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ESTUARIES OF THE KWADUKUZA MUNICIPALITY

FINAL REPORT

FOR

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Preliminary Assessment for the Biodiversity and Open Space
Management Plan

Estuaries are important assets along the sub-tropical coastline. They provide and support important goods and services to the area and are attractive nodes for tourism and development. To ensure the sustainable use of these systems and prevent the cycle of degradation which has occurred in other adjacent municipalities it is important to be proactive before irreversible damage is results in limited options. The regional assessment of the biodiversity assets of the estuaries of the Kwadukuza Municipality provides an important opportunity to put in place the measures which will ensure sustainability into the future.



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Terms of Reference

The Institute of Natural Resources (INR) has been appointed to develop a biodiversity and open space management plan for KwaDukuza local municipality. This project will aim to identify and assess important areas in the municipality for the conservation of biodiversity and ecosystem services and to identify important corridors which contribute to the persistence of species and habitats. The study area begins at the high water mark and extends inland to the municipal boundary, including estuaries. MER has been appointed by INR to undertake a desktop assessment of the estuaries in the study area and to provide information to the INR regarding the importance (with respect to biodiversity conservation) of these estuarine features in the study area, the important species which occur there (red data and endemic species) and the ecosystem services provided by these environments. Additionally it is important to identify current and future activities / issues which threaten the coastal systems in the study area, and potential management actions which may negate or mitigate against these threats.

The terms of reference provided to MER for the estuarine specialist role in this project are outlined below and include scope of work, methodology, and deliverables of the sub-contract.

MER Role and responsibilities;

- a specialist report detailing the following information:
 - The role of the estuaries of this municipality in greater coastal ecosystem functioning
 - The identification of estuaries of importance from a biodiversity conservation and from an ecosystem service perspective
 - The identification of important species (red data species and endemic species) known to occur in the study area
 - The identification of current and future activities which threaten the estuaries of the study area and the important species that occur there
 - The identification of management actions which may serve to protect the estuaries of the study area and mitigate against the identified threats.



ESTUARIES OF THE KWADUKUZA MUNICIPALITY

Preliminary Assessment for the Biodiversity and Open Space Management Plan

1. BACKGROUND AND INTRODUCTION

Poor people in developing countries often depend more directly on natural resources than any other group in society. They are usually the first to suffer when those resources are damaged or become scarce. This means it is vital that we consider the environment in all our development work. How we manage the environment will affect the long-term success of development and play a significant part in our progress towards the Millennium Development Goals (MDGs).

A regional perspective of the key biodiversity/productivity areas which provide important goods and services is an invaluable exercise for the planning of open space areas. This allows for the consideration of current and potential environmental issues whilst planning development initiative over a wide area. The process evaluates the opportunities that the environment offers to development and the constraints that it imposes. Sadler (1995) recognizes the need to integrate environmental (biophysical, social and economic) considerations into the earliest stages of planning development. This process thus provides an opportunity for the encouragement and promotion of sustainable development on a strategic level (i.e. for areas, regions or sectors of development).



2. RELEVANT LEGAL FRAMEWORKS – POLICY, GUIDELINES AND LAW

2.1 Integrated Coastal Management Act

The new Integrated Coastal Management Act (ICM Act) 24 of 2008 recognises that estuaries are highly productive ecosystems which provide a number of important ecological functions that yield significant benefits to people. Estuaries are unique in that they are transition and mixing zones between the salt water and freshwater environments which creates unique and



important habitats and species assemblages. This imparts significant importance from both a biodiversity point of view and from a functional perspective. The role estuaries play in the broader coastal environment, the fact that estuaries are often the recipients of effluent created higher up in the river catchment, and their role as recreation nodes, has resulted in estuaries having been singled out as an important strategic objective in the management of the coastal zone within adjacent Municipalities (eThekweni Coastal Management Strategy 2012). Their sensitivity to human impacts (DEAT, 2000) means that a careful and co-ordinated approach is essential to ensure that these systems are maintained in a condition which provides sustainable delivery of biodiversity values, goods and services. This is the basis for the requirement within the ICM Act for integrated and improved management of estuaries in South Africa. The act requires that individual management plans for individual estuaries are developed in terms of the National Estuarine Management Protocol.

2.2 The National Water Act

The National Water Act 36 of 1998 has significance for estuaries as it determines the water quantity and quality requirements to sustain these systems for future generations. The Minister of the Department of Water Affairs and Forestry is required to ensure a portion of the mean annual runoff be set aside for the environment and users in terms of this act as well as determine resource quality objectives.

With the promulgation of the National Water Act 1998 the DWA recognised that a wider frame of information was needed by decision-makers and these ideas have been influential in guiding Integrated Water Resources Management (IWRM) in various catchments. The concepts and characteristics useful in an assessment such as this include:

- the integration of environmental and social considerations into multisectoral decision making;
- the emphasis of participatory and consultative approaches;
- monitoring and the evaluation of outcomes;
- widening the perspectives of planners beyond immediate sectoral issues; and;
- the idea that the outcome of this kind of assessment is a tangible product (a policy, strategy or plan) as well as a process.

3. ESTUARIES IN THE SUBTROPICAL ZONE AND KZN

3.1 Regional perspective

There are 300 currently recognised estuaries in South Africa. However, the latest National Biodiversity Survey (2011) has concluded that based on the proportion of estuaries in good ecological condition, 43% of estuary ecosystem types (20 types out of 46 types) are classified as threatened, **representing 79% of SA estuarine area**. The estuaries of KZN as a subset of this national list fall into the sub-tropical zone and the latest assessment considers that **75% of**



the province's estuarine resource is in POOR condition. The KwaZulu-Natal south coast had the highest number of estuaries in a poor state. This was largely due to direct habitat loss and artificial breaching related to development pressures in the estuarine functional zone, as well as intensive sugar cane farming in most of the catchments.

The loss of estuarine habitat and function that has already occurred within this region means that it is now essential to begin to protect more definitely what remains in order to accommodate regional ecosystem processes. This is important due to issues of connectivity between systems and by stepping-stone principle to the regional scale. The small size of many of the estuaries in the region makes them in the first instance vulnerable to the impact of human activities at the coast but also makes them a more important resource as a collective. It is important to note here that it is acknowledged and recognised that large systems support large populations thereby ensuring greater probability of persistence of these organisms. However these large systems also provide important marine linked goods and services such as a) larger cues to marine species in terms of freshwater outputs (this also increases their regional influence on a stretch of coastline), and nutrients and sediments to support coastal processes and activities. The collective value of the small systems of KZN come from the cumulative area of the estuarine nursery grounds contained within the estuarine functional zones and the overall connectivity they impart to estuaries within the region. What is also particularly important is that not all the systems open at the same time or for the same length of time. Thus the way in which populations interact with these estuaries may be relatively unpredictable in some areas (Turpie et al 2010).

Connectivity is important for populations of resident estuarine species in particular. Smaller systems are much more vulnerable to reduction in mouth opening (due to reduced water supply) than larger systems. The reduction in usability of closed systems along the coast affects those estuarine dependent species which have to move between rivers, estuaries and marine environments to breed, also limiting the nursery habitat available to important migrant invertebrates (e.g. prawns) and fish (e.g. spotted grunter, Natal stumpnose).

From an evolutionary point of view, protecting small estuaries may be important owing to the high variability of their physical characteristics (Turpie et al 2010) . Incorporating such variability into the planning around estuaries is extremely valuable in that it ensures that within-species genetic diversity is maintained at a high level and because it facilitates the persistence of rare species that may be outcompeted and extirpated in the larger, more stable systems.

The philosophy which underpins this report and provides the basis for the recommendations ensure that the existing populations are protected and remain viable and sustainable and that connectivity can remain at a scale sufficient to maintain genetic integrity and evolutionary processes. They also aim to maintain landscape-level processes that maintain ecological integrity at a large scale.



3.2 Estuary Processes

Estuaries are highly productive ecosystems that play an important role in the supply of organisms, sediments and nutrients to the coastal environment. Ecologically they serve as vital nursery areas for a number of marine fish and invertebrates and are important feeding and roosting areas for a number of bird species, both resident and migratory. In addition to their ecological function, estuaries fulfill important economic and cultural functions as described in the following section. They are also affected by catchment and coastal activities, both of which are impacted by global change. The presence of extensive tracts of salt marsh or mangrove habitats protect adjacent land and human settlement from storm surges caused by high intensity coastal storms. Salt marshes and other littoral vegetation also intercept contaminants in runoff and thus can buffer the effects of pollution.

