

**PROPOSED FLOOD CONTROL EMBANKMENTS
FOR THE LOWER MGENI RIVER
AT SPRINGFIELD PARK**

PRELIMINARY BIODIVERSITY ASSESSMENT

CSIR REPORT

August 2005

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1. BACKGROUND

During the severe floods experienced in the 1980's, properties alongside the lower Mgeni River at the Springfield Industrial Park were subjected to severe flooding with consequent damage to property and financial losses. In order to reduce this risk of flooding, the eThekweni Municipality has proposed a widening of the present channel for a distance of approximately 1km (see fig. 1 at end of document,) through excavation along the north bank of the river in the vicinity of Connaught Bridge (some 4km upstream of the mouth). The newly created banks are to be stabilized by gabions and the use of hard engineering structures (concrete) will be minimised. The opposite bank of the river has previously been "re-engineered" in this manner.

The envisaged primary impact of this project is the loss of land area through excavation and there is thus a need to understand the impact on biodiversity due to this loss. This purpose of this study is to undertake a preliminary survey of vegetation communities in this area and to assess the significance of the loss these habitats in terms of biodiversity.

While the eThekweni Municipality has indicated that construction activities will remain outside of the present flow channel, there is nonetheless a potential for impacts on in-stream biota during storm events. This may occur during the construction phases of this project and possibly in the medium term thereafter if mitigation measures are inadequate. This type of impact is indicated through an understanding of the species/communities that are likely to occur in this habitat and no actual surveys of biodiversity in the river or the estuary downstream have been conducted as part of this assessment. Thus this part of the assessment is one of specialist "opinion" rather than one based on actual records to determine the present state of in-stream biodiversity.

2. TERMS OF REFERENCE

2.1 Study Description

- Identify the presence of undeveloped land area within the study site using recent aerial/orthophotos.
- Describe the vegetation communities (cover of dominant species) based on a once off field survey.

- Provide a preliminary list of species noted in this “reconnaissance level” survey and list any rare or endangered species.
- Indicate any fauna that are incidentally noted during the survey.
- From the information gained in this survey and any relevant literature assess the potential impact that will result from the loss of these undeveloped areas.
- Assess any risks to in-stream biota that may potentially occur as a result of the development
- Provide relevant recommendations to reduce the risks of potential impacts

2.2 Limitations and Assumptions

- The assessment is for stream-bank and surrounding communities of the affected area and does not include in-stream biota (i.e. algae, fish, aquatic invertebrates)
- The assessment is based on vegetation communities that are present as this provides an indication of the habitats available to faunal communities.
- This is a preliminary assessment based on desk top data and one rapid qualitative field assessment i.e. quantitative surveys along transects or within quadrants are not included as part of the survey

3. METHODS

A vegetation survey was undertaken on 2nd August 2005. The types of vegetation communities present were noted in the field and lists of species were recorded in the affected area and in areas immediately above and below this. The new position of the embankment was noted in order to assess the significance of the quantity of materials that may need to be excavated to achieve channel widening.

4. RESULTS

4.1 Site Description

The present banks of the river in the study area forms two distinct zones. These are:

- a) An outer (landward) vertical or near vertical slope (70° - 90°) descending for approximately 5-7 metres
- b) A gently sloping inner bank extending from the base of the outer bank to the waters edge. The width of this varied from 4-10 metres.

Above these banks, the affected area is essentially flat and the land is either undeveloped or in some instances support buildings or paved industrial areas.

4.2 Vegetation Description

The vegetation above the banks of the river consisted of a mixture of exotic weedy species (e.g. *Riccinus communis*, *Chromolaena odorata*, *Cardiospermum grandiflorum*) and few indigenous species generally characteristic of highly disturbed secondary habitats. This habitat may best be described as open scrub consisting of secondary grasses (e.g. *Cynodon nlemfuensis*, *Sporobolus africanus*, *Panicum maximum*), with shrubs (e.g. *Abutilon sonneratianum*, *R. communis*, *C. odorata*, *Lantana camara*, *Solanum mauritianum*) and occasional trees (e.g. *Erythina lysistemon*, *Trema orientalis*, *Ficus natalensis*, *Melia azedarach*). The exotic creepers, *Ipomoea purpurea* and *C. grandiflorum*, were also prolific in this habitat. At the lower section of the study area (Riverside Road end) part of this area had previously been developed into a grassed recreational area.

