DELINEATION OF WETLANDS AT A DEVELOPMENT SITE IN PANORAMA GARDENS, PIETERMARITZBURG

Alletson Ecologicals

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1. INTRODUCTION

This document reports the findings of a wetland delineation exercise undertaken at the site of a proposed light industrial complex in the Panorama Gardens area adjacent to Northdale, Pietermaritzburg. The property had been examined before but other than for a small stream through it, no compelling evidence of wetlands was found. However, a plan from the Msunduzi Municipality indicates "Wetland Constraints" in a band along the south-western side of the property. The purpose of the exercise was to ascertain if the indicated area is in fact wetland or, if not so, where any wetlands do in fact lie.

The findings of the study were that some damp, wetland-like conditions do occur at the site. However, due to the very extensive transformation of the area, including widespread disturbance of the soils, it cannot be firmly ascertained whether these conditions are natural, or whether they have arisen as the result of canalization of a small surface stream flow.

Finally, in a departure from a conventional wetland delineation, a management proposal is put forward which seeks to improve the quality of the water entering the Baynes Spruit while still providing habitat for indigenous biodiversity. It offers means of minimizing inputs of garbage and other pollutants and also makes planning for the area easier.

2. STUDY PROCEDURE

The study area was visited twice in order to undertake *in situ* examination of the soils and vegetation. The procedure to be followed was that of DWAF (2005) and which uses four indicators to determine the presence of wetlands. These are:

- The Terrain Unit Indicator. The terrain unit indicator identifies those parts of the landscape within which wetlands are most likely to occur. However, this is a weak indicator as suitable topography does not automatically imply the presence of wetland conditions.

- The Soil Form Indicator. The soil form indicator consists of soils which show characteristics of frequent and prolonged saturation.

- The Soil Wetness Indicator. The soil wetness indicator identifies those morphological characteristics which arise as a result of frequent and prolonged saturation.

- The Vegetation Indicator. The vegetation indicator is based on the presence hydrophilic vegetation which consists of plant species which have a preference or tolerance for soils which are frequently water saturated.

The entire expanse of the study area was walked over and all areas which were suggested as possibly having wetlands under the Terrain Indicator were visited first. At each place the setting was examined with reference to the other indicators and note was taken of the soil conditions and/or the vegetation. In order to examine the soil, rough transects were identified and, along these, holes were either augered with a 150 mm bucket auger, or else were excavated with a spade. The soil was extracted was then examined for colour, mottling, and bleaching. The presence of hydrophilic plants such as reeds, sedges, certain grasses, and certain forbs, was to be taken as the Vegetation Indicator. The position of each observation was recorded to an accuracy of less than 7 metres with a Garmin GPS which was set to the WGS 84 datum.

In addition to the field surveys, the Ezemvelo KZN Wildlife wetland data base was also examined. This database covers the entire province and was prepared by using a combination of several data resources, primarily aerial imagery, and some personal knowledge. Although extensive, it has not been fully verified by *in situ* surveys.

3. RESULTS

The Ezemvelo KZN Wildlife database does not indicate any wetlands within the study area.

From the terrain on the property in question, it was immediately apparent that wetlands would be most likely to be present along the western side in the vicinity of the Baynes Spruit and this candidate area was visited for examination. However this was not found to be the case as there was no indication of wetness in the soils to the west of a service track which runs from Birmingham Road through to the Natal Crushers quarry.

It soon became apparent that the soils over almost the entire property have been disturbed in the past. Evidence of topsoil mining was present in places but, even where topsoil was present, the presence of excavator bucket gouges and other such marks indicated disturbance. As the area used to be a plant nursery, such disturbance was to be expected. It was also apparent that, except in the southern area, downslope of the school, almost all of the original vegetation has been destroyed and that the present cover is strongly dominated by a variety of invasive weed species, both alien and local.