All estuaries are typically areas of transition from a tidal regime at the mouth or lower reaches during open mouth conditions to freshwater flows from landward. This involves a change from the reversing tidal flow in the lower reaches, which will depend on the mouth condition, to the permanent unidirectional river flows upstream and an overall transition or gradient from saline to freshwater conditions. As saline and freshwaters meet, degrees of mixing occur depending on forcing conditions such as wind and currents, resulting in both longitudinal and vertical gradients.

Estuaries are further characterised by patterns of sediment distribution arising from the inputs of fluvial and marine sediments and the sorting and dispersion of these materials by tidal and riverine currents. Salinities and sediments critically affect a suite of physical and chemical conditions in the estuary with knock on effects on the nature and distribution of both the estuarine flora and fauna.

3.3 Issues and Opportunities

3.3.1. *Factors affecting estuarine functioning and degradation in KZN*

The importance of estuaries globally (REF) and nationally (Whitfield 2000; DEAT 2000; Allanson and Baird 2001) has long been appreciated but this has unfortunately not always translated into formal protection on the ground. This is a significant aspect because estuaries are important natural habitats, being highly productive and playing an important ecological role for a number of resident and migrant invertebrate, fish and bird species, a variety of which is of significant commercial value. **Global assessments have found that unfortunately, coastal and marine ecosystems are among the most productive, yet threatened, ecosystems in the world (Millennium Assessment Report 2005). Of all coastal subtypes, estuaries and marshes support the widest range of services and may be the most important areas for ecosystems services.** This is because these systems produce



disproportionately more services relating to human well-being than most other systems, even those covering larger total areas. At the same time, estuarine habitats are experiencing some of the most rapid environmental change: approximately 35% of mangrove area worldwide has been lost or converted (in those countries for which sufficient data exist, which encompass about half of the area of mangroves) and approximately 20% of coral reefs have been destroyed globally in the last few decades, with more than a further 20% being degraded. Coastal wetland loss in some places has reached 20% annually.

The major anthropogenic issues and factors affecting estuarine function and driving degradation can be listed as follows:

- **Irreversible habitat loss** is caused by the development of urban/commercial or industrial zones and infrastructure developments such as road and rail bridges with the associated causeways **within the delineated estuarine functional area**. This will be compounded by fringing urban and industrial development and general infilling of estuarine wetlands.
- Estuaries over geological time are **natural sediment traps**, the rate depending on local catchment erosion dynamics and land use. In the KZN context of hilly conditions and steep gradients the historical development of sugar cultivation within floodplains and the estuary boundaries accompanied by drainage of wetlands and clearance of natural vegetation is seen as having a major accelerating impact on catchment erosion and consequent estuarine processes, influencing sedimentation and water flow patterns. A complicating factor in terms of sediment mobilization is the effect of sandwinning operations which appear to be under minimal or zero levels of control. These activities disrupt river flow channels mobilizing sediments, destroy riparian vegetation, are potential sources of pollutants derived from oil or fuel spills and are characterized by no known attempts at rehabilitation or re-vegetation.
- Estuaries are typically associated with **spatial or temporal salinity gradients**. These are disrupted by damming or other forms of abstraction from catchment rivers which disrupt seasonal water flow patterns. In most cases it is a matter of water loss but in some cases flow is enhanced by addition of treated waste water from sewage works. Water quantity changes require DWA licensing procedures to be followed.
- **Artificial breaching of the sandbars / mouths of estuaries** in the case of intermittently open systems has been carried out for decades in order to protect agricultural or low lying developments in the aptly named flood plains which would be naturally inundated following mouth closure. This inundation significantly extends the functional estuarine habitat, carrying capacities and diversifies habitat availability. Artificial breaches have been shown to have significant adverse impacts on estuarine fauna and unseasonal breaches disrupt life cycles of estuarine dependent species e.g.



spotted grunter, white prawns (both recreationally and commercially significant species).

- **Water quality** is significantly degraded by agricultural and waste water runoff. Agricultural runoff and waste water discharge significantly add to nutrient levels and accelerates macrophytic plant and algal growth, particularly alien species such as the water hyacinth. This plant proliferation eventually dies and decays reducing oxygen levels in the water column with highly adverse effects on the fauna. Algal proliferation in the water column produces extreme dissolved oxygen fluctuations over 24 hour periods with similar adverse effects. Waste water runoff may be contaminated by nutrients, organic materials and harmful bacteria thereby generating adverse effects for both the natural fauna as well as endangering human use of such waters. These latter effects are particularly significant in intermittently open systems which are highly vulnerable during closed mouth periods when there is no diluting or flushing effect. Even when operating to legally acceptable standards, treatment works still constitute major sources of nutrients to closed estuaries thereby further driving artificial breaching activities to deal with the harmful effects of these anthropogenic impacts.

4. ESTUARIES OF THE KWADUKUZA DISTRICT MUNICIPALITY

The KwaDukuza municipal boundaries incorporate eight estuaries, viz. from south to north,

- uThongathi
- uMhlali
- Bob's stream
- Seteni
- uMvoti
- Mdlotane
- Nonoti and
- Zinkwasi.

These eight estuary all fall fully (entire estuary) within the KwaDukuza municipality except for the uThongathi where the south bank falls under the eThekweni municipality.

4.1 Estuary Characteristics

Five estuarine types are recognized in the South African context, viz.

- permanently open;
- estuarine lakes such as St Lucia, where tidal influence is minimal;
- marine dominated, tidal estuarine bays such as Durban Bay;
- river mouths where the topography and river flow levels maintain largely permanent fresh water conditions,



- and finally the most common type on the KZN coast which are referred to as temporarily open/closed or, alternatively, intermittently open systems.

This last category recognizes the fact that these systems tend to close off from the sea during the relatively dry winter months and to breach during the relatively wetter summer months when river flow is greater. Mouth closure results in the absence during this period of any tidal effects and, depending on winter river flows, a progressive change towards fresh conditions and varying degrees of back flooding occurs, depending on the height of the sand berm at the mouth.

Not all estuaries fall easily into one or other category and consequently Harrison, Cooper & Ramm (2000) partially agree with Whitfield (2001) but describe the uMvoti and uMhlali as open systems. Surveys undertaken by the authors of this report provide data to suggest that the uMhlali is more appropriately (Table 3.1) categorised as a river mouth. More recent assessments (MER 2007, 2009 & 2010 and Sanbi 2012) have incorporated a previously unlisted estuary Bob's Stream and confirmed that all KwaDukuza systems fall into the intermittently open category except for the uMvoti which is given river mouth status.

Table 4.1 Estuarine types found within the Kwadukuza Municipality

Estuary name	Estuarine Category Whitfield (2001)	Estuarine Category Harrison, Cooper & Ramm (2000)	Estuarine Category MER (2007, 2009, 2010)	Estuarine Category SANBI (2012)
uThongathi	Intermittently open	Intermittently open	Intermittently open	Intermittently open
uMhlali	Intermittently open	Open	Intermittently open	Intermittently open
Bob's Stream	-	-	Intermittently open	Intermittently open
Seteni	Intermittently open	Intermittently open	Intermittently open	Intermittently open
uMvoti	River mouth	Open	Not sampled	River mouth
Mdlotane	Intermittently open	Intermittently open	Intermittently open	Intermittently open
Nonoti	Intermittently open	Intermittently open	Intermittently open	Intermittently open
Zinkwazi	Intermittently open	Intermittently open	Not sampled	Intermittently open

4.1.1. Factors affecting estuarine functioning and degradation within the Kwadukuza Municipality

Following on from the factors listed in Section 3.3.1 the factors affecting estuarine health in the Kwadukuza municipality are described more specifically below.

Irreversible habitat loss and sedimentation

As regards irreversible habitat loss, a major contrast between the KwaDukuza estuaries and the eThekweni and south coast systems is that the immediate estuarine surrounds, with relatively minor exceptions, have not experienced the same degree of irreversible habitat loss due to



urban, industrial and road and rail development that is a feature of virtually every estuary from Durban southwards to the KZN border. This is not to say that the KwaDukuza estuaries have not changed during the period of human modification of the catchments. Anecdotal evidence indicates that the original sugar mill in the vicinity of the Tinley Manor rail siding was constructed using materials brought up by boat from the uMhlali estuary; this would clearly be impossible now. Further anecdotes suggest that the bridge opposite the above rail siding was accessible by skiboat from the estuary in the 1960's. Published data (Blaber, Hay, Cyrus & Martin 1984) indicate that skiboat access as far as the N2 freeway on the uThongathi was possible in 1980. There are strong arguments that accelerated and sedimentation of virtually all KZN estuaries has been associated with insensitive agricultural development in the frequently steeply sloped catchments. Evidence of this is clearly seen in the herring bone drains which indicate wetland areas as well as farming activity into the riparian zone and into the estuarine functional space. **A systematic loss of habitat has occurred as a result of agricultural activities but this is now considered to provide opportunities for improvement of these systems as it is considered to be largely reversible. This loss of habitat is particularly pronounced in the following systems in order of magnitude;**

1. Zinkwazi (65%)
2. Umhlali (60%)
3. Nonoti (60%)
4. Umvoti (85%)
5. uThongathi (55%)

It is important that this should not be taken to mean that the habitat remains is insignificant or that the lost habitat is irreversibly lost from the estuary. This makes the functional estuarine habitats remaining even more significant and worthy of protection.