Of the outer banks those that were vertical were essentially devoid of vegetation except for occasional tufts of grasses such as *S. Africanus*. Sloping banks were better vegetated with taller grasses (e.g. *Phragmites mauritianus*, *Arundo donax*, *Digitaria eriantha*), weedy shrubs such as *C. odorata* and occasional trees (e.g. *F. natalensis*, *M. azedarach*, *P guajava*, *T. orientalis*).

The inner gently sloping banks were characterized by more hygrophilous vegetation. The landward section and raised islands within this habitat were characterized by tall stands of *P. mauritianus* and *A. donax*. Occasional trees such as *Ficus sur*, *T. orientalis* and *F. natalensis* had also colonized these areas since the last major flood. Closer to the channel *Phragmites australis* dominated while at the waters edges and on islands within the channel the grass *Echinochloa crusgalli* was the dominant species.

During this survey the vegetation upstream and downstream of the affected area was also briefly surveyed and was found to have an essentially similar community structure and species composition to that of study area. The plant species list for the study area is recorded in Table 1 below.

Table 1. Plant list for the study area

TAXON	COMMON NAME	GROWTH FORM	LOCALITY
Typhaceae:			
<i>Typha capensis</i>	Bulrush	Herb	Inner bank, waters edge
Poaceae:			
<i>Phragmites australis</i>	Common reed	Robust grass	Inner bank, waters edge
<i>Phragmites mauritianus</i>		Tall reed	Outer/inner bank, above banks, islands
<i>Arundo donax</i> *	Giant reed	Tall reed	Outer/inner bank, above banks, islands
<i>Panicum maximum</i>	Guinea grass	Tufted grass	Above banks
<i>Eragrostis curvula</i>	Weeping love grass	Tufted grass	Above banks
<i>Cynodon dactylon</i>	Couch grass	Creeping grass	Above banks
<i>Cynodon nlemfuensis</i> *	Star grass	Creeping grass	Above banks
<i>Echinochloa crusgalli</i>	Barnyard millet	Branched grass	Waters edge, islands
<i>Digitaria eriantha</i>	Finger grass	Tufted grass	Outer banks, above banks
<i>Paspalum urvillei</i> *	Giant paspalum	Tufted grass	Inner bank
<i>Sporobolus africanus</i>	Ratstail dropseed	Tufted grass	Outer banks, above banks
Cyperaceae:			
<i>Cyperus dives</i>	Giant sedge	Robust sedge	Waters edge
Lemnaceae:			
<i>Spirodela punctata</i>	Duckweed	Tiny floating herb	In channel backwaters
Commelinaceae:			
<i>Commelina erecta</i>	Blue commelina	Spreading herb	Lower bank, waters edge
<i>Aneilema dregeanum</i>	Blue aneilema	Trailing herb	Above banks
Pontederiaceae:			
<i>Eichhornia crassipes</i> *	Water hyacinth	Floating herb	In channel backwaters
Ulmaceae:			
<i>Trema orientalis</i>	Pigeonwood	Tree	Inner/outer banks, above banks
Moraceae:			
<i>Ficus natalensis</i>	Natal fig	Tree	Inner/outer banks, above banks
<i>Ficus sur</i>	Cape fig	tree	Inner bank
Polygonaceae:			
<i>Persicaria sengalensis</i>	Silver polygonum	Robust herb	Inner bank
<i>Persicaria lapathifolia</i> *	Spotted knotweed	Herb	Inner bank
Chenopodiaceae:			
<i>Chenopodium album</i> *	Fat hen	Herb	Above banks
Amaranthaceae:			
<i>Amaranthus hybridus</i> *	Common pigweed	Robust herb	Above banks
<i>Amaranthus spinosus</i> *	Thorny Pigweed	Herb	Above banks

