CHAPTER THREE

Introduction

The aim of this chapter is to compile a program that will attempt to solve the problems identified in chapter 2. The program is an implementation of the urban vision and include development of the systematic requirements.

3.1 Program

"An explicit programming process provides a more dependable basis for design" (Lynch 1984:p107).

Systematic requirements on site is the main structure to the recreational space and a key part of the urban proposals. A phased approach to the site leads to the early completion of income-generation components of the scheme while healing the site. The process proposed to rehabilitate the contaminated soil is a leaching system. Current approaches to the rehabilitation of tailings sites are rather a best management practice than a long-term solution to eradicate the issues (Liefferink 2017). Current approaches include the establishment of pioneer grass species such as *Hyparrhenia hirta* to ensure that the side of these tailing sites are at a lesser slope to prevent erosion. Unfortunately, the acid mine drainage seeps into the groundwater due to the acidic nature of the material (Walker 2015).
The feasibility of developing the site will depend on the successful removal of the heavy metals, especially cyanide. Three methods that may be used to decommission cyanide-contaminated ore tailings are described below (U.S Environmental Protection Agency 1994).

1. Leave the heap to enable natural processes to act on the soils until an acceptable quality balance is reached. This is, however, a lengthy process and the site remains in structure and form a tailings site.
2. Remove the tailings in smaller batches off-site because insufficient pads under tailings (pollution control layer under tailings heap) were constructed; or because the tailings are impermeable and methods not feasible.
3. The third method involves the "rinsing" of the heap to leach the cyanide with the leachate, to be captured in tanks, as described in detail below.

Flushing the cyanide is the most effective process in that it treats the heap on site and does not dispose of the toxic material to another site where it will still be problematic (U.S Environmental Protection Agency 1994).

The proposed INCO (The International Nickel Company) sulfar dioxide/air process consists of four process tanks and a clarifier tank with a pump house, which makes for simple assembly on site. The wastewater containing cyanide is pumped into the first tank, a mixing vessel, where copper sulphate form another tank is added which reacts with the cyanide. The mixture is pumped to the next mixing vessel through an aeration valve. A lime solution in a third tank is circulated to assist with maintaining the required acidity of the mixture as the pH of the water determines the effectiveness of the process (U.S Environmental Protection Agency 1994). The final stage of the process is a clarifier tank to settle out the particles which are then disposed of in an existing hazardous waste site just north of site.
From there, the water is released into an on-site eco-service system (an artificial wetland system). This system treats the acidity and the remaining heavy metals, such as manganese, iron, and aluminum. The system requires a total of six ponds that function as follows (AMD&ART

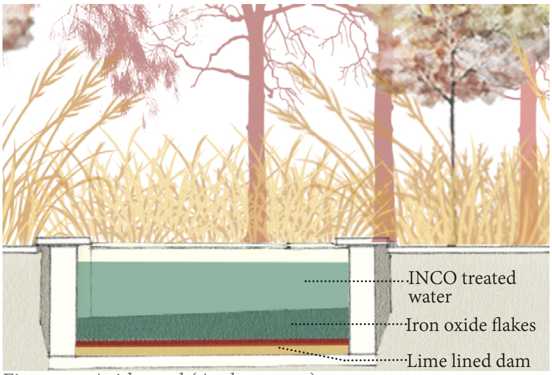


Figure3.1 Acid pond (Author 2017)

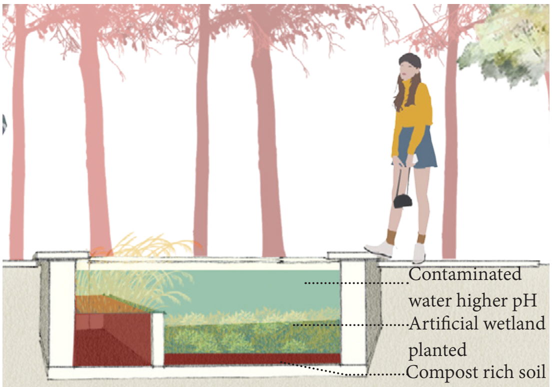


Figure3.2 Artificial wetland (Author 2017)

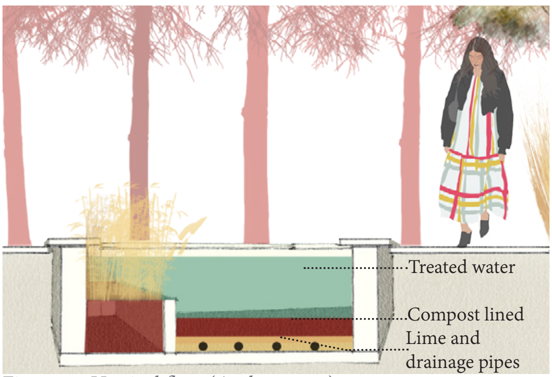


Figure3.3 Vertical flow (Author 2017)

Figure3.4 Settling pond (Author 2017)

2016):

3.1.1 Pond one: The acid pool

This pond, in Figure 3.1, is lined with limestone. The red/ orange particles in the water flake out in reaction to the lime lining (AMD&ART 2016).

3.1.2 Ponds two to four: Treatment system

These ponds, Figure 3.2, are the artificial wetlands that provide for phytoremediation to take place. Specific plants contain certain micro-organisms and can take up heavy metals (AMD&ART 2016).

3.1.3 Pond five: Vertical flow pond

This stratified pond, Figure 3.3, has a thick top layer of compost that strips the water of oxygen. Below this is a thick layer of lime where the acidity is reduced. Water is conveyed to the next pond by an underflow vertical pipe system creating vertical flow through the lime that improves the effectiveness of the lime in treating the acidity (AMD&ART 2016).

