BALANCED ENVIRONMENT

Proposed KwaNgqathu Residential Development, Shongweni

Wetland Delineation

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Expertise / Field of Study: …B.Sc (Hons) Env Man - Wetland Ecologist …………………

I, …Robert Gregory Mullins…….. declare that this report has been prepared independently of any influence or prejudice as may be specified by the Department of Agriculture and Environmental Affairs.

Signed:…………………………………… Date:……02/12/ 2007………..

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PROPOSED KWANGQUTHA RESIDENTIAL DEVELOPMENT, SHONGWENI

WETLAND DELINEATION REPORT

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WETLAND DELINEATION REPORT

1 WETLAND DELINEATION

1.1 Introduction

Wetlands are defined as those areas that have water on the surface or within the root zone for long enough periods through the year to allow for the development of anaerobic conditions. These conditions create unique soil conditions (hydric soils) and support vegetation adapted to these flood conditions.

In terms of Section 1 of the National Water Act (Act 36 of 1998), wetlands are legally defined as:

(1)...land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.

Hydric soils develop a grey or sometimes greenish or blue-grey colour, as a result of the chemical reduction of iron (gleying). Hydric soils that are seasonally flooded are characterised by the formation of mottles, which are relatively insoluble, enabling them to remain in the soil long after it has been drained. Consequently it is possible to identify wetland areas on the basis of soil colour, using a standard colour chart, as matrix hue and chroma decrease, while mottle hue and chroma initially increase and then decrease the more saturated the soils become (Table 1).

Table 1: Relationship between degree of wetness (wetland zone), soil-physio-chemistry and vegetation (after Kotze et al, 1994)

<table>
<thead>
<tr>
<th>Degree of wetness</th>
<th>Temporary</th>
<th>Seasonal</th>
<th>Permanent / Semi-permanent</th>
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<tr>
<td>Soil Depth (0cm – 10cm)</td>
<td>Matrix chroma: 1-3 Few / no mottles Low / intermediate OM Non-sulphuric</td>
<td>Matrix chroma: 0-2 Many mottles Intermediate OM Seldom sulphuric</td>
<td>Matrix chroma: 0-1 Few / no mottles High OM Often sulphuric</td>
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<tr>
<td>Soil Depth (40cm – 50cm)</td>
<td>Few / many mottles Matrix chroma: 0-2</td>
<td>Many mottles Matrix chroma: 0-2</td>
<td>No / few mottles Matrix chroma: 0-1</td>
</tr>
<tr>
<td>Vegetation</td>
<td>Predominantly grass species</td>
<td>Predominantly sedges and grasses</td>
<td>Predominantly reeds and sedges</td>
</tr>
</tbody>
</table>

Vegetation distribution within wetlands is very closely linked to the flooding regime. Terrestrial plants are not tolerant of flooding within the root zone for periods long enough to cause anaerobic conditions, and are thus found on higher ground. The distribution of wetland plants is related to their tolerance of different flooding conditions, and their distribution within a system can be used as an indication of the wetness of an area.

Typically, indicators of soil wetness based on soil morphology correspond closely with vegetation distribution, since hydrology affects soils and vegetation in systematic and predictable ways. However, in systems where the hydrological regime has been modified due to human activities, vegetation distribution will not vary systematically with soil morphology. The response of vegetation to alteration of hydrological conditions is rapid (months/years), whereas the response of soil morphology to such alteration is slow (centuries). Therefore, lowering of the water table or reduction...
of surface flows, may lead to rapid establishment of terrestrial vegetation, whereas the soil morphology will retain indicators of wetness for a lengthy period.

Soil morphology forms the basis of wetland delineation nationally, following international protocols, mainly because it provides a long-term indication of the “natural” hydrological regime. However, soil morphology cannot be considered to necessarily reflect the current hydrological conditions of the site where the hydrological regime has been altered, and in such circumstances vegetation provides the best indication of the distribution of wetlands as it best reflects current hydrological conditions.