Lauraceae:			
<i>Litsea glutinosa</i> *	Indian laurel	Tree	Above banks
Fabaceae:			
<i>Acacia karoo</i>	Sweet thorn	Tree	Outer banks, above banks
<i>Erythrina lysistemon</i>	Coral tree	Tree	Above banks
<i>Senna didymobotria</i> *	Peanut cassia	Shrub	Above banks
Oxalidaceae:			
<i>Oxalis latifolia</i> *	Pink garden sorrel	Herb	Above banks
Meliaceae:			
<i>Melia azedarach</i> *	Indian lilac	Tree	Outer Banks, above banks
Euphorbiaceae:			
<i>Ricinis communis</i> *	Castor oil bean	Shrub	Above banks
Sapindaceae:			
<i>Cardiospermum grandiflorum</i> *	Ballon vine	Shrub	Inner/outer banks, above banks
Malvaceae:			
<i>Abutilon sonneratianum</i>	Forest abutilon	Shrub	Above banks
<i>Sida cordifolia</i>	Flannel weed	Herb	Above banks
Myrtaceae:			
<i>Psidium guajava</i> *	Guava	Shrub/tree	Outer banks, above banks
Convolvulaceae:			
<i>Ipomoea purpurea</i> *	Common morning glory	Herb- creeper	Outer/inner banks, above banks
<i>Ipomoea cairica</i>	Common ipomoea	Herb- creeper	Above banks
Verbenaceae:			
Lantana camara	Tickberry	Shrub	Outer banks, above banks
Solanceae:			
<i>Solannum mauritianum</i> *	Bugweed	Shrub	Outer banks, above banks
<i>Nicandra physalodes</i> *	Apple of Peru	Herb	Above banks
<i>Cestrum laevigatum</i> *	Inkberry	Robust shrub	Outer banks
Acanthaceae:			
<i>Asystasia gangetica</i>	Asystasia	Spreading herb	Outer banks, above banks
Asteraceae:			
<i>Ageratum houstonianum</i> *	Blue weed	Herb	Inner banks
<i>Chromolaena odorata</i> *	Triffid weed	Shrub	Outer banks, above banks
<i>Tithonia diversifolia</i>	Mexican sunflower	Shrub	Above banks

* Denotes exotic species

4.3 Fauna

As noted above, this study did not include specific faunal surveys. In the terrestrial environment the only fauna incidentally noted were two pairs of Egyptian geese (*Alopochen aegyptiacus*). The habitat could however, support several species of small mammals (mice, moles), lizards (skinks, agamas) and snakes. The plant community that was present did not indicate any species-specific insect-plant relationships with the exception of those of the *Ficus* species with their species-specific pollinator relationship with Agaonid wasps. Trees of this species were however well represented outside the affected area.

At the waters edge, two Nile monitors (*Varanus niloticus*) were noted. In the open water a pair of ducks (South African Pochard - *Netta erythrophthalma*) were noted in the deeper water of the channel. The lower banks and vegetated backwater areas are expected to support several frog species. The channel area with its marginal vegetation is also expected to support a very rich invertebrate fauna. This would include larger crustaceans such as the shrimps and crabs (e.g. *Caridina spp.*, *Palaemon spp.*, *Macrobrachium spp.*, *Varuna sp.*) as well as the much smaller amphipod, copepod, ostracod etc. species. The characteristics of this habitat especially the abundant marginal vegetation also suggest that it would support a rich diversity and abundance of aquatic insect fauna belonging to several different orders.

In the upper sections of the study site the most common freshwater fish species expected to occur are tilapia (*Oreochromis mossambicus*) and catfish (*Clarias gariepinus*). However, tidal influence is expected to reach the study area especially at spring highs and estuarine fish may thus occur within the habitat. Potential impacts from the proposed project, if correct mitigation measures are not executed, can nonetheless extend into the estuary and thus effect estuarine fish populations. The Mgeni estuary has a typical estuarine fish fauna and the system is functional as a nursery area for marine spawned fish species.