The finding of the field surveys was that the greater part of the property is dry but that a small drainage line passes from east to west almost along the midline of the site. However, the flows in this stream are not entirely natural and it is known that at least part of the water is derived from either broken sewer lines, or from other drains. On 27 August 2010 it appeared that most of the flow was derived from such sources and water samples taken at the time indicated very high coliform bacteria counts. During the course of the present survey, the water appeared clean on 28 February 2010 but was grey, strong smelling and with foam on it on 4 March 2011. It was noted that for much of its length this stream flows through a ditch which appear to have been

excavated by means of either a small machine or else by hand with spades. The banks of the channel are covered by a mix of plants including weeds but also with some hydrophilic species including sedges, *Persicaria* sp., and mdumbes. The channel itself however, appears to disappear on the flatter ground near the service track and the flow becomes diffuse in that area. From there, there is a strip of wetter soil extending in a northerly direction along the side of the track and it reaches to a point close to some squatter shacks which have been built between the track and the Baynes Spruit.

A second, and bigger, drain passes down the entire side of the property adjacent to Birmingham Road. It too appears to be man-made as a heap of the excavated material lies alongside most of its length. Its origin seems to be close to a valve chamber on a pipeline and it is probable that its prime function is to carry off water released when the pipe is scoured or undergoes some similar management activity. The flows can be quite strong as is shown by erosion in the channel and, in places, all the soil above a ferritic plinthite stratum has been removed. At the time of the visits this drain was dry over much of its length but water appeared in it at a point close to where the channel of the other drainage line disappears.

The co-ordinates of the points where geo-referenced observations were made are shown in Table 1 and the sites are shown in Figures 1 and 2. In many instances the transformed conditions on the ground made interpretation of the observations quite difficult as either the soils had been disturbed by cultivation or water was present but might have come from the drainage ditch.

4. CONCLUSION AND RECOMMENDATIONS

On the basis of the soil surveys there is very little evidence of wetland development at the site. At a few points some very poor mottling was evident but it since there is an underlying plinthite layer it is possible that some of the colour was derived from there. Heavy black, clay-rich soils suggested that water is present in places at times but they commonly contained either no red/brown gleying at all or else only very weak traces of such colour. Hydrophilic vegetation was absent.

However, surface water, or recent evidence of surface water, was observed in an area close to the point at which the service track from Birmingham Road enters the property, and then for about 85 metres along the track towards the quarry. This water was underlain by heavy soils but the distribution of the soils was restricted to a strip along the eastern side of the track. By contrast the area between the track and the Baynes Spruit, even though it is largely in the 1 in 10 year floodplain (Terratest, 2010), showed neither any wet areas nor any signs of wetness in the soil. It is assumed that development in this area would be restricted due to the presence of the floodplain and so a buffer would incidentally be set in place.

The drain which runs parallel to Birmingham Road from the corner of Naven Boulevard is also of relevance in this survey as it indicates the hydrological regime on that side of the property. Although dry for much of its length at the time of the site visits, it is clear that it carries large flows at times. The banks and bed are eroded, and in places the underlying plinthite layer is

exposed. However, at a point close to where the surface water was seen, water appears in the channel and then continues to flow down to the Baynes Spruit.

On the basis of the observed stream flows it appears that the small stream which flows from the east side of the property is the primary source of water in the area near the service track. Once its excavated channel flattens out, the water diffuses over a wider area. It is unable to percolate away due to the underlying plinthite layer and so the soils in the area are seasonally saturated. This accounts for the appearance of the water in the drain from the pipeline valve chamber and also explains the observed damp conditions along the eastern side of the track. The track itself appears to be impermeable as it has, over the years, been regularly hardened with road material and so now acts as a "buried dam wall". Such impermeability also explains the complete absence of wet conditions on the western side of the track.

The wet conditions along the track reach as far as a pit which probably acts as a small attenuation pond at times when there is sufficient flow but even from there no water seems to pass through the road. On the basis of terrain, this pit might also trap some surface flows at times of high rainfall although there was no evidence of this at the time of the site visits.