### Terrestrial
- Some erosion
- No baseflow
- No residual pools
- Terrestrial plants
- No mottles
- No wetland vegetation

### Temporarily waterlogged
- Yellow-brown soils
- Few mottles
- Mixture of Terrestrial and wetland plants
- Some Wetland Vegetation
- Intermittent baseflow

### Seasonally waterlogged
- Mixture of wetland and terrestrial grasses
- Significant wetland vegetation
  - (Hydrophilic grasses and sedges)
- Deposition of Coarse material
- Seasonal Base Flow
- Often Residual Pools
- Grey soils
- Many mottles

### Permanently waterlogged
- Significant Wetland Vegetation (Sedges, reeds, bulrushes)
- Permanent Base Flow
- Permanent Inundation
- Grey soils
- Few mottles

Figure 1: Cross section through a wetland, indicating how the soil wetness and vegetation indicators change along a gradient of decreasing wetness, from the middle to the edge of the wetland. (Reproduced from Kotze (1996), DWAF Guidelines)

Wetlands are known to perform a number of important functions within ecosystems. These include flood attenuation, sediment trapping, improving water quality and being areas of rich biodiversity. The disturbance or loss of wetlands has been directly linked with numerous natural disasters and species loss, both within South Africa and globally. What is important to note is that, should one of these wetland functions be greatly affected, this does not necessarily mean that other functions are not still intact. In other words should the flood attenuation function of a wetland have been greatly reduced through the cutting of vegetation across the site, this does not necessarily mean that the wetlands ability to purify water has also been lost. In many cases, obviously dependent on the degree and nature of disturbance, wetlands still maintain some degree of functionality.

### 1.2 Terms of reference

SiVEST was required to carry out the following scope of work during this investigation:

- Identify and delineate all wetland areas within the designated development area;
- Provide suitable buffer zones to these wetland areas (20 metre);
- Assess potential impacts that may arise from any development or associated infrastructure; and
1.3 Site description

The proposed KwaNgqutha housing development is located on approximately 9 kilometres south east of Mpumalanga / Hammarsdale on the plateaux overlooking the Sterkspruit River to the east (Figure 2). The site comprises a generally flatter western portion which slopes towards the east and significantly steeper eastern section which forms part of the incised Sterkspruit River Valley.

A series of small, eroded wetland drainage lines are located on the northern portion of the property. Various land-use practices on the site have significantly degraded these wetlands.

The majority of the site is dominated by disturbed grassland, rocky outcroppings, informal residences and a narrow hydrophytic zone (Figure 2).

1.4 Legislation

The protection and correct management of wetlands is entrenched in a number of places within South African Law. The following is an indication of the relevant legislation pertaining to development and wetlands and is by no means a full legal review.


The legal source for environmental law in South Africa is the Constitution of the Republic of South Africa (108 of 1996). The Constitution fundamentally altered the legal environment in South Africa and all laws must be interpreted within the context of the Constitution. After the Constitution the National Environmental Management Act (107 of 1998) and the Environmental Conservation Act (73 of 1989) are the most important pieces of Environmental Legislation. Under the Constitution greater emphasis has been given to improving the social environment. The Bill of Rights is fundamental to the Constitution of the Republic of South Africa, and in Section 24 states that:

*Everyone has the right (a) to an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that (i) prevent pollution and ecological degradation; (ii) promote conservation; and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*

**National Environmental Management Act (107 of 1998)**

NEMA is South Africa’s overarching environmental legislation and has, as its primary objective to provide for co-operative governance by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance and procedures for co-ordinating environmental functions exercised by organs of state and to provide for matters connected therewith (Government Gazette, 1998).

The Act provides for the right to an environment that is not harmful to the health and well being of South African citizens; the equitable distribution of natural resources, sustainable development, environmental protection and the formulation of environmental management frameworks. In addition there is recognition that development must be socially, environmentally and economically sustainable and that the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied (Government Gazette, 1998).
Figure 2 - KwaNgqutha Site with cadastral
Section 30 (1, 3 and 4) of the NEMA states that:

(1) (a) “incident” means an unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed. (b) “responsible person” includes any person who; (i) is responsible for the incident; (ii) owns any hazardous (as listed in SABS 0228) substance involved in the incident; or (iii) was in control of any hazardous substance involved in the incident at the time of the incident;

(3) The responsible person or, where the incident occurred in the course of that person’s employment, his or her employer must forthwith after knowledge of the incident, report through the most effective means reasonably available (a) the nature of the incident; (b) any risks posed by the incident to public health, safety and property; (c) the toxicity of substances or by-products released by the incident; and (d) any steps that should be taken in order to avoid or minimise the effects of the incident on public health and the environment to; (i) the Director-General; (ii) the South African Police Services and the relevant fire prevention service; (iii) the relevant provincial head of department or municipality; and (iv) all persons whose health may be affected by the incident.