Abstraction and damming

There are no major dams on the rivers within the KwaDukuza municipal area but farm dams are not uncommon, abstraction for irrigation occurs and Merthley Dam near Greytown is situated on the upper reaches of the uMvoti river. It is to be expected that dam proposals will become more frequent as the demand for water at the coast increases and the effects of climate change become more pronounced. A dam on the uMvoti river is currently under consideration.

Artificial breaching

Begg (1984) refers to artificial breaching for various reasons of **all the estuaries from the uMhlali to the Zinkwasi** at various times and at varying frequencies during the 1960s and 1970s. The records in this report indicate that breaching was most frequent – 10 occasions between 1977 and 1982 - in the case of the Zinkwasi for “health reasons” which suggest that pollution of some sort was the underlying driving force although it is suspected that this drier period resulted in mouth closure and backflooding of farm dams. This impact is irrevocably



linked with habitat loss and the two act cumulatively to produce a profound effect on estuarine health, integrity and function.

Water quality

Along with habitat loss the second most common degrading impact for all the KwaDukuza estuaries has been the input of various pollutants, derived partly from agricultural runoff, but more commonly and obviously from sugar and paper mills and from waste water treatment works. Prior to 1984 Begg (1984) described serious bacterial contamination in the Zinkwasi lagoon arising from septic tanks, the caravan park and organic pollution derived from the Darnall mill. Not all these problems appear to have been resolved. The Nonoti had apparently recovered from a “black and lifeless” condition in the 1960s by the 1980s (Begg 1984) but bacterial levels were still poor in 2010 (Forbes & Forbes 2011). Begg (1984) described the Mdlotane as having depressed oxygen levels but overall the Mdlotane represents one of the less impacted KwaDukuza estuaries (Demetriades & Forbes 2006). The uMvoti is the largest system in the KwaDukuza area with a catchment area of about 2 500 km² and a length of about 200 km. It is subject to major flood events but has also arguably been the system most affected by human activities. These historically included “severe siltation” and “gross pollution” (Begg 1984) and ongoing impacts derived from sand winning, water abstraction and the waste products of sugar and paper mills (Harrison, Cooper & Ramm 2000; Mackay, Weerts & Cyrus 2000).

The Seteni is a relatively small system with a catchment totally dominated by sugar cane. According to Begg (1978) siltation has been “severe” but the system seems to have escaped other impacts. There is relatively little historical information on water quality in the uMhlali apart from some comments (Begg 1984) on organic and faecal pollution of the Etete tributary. Studies in 2008 (Forbes & Demetriades 2009) indicated raised nutrient and bacterial concentrations beyond acceptable levels for domestic use above the estuary and for recreational contact in the estuary. The vulnerability to floods of the cabana development on the northern end of the sandbar has been pointed out by Begg (1984). The northern bank of the uThongathi falls within the KwaDukuza municipal area. The uThongathi has arguably been the most polluted river and estuary in the municipal area having been historically impacted by discharges or run off from sugar mills, dunder dams, ash dumps and various factories including textile manufacturers which were able to totally change the colour of the water. Surveys in August 2007 and January 2008 (Forbes & Demetriades 2010) indicated improvements in the levels of sewage pollution but no significant improvements in other parameters. The long term success of the Zimbali Lakes development on the lower flood plain will depend critically on further improvements in the water quality and the ability of the development to deal with floods.

The overall impression of the KwaDukuza estuaries is that they have all been adversely impacted to some degree beginning with accelerated sedimentation and general habitat loss,



conditions which have been exacerbated by consistently poor water quality. The unfortunately common use of estuaries as conduits for waste water has led to wide spread degradation of these habitats throughout the province. This is a result of the introduction of nutrients to these systems. This nutrification results in a ripple effect through the food chain often resulting in nuisance algal blooms, odours and fish kills.

Development planning within and around estuaries must therefore address the issues of

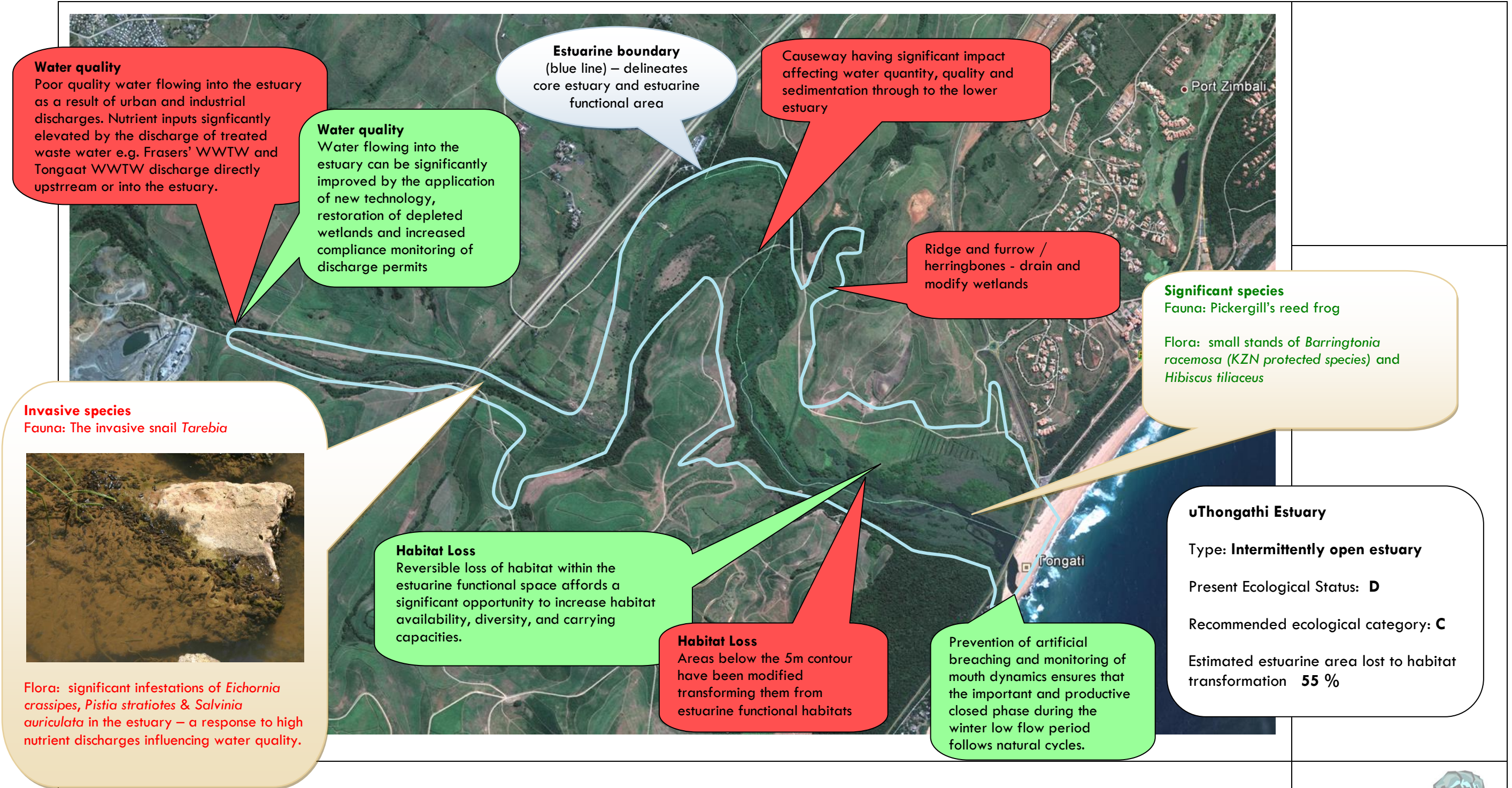
- physical, chemical and biological interactions in these habitats;
- system response (including socio-economic interactions); and
- long-term change

while bearing in mind that in the natural state the term “estuary” actually incorporates a variety of physico-chemically different aquatic environments, each with often distinctive biological features and processes and that “management” should be critically aimed at the control of impacting human activities.