The above observations and deductions indicate that there is a wet area in the corner of the property as indicated in the Msunduzi plan. However, it is much smaller than indicated although the plan may include a buffer area and it cannot ascertained whether or not the system occurred naturally. In order to allow planning of the site to continue it is necessary to consider how to manage the area to best effect. An earlier report on this subject (Alletson Ecologicals 2010) recommended that the stream channel could be passed into an underground pipe in order to allow it to pass through the area with minimal risk of picking up additional contamination. That report suggested that the water would be unlikely to pick up further pollutants and debris if it were in a pipe and so the quality of the Baynes Spruit would, in view of the proposed industrial development on the site, be best served by this option. To a large extent this proposal is again supported here but with three key modifications which are as follows:

- At the upper end of the stream where the water emerges from the neighbouring properties, the existing small dam should be cleaned out and be repaired so as to form a small wetland. This wetland will act as a preliminary biological filter and some water purification may be expected before the water flows into the subterranean pipe.
- The pipe should, at its downstream end, discharge into a pond which may additionally serve as a stormwater flow attenuation pond. This pond must be east of the service track and the water should be no more than a metre deep in the dry season. Growth of reeds, sedges, and the like should be encouraged so as to act as a further biological filter. There should be two outlets with the lower one being for the release of normal flows, and a second, higher outlet which discharges directly into the Birmingham Road drain. The latter outlet will cope with stormwater flows and will also serve to protect a further downstream pond.

  It is probable that solid waste will be trapped in the pond and this is intended as it may be relatively easily collected by the site management or an appointed contractor.

- The low flow outlet from the second pond should be screened and should have a flap valve, or similar, so that it is closed off if the pond is filled by incoming storm water. The flow from this outlet must pass under the service track/road and into a second and larger pond which may be developed as a water feature with a park-like area around it. Suitable trees may be planted around it and reed beds would serve to both attract birds and to further purify the water. Outlet from this pond should pass into the Birmingham Road drain and then on into the Baynes Spruit. The above proposals are shown conceptually in Figure 3.

By the time the water leaves the third pond it should be very much cleaner than it was at the top of the property. Thus a useful service will have been provided and, at the same time, habitat for some wildlife will have been retained. This system should be more sustainable in the long term than an open stream through the site. Other such streams in industrial areas, as indicated in the photograph below, tend to become open drains where wastes of many sorts accumulate.

Photograph 1. Mkondeni Stream in an industrial area. Note the accumulation of solid wastes in the channel as well as evidence of oil or other such contaminants on the water. The channel is being scoured.

The scheme proposed here is intended to both maintain the quality of the water which enters the Baynes Spruit while still preserving some semi-natural environment as a refuge for biodiversity. Given that the property is likely to take on the characteristics of the surrounding industrial area, it is proposed that this is a workable compromise.

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TERRATEST. 2010. Panorama Gardens Development: 1:10 year and 1:50 year floodline and stormwater management report. Terratest Geothechnical, Environmental, and Earth Science Consultants. P.O. Box 794, Hilton. 3245.

Table 1. Coordinates of geo-referenced points and the observations made at each site.

