EARTH BUND
-  OPTIONAL ADDTN. AREA
-  PRESENTLY KULALUK



Proposed Concept Plan for  
**EAST-HAVEN DEVELOPMENT  
 & RE-AFFORESTATION OF  
 EAST POINT RESERVE**  
 AUGUST 1981 (SUBJECT TO FURTHER ALTERATIONS)

Should the scheme proceed?

Bagot residents were 88% opposed and 4% in favour of the development. Kulaluk people were also 88% opposed but 12% were in favour. 22% of users were in favour and 65% opposed.

Other residents were 30% in favour and 62% opposed.

This provides an overall opposition to the scheme of people likely to be directly affected of 71% with 21% in favour and only 8% undecided.

Environmental Impact

Because these questions have been asked in an open ended manner they are going to require further analysis. At this point all that can be provided is a list of the perceived changes.

Kulaluk people

Will not be able to go hunting.  
It will stop fishing.

Bagot people

Won't be able to get fish.  
Stop people going to creek.  
Break everything up.  
Destroy beauty of flowers and trees.  
Make hunting difficult or stop it.  
Not be able to get salt water food.  
Not be able to get some bush medicines.  
Change country.  
Remove the animals.  
Block up creek.

Other residents

Lose mangroves, spoil natural bush.  
Small animals will be lost, cut down wild life.  
Clutter area and take away disaster barrier against storm surge.  
Spoil fishing.  
Mess up ecology.  
Spoil view.  
More noise.  
Increased traffic.  
Spoil walks in natural bush area.  
Take crabs away.  
Interfere with bike riding (children).  
Positive environmental impact - other residents only.  
Upgrade the area, progress.  
Provide protection against tidal surge.  
Reafforestation will allow more animals.

Users

Wreck whole area. Endanger people because of storm surge.  
 Mangroves, crabs, fish, birds will all be lost.  
 Hunting lost.  
 Lose green belt and coastline.  
 Destroy view.  
 Pollution and rubbish from boats in canals.  
 Affect sea bed.  
 Kill the swamp.  
 May release chemicals from old dumps in area.  
 More of a rubbish problem.  
 Put pressure on other areas.

Social ImpactKulalukPositive

Money to help Kulaluk people.  
 Be able to assimilate with Whites.

Negative

Good for Whites bad for Aborigines.  
 May have to move.  
 Change relationships.  
 Don't think races will mix.  
 Too many houses.

Bagot

New parks OK if people can go in.

Stop people going to the creek.  
 Remove kids enjoyment.  
 Remove feelings.  
 People without cars won't be able  
 to go fishing and hunting.  
 Break everything up.  
 Affect old people.  
 Another area marred by White man.  
 Too many buildings.  
 Change life style.  
 Everything different all go White way.

Other Residents

Upgrade locality - progress.  
 Get rid of drunken vagabonds.  
 Will create work.  
 More housing would be available.  
 Clean up area.  
 More places for outings.  
 Bring money into the community.

Make area more crowded.  
 Increased traffic.  
 More noise.  
 Stop childrens enjoyment.  
 Extra pressure on surrounding.  
 Schools, housing and shopping centres.  
 Will move out.  
 Decreased privacy.  
 Cuts out low income people.  
 Have to buy crabs, fish.  
 Restrict public use of area.



UsersPositiveNegative

Population pressure.  
 Increased pollution.  
 People won't be able to hunt, fish and crab.  
 Aboriginal land will be lost.  
 Too much traffic.  
 No place close for people who can't afford petrol to drive to other places.  
 Present creek easy to get to other creeks are a considerable distance requiring motorised transport.

Users of the Creek

22%			came from the Northern Suburbs.
11%	"	"	Nightcliff/Rapid Creek
16%	"	"	Town or Stuart Park
35%	"	"	Ludmilla, Parap, Fannie Bay

Advantages

The increased supply of houses sufficient to accommodate 2,500 people would create employment - but they would create that employment wherever they were built. It may be with the need for schools, health centres and other social services which will be required in the new Palmerston township that it would be more rational to site the houses in that area rather than crowd them into the Ludmilla area.

Much has been made of the advantages of having a canal development - it would certainly provide a different way of life for the rich but it will do little for the average working man and woman who will be unable to afford the price of a block.

It has been suggested by some people that the mangroves should be done away with to control mosquitoes. Eddy Hegel, Director of the Australian Littoral Society, argues that mosquitoes don't breed in mangroves and we might be wiser trying to regenerate mangrove growth as a method of mosquito control. He has also commented that sandfly breeding areas are often increased whenever there is a canal development.

The Dredged Channel

The development includes a dredged channel from the lock to the open sea which will allow all tide access to the estate. No matter how this channel is constructed it will necessitate regular dredging to keep it negotiable and this will also be a public cost.

Increased Height of Water

At present the creek dries almost completely leaving a few holes of little more than a metre deep. The developer proposes to maintain the canal at a height of mean high tide. This is as well as deepening the canal lake to an average depth of 5 metres.

We fear that the presence of such a substantial body of water constantly

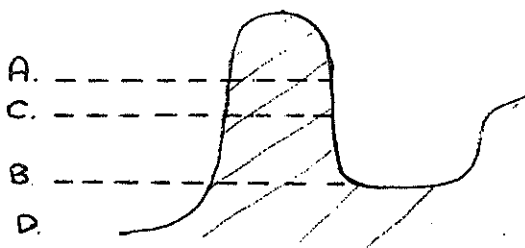
retained in the canal lake could drastically affect the surrounding water table.

If maximum high tide is A

and Minimum low tide is B

Mean high tide is C

extra excavation height is D



It can be seen that at the moment with the existing undisturbed creek bottom that the maximum pressure exerted on the creek bottom is the weight of the water between A and B and that exists only for a few hours each day at the top of the springs the average maximum pressure on the bottom of the creek is the weight of the water between B and C, again that is only reached for a few hours each day.