(4) The responsible person or, where the incident occurred in the course of that person’s employment, his or her employer, must, as soon as reasonably practicable after knowledge of the incident; (a) take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons; (b) undertake clean-up procedures; (c) remedy the effects of the incident; (d) assess the immediate and long-term effects of the incident on the environment and public health.

The National Environmental Management Act (107 of 1998) extends legal liability beyond simply the person directly responsible for environmental degradation. In terms of the Act the land owner, his representatives and the person responsible for the environmental degradation will be liable for any costs of remediation if any construction were to take place within the Permanent / Semi-permanent and Seasonal boundary.

NEMA also governs the Environmental Impact Assessment process and the list of activities deemed, under the Act, to require either a basic or a full Environmental Impact Assessment.

According to Government Notice 386 and 387 issued in terms of Section 24 of NEMA (Act 107 of 1998), the following listed activities potentially affect development in and around wetlands and riparian areas.

**GNR No. 386 - Activities requiring a Basic Assessment**

1. any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including –

   a) canals;
   b) channels;
   c) bridges;
   d) dams; and
   e) weirs;

   (t) marinas and the launching of watercraft on inland fresh water systems;

4. The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic metres from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.

12. The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
16 The transformation of undeveloped, vacant or derelict land to –

(a) establish infill development covering an area of 5 hectares or more, but less than 20 hectares; or

(b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare.

GNR No. 387 - Activities requiring a Scoping Study and Environmental Impact Assessment

4 The extraction of peat.

6 The construction of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high-water mark of the dam covers an area of 10 hectares or more.

10 Any process or activity identified in terms of section 53(1) of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).

National Water Act (36 of 1998)

According to Section 2 of the National Water Act (36 of 1998), the purpose of the Act is to ensure that the countries water resources are protected in a sustainable and equitable manner for the benefit of all South Africans.

(2) The purpose of this Act is to ensure that the nation’s water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors; (a) Meeting the basic human needs of present and future generations; (b) Promoting equitable access to water; (c) Redressing the results of past racial and gender discrimination; (d) Promoting the efficient, sustainable and beneficial use of water in the public interest; (e) Facilitating social and economic development; (f) Providing for growing demand for water use; (g) Protecting aquatic and associated ecosystems and their biological diversity; (h) Reducing and preventing pollution and degradation of water resources; (i) Meeting international obligations; (j) Promoting dam safety; (k) Managing floods and droughts and for achieving this purpose, to establish suitable institutions and to ensure that they have appropriate community, racial and gender representation.

Thus as the Public trustee (Section 3 (1)) it is National Governments responsibility, through the Minister of Water Affairs and Forestry, to ensure that water use is in the public interest (Section 2 (d)), aquatic ecosystems and biodiversity are protected (Section 2 (g)), and there is a reduction and prevention of pollution and degradation to water resources (Section 2 (h)).

In terms of Section 1 (xxiv) of the Act, a watercourse is defined as:

(xxiv)```watercourse``` means -

a) a river or spring;
b) a natural channel in which water flows regularly or intermittently;
c) a wetland, lake or dam into which, or from which, water flows;
d) and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Thus the development or modification of wetlands in any form falls is governed by the conditions stipulated in Chapter 4, Part 1 of the Act which sets out general principles for regulating water use.

Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. In general a water use must be licensed unless it is listed in Schedule I, is an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a licence.
21. For the purposes of this Act, water use includes –

a) taking water from a water resource;
b) storing water;
c) impeding or diverting the flow of water in a watercourse;
d) engaging in a stream flow reduction activity contemplated in section 36;
e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
g) disposing of waste in a manner which may detrimentally impact on a water resource;
h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
i) altering the bed, banks, course or characteristics of a watercourse;
j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
k) using water for recreational purposes.

22. (1) A person may only use water –

a) without a licence –
   a) if that water use is permissible under Schedule 1;
   b) if that water use is permissible as a continuation of an existing lawful use; or
   c) if that water use is permissible in terms of a general authorisation issued under section 39;

b) if the water use is authorised by a licence under this Act; or

c) if the responsible authority has dispensed with a licence requirement under subsection (3).

As development or modification of watercourses / wetlands is not included in Schedule 1, a license is required to carry out any activity involving a wetland.

In terms of Section 1 (xv) of the Act, pollution is defined as:

(xv) … the direct or indirect alteration of the physical, chemical or biological properties of a water resource…

It is broadly recognised that wetlands are beneficial in terms of stream flow regulation, flood attenuation and water purification. Any construction activity that takes place within a wetland may be considered to be an activity that is potentially harmful to both aquatic and non-aquatic organisms and generally reduce local water quality.