WGS 84 Co-ordinates				**Point**	**Feature**	**Observation**
	Deg	Min	Sec			
S	29	34	15.4	P1	Damp soil. No wetland structure	Dammed up behind road.
E	30	25	06.0			
S	29	34	14.8	P2	Very weak red colorations. Secondary?	Bullrushes, Napier reed.
E	30	25	09.0			
S	29	34	16.8	P3	Bridge	
E	30	25	06.9			
S	29	34	17.8	P4	Stream in ditch.	
E	30	25	11.6			
S	29	34	17.9	P5	Dry	
E	30	25	13.3			
S	29	34	18.6	P6	Stream in ditch.	*Persicaria, Cyperus dives.*
E	30	25	14.6			
S	29	34	20.7	P7	Dam wall near residential area.	
E	30	25	19.1			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	21.5	P8	Stream source.	On property boundary.
E	30	25	21.3			
S	29	34	26.0	P9	Very dry.	Soil mining.
E	30	25	16.6			
S	29	34	13.1	P10	Dry rubble.	
E	30	25	10.9			
S	29	34	12.7	P11	Dry rubble.	
E	30	25	11.0			
S	29	34	14.1	P12	Dry.	
E	30	25	08.1			
S	29	34	14.0	P13	Dry.	
E	30	25	07.3			
S	29	34	14.4	P14	Dry.	
E	30	25	08.7			
S	29	34	14.8	P15	Dry.	
E	30	25	06.4			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	15.2	P16	Dry.	
E	30	25	07.0			
S	29	34	21.9	P17	Dry.	
E	30	25	17.4			
S	29	34	16.5	P18	Very weak colour at 200 mm.	
E	30	25	08.6			
S	29	34	16.8	P19	Surface water.	
E	30	25	08.3			
S	29	34	15.9	P20	Heavy black clay.	
E	30	25	08.5			
S	29	34	16.1	P21	Surface water	
E	30	25	08.2			
S	29	34	16.4	P22	Heavy black clay	
E	30	25	09.1			
S	29	34	16.5	P23	Heavy black clay	
E	30	25	09.3			
S	29	34	17.2	P24	Disturbed soil with rubble	
E	30	25	09.0			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	16.5	P25	Light soil. Mottling?	
E	30	25	10.6			
S	29	34	16.3	P26	Dry.	
E	30	25	10.1			
S	29	34	15.9	P27	Dry.	
E	30	25	10.1			
S	29	34	16.0	P28	Weak colour at 200 mm.	
E	30	25	09.1			
S	29	34	15.6	P29	Heavy black clay.	
E	30	25	09.2			
S	29	34	15.4	P30	Heavy black clay.	
E	30	25	09.5			
S	29	34	15.0	P31	Dry.	
E	30	25	09.6			
S	29	34	14.7	P32	Surface water.	
E	30	25	09.5			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	14.5	P33	Surface water.	
E	30	25	9.3			
S	29	34	13.8	P34	Rubble.	
E	30	25	9.8			
S	29	34	14.0	P35	Rubble.	
E	30	25	10.0			
S	29	34	13.8	P36	Rubble. Water at 250 mm.	
E	30	25	14.2			
S	29	34	13.6	P37	Soil moist. No colour	
E	30	25	10.6			
S	29	34	13.5	P38	Dry	
E	30	25	10.9			
S	29	34	17.7	P39	Stream	
E	30	25	08.9			
S	29	34	18.0	P40	Dry.	
E	30	25	08.8			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	18.1	P41	Dry.	
E	30	25	08.7			
S	29	34	18.5	P42	Dry.	Did have surface water.
E	30	25	09.9			
S	29	34	18.4	P43	Ditch	For watering of crops?
E	30	25	10.9			
S	29	34	18.0	P44	Stream in ditch.	Water has grey colour. Foaming where aerated.
E	30	25	11.1			
S	29	34	18.7	P45	Soil may be wet?	
E	30	25	12.6			
S	29	34	19.0	P46	Soil may be wet?	
E	30	25	13.7			
S	29	34	20.1	P47	Dry.	*Acacia sieberiana.*
E	30	25	15.4			
S	29	34	20.5	P48	Dry. Soil scraped	*Acacia sieberiana.*
E	30	25	13.9			

WGS 84 Co-ordinates				Point	Feature	Observation
	Deg	Min	Sec			
S	29	34	21.1	P49	Dry.	*Acacia sieberiana.*
E	30	25	12.5			
S	29	34	19.8	P50	Dry ferricrete plinthite in drainage ditch.	
E	30	25	09.7			
S	29	34	18.3	P51	Water appears at surface in ditch.	
E	30	25	08.5			
S	29	34	20.8	P52	Dry ditch.	
E	30	25	12.7			
S	29	34	28.1	P52	Valve chamber on pipeline	
E	30	25	13.4			
S	29	34	17.7	P53	Dry ditch.	
E	30	25	10.3			