In the canal lake the constant pressure on the excavated bottom will be the weight of water between C and D and the maximum pressure is that between A and D which will exist for a few hours each only at the spring tides.

The problem which we see with this increased water is that at a minimum it will affect the water table in the immediate area. There is considerable existing effects on the water table during spring tides in the area as witnessed by the fact it was the combination of the wet and the underground water flow generated by the spring tides which finally extinguished the fires in the Ludmilla dump some years ago.

Any interference with the existing creek bottom will increase this flow problem. At a minimum it could just destroy much of the surrounding vegetation at Kulaluk and in the houses at Ludmilla and Fannie Bay. What is of even more concern is that the several old dump sights in the adjacent area containing unrecorded chemicals could be flooded by the altered water table. This would release such chemicals and could cause a severe health problem.

#### Sewerage

At present considerable quantities of raw sewage treated only with lime are released into the Creek system. There is also the East Point Sewerage outflow through which considerable quantities of similar materials flow. As is pointed out in the section dealing with mangroves, mangroves act as a filter and retainer of harmful chemicals released into the water systems. If these mangroves are destroyed, as they would be in the canal area then not only is this filtering effect lost but the storehouse of chemicals they now hold will be opened and these chemicals will be recirculated through the canal and creek system. A lot of the problems with the Fannie Bay Treatment works could be solved if the government spent \$5,000 on an incinerator fan and \$3,000 on a flow monitor. At present it is using three times as much lime as is necessary because these have not been purchased - this situation has existed for over 12 months.

If this canal proposal is to go ahead then the Treatment Plant will need to be converted to a pumping station at considerable public expense. It will mean then that either the sewage will be released into the sea or it will be pumped to Leanyer at considerable expense where new facilities will have to be built. In any case it would put increased pollution pressure

on the Leanger swamp and Buffalo Creek system which will be one of the places most likely to be used for fishing, crabbing and prawning by the people who now use Ludmilla Creek. There was recently a major fish kill in Buffalo Creek due to the buildup of naturally occurring contaminants (algie). Such "flowering" of algie are made more frequent in tropical areas whenever there are increased levels of discharge of waste products.

There is no doubt that the Treatment Plant at Fannie Bay should be brought up to its design standard immediately, whatever decisions are made about its ultimate future. There has been too much internal fighting in the Department and too little action to improve the efficiency of the plant.

### Public Space

Current designs for the scheme being circulated in the area adjacent to the development show considerable areas of public space in the estate. The public space will be upkept at public expense - \$6,000 a hectare per year is the cost for gardens and high grade parks, \$3,000 for ovals and such like. The cost of keeping bund walls grassed and mowed would possibly be a bit cheaper than that. The Developer is currently negotiating with some city council people to decrease the amount of public space to cut down costs but that will mean less public access.

### Bund Walls

The upkeep of the bund walls will be a further public expense and without access to the cost of maintaining such walls in high rainfall areas such as Darwin there is no way of calculating the ongoing costs. Placed in a marine environment, in a cyclone prone area, there is no way of being certain that the walls will not degenerate within a few years (until extensive trials are done).