4.2 The seven estuaries at a glance

The next section provides a look at each of the Kwadukuza Municipality’s estuaries and provides an easy at-a-glance summary of estuary characteristics, boundaries, issues and opportunities which should form the basis for any planning or consideration of activities on or adjacent to each system.





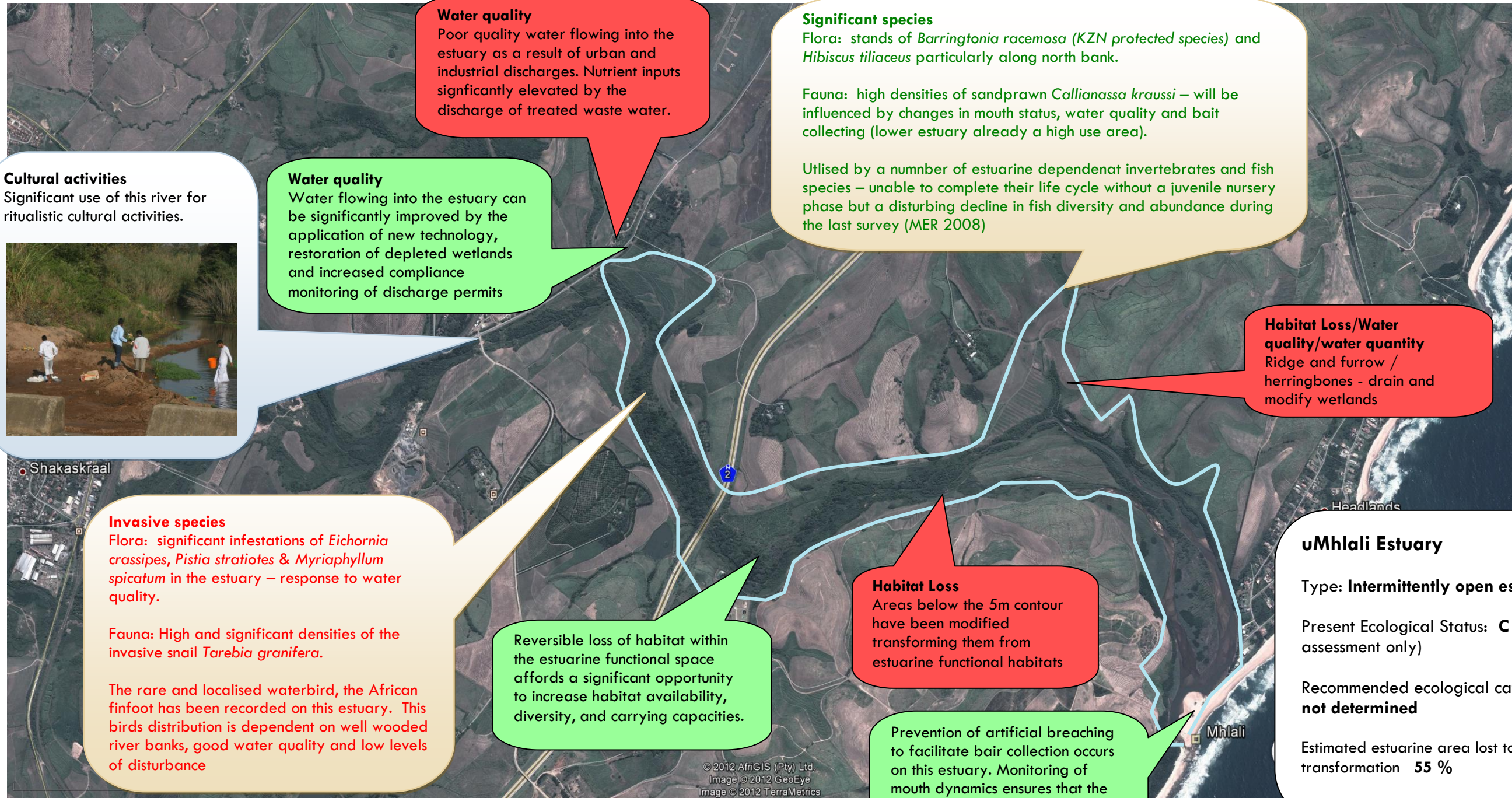
uThongathi estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or know from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.



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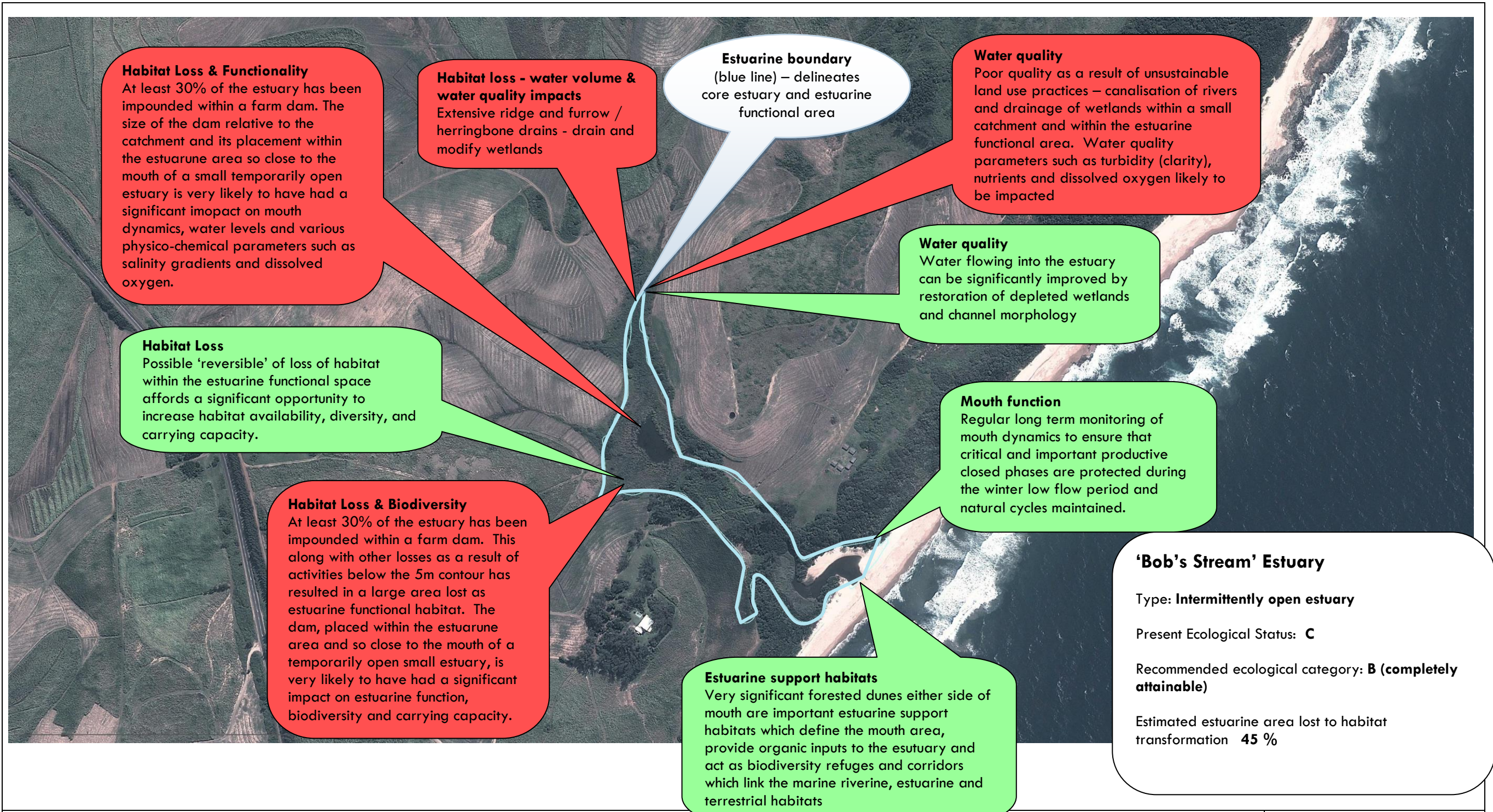
uMhlali estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or know from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.