FIGURES

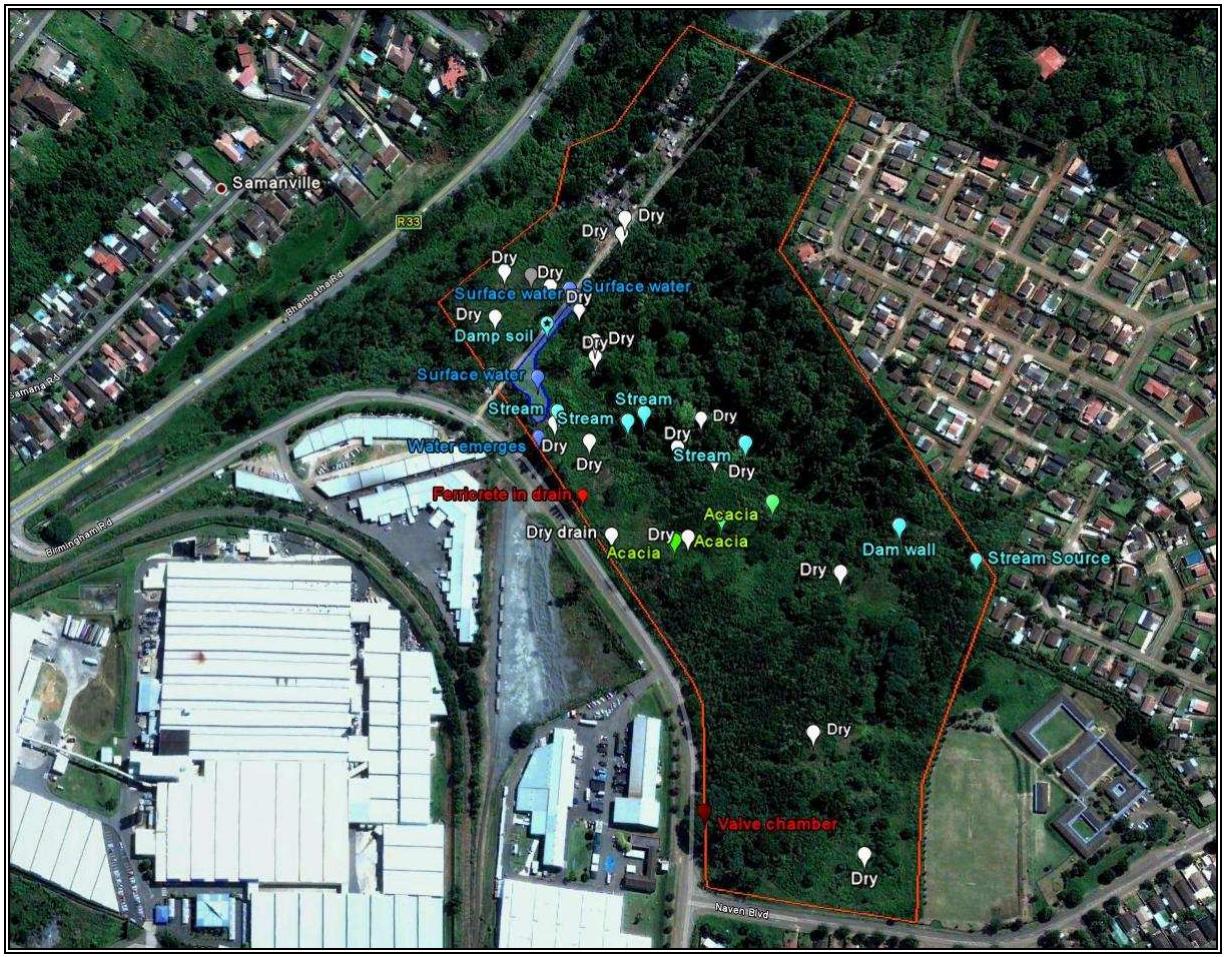

Figure 1. Distribution of the soil survey points on the Panorama Gardens site. Note the pipeline valve chamber and the ferricrete which indicate the position of the Birmingham Road drain.