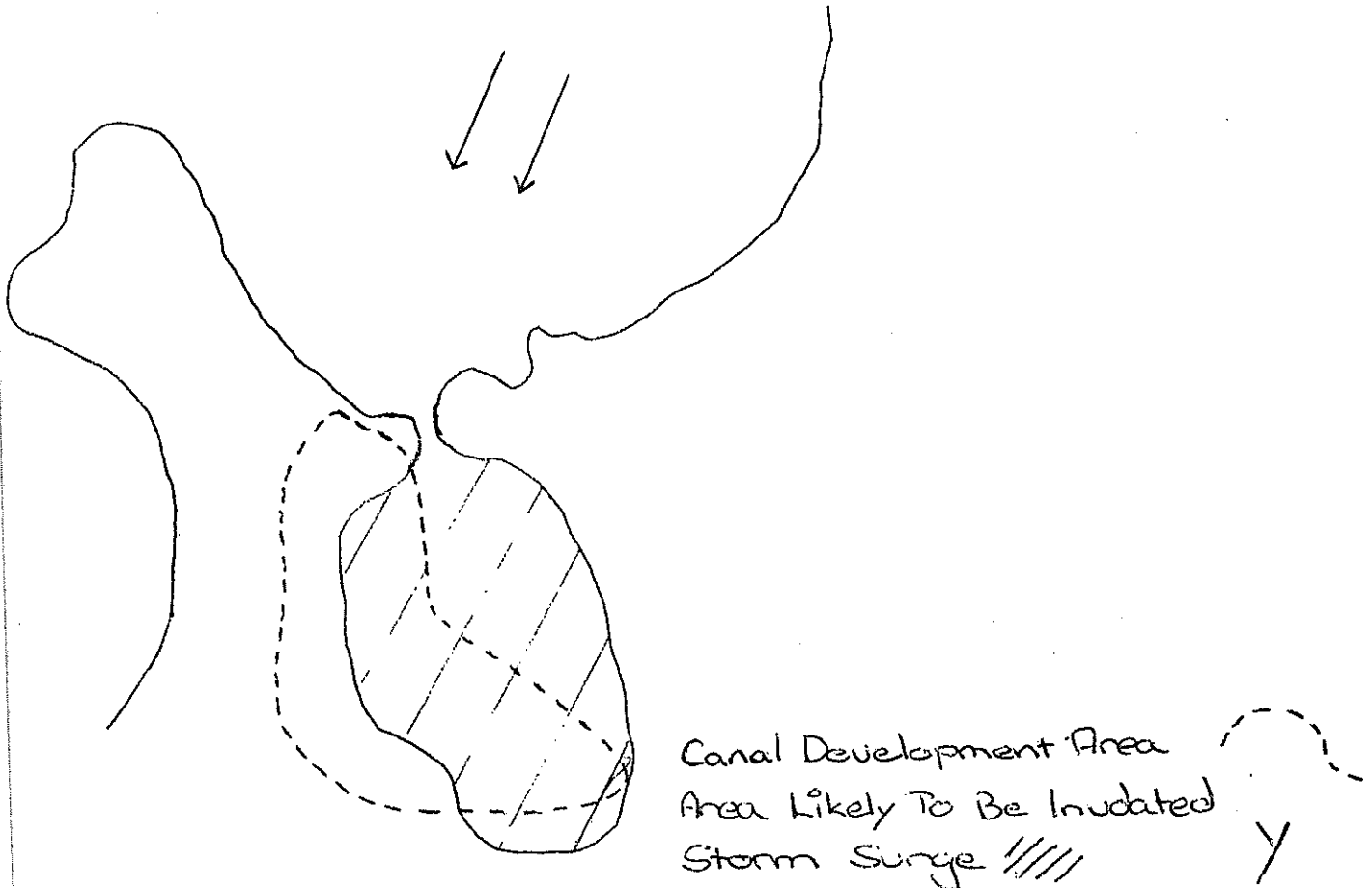
### The Lock

We do not feel competent to comment upon the technical feasibility of the lock which is proposed to maintain the level of water in the canal development. WE FEEL HOWEVER, IT IS NECESSARY TO POINT OUT THAT WE HAVE NOT BEEN ABLE TO FIND ANY EXAMPLE OF AN ARTIFICIAL CANAL DEVELOPMENT IN ANY AREA WHERE THERE ARE SUCH VAST DIFFERENCES BETWEEN HIGH AND LOW TIDES AS EXIST IN DARWIN. One continuing cost, which will be a public cost, is that of running the lock and this will not be in any sense inconsiderable.

### Storm Surge

A potential problem for residents living in houses adjoining the proposed canal development is that of increased storm surge. If it is assumed that the mass generated by a small storm surge is M and the velocity is V, that the area currently likely to be inundated by such a surge is Y. According to the best advice we can obtain from the developer, the present creek mouth will be retained but that immediately along the western bank will be a fifteen metre bund wall. This will mean that the area currently likely to be inundated by a small storm surge will be halved. That is roughly the same mass of surge will be flowing into half the area. As it will not be able to spill out over the western half of the mouth as it would do at present it will mean that the surge will flow through about half the space. This will increase velocity to approximately double the existing speed. This will result in the storm surge mass M flowing into half the existing space Y at something like double the velocity.

M flows then at 2V into half Y. This likely to result even with a small storm surge in extensive inundation of existing housing. A major storm surge would destroy much of the Ludmilla area and could cause considerable loss of life.



#### Social Impact

A population of 2,500 more people living in the Ludmilla area will create pressures on existing school and health services. Darwin and Nightcliff High Schools and the Parap and Ludmilla schools would not be able to cope with the influx of new students. Creche facilities already stretched to the limit in these areas will not handle the added burden.

#### Traffic

The proposed canal estate will have a population of 2,500 people. This will result in a greatly increased traffic flow along Dick Ward Drive and East Point Road.

Currently the residents of Kurringal Flats have been urging that an overpass be provided to allow the elderly and children to cross this road without danger. If the development goes ahead then the current difficulties experienced by Kurringal residents will be greatly exacerbated.

A further overpass would be needed at the Darwin High School. Increased traffic flow through Parap will also cause problems for children at the Parap Primary School.

Whatever is done to handle the problem of the increased traffic it will necessitate considerable expenditure of public money. Noise difficulties are already a considerable nuisance to people on East Point Road and the Kurringal Flats. The buildup in traffic density will degrade the quality of housing in the surrounding area.

### Conclusions

We have attempted to investigate the proposed canal scheme as objectively as possible, but in the end we are forced to these conclusions.

- There will be a considerable advantage in style of living for those citizens who can afford the price of a block fronting onto a canal.
- There will be employment created if the scheme goes ahead, but most, if not all, of this employment would be created wherever the housing was built.
- The canal scheme will require considerable public money to be spent just to allow it to go ahead, e.g. the resiting of the sewerage works, traffic solutions, health and educational facilities.
- There will be a high public expenditure needed to maintain this development, upkeep of lock, bund walls, public space, dredging channel, monitoring the cleanliness of the lake, etc.
- There is going to be a considerable loss to the poorest citizens living in the area, in particular they will lose a major part of the fish, crab, and prawn areas and they will lose an important hunting and bushwalking area.
- The proposed scheme could exacerbate any storm surge problems.
- There could be health and ecological difficulties created by the scheme.
- The scheme will cause increased social problems in the adjacent areas, noise, traffic, competition for health and educational services.

But what has had the most important impact on our thinking is that 71% of our respondents are opposed to the scheme. The poorest people are most opposed. We would stress that we set out to sample the people most likely to be affected by the development. Having studied the development we do not feel there are sufficient reasons to warrant it being allowed to proceed.