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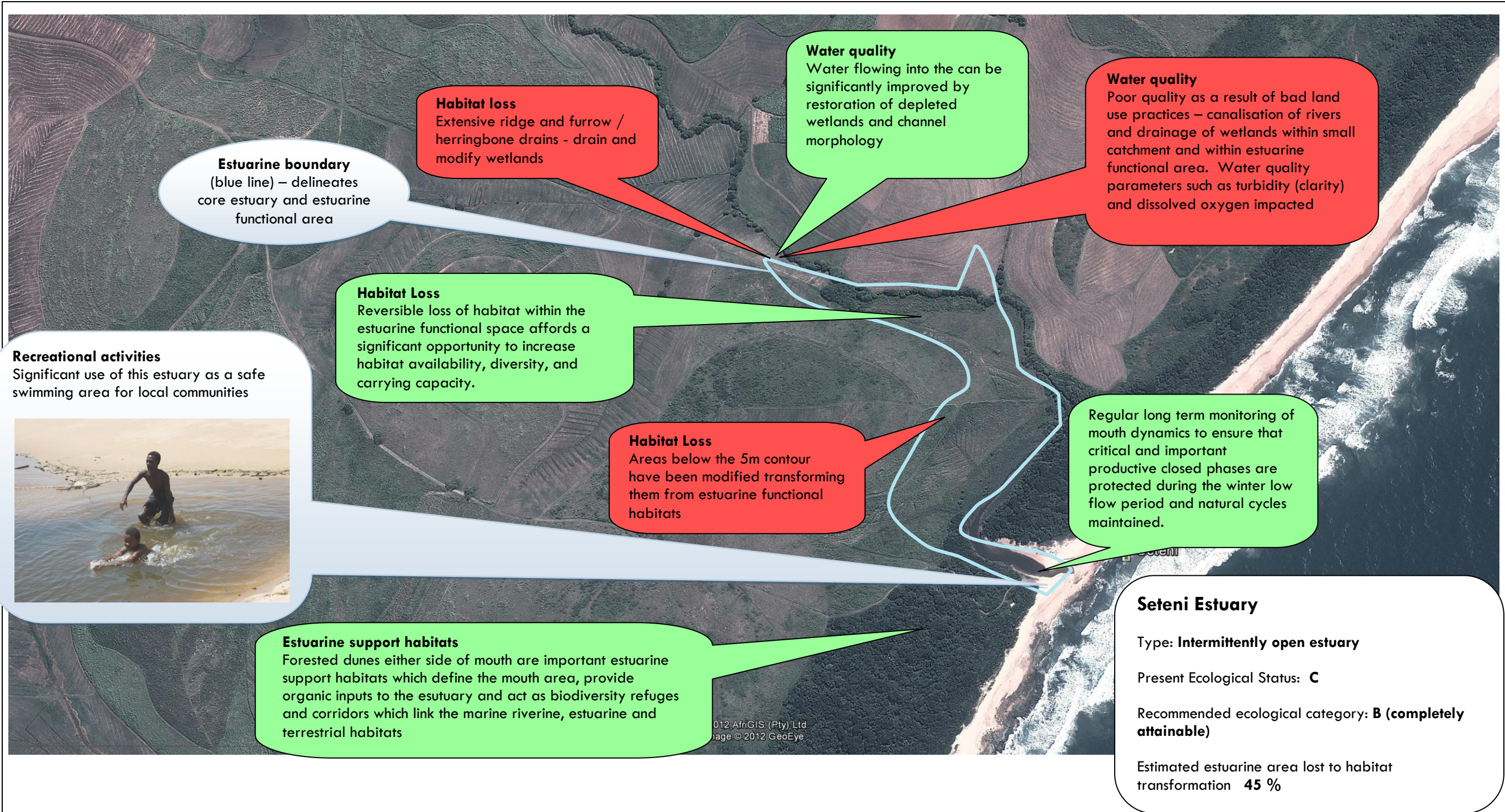




'Bob's Stream' estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or known from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.

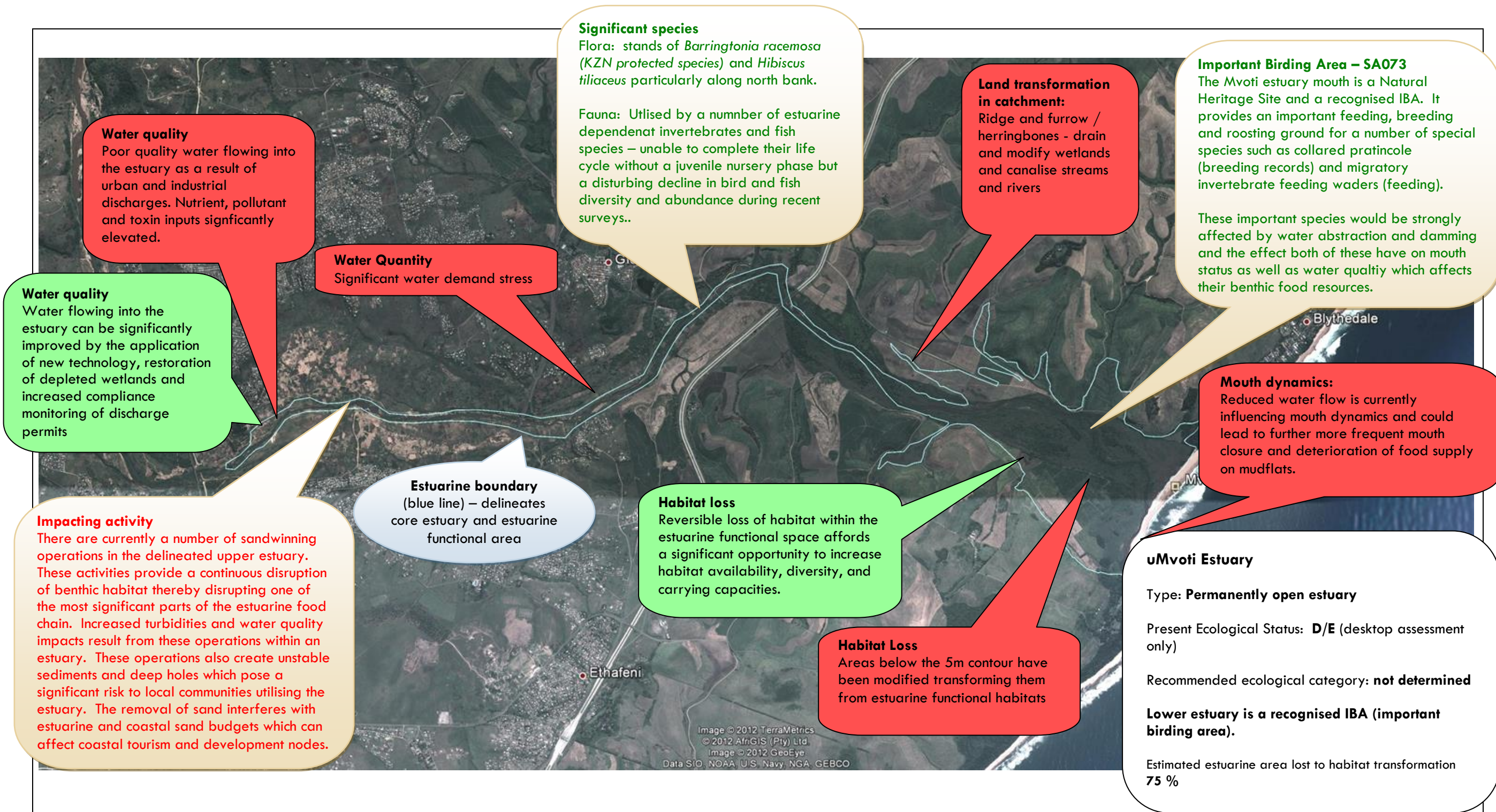




Seteni estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or known from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.