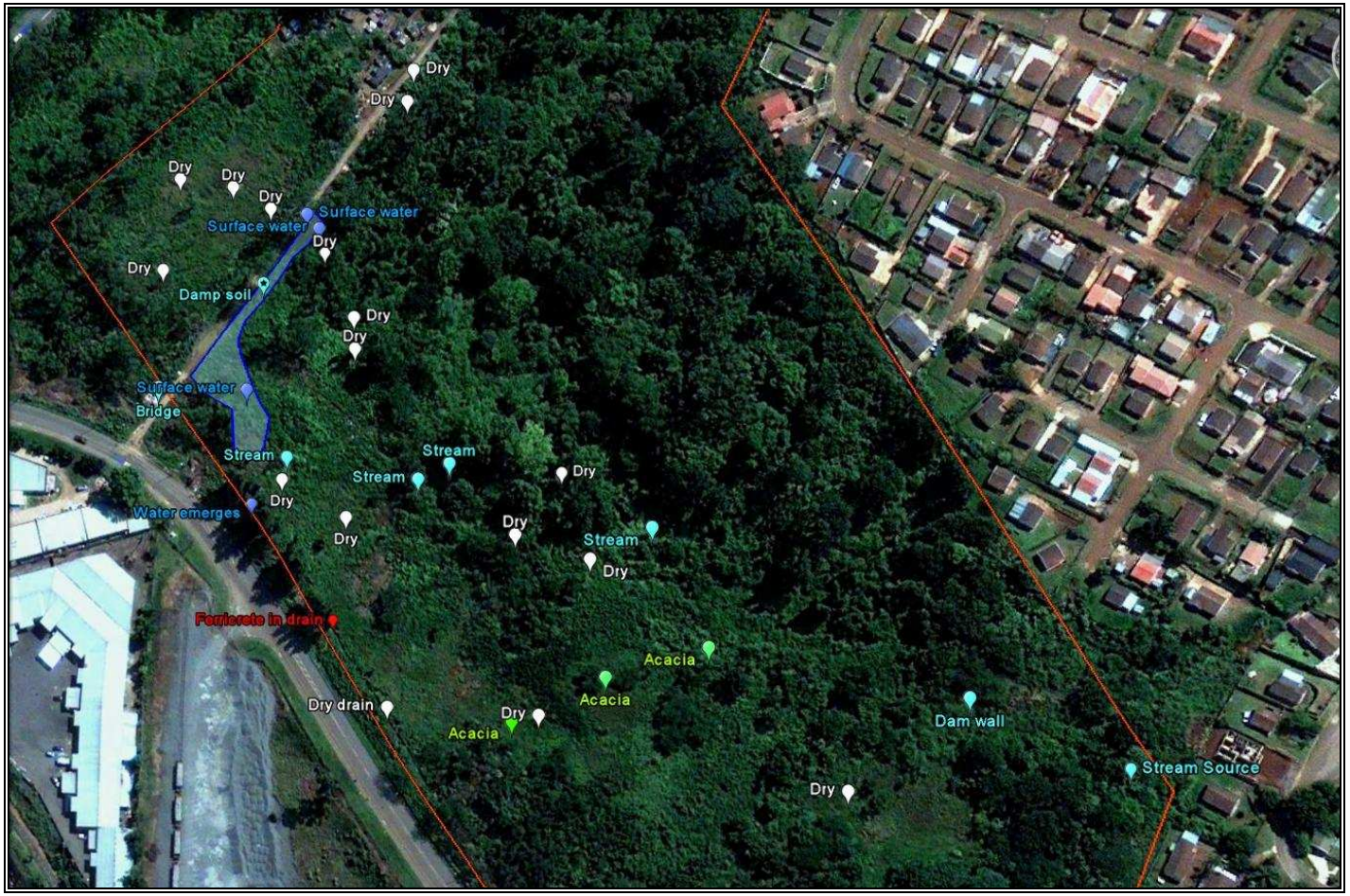

Figure 2. Portion of the property showing the area along the stream and where wet/moist conditions were encountered. Survey sites are shown in the following colours: White = dry, Light blue = stream or damp conditions, Dark blue = surface water, Green = trees which require dry conditions. Also shown as a blue polygon is the area within which moist conditions were found.