Q. 1 Have you ever been to Ludmilla Creek?

	BAGOT		RESIDENTS		KULALUK		FISHERMAN		TOTAL	
	%	No.	%	No.	%	No.	%	No.	%	No.
Yes	84	21	70	50	100	23	N/A	N/A	79	94
No	16	4	23	16		-	N/A	N/A	17	20
No Answer		-	7	5		-	N/A	N/A	4	5
Total	100	25	100	71	100	23	N/A	N/A	100	119
Yes	96	24	72	51	74	17	N/A	N/A	77	92
No	4	1	20	14	13	3	N/A	N/A	15	18
No Answer		-	8	6	13	3	N/A	N/A	8	9
	100	25	100	71	100	23	N/A	N/A	100	119
Last Week	16	4	39	21	17	4	39	14	31	43
2 weeks	16	4	11	6	4	1	19	7	13	18
1 month	12	3	20	11	4	1			11	15
3 months	20	5	6	3	17	4	31	11	17	23
6 months	8	2	9	5		-	8	3	7	10
1 year	24	6	15	8	58	14	3	1	21	29
No Answer	4	1								1
Total	100	25	100	54	100	24	100	36	100	139

Q. 2 Does anyone in your house go to Ludmilla Creek?

Q. 2(a) When were you/they last there?

	BAGOT		RESIDENTS		KULALUK		FISHERMAN		TOTAL	
	%	No.	%	No.	%	No.	%	No.	%	No.
Fish	34	22	25	16	54	21	45	27	38	86
Crabs	25	16	13	8	28	11	17	10	20	45
Prawns	6	4	3	2	8	3	8	5	6	14
Swim	3	2	6	4	8	3	18	11	9	20
Other Reason	27	17	53	33	2	1	12	7	26	58
No Answer	5	3							1	3
Total	100	64	100	63	100	39	100	60	100	226
Once		7	16	8	17	4	14	5	12	17
Twice	4	1	14	7	4	1	11	4	10	13
5 times	8	2	20	10	4	1	14	5	13	18
10 times	44	11	10	5		Nil	19	7	17	23
More	32	8	40	21	71	17	42	15	45	61
No Answer	12	3		-	4	1		-	3	4
Total	100	25	100	51	100	24	100	36	100	136

2. 2(b) When you go there do you go to catch?

3. 2(c) How many times a year do you go there?

	BAGOT		RESIDENTS		KUALALUK		FISHERMAN		TOTAL	
	%	No.	%	No.	%	No.	%	No.	%	No.
1-3	16	4	23	12	8	2	44	15	24	33
3-5	36	9	27	14	17	4	12	4	23	31
More	40	10	50	26	75	18	44	15	51	69
No Answer	8	2	-	-	-	-	-	-	2	2
Total	100	25	100	52	100	24	100	34	100	135
Yes	64	16	68	49	92	22	43	16	65	103
No	28	7	17	12	8	2	57	21	27	42
No Answer	8	2	15	11	-	-	-	-	8	13
Total	100	25	100	72	100	24	100	37	100	158
Raise		N/A	76	40	96	23	-	N/A	82	63
Lower		N/A	24	13	-	-	-	N/A	17	13
Don't know		N/A			4	1			1	1
Total		N/A	100	53	100	24		N/A	100	77

Q. 2(d) How many years have you/they been going there?

Q. 3 Before today had you heard about the proposed canal development?

Q. 9 Do you think the canal development will raise or lower the value of your block?



One of the factors which Dave Hibbet of Transport and Works states as being a major factor in the pressure to remove the plant is the high running cost. Yet if the plant was given adequate maintenance funds it could become much more efficient and running costs would be substantially lowered.

One of the major cost factors is the lime used in the treatment process. The amount of lime used could be reduced to a third of the amount now used if there was an expenditure of \$5000 on the plants' furnace. This expenditure could be recovered within two months of running at the increased efficiency achieved by this.

It seems that the plant is being deliberately allowed to run down through a lack of maintenance funds. This is being done at a possible disregard to public health. If a health risk exists it is the users of the Ludmilla area who are most endangered by it.

Moves to make the works a pumping station, sending the sewage to Leanyer involves turning a 4.8 million dollar treatment plant into a pumping unit. If the Redco development goes ahead then this 4.8 million must be added to the cost the tax payer will have to incur.

The information used in examining the Treatment Plant comes from Transport and Works, Water Division, The Information Brochure and two chemists report.

## SERVICES TO CHILDREN

The proposed development of Ludmilla Creek would bring an influx of approximately 2,500 people into the Ludmilla area. Of these people there would be a proportion of children of a variety of ages, resulting in a demand on resources such as childminding facilities. To discover whether existing facilities could cater for an influx of children, services in the Parap, Fannie Bay, Darwin and Nightcliff areas were telephoned, and asked the following questions:

1. How many children can you cater for?
2. Do you have any vacancies at this time?
3. Do you have a waiting list?

Five creches were contacted in all, and Darwin Family Centres, who provide for children to be cared for in a home situation was also contacted. Services that provide after school care only were not included in the survey.

Of the five creches contacted only one centre had any vacancies for full time care. However, this creche also had a waiting list of fifteen people so it could be anticipated that these vacancies will be filled with little delay. The remaining four creches had no vacancies for fulltime care, although two did have places for some children part time.

In some ways this survey was unsatisfactory in obtaining a true picture of the availability of childminding in the Darwin area. Every centre providing this service would need to be contacted, as people use childminding centres that are or on their route to work. However, at this time there is an expansion of people living in the Northern Suburbs of Darwin due to the development of new subdivisions. Therefore I would speculate that childminding centres in this region are being utilized to capacity.

A spokesperson for Family Day Care Incorporated said that at this time their facilities were stretched to their full capacity. Currently they care for 430 children in private homes, a number that has risen significantly this year.

## HIGH SCHOOL STUDENTS

A housing development at Ludmilla Creek would place high school children moving into the estate into the zone serviced by Darwin High School. To ascertain whether there would be places for these children at Darwin High School the school was contacted.

Darwin High School preferred not to comment on the subject of the availability of places in the school at a future date, as the school felt that the Education Department's Demographer would be a more qualified person to speak on this subject.

The demographer's comment, at short notice, was that if the influx of people was immediate there may be problems in accommodating the estimated (two hundred) number of high school aged children from the proposed development in Darwin's High Schools. It should be noted that zoning regulations are not strictly adhered to in Darwin, giving parents a choice as to which of the five High Schools their children will attend.