Fish species previously recorded in the system are listed in Table 2 below. This species list is based on very limited fieldwork (CSIR unpublished data; Harrison et al., 2000; Begg 1984) and should be regarded as incomplete. Harrison et al (2000) considered the ichthyofauna to be in a moderate condition. In prioritising South African estuaries based on their potential importance to estuarine associated fish species, Maree et al (2000) regarded the importance of the estuary as the 34th of 248 systems assessed. Several species are important in recreational

(estuarine and marine environments) and commercial fisheries (in marine environments). Several rare and endangered fish species, including sleepy goby *Glossogobius biocellatus* and checked goby *Redigobius dewaali*, are also expected to occur in the system although these have not been recorded in the limited surveys undertaken to date.

Table 2: Fish species list for Mgeni Estuary.

SCIENTIFIC NAME	COMMON NAME	ENDEMIC	CONSERVATION STATUS
<i>Ambassis productus</i>	Longspine glassy		
<i>Ambassis natalensis</i>	Slender glassy		
<i>Ambassis gymnocephalus</i>	Bald glassy		
<i>Oligolepis acutipennis</i>	Sharptail goby		
<i>Oligolepis keiensis</i>	Speartail goby		2003 IUCN Red List of Threatened Species
<i>Periophthalmus</i> sp.	Mudskipper		
<i>Caffrogobius natalensis</i>	Baldy	E	
<i>Glossogobius callidus</i>	River goby	E	
<i>Argyrosomus japonicus</i>	Dusky kob		
<i>Elops machnata</i>	Ladyfish		
<i>Terapon jarbua</i>	Thornfish		
<i>Rhabdosargus holubi</i>	Cape stumpnose	E	
<i>Acanthopagrus berda</i>	Estuarine bream		
<i>Pomadasys commersonnii</i>	Spotted grunter		
<i>Valamugil robustus</i>	Robust mullet		
<i>Valamugil cunnesius</i>	Longarm mullet		
<i>Liza macrolepis</i>	Largescale mullet		
<i>Valamugil</i> spp.	Mullet		
<i>Mugil cephalus</i>	Flathead mullet		
<i>Liza</i> spp.	Mullet		
<i>Solea bleekeri</i>	Blackhand sole	E	
<i>Caranx sexfasciatus</i>	Bigeye kingfish		
<i>Leiognathus equula</i>	Slimy		
<i>Rhabdosargus sarba</i>	Tropical stumpnose		
<i>Liza alata</i>	Diamond mullet		
<i>Liza dumerilii</i>	Groovy mullet		
<i>Valamugil buchanani</i>	Bluetail mullet		
<i>Clarias gariepinus</i>	Sharptooth catfish		
<i>Oreochromis mossambicus</i>	Mozambique tilapia		
<i>Anguilla</i> spp.	Freshwater eels		
<i>Myxus capensis</i>	Freshwater mullet	E	Rare

5. IMPACT ASSESSMENT

The potential impacts from the proposed project are summarized in Table 3 below. In general the loss of terrestrial species (including hygrophilous species on the inner banks) due to actual disturbance and bank reconfiguration is not considered to be of major significance due to the following:

- These were essentially disturbed secondary habitats and in terms of the vegetation there were many opportunistic alien species
- From this preliminary survey this habitat is not expected to contain any rare or endangered species
- The relatively small affected area was very similar in habitat to areas above and below this section and species composition (terrestrial and aquatic) are thus expected to be similar

In addition the more mobile members of the faunal communities are likely to move out of the area into surrounding habitats once the activities and noise associated with construction becomes evident.