Part 4 of the National Water Act (36 of 1998), deals with pollution prevention, and in particular the situation where pollution of a water resource occurs or might occur as a result of activities on land. The person who owns, controls, occupies or uses the land in question is responsible for taking appropriate measures to prevent pollution of water resources and if these measures are not taken, the catchment management agency concerned may itself do whatever is necessary to prevent the pollution or to remedy its effects, and to recover all reasonable costs from the persons responsible for the pollution.
In terms of Section 19 (1 and 2) of the National Water Act (36 of 1998);

(19) (1) An owner of land, a person in control of land or a person who occupies or uses the land on which

(a) Any activity or process is or was performed or undertaken; or;

(b) Any other situation exists, which causes, has caused or is likely to cause pollution of a water resource, must take all reasonable measures to prevent any such pollution from occurring, continuing or recurring.

(2) The measures referred to in subsection (1) may include measures to –

(a) Cease, modify or control any act or process causing the pollution;
(b) Comply with any prescribed waste standard or management practice;
(c) Contain or prevent the movement of pollutants;
(d) Eliminate any source of the pollution,
(e) Remedy the effects of the pollution; and
(f) Remedy the effects of any disturbance to the bed and banks of a watercourse.

Conservation of Agricultural Resources Act (43 of 1983)

The aim of CARA is to provide for control over the utilisation of the natural agricultural resources within South Africa and to promote the conservation of soil and water resources, indigenous vegetation and the control of invasive plants.

In terms of Section 3 of the Act, soil conservation works are defined as;

(1)...work which is constructed on land for – (a) The prevention of erosion or the conservation of land which is subject to erosion; (b) The conservation of improvement of the vegetation or the surface of the soil; (c) The drainage of superfluous surface or subterranean water; (d) The conservation or reclamation of any water source, or; (e) The preventing of the silting of dams and the pollution of water...

The Act goes on to state in Section 12, that;

(12) (1) (a) A soil conservation work shall, except where otherwise provided in this Act or a scheme, be maintained by every land user of the land concerned and his successor in title at his own expense in a manner, which, in the opinion of the executive officer, will ensure the continued efficiency thereof...

Thus in terms of the Act the land owner or land user is responsible for the maintenance of all soil conservation works located on his property. As already discussed, it is broadly recognised that wetlands provide a number if valuable functions, including, stream flow regulation, flood attenuation and water purification. Consequently the maintenance and improvement of the structure and function of wetlands furthers the aims of the Conservation of Agricultural Resources Act (43 of 1983).

In order to achieve the aims of CARA the Minister of Agriculture may prescribe control measures which are to be complied with by all land users, and include;

(6)...(e) The utilisation and protection of vleis, marshes, water sponges, water courses and water sources.
1.5 Wetland Delineation

1.5.1 Methodology

Sampling was carried out across the proposed development site. At each of the points, soil was sampled at 0-10cm and 40-50cm. The hue, value and chroma were recorded for each sample, as well as the degree of mottling. Vegetation sampling was limited as the majority of the wetlands on site have been planted to sugar cane.

Mapping of the wetland was carried out using ArcGIS 9 and was based on the field data collected (Figure 3). Soil and vegetation change indicated the interface between wetland and non-wetlands. These boundaries were then extrapolated to follow local contours, but also took into account the hydraulic conductivity of the soils and their effect on drainage.

A wetland buffer of 20m was added to all wetlands on site as per the requirements of the Department of Water Affairs and Forestry.

1.5.2 Soil

Soil sampling across the site identified the presence of small portions of wetland in the eroded drainage lines on the property. The majority of the wetlands have been heavily degraded, with areas of erosion and slumping. In some parts, soil samples were inconclusive in parts. Where gaps existed, local topography was used to infer wetland extent (Figure 3).

Sampling down the length of the drainage lines revealed the presence of small portions of seasonal and temporary wetland within the water courses. The smaller drainage lines was characterised by the presence of only temporary wetland conditions. Sampling away from the centreline found a shift to seasonal and temporary wetness, associated with increasing elevation.

Samples in the seasonally wet portions of the site had low matrix chroma values. Soils in these area rich in clays, silt and fine materials. The soils are slightly gleyed and heavily mottled, a result of frequent water table fluctuation. The temporary wetland soils identified surrounding the seasonal zones were characterised by higher chroma values and less mottling - a result of less frequent water table fluctuation.