In the future, it is expected that a High School in Darwin's rural area will be completed to accommodate the three hundred children from the rural area currently catered for in city high schools. It might be summarised that the building of a rural High School would leave three hundred places free for urban situation children.

However, it cannot be taken for granted that the building of a rural High School will actually provide three hundred places in Darwin's High Schools because of the following factors:

- Some of the rural area children attend the Catholic High School through religious preferences of their parents;
- The parents of other children may prefer their children to attend a High School such as Darwin High School whose excellence has already been proven;
- Some parents may not wish to move their children from the school where they have already established themselves because of effects the disturbance might have on the child's educational attainment.

Survey of five creches

Question	1	2	3	4	5
Capacity of creche	40	32	24	24	60
Vacancies: Fulltime Part-time	0  2 (on 2 days)	2 (over 3 years)	0	0	0  some (2-3)
Number on waiting list	0	15	0	15	106

## MANGROVES: A STUDY

### Introduction

The proposed canal development at Ludmilla Creek will affect the existing mangroves. The function of mangroves as cleaners of the environment is often poorly appreciated. Mangroves provide a life support system for marine life.

### Mangroves

Mangrove areas are commonly assumed to be pest infected, smelly wetlands serving little or no purpose. In fact, mangroves provide matter and energy pathways which are driven by physical forces, that is, rivers, tides and runoffs, as well as the production of plant debris and decomposition. This controls the rates of import, export and storage of organic and inorganic matter. Mangroves use the imparted organic matter and export organic matter as plant debris which supports inshore food chains.(1)

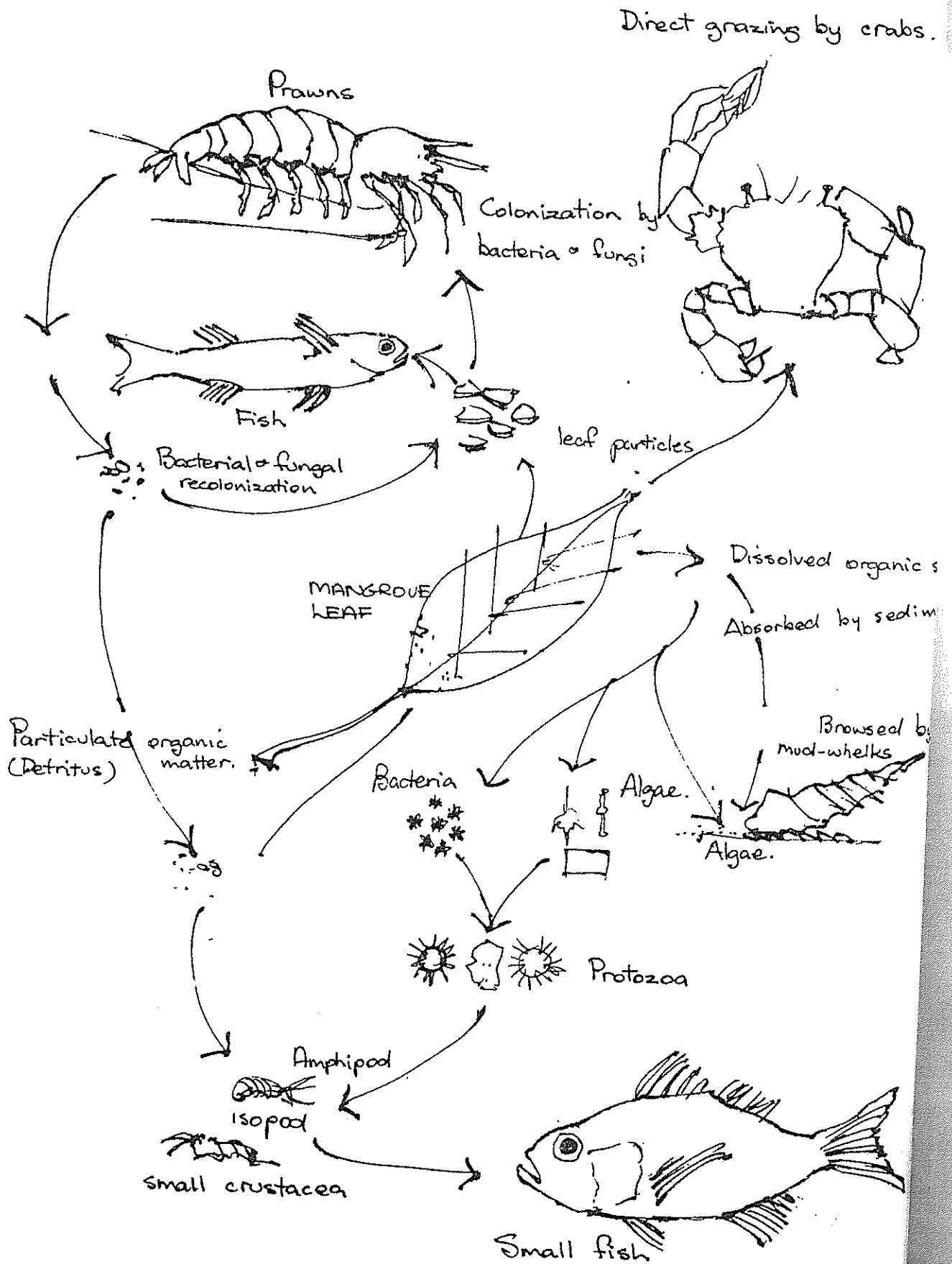
Mangroves situated in tropical areas with exposure to strong tides and high levels of nutrients (e.g. Ludmilla Creek), have the highest net productivity. This productivity at Ludmilla Creek is estimated at "2 tonnes of dry organic matter per hectare per year".(2)

The organic content originates in the main from deposition of plant debris derived from mangroves. This is broken down under slight acid conditions by micro-organisms such as bacteria, fungi and algae. The following diagram explains the system by which the mangroves supply material to basic estuarine chains:

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(1) Mangroves of Australia, Lear & Turner, QLD, 1977, p.46.