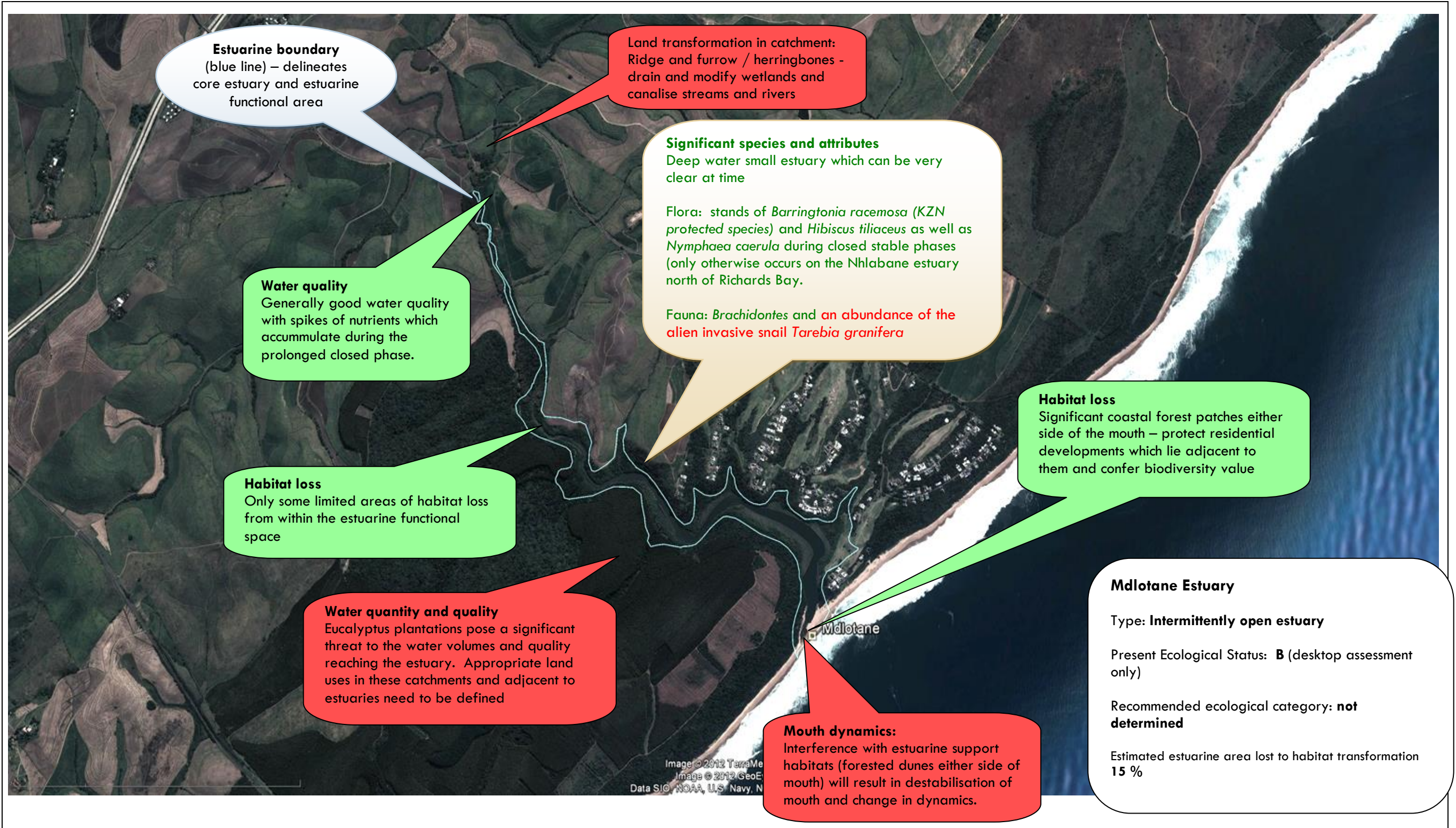
uMvoti estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or known from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.



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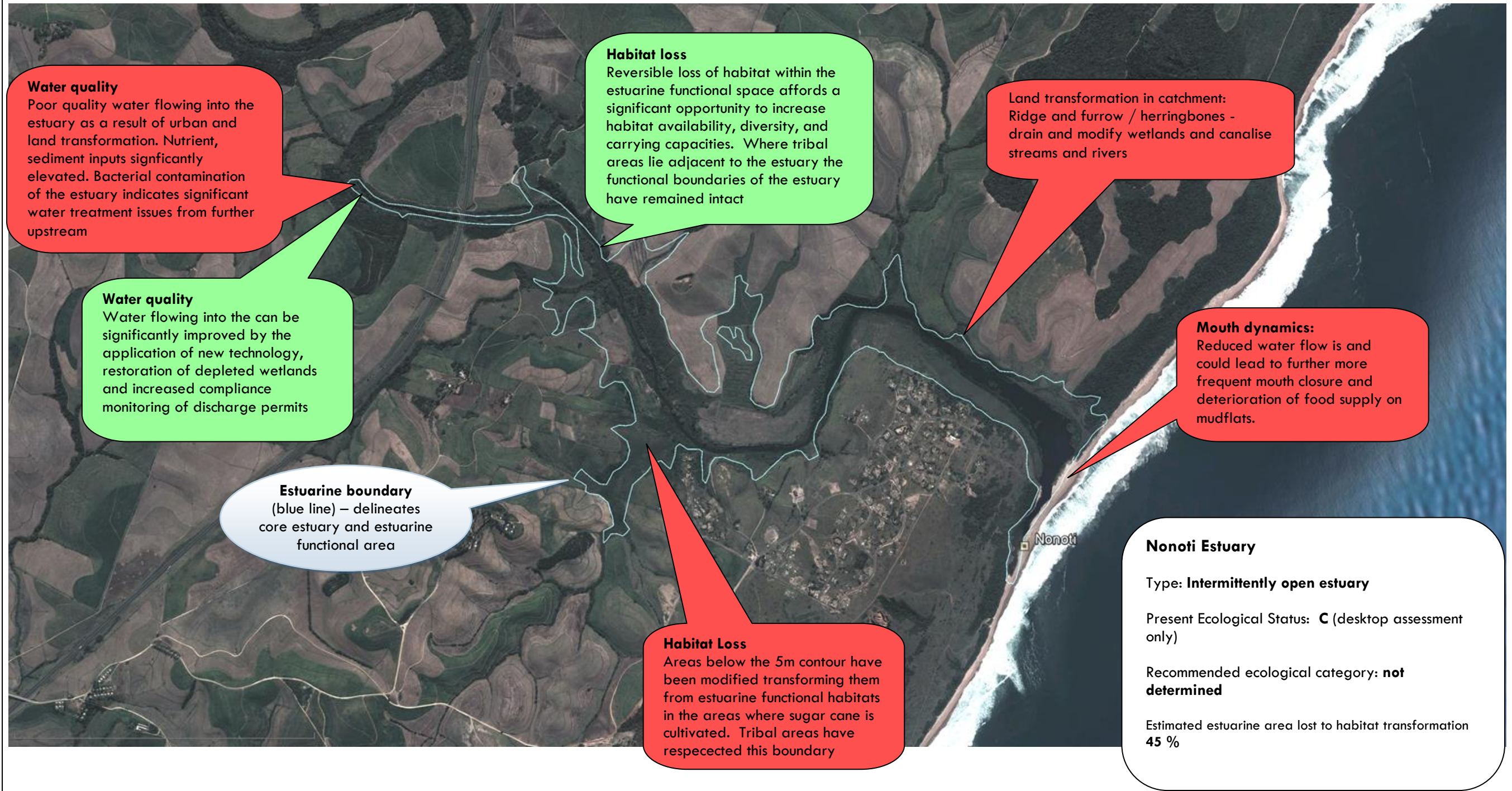




Mdlotane estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or know from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.