1.5.3 Vegetation

The majority of the wetlands have been disturbed through erosion, market gardens, informal agriculture, sand-winning and alien plant invasion. Indigenous wetland vegetation has been for the most part been removed or impacted through erosion and a change in the hydrology of the systems.

Species identified on site included a small pocket of *Typha capensis*, *Ludwigia octovalvis* and *Imperata cylindrica*. Due to the impacts of erosion of the local hydrological regime, typically terrestrial species had invaded parts of the wetland. These species included *Aristida junciformis*, *Eragrostis curvula* and some isolated culms of *Hyparrhenia hirta*.

A number of alien invasive species were also identified within the wetland environment and adjacent grassland. These included *Melia azedarach*, *Schinus terebinthifolius*, *Chromolaena odorata*, *Lantana camara* and *Ricinus communis*. 
Figure 3 - KwaNgqutha Site with wetlands and 20m Buffer
1.6 Potential Impacts and Mitigation

Roads

The construction of roads in and around wetlands is known to have some of the most detrimental impacts on the functioning of these systems. The canalisation of the water through culverts has been proved to cause major upstream and down stream erosion within wetlands if not managed properly.

Roads within the development should be located outside of the designated buffer zones and where crossings are unavoidable; bridges should be designed so as to limit the disruption, constriction or canalisation of flow under them. Furthermore, where possible, existing crossing points should be upgraded rather than new crossings created. This will limit the cumulative impact of these structures on the wetlands.

Runoff from the roads is dealt with in more detail in the Stormwater Runoff section below.

Units

In the past, town planning layouts surrounding wetlands have allowed for the inclusion of portions of the proposed erven within the wetland buffer zone provided the section within the buffer is managed as part of the open space system rather than as a garden. This practice is very simple in theory and if managed properly is very effective, providing both the required areas for the erven while conserving the buffer zone. However, in some cases monitoring of the buffer zone within these erven has not been thorough and gardens have encroached into areas marked for protection, reducing the buffer size. It is thus recommended that the wetlands and buffers be zoned as conservation or open space areas and managed as such. All erven should be located outside of the wetlands and buffers.

Services

The reticulation of water, sewer and telephone lines throughout a development is often overlooked from a wetland perspective. The impact of installing these services is often extensive if not planned properly.

Sewage reticulation and stormwater runoff (See Stormwater Runoff below) both rely on gravity to flow to low points in the landscape from where effluent can be pumped to treatment works. The use of natural drainage lines and slope to achieve this, often brings these lines into direct conflict with wetlands, as they occupy the low points in valley lines and water courses.

Every effort should be made to reticulate various services outside of the wetlands and buffer zones. This may require the addition of some extra pump stations. Should services need to cross a wetland, efforts should be made to make use of existing crossings or possibly pipe bridges to limit impacts and excavation in the wetlands.

Stormwater runoff and erosion

With the increase in hardened surfaces across the site, the volume of stormwater runoff will increase significantly and with it the risk of erosion within the wetlands on site. Management and successful attenuation of runoff prior to it entering the wetlands and river systems will reduce the impact on the environment.

Stormwater should be returned to the ground as swiftly as possible to reduce erosion through overland flow. The use of grass blocks and swales to locally attenuate storm water is one such option. Should runoff need to be reticulated to attenuation features, these should be located outside of the wetland and buffer zones. All stormwater discharge points must be located outside of the buffer zone and should be armoured against erosion with vegetated Reno mattresses.

Erosion and nick points within the wetlands and drainage lines should be rehabilitated to prevent further degradation of the systems. Smaller points can be rehabilitated with slope modification and
correct vegetation. Larger erosion points may require the keying in of gabion structures and Reno mattresses to arrest further soil loss.

2 CONCLUSION

The wetlands on the KwaNgqatu property have been impacted on through past land use practices. Agriculture, alteration of the catchments, erosion, grazing and various earthworking activities have all had impacts on the systems, reducing the level to which some of the goods and services typically associated with these wetlands are performed. Development should be withdrawn from the wetlands and buffers and these areas protected as part of the open space system for the township.

A rehabilitation and management plan must be drawn up to ensure the wetlands and the buffers are rehabilitated and managed in order to properly conserve and enhance the ‘goods and services’ provided to the site and the broader environment.

Should any clarity be required with regards to any of the procedures contained within this Wetland Delineation Report, please contact SiVEST.

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