(2) Operculum, Vol.5., No.3., pp. 105-112.



Supply of mangrove material to base estuarine food chains.

In the paper "Foreshore problems of Darwin", the function of mangroves is explained. (3)

1. Mangroves provide shelter against erosion of foreshores, especially in stormy weather;
2. Due to leaf drop and decay (as explained above) they provide organic matter that is the start of food chains for much estuarine life;
3. Clearing of mangroves can leave open areas suited to the breeding of mosquitoes and sand flies.

In normal circumstances there is no mosquito breeding among mangroves inundated by daily tides. Breeding occurs on occasions in less frequent inundated mangroves. Marks & Mabbett when doing a mosquito survey and assessment of potential mosquito problems of the Brisbane airport development and environs found that when mangroves are felled and left on the substrata, or bund walls are constructed to prevent tidal inundation, extremely favourable conditions for mosquito breeding may be created. (4)

Mosquitoes and biting midges have always been associated with mangroves. However, it has been commonly observed that mosquitoes are most numerous in mangroves which have been disturbed in some way. "Biting midges do live and breed in mangroves but the larvae also live in the substrata of many intertidal areas - so that clearing or disturbance of mangroves may actually increase the nuisance of midges by creating a more favorable environment for noxious species".(5)

As mangroves are plant that live between sea and land, these trees and shrubs grow between mean sea level and the high tides. The tides affect mangroves by varying salinity/alteration of temperature nutrient supply and the level of oxygen in soil and water.

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(3) Foreshore Problems of Darwin

(4) Mangrove Management in Australia, by E.J.Hegerl, 1979, p.6.

(5) op.cit.

Land and sea animals congregate in this environment and in no other ecosystem do animals such as crabs, oysters, prawns, and barnacles coexist with bats, lizards, wallabies, geese, bandicoots and bird life. Mangroves are the most fertile ecosystem in the world and are essential to the life cycle of fish and other marine animals. They are also considered to help reduce the strength of storm surges in some tropical areas.(6)

### Animals

"Crustacea are probably the most conspicuous group of marine animals living in mangroves in Australia and at least 70 different species have been distinguished. Of these, 65% are crabs, the remainder being made up of isapods, amphipods, barnacles, shrimps and prawns." (7)

Crocodiles are also known to inhabit mangrove areas. In the Darwin area records indicate that there are 12 species of amphibia, 19 species of lizards and 14 snake species. (8)

In the Darwin metropolitan area there are 265 species of birds which have been observed. The 19 particular species sighted at the Ludmilla Creek areas are as follows:

- |                         |                                      |
|-------------------------|--------------------------------------|
| "1) white faced heron   | 11) rainbow bee eater                |
| 2) mangrove heron       | 12) black faced cuckoo-shrike        |
| 3) straw-necked ibis    | 13) mangrove robin                   |
| 4) black kite           | 14) silver crowned friarkind         |
| 5) brahminy kite        | 15) rufous-banded honeyeater         |
| 6) whistling kite       | 16) red headed honeyeater            |
| 7) whimbrel             | 17) yellow white-eye                 |
| 8) whiskered tern       | 18) Australian magpie lark           |
| 9) bar shouldered dove  | 19) white breasted wood swallow" (9) |
| 10) mangrove kingfisher |                                      |

26 mammals have been recorded in like habitat in the Darwin area. Omitting flying mammals and macropods there are 11 species of small mammals. Bandicoots are widespread, but possums seem to be restricted. Crocodiles are sighted occasionally in the Ludmilla Creek area.

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(6) Mangroves in Australia, Lear & Turner, 1977, pp.36-48.

(7) op.cit. p.36.

(8) Biological Impact Study for Rapid Creek Recreational Project, Darwin, N.T., 1979, p.A.23.

(9) op.cit. p.A.25.



### Canalization

As mangroves are located on the foreshore, pressure is placed on these areas by developers as they represent prime real estate locations. To reclaim these sites for residential purposes, estuarine dredging is necessary for the creation or maintenance of navigable channels. The impact on the environment includes "destruction of habitat ..... in the dredged area, altered currents and scouring of channels and riverbanks, hence increased erosion and increased turbidity and siltation." (10)

"When mangroves are replaced by retaining walls to speed up the runoff of floodwaters, collapse of banks may result. This shallows the waterway and unless remedial dredging is undertaken the result may be flooding of surrounding properties". (11)

### Environmental

A separate study is being undertaken on the sewerage treatment plant and its environmental implications. However, it is necessary to state here that on occasions interruption to normal operation does occur. This results in offensive odours. Presently the mangroves and the tidal washing cope with these problems but a canal development is unlikely to. All human activity produces some change in the environment; the further interference of the mangrove population can only arrest the natural changes taking place. This interference can have widespread influence on the stability of the coast of Darwin. The marine and bird life will be discouraged and eventually the natural system of the relationship between plant life, marine life and bird life will completely break down, therefore upsetting recreational and commercial fishing potential.

"The viability of tidal wetlands can be threatened by a number of human actions whose effects are presently often unanticipated by administrators charged with management of submerged public lands. These actions may result in soil erosion in the water catchments, water pollution, alteration of water flow, or direct destruction of the wetlands by dredging and filling operations". (13)

Aside from these environmental factors, the Aboriginal and European people in Darwin use this area for fishing and hunting.

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(10) Mangrove Management in Australia, pp.6-7.

