ASSESSMENT OF A SMALL DRAINAGE LINE NEAR PANORAMA GARDENS IN RELATION TO PROPOSED INDUSTRIAL DEVELOPMENT IN THE AREA

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1. INTRODUCTION

This report covers the issues around the way in which a minor drainage line emanating from the Panorama Gardens residential area will best be treated if the area around its lower end is developed for industrial purposes. At present the drainage line flows across the site but is severely polluted from a leaking or burst sewer. Three options, which are an open earthen channel, an open concrete-lined channel, and a buried pipeline system, are assessed in relation to their impacts on, or benefits to, the ecological and social environments. It is concluded that the ecological costs associated with the buried pipeline are more than offset by the social benefits which such a system would produce. The latter include reduction of exposure to contaminated water and less litter or other solid waste in the stream which flows past Sobantu. However, before the buried pipeline system can be installed, the damaged sewer must be repaired.

2. SITE DESCRIPTION

The proposed development area is centred at S 29^{o} 34' 22.0" E 30^{o} 25' 16.5" and lies between an existing industrial area and the Panorama Gardens residential area. The layout plan indicates that the proposed new subdivisions will be numbered as being in Panorama Gardens. At present the area is largely derelict, having held the Jesmondene Plant Nursery in the past but now being disused other than by squatters residing in the north western corner. Domestic and other refuse is being dumped in places.

The vegetation on the property consists almost entirely of alien weed and ornamental species. At the time of the site visit (27/8/2010) most of the smaller understorey plants had been cleared and extensive areas of bare ground were evident. The drainage line in question runs from east to west and roughly bisects the property. It is very small and is not indicated on the 1:50,000 map sheet. Its origins appear to be a number of drains exiting from the residential area, and it is probably dry throughout much of the winter season or at other times when there is no rainfall. At the western end, the line flows into the Bayne's Spruit which then flows down into the Umsunduzi River in Sobantu. On the way across the property in question it maintains a small channel and, at one point where there is an obstruction, it has formed a pond which has bull-rushes growing in it. Towards the Bayne's Spruit the channel appears to have been deepened and straightened at some time in the past.

The Bayne's Spruit has its primary source in the nearby rock quarry and so is not dependant on the tributary for any great part of its flows. However, even cursory examination showed it to be in very poor ecological condition, and in the vicinity of the Birmingham Road bridge, it has been confined to a concrete canal.

At the time of the site visit flows were minimal and appeared to be derived primarily from a broken sewer in the residential area to the east. On the property boundary two small flows of water joined to form the stream and it was immediately clear that they were significantly polluted. A great deal of domestic garbage was present in the channel and the water, which was a dirty grey colour, contained dense growths of fungi and bacteria. The channel appeared to have been artificially widened at this point. See Photographs 1 and 2. Water samples were taken in each of the two feeder flows and also at a point further downstream below the pond. The samples were analysed for total coliforms and the results are presented in Table 1. The figures indicate an extremely high bacterial count in the main source of the stream, but a lower value in the secondary source. Further down the stream the bacteria count was somewhat lower than that of the primary source, but was still high enough to pose a severe danger to human health.

Table 1. Total coliform counts from three points on the study property. NOTE: A count of less than 5 colonies is the preferred norm for domestic water. From 5 to 100 colonies is rated as a progressively severe risk to health. DWAF (1996)

	Site 1	**Site 2**	**Site 3**
	Primary water source	Secondary water source	Downstream of the pond
Total Coliforms. Colonies per 100 ml	3000	79	1030

Given that the drainage line in question joins a stream which then flows down through areas which have high levels of poverty and where people may be using the water for domestic purposes, it is clear that the pollution poses a significant threat to society.

3. MANAGEMENT OPTIONS FOR THE DRAINAGE LINE SHOULD THE DEVELOPMENT PROCEED

If the proposed development does take place then the character of the area will be significantly transformed by buildings, roads, and other such hardened surfaces. Rain and storm water runoff rates will be greatly accelerated. Human presence in the area will be increased and the abundance of garbage and litter will increase over current levels. Experience shows that streams in industrial areas become increasingly encroached upon and that they are often used as dump sites for soil or wastes. See Photograph 3. The banks tend to lose their indigenous flora to invasions of hardy pioneer alien species and ultimately the stream may become little more than an open drain. It is also recognised that there are attempts being made to rehabilitate streams by organizations such as DUCT (Duzi – Umngeni Conservation Trust). Thus, while the stream in question still passes through a “soft” landscape, there is opportunity to consider how it may be handled in the future. In this regard, three scenarios are possible although they may be applied in various combinations.

3.1 Open Stream - Unhardened Channel

The first scenario consists of demarcating a riparian corridor through the development area and of allowing the stream to pass through it. The channel would be bordered on either side by vegetation and would be stabilized by the roots of the plants. Some hardening of the base by means of stone packs might be done in places. Such treatment would allow for some development of the aquatic ecosystem and its included plant and animal species.

Surface water from rainfall would be directed into the stream either through drains or by simple runoff from the surrounding surfaces. In either case, it is probable that a certain amount of litter would be washed into the channel. It is also possible, or even probable, that factories or other businesses would clandestinely discharge various effluents into the system. Without any doubt, garbage and other waste materials, including soil, would be dumped into the channel at times.