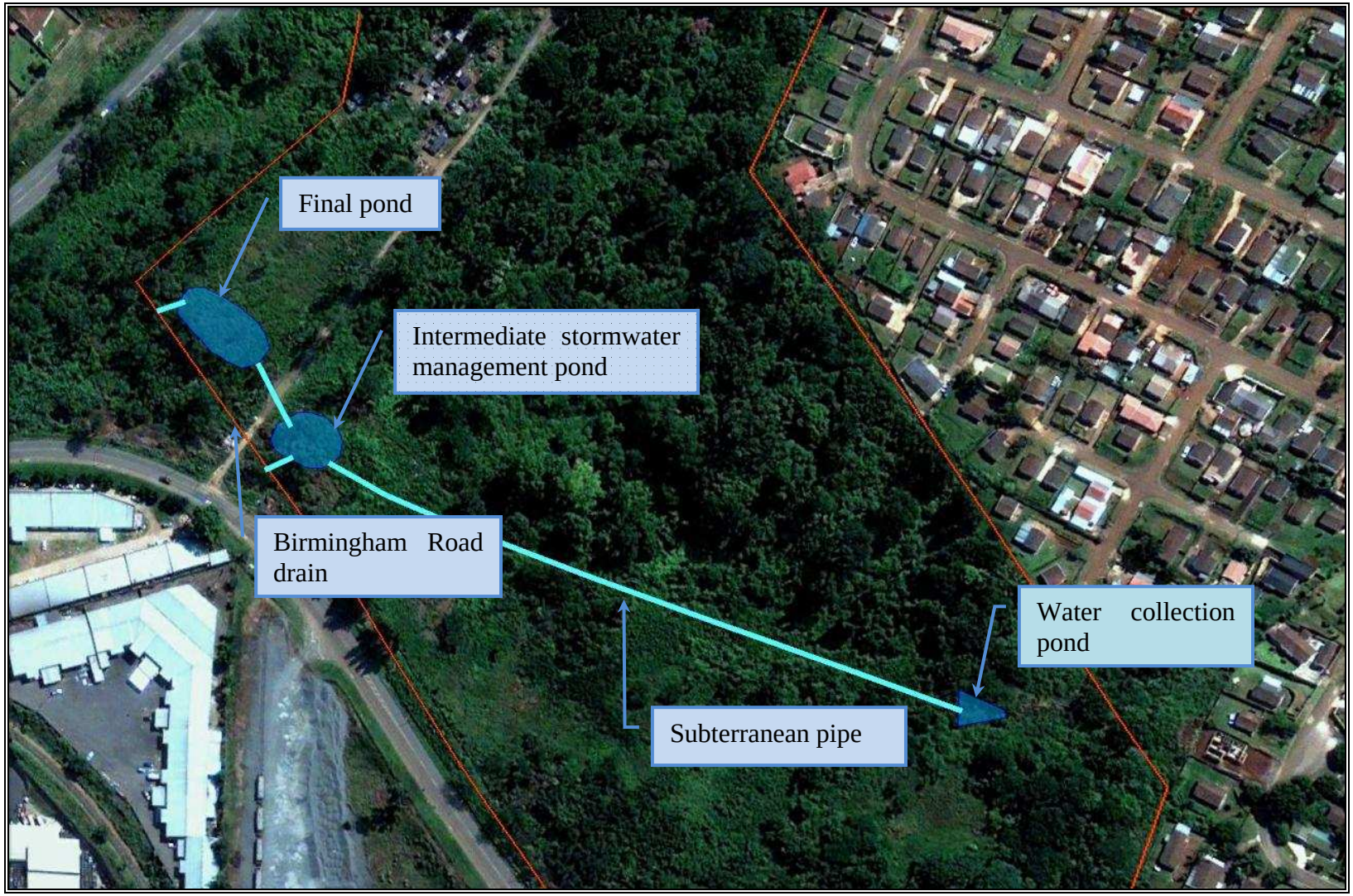

Figure 3. Schematic representation of water management on the Panorama Gardens site.