The construction activities however, are of greater concern in terms of potential impacts on the aquatic environments within and below the study area. The delivery of large amounts of sediment to the aquatic environment, especially if construction occurs during the rainy months, has the potential to have the following impacts:

- Reduced primary (algal) productivity due to compromised light penetration resulting from increased turbidity
- The clogging of gills of fish and feeding structures of planktonic filter feeders
- Decrease in visibility can affect feeding (prey capture) of fish, predatory invertebrates and zooplankton
- Settling of sediment can result in the smothering of benthic communities. Such sediment deposition is likely to occur when flow rates reduce in the wider estuarine area. These benthic communities are an integral part of the food web in estuarine ecosystems

The potential impacts described above may be exacerbated if there is an intention to leave most of the sediment between the present outer bank and the newly constructed bank in situ,

as has been proposed. While a large flood such as that of 1987 is likely to remove this sediment out to sea, most smaller storm events would only result in gradual erosion of the areas and the sediment is most likely to be deposited in the estuary. If such storm events are accompanied by high seas and outflow is compromised by simultaneous high tides such turbid waters could backup into the Beachwood Mangroves via the outflow creek close to the mouth of the Mgeni. Sediments deposited here would have impacts on the aerial roots of mangroves and the benthic communities in this habitat.

Table 3. Summary of Potential Impacts and Relevant Ratings

IMPACT	STATUS	EXTENT	INTENSITY	DURATION	PROBABILITY	SIGNIFICANCE	CONFIDENCE
1. Site specific loss of biodiversity	Negative	Site specific	Low	Long term	100%	Low/NS	High
2. Increased turbidity -Reduced primary productivity	Negative	Site specific and estuary	Medium	Short term	70%	Medium	Medium
3. Increased turbidity – clogging of gills and feeding structures	Negative	Site specific and estuary	Medium	Short term	70%	Medium	Medium
4. Increase turbidity – affecting prey capture	Negative	Site specific and estuary	Medium	Short term	70%	Medium	Medium
5. Smothering of benthic communities – especially in estuary	Negative	Site specific and estuary	Medium	Short term	60%	Medium	Medium
6. Medium/long term erosion of sediments left in situ- several resultant impacts similar to 2-5 above	Negative	Site specific and estuary including mangroves	Medium/ Long	Long term	80%	Medium/ High	Medium/ High

NB: Impacts 2-5 will only occur if storms events happen during the construction phase. NS = Not Significant

6. RECOMMENDATIONS/MITIGATION MEASURES

The following recommendations are made to address the potential impacts described above. The effects of implementing mitigation are summarized in Table 4 below.

- If at all possible, construction should occur during the dry season
- The area described as the inner bank and the river channel should largely remain undisturbed

- During excavation and construction activities any sediment delivery to the water as a result of storm events, should be avoided. A temporary dam to trap sediments should be built at the outer edge of the inner bank using sandbanks and bidim etc.
- All sediments between the present outer banks and the proposed new flood control bank should be excavated and removed from the area. The height of the substrate at the base of the new bank should not be higher than 0.5 metres above the outer edge of the present inner bank.

Table 4. Summary of Recommendations and Mitigation Measures

No.	IMPACT	SIGNIFICANCE WITHOUT MITIGATION	MITIGATION DESCRIPTION	SIGNIFICANCE WITH MITIGATION
1.	Site specific loss of biodiversity	Low/NS	None required	NA
2.	Increased turbidity -Reduced primary productivity	Medium/high	Appropriate dam for sediment trapping	Low/NS
3	Increased turbidity – clogging of gills and feeding structures	Medium/high	Appropriate dam for sediment trapping	Low/NS
4	Increased turbidity – affecting prey capture	Medium/high	Appropriate dam for sediment trapping	Low/NS
5.	Smothering of benthic communities –especially in estuary	Medium/High	Appropriate dam for sediment trapping	Low/NS
6.	Medium/long term erosion of sediments left in situ- several resultant impacts	High	Excavate and remove sediments between present outer bank and new flood control bank	NS

NA= not applicable

NS = Not Significant

7. CONCLUSION

This survey has indicated that the proposed construction of a flood control bank in the study area is not expected have any significant impacts if the mitigation measures described above are adhered to.