A further issue related to an open channel would be the need to provide a bridge or bridges to allow for access to the northern parts of the property. While the necessary structures would not need to be more than a box culvert, there would be a cost implication.

If the source of the sewage pollution remains then the stream would be a health hazard to anybody exposed to contact with the water.

3.2 Open Stream - Hardened Channel

In this scenario, the stream channel is left open but the channel is hardened into a concrete-lined canal. Such action would mean that the instream ecosystem would be totally destroyed and that the stream would simply be an open drain. All of the problems associated with the open, unhardened, channel would also be applicable here.

3.3 Enclosed Stream in an Underground Pipe

In this scenario, the surface water entering the property along the eastern boundary would be channeled into a system of converging pipes which flow toward, and discharge into, the Bayne's Spruit. While this scenario would totally destroy the aquatic ecosystem, it does have a number of advantages. Apart from those associated with the lack of obstruction to roads or other conduits through the area, the opportunity for garbage and/or pollution to enter the system will be very significantly reduced. Stormwater from around the site would either have to lead into the pipe via road drains and the like or else would have to be diverted away toward the Bayne's Spruit. However, any such inputs would inevitably contain litter which could accumulate and cause blockages.

It has been proposed that the best route for an underground pipe would be from collection points along the eastern boundary as needed, to a central junction, and then in a north westerly direction toward the Bayne's Spruit. In view of the natural surface contours this may not be feasible as the required gradient may only be possible if the line is more westerly in direction. However, the design detail is not a part of this report and so is not considered further.

3.4 Consideration of the Drainage Options

The various components of the three scenarios presented above are summarized in Table 2.

On the basis of the information presented, it is apparent that the easiest development option is that of a buried pipe or system of pipes. The opportunities for litter and wastes to enter the system are minimised, and the installation of infrastructure is facilitated. However, against this convenience is the issue of environmental protection and functionality. At present the water is highly polluted and represents a very significant health risk to anybody coming into contact with it. In a surface system, it is apparent that some reduction in pollution can take place but this capability will be completely lost if the water is discharged through pipes. There is some indigenous ecosystem function in place at present but it must be regarded as being of very low conservation value.

Table 2. Summary of the various elements in the three possible drainage scenarios.

Criterion	Option 1 Open earthern or stonepack channel	Option 2 Open lined canal	Option 3 Subterranean pipe system
Ecosystem/biodiversity	Some, but limited, ecological functionality remains.	No ecological functionality remains.	No ecological functionality remains.
On site communications and transport	The channel will form an obstruction which must be bridged.	The channel will form an obstruction which must be bridged.	The buried pipe will not form an obstruction.
Litter and refuse accumulation	Wastes will enter the system either by surface water washing or by direct littering and dumping.	Wastes will enter the system either by surface water washing or by direct littering and dumping.	The amount of wastes entering the system will be reduced.
Pollution	Illegal disposal of wastes into an open drain is relatively easy.	Illegal disposal of wastes into an open drain is relatively easy.	It will be relatively difficult to dump liquid pollutants into a buried system.

If the development does proceed, then virtually all of the fauna which is present now will either be destroyed or else will move away. There are very few indigenous plants left now and they will, in time, be displaced by weed species. Therefore the deliberate loss of the tiny stream system due to diversion of the water via pipes is not a significant issue since there will be degradation in any event. On this basis the use of an underground pipe system is not a threat to the environment and it is not opposed here.

Further consideration of the three scenarios must be made in regard to the outputs into the Bayne's Spruit. If the water flows through an open, earthen channel, then there may be some natural processing of the pollutants in it and thus the Bayne's Spruit will benefit accordingly. Although the contribution to flows in the spruit is small, any improvement is of importance to the people downstream. However, an open channel, whether unhardened or hardened, will bring in a larger load of solid wastes and possibly some liquid effluents as well. By contrast, a buried pipe system will not process the water very well but will bring in less waste and effluent.

Whichever system is chosen, it is imperative that the spillage of sewage onto the site is stopped. The leaks in the sewer line must be found and be repaired. There is legal obligation for such work to be done by the responsible authority (municipality). If the source of the sewage is removed, and the water running onto the site is improved in quality, then the use of an underground pipe system becomes the option of choice. The reasons for this are that the need to purify surface water before it enters the Bayne's Spruit is eliminated, and that there will be less *in situ* input of solid and liquid wastes. These benefits will apply not only on the property in question but, more importantly, will also accrue to both the Baynes Spruit as well as the human community over a much larger area.

BIBLIOGRAPHY

DWAF. 1996. South African Water Quality Guidelines. Volume 1. Domestic Use. Second Edition. Department of Water Affairs and Forestry. Pretoria.

DWAF. 1996. South African Water Quality Guidelines. Volume 2. Recreational Use. Second Edition. Department of Water Affairs and Forestry. Pretoria.

PHOTOGRAPHS

Photograph 1. Grey scum and other growths on the water near the eastern boundary of the property. Note that the channel appears to have been excavated.

Photograph 2. Drainage line on the study property. Note the abundance of garbage.

Photograph 3. Mkondeni stream in an industrial area. Note the encroachment into the channel and the litter/garbage. Virtually all the plants are alien species.