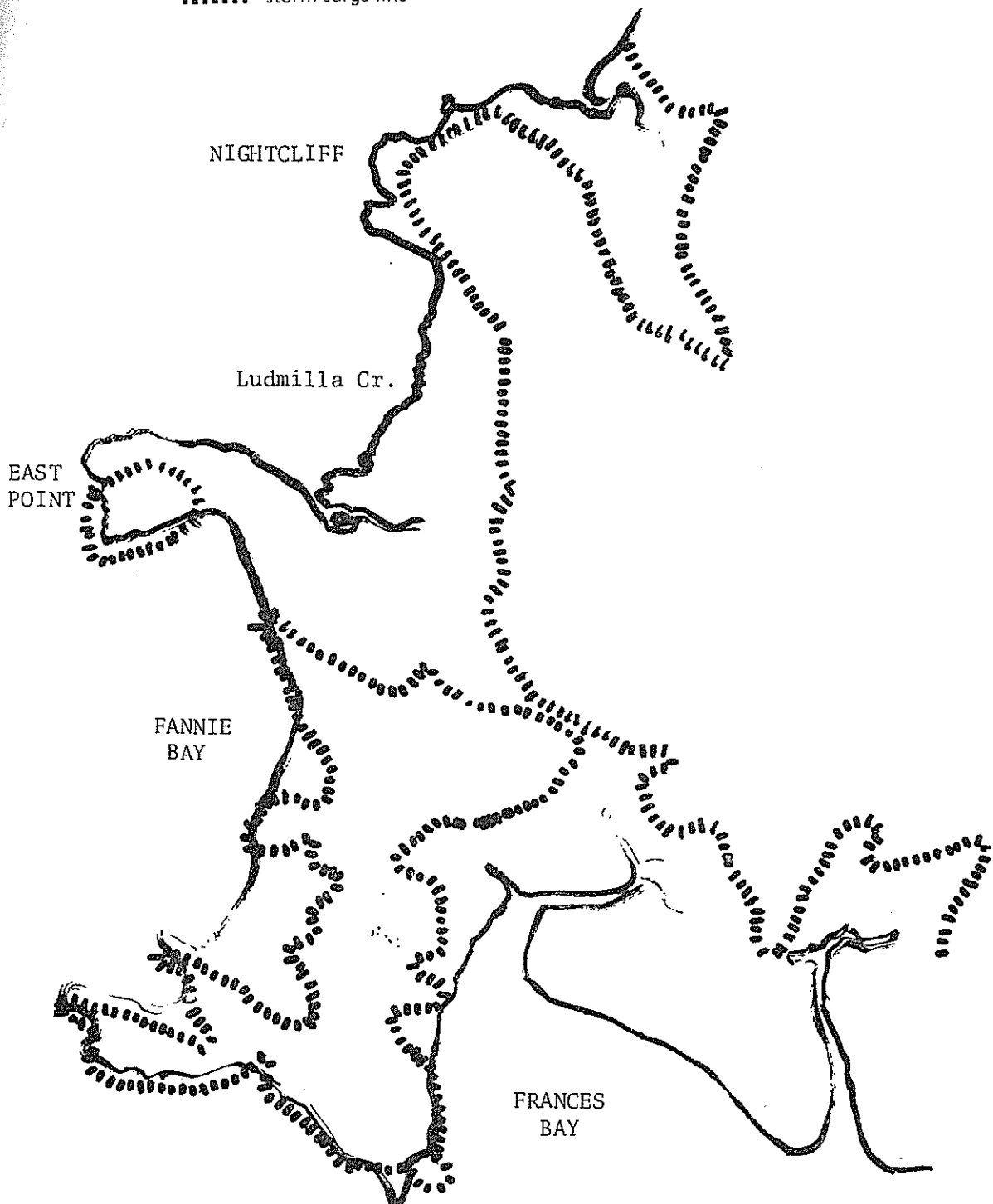
(11) op.cit.

(12) Operculum, Vol.4., No.2., 1974, p.61.

# Darwin Planning Guidelines

Cities Commission  
March 1975

..... storm surge line



## STORM SURGE

A storm surge is a rise in sea level defined as the difference between the height of the predicted tide and the actual tide level occurring. Extraordinary storm tides resulting from tropical cyclones, flood, low lying coastal areas may cause serious loss of life and property damage. In addition to the waves and swell generated by the strong winds of a tropical cyclone, the very low pressure and the stress of the wind on the sea surface produce a rise in sea level, which can become considerably greater than the normal tide level when the cyclone approaches or crosses the coastline. This rise in sea level is known as the storm surge.\*

### Townsville

Attention on surge danger and an awareness of the probability of such occurrence in Darwin increased after Cyclone Althea struck Townsville. Damage was considerably although Cyclone Althea had coincided with a mean tide.

### Darwin

If Cyclone Tracy which struck Darwin on Christmas Day 1974, had occurred at the highest astronomical tide, flooding to a depth of three metres would have occurred in some housing areas, with waves up to two metres high. Where the depth of flooding exceeds approximately one metre, wave action takes place causing major structural damage.

In March 1975, the Cities Commission had recommended to the Darwin Reconstruction Committee that 900 blocks in primary surge areas should be converted into non-residential uses for example, recreation. These recommendations were not formulated into policies owing to the resistance by property owners who were unwilling to relocate.

### What is a surge line?

The surge line is the limit to which the storm tide level rises, the land below such a line being flooded by that particular storm tide condition. Such a line is either derived from factual past history, or more often calculated for the local conditions and probable cyclones.

An analysis was made after Cyclone Tracy using accepted international procedures to determine surge lines for the Darwin area. In the analysis, the characteristics of Darwin's normal astronomical tides were combined with typical cyclone conditions, and the probabilities of such cyclones occurring. Allowances were also made for reductions or increases in the storm tide level caused by sheltering and/or funnelling effects in some coastal areas. Surge lines were then drawn for the Darwin coastal areas, for the following probabilities of occurrence.