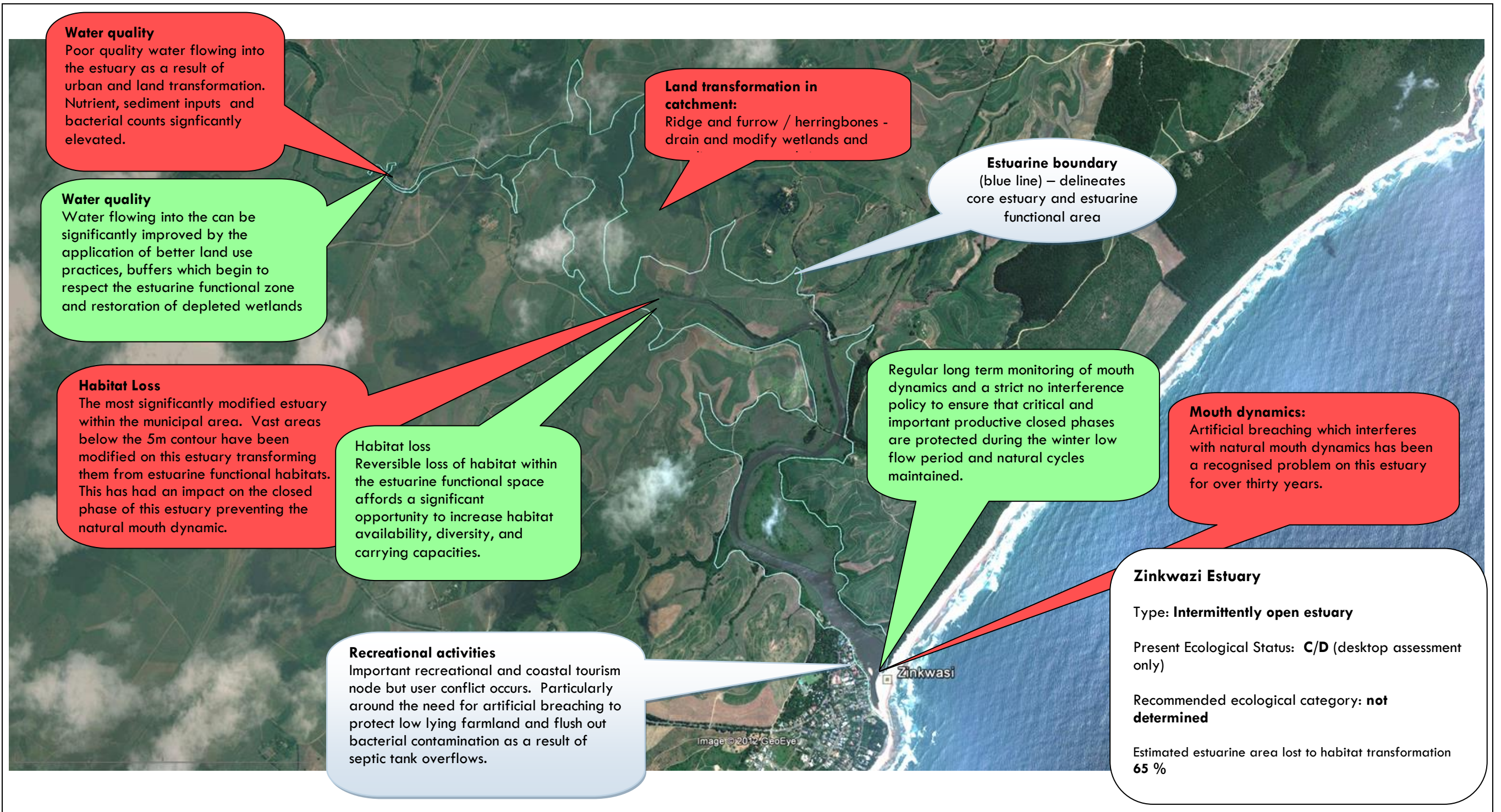




Nonoti estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or know from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.





Zinkwazi estuary at a glance – delineation, key features and issues

The aerial image shows current estuarine delineation (blue line), issues and impacting activities (red boxes) and opportunities (green boxes). Significant, rare, protected or endangered species sampled or know from the estuary are indicated (light coloured boxes with green writing) as well as invasive plant and animal species (light boxes red writing). Commercial, recreational and cultural uses noted as well where known.

5. ASSESSMENT, CONCLUSIONS AND RECOMMENDATIONS FOR IMPLEMENTATION AND ACTION

5.1 Concluding assessment

The eight estuaries which fall within the Kwadukuza Municipality boundaries are categorised as intermittently open estuaries with the exception of the uMvoti estuary which is classified as a river mouth (Table 4.1). Only one estuary with the municipality (uThongathi estuary) has had its present ecological status and preliminary ecological reserve determined formally using the methods described by the National Water Act of 1998. This is unfortunate as this process would clarify a great deal about the water quantity and quality issues facing these systems as well as provide a sound basis for the Estuarine Management Plans which are required as part of the new Integrated Coastal Management Act. Both would contribute towards the better management of impacting activities which are influencing the status of these systems thereby assisting in the restoration and proactive protection of these important ecosystem units. Fortunately a number of the estuaries have been sampled during recent times by MER and this was used recently, together with other recent information to conduct a desktop assessment as part of the National Biodiversity Assessment conducted by SANBI.

It is extremely important to take into account the regional significance of these eight estuaries. Although only eight of a total of eighty estuaries these systems are **eight** out of a total of **only nineteen** estuaries north of Durban. In addition, they are immediately adjacent to the estuaries of the eThekweni Municipality which have been recently assessed and found to be in an extremely poor state with only two of sixteen systems in a good condition and the remainder considered to be in poor to degraded condition. This makes these estuaries even more significant in the role they play on the KZN coast and particularly their role in terms of nursery function for important marine species which utilise these habitats to complete their life cycles.

The desktop assessment provides an indication of Present Ecological Status (PES) and a regional overview of the estuarine area of the municipality as well as the condition of the estuarine resource (Table 5.1). It can be quickly and clearly seen from this and Figure 5.1 that the estuarine assets of the Kwadukuza Municipality which total 924 ha (a reduced total) are on a negative trajectory. This is in evidence with only one relatively small estuary (3 ha) being considered to currently exist in a B category (largely natural with few modifications) or Good condition. This only comprises 0.4% of the estuarine habitat within the municipal area. No estuaries could be rated in an A category or Excellent condition and no estuaries have any formal protection. Four of the systems are currently sitting in a category C or Fair condition which contributes 31% of the total estuarine and a total area of 288 ha. The remaining three are considered to be in poor to highly degraded condition. One of these, namely the uMvoti estuary, is the only estuary categorised within this stretch of coastline as a river mouth and it is



Table 5.1: Estuarine Category, DWA Reserve determination status and PES of estuaries within the Kwadukuza Municipality

Estuary	Category	Size	Estuary Area (ha)	% area	Catchment Area (ha)	DWA Reserve Determination level and date	Estuarine Management Plan	PES
uThongathi	Temporarily open estuary	M	155	17.5	40 864	Intermediate level RDM conducted 2007	N	E
uMhlali	Temporarily open estuary	L	134	15.1	24 939	-	N	C
Bob's Stream	Temporarily open estuary	S	3	0.3	309	-	N	C
Seteni	Temporarily open estuary	S	5	0.6	787	-	N	C
uMvoti	River mouth	L	230	26.0	273 887	-	N	D
uMdlotane	Temporarily open estuary	S	3	0.4	3 368	-	N	B
Nonoti	Temporarily open estuary	M	145	16.4	17 531	-	N	C
Zinkwasi	Temporarily open estuary	L	211	23.8	7 790	-		C/D

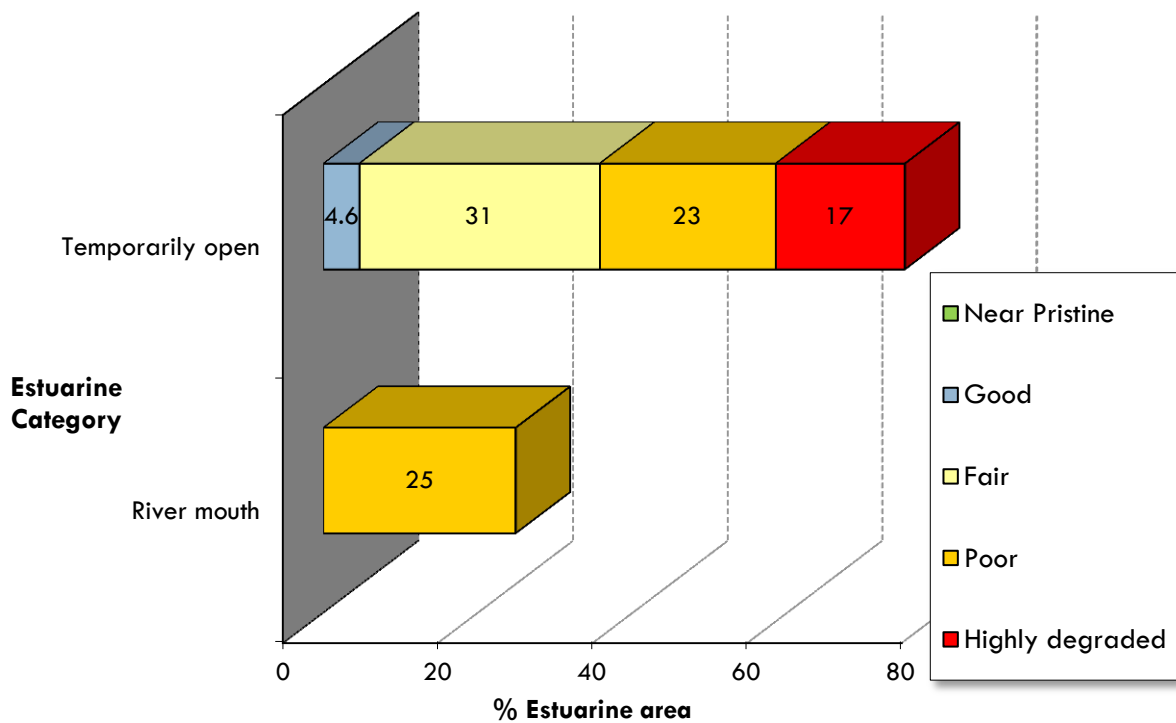


Figure 5.1 The percentage of estuarine area by estuarine category and health status within the Kwadukuza Municipality



considered to be in a category D or Poor condition. This means that for this estuarine category 100% of the estuarine area is in Poor condition.