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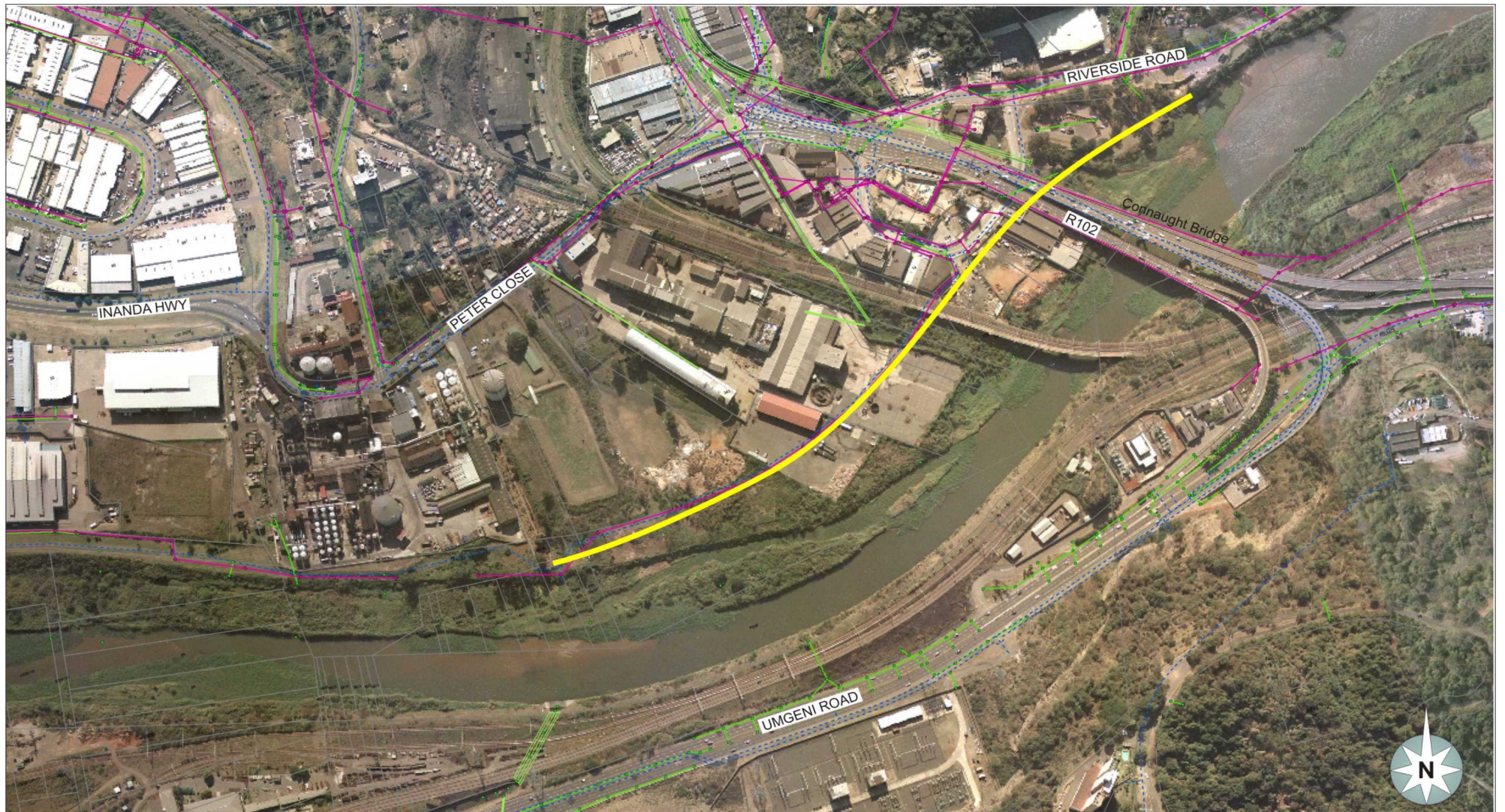


Figure 1. Location of New Flood Control Embankment (yellow line)