\* Report by Director General National Disasters Organisation, 25/12/74-3/1/75, Darwin Disaster Cyclone Tracy, p.17, Canberra, 1975.

- (a) 1.0% probability of exceedance per annum (or 1/100). This is called the Primary Surge Line, and all areas below this line being called the Primary Surge Zone. This means that in any year there is a 1 in 100 chance that a surge caused by a cyclone would exceed the primary surge level.
- (b) 0.1% probability of exceedance per annum (or 1/1000). This is the Secondary Surge Line and all areas between this line and the Primary Surge Line being called the Secondary Surge zone. In this case there is a 1 in a 1000 chance that a storm surge would exceed the secondary surge level.

It is not generally known that a surge did occur when Tracy struck Darwin. It is estimated to have been about four metres at Casuarina Beach and was measured at 1.6 metres at Darwin Harbour. Fortunately, because the cyclone occurred in a period of low tides, the maximum water level that occurred during Tracy was only about one metre above Darwin's highest astronomical tide.

If the cyclone had occurred at the highest astronomical tide, the storm surge would have caused extensive inundation in the City, exceeding the secondary surge level and causing greater loss of life. Only 55 persons were officially reported killed by Cyclone Tracy.

#### Ludmilla Creek development

The proposed East Haven Development would all be within the primary surge zone. It is known that confined bays have the effect of amplifying surges and this could be the case for the Ludmilla proposed canal development. Dr. Neil Frank, Director of the National Hurricane Centre in America, sees canal developments in cyclonic areas as "a disaster that's waiting to happen". If 12 daylight hours of warning to evacuate are given, and correspond with overcrowded roads and transport problems as the storm builds up, Civil Defence studies have shown that many people would refuse to evacuate their homes voluntarily.\* Many new residents have never experienced a direct hit by a major cyclone such as Cyclone Tracy, and these people are the most likely to refuse evacuation. It can be argued that in the history of Darwin only three major cyclones have been recorded, but as Dr. Frank notes, "Man, it only takes one".

#### Main source material

National Geographic, Vol. 158, No.3, September, 1980.

Cities Commission, Darwin Planning Guide Lines, Cities Commission, Canberra, 1975.

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\* frequently people are not told to evacuate until a couple of hours before a cyclone arrives

QUESTIONNAIRE FOR THE RESIDENTS OF THE LUDMILLA CREEK, AND ADJACENT AREAS

1) Have you ever been to Ludmilla Creek?

yes ..... ☐

no ..... ☐

2) Does anyone in your house go to Ludmilla Creek?

yes ..... ☐

no ..... ☐

IF YES

a) When were you/they last there?

last week ..... ☐

2 weeks ago ..... ☐

1 month ago ..... ☐

3 months ago ..... ☐

6 months ago ..... ☐

1 year ago ..... ☐

b) When you/they go there do you go to catch:

fish ..... ☐

crabs ..... ☐

prawns ..... ☐

swim ..... ☐

any other reason ..... ☐

c) How many times a year do you/they go there?

once ..... ☐

twice ..... ☐

5 times ..... ☐

10 times ..... ☐

more ..... ☐

d) How many years have you/they been going there?

1-3 years ..... ☐

3-5 years ..... ☐

MORE ..... ☐

3) Before today had you heard about the proposed canal development?

yes ..... ☐

no ..... ☐

4) What changes do you think it will make?

5) How will the canal development affect you?

6) If the canal development affects fishes/crabs/etc. which other creek would you use?

7) What environmental impact do you think the canal development will have?

8) What social impact do you think the proposed development will have?

9) Do you think the canal development will raise or lower the value of your block?

raise ..... ☐

lower ..... ☐

10) Are you in favour or opposed to this development?

in favour ..... ☐

opposed ..... ☐

11) What are you going to do about this development?

a) Write to your Government minister..... ☐

b) Write to your local member ..... ☐

c) Write to a newspaper ..... ☐

d) Buy a block ..... ☐

e) Join an opposition group..... ☐

QUESTIONNAIRE FOR USER'S OF LUDMILLA CREEK

1) How many people are there in your party?

2) When were you last here?

last week ..... ☐  
2 weeks ago ..... ☐  
3 months ago ..... ☐  
6 months ago ..... ☐  
1 year ago ..... ☐

3) When you come here, what do you do?

catch - fish ..... ☐  
crabs ..... ☐  
prawns ..... ☐  
enjoy the view ..... ☐  
sun bath ..... ☐  
any other reason ..... ☐

4) How many times a year do you come here?

once ..... ☐  
twice ..... ☐  
5 times ..... ☐  
10 times ..... ☐  
more ..... ☐

5) How many years have you been coming here?

1 -3 ..... ☐  
3 -5 ..... ☐  
more ..... ☐

6) Where do you live?

Northern suburbs ..... ☐  
Nightcliff/Rapid Creek ..... ☐  
Town/Stuart Park ..... ☐  
Ludmilla/Parap/Fanny Bay ..... ☐  
elsewhere ..... ☐

7) Had you heard about the proposed canal development before today?

yes ..... ☐  
no ..... ☐

8) What changes do you think it will make?

9) How will it affect you?

10) What environmental impact do you think the canal development will have?

11) What social impact do you think the proposed development will have?

12) If the canal development affects fishes/crabs/prawns, which other creek would you use?

13) Are you in favour of, or opposed to the canal development?

in favour ..... ☐  
opposed ..... ☐

14) What are you going to do about this canal development?

a) Write to your Government minister ..... ☐  
b) Write to your local member ..... ☐  
c) Write to a newspaper ..... ☐  
d) Buy a block ..... ☐  
e) Join an opposition group ..... ☐  
f) Other - specify ..... ☐