The conditions which exist in these systems are a result of poor management of anthropogenic impacting activities and are in many cases considered completely reversible. This would require proactive interventions and collaboration between various levels of government, NGO's, landowners and stakeholders.

A note on estuaries and urban development

It should be noted that the estuarine specialists involved in this project do not consider that development and estuarine protection and enhancement are mutually exclusive. If the processes and boundaries of any estuary are integrated into planning it is completely possible to develop an area and retain a significant proportion of estuarine function and ensure the sustainable delivery of goods and services to the people of an area into the future.

5.2 Recommendations for implementation and action

A regional assessment of the biodiversity value of the municipalities estuarine resource is important to underpin large scale planning and development activities as well as providing an overview of the current state of a particular habitat to allow appropriate action plans to be drawn up. This includes:

- Application of the information provided for use at a high level to inform policies, plans or programs;
- Being pro-active around issues and impacts which may arise with future proposed activities;
- Providing a platform for partnerships (for example, public-private sector partnerships); and
- Leading to plans or strategies for action, such as policy changes, new proposals or focused EIAs for specific projects.



This therefore provides an important opportunity for the Kwadukuza municipality to consolidate and put in place the appropriate measures to protect, enhance and appropriately utilise the goods and services provided by the estuarine assets of this area.

It is recommended that the following priority actions are put in place to protect and enhance the estuaries of the Kwadukuza Municipality;

- It should be **recognised** that the estuaries of this area of coast are critically important local assets to the municipality as they are areas of natural beauty and also supply and provide critical goods and services. This is even more important in the regional context of the condition of the estuaries of KZN which has been assessed as being in general highly degraded. It is important that the Kwadukuza Municipality learns from the mistakes made in the past in adjacent municipalities to avoid estuaries becoming as highly degraded as the iSipingo or Siyaya estuaries.
- The **estuarine boundaries as defined should be adopted as a planning boundary** and no development should be allowed within the estuarine functional space. It may also be appropriate to define buffers to the lines indicated in this report for the more sensitive systems. This would be one of the major steps towards the proactive management of impacting activities and protection to prevent further degradation of these systems. This strategy is in line with the Provincial Biodiversity Guidelines of EKZNW as well as the National Biodiversity Assessment of SANBI.
- Many of the estuaries have had a major loss of estuarine habitat as a result of farming activities which have moved into the **estuarine functional zone**. This has impacted on sensitive intermittently open estuaries and had a profound effect on estuarine habitat diversity and carrying capacities. This is particularly pronounced in the **Zinkwasi as well as the Nonoti, uMhlali and uMvoti**. It is extremely important that this loss is reversed while this is still possible and includes the drawing back from the edges of the estuary by farmland as well as the removal of septic tanks and other infrastructure which becomes vulnerable or damaged during rising water levels. This would also tie in with the more natural mouth functioning in all these intermittently open estuaries.
- The interference with the mouths of estuaries is regulated in terms of the National Seashore Act and jurisdiction lies with EKZNW. Interference with a number of these estuary mouths occurs mainly as a result of waterlogging of inappropriately sited infrastructure and farmland. Water levels are usually at their highest during winter and this results in requests to breach and breaching of estuaries at their most productive and sensitive stage of the annual cycle. It is extremely important that this activity is strictly managed and that no artificial breaching is permitted or conducted. The establishment of the estuarine boundaries and restoration of the estuarine functional space as described above would likely remove the pressures which currently exist which require breaching.



- Large scale modification of the catchment rivers, streams and wetlands has occurred adjacent, in and around the estuarine boundaries. Aside from their inherent biodiversity value these systems are extremely important estuarine support areas protecting the downstream estuary from excessive sedimentation, acting as flood buffer areas and providing habitat diversity. As a result the prevailing condition in most of the estuaries within the Municipality is a linear channel with limited flow variability and habitat availability. The restoration of streams and wetlands in these catchments needs to occur and it is recommended that a more detailed analysis is conducted to identify priority wetlands and areas where this can occur.
- Many of the estuaries within this Municipality are affected by point source or diffuse pollutant inputs. Activities and discharges impacting on water quality (includes nutrient enrichment) need to be clearly identified and strategies put in place to ensure improvement in the quality of point source discharges as well as land care arrangements to deal with diffuse run-off. It is suggested that the point source discharges are dealt with initially and that the municipality work with the responsible authority DWA to identify and resolve these issues.

5.3 Final summary statement

It is worth repeating that although South Africa is well endowed with estuaries having a total of 300 those systems within KZN have been significantly degraded to the extent that 75% of the estuarine area of the sub-tropical region is considered in POOR condition. This loss of estuarine habitat and function within this region means that it is now essential to begin to protect more definitely what remains in order to accommodate regional biodiversity, function and ecosystem processes. It is important to recognise the importance of connectivity between systems which confers regional function. The small size of many of the estuaries in the region makes them in the first instance vulnerable to the impact of human activities at the coast but also makes them a more important resource as a cumulative area covering more than 150 kms of coastline. The Kwadukuza estuaries lie between the seriously compromised estuaries of eThekweni and the coastal plain estuaries beyond the Thukela. They are therefore already struggling with connectivity as a result of the loss of estuarine function in the adjacent municipality to the south and they therefore play an extremely important linking role with important marine linked goods and services along the KZN coastline. The collective value of the small systems of KZN comes from the cumulative area of the estuarine nursery grounds contained within the estuarine functional zones and the overall connectivity they impart to estuaries within the region. The Kwadukuza estuaries being predominantly temporarily open ones are a highly significant resources and it is important that not all these systems will be open at the same time or for the same length of time. Thus the way in which coastal populations interact with these estuaries is highly significant and serious efforts should be made to protect and restore wherever possible their estuarine area and processes.



6. REFERENCES

- Allanson, B.R. & Baird, D. 1999. Estuaries of South Africa. Cambridge University Press, Cambridge.
- Badenhorst P. 1990 Mouth dynamics and siltation of the estuary. In: Ecological water requirements of the Mvoti river estuary workshop 25-26 April 1990. La Montagne Hotel, Ballito. Unpubl.
- Begg G.W. 1978 The Estuaries of Natal. *Natal Town and Regional Planning Report* 41:1-657
- Begg G.W. 1984a The Estuaries of Natal. Part 2. Supplement to NTRP Report Vol.41. *Natal Town and Regional Planning Main Series Report* Vol 55:1-631
- Begg G.W. 1984b The Comparative Ecology of Natal's Smaller Estuaries. *Natal Town and Regional Planning Report*. Vol 62:1-182
- Blaber S.J.M., Hay D.G., Cyrus D.P. & Martin T.J. 1984 The ecology of two degraded estuaries on the north coast of Natal, South Africa. *South African Journal of Zoology* 18:311-319
- SANBI 2012. *National Biodiversity Assessment 2011: An assessment of South Africa's biodiversity and ecosystems. Synthesis Report*. South African National Biodiversity Institute and Department of Environmental Affairs, Pretoria.
- Forbes A.T. & Demetriades N.T. 2009 Ecological Assessment of the uMhlali estuary July – October 2008. Report for Siza Water.
- Forbes A.T. & Forbes N.T. Date Ethekekwini estuaries
- Harrison T.D., Cooper J.A.G. & Ramm A.E.L. 2000 State of South African Estuaries. Geomorphology, Ichthyofauna, water Quality and Aesthetics. *State of the Environment Series. Report No. 2*. Department of Environmental Affairs and Tourism, Pretoria, South Africa
- Mackay C.F., Weerts S.P. & Cyrus D.P. 2000 Ecological evaluation of the lower Mvoti river and estuary. CRUZ Environmental Report No. 4. 91 pp + Appendices. Unpubl.



Morant, P.D. & Quinn, N.W. 1999. Influence of Man and management of South African estuaries. In: *Estuaries of South Africa*. pp. 289-320. Allanson, B.R. & Baird, D. (eds). Cambridge University Press, Cambridge.

Sadler B, 1995. *Towards the improved effectiveness of environmental assessment*. Executive Summary of Interim Report Prepared for IAIA'95. Durban, South Africa.

Turpie J.K., Adams J.B., Joubert A., Harrison T.D., Colloty B.M., Maree R.C., Whitfield A.K., Wooldridge T.H., Lamberth S.J., Taljaard S. & van Niekerk L. 2002 Assessment of the conservation priority status of South African estuaries for use in management and water allocation. *Water SA* 28(2):191-206

Whitfield A.K. 2006 Available Scientific Information on Individual South African Estuarine Systems. *Water Research Commission Report No. 577/3/00*