3.1.4 Pond six: Settling pond

Water from pond five then flows through an aeration system into pond six, Figure 3.4. This settling pond reduces the flow velocity so that left-over iron oxide settles out (AMD&ART 2016).

3.2 Site

The site for the system is identified as the space on-site that links the existing silt pond with the other existing pond on the southern side of the site.

3.3 Palimpsest

As identified in the site analysis, the site has a unique identity. The main forms on site are the mound, the ridge and the plain.

Figure3.5 Mound on site to be retained (Author 2017)

Figure3.6 Erosion caused by drainage (Author 2017)

Figure3.7 Ridge with settling layers (Author 2017)

3.3.1 The mound:

The mound in Figure 3.5 will be a viewing area and seating area for visitors will be provided at the trees planted as a background for the mound.

3.3.2 The plain:

The plain as seen in Figure 3.6 is retained to illustrate the effects natural processes can have on the sandy material on site. The formation of patterns occurs from natural actions such as flowing water to the footstep patterns on the plain. Currently on site, the vastness of the specific area was identified as an unique characteristic of site. As an intervention and approach to this specific feature, the plain will be considered with "soft landscape" to enhance the specific characteristics.

3.3.3 The ridge

The ridge, Figure 3.7, is left in place as a viewing zone onto the system to illustrate the water flow pattern and processes that treat the water. The ridge also acts as a backdrop for the water system and is planned to form part of a set of pathways which includes a running track.

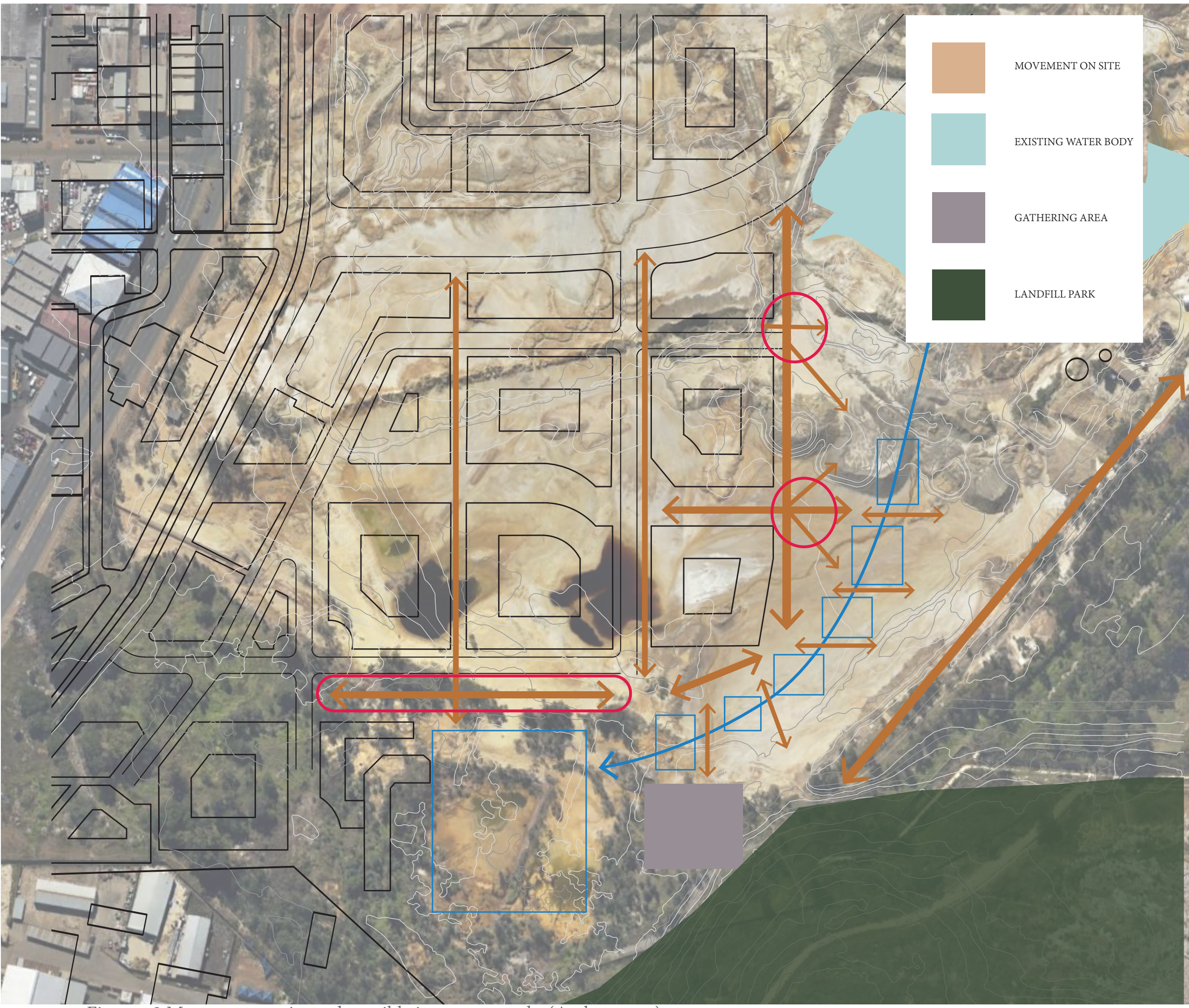


Figure3.8 Movement on site and possible important nodes(Author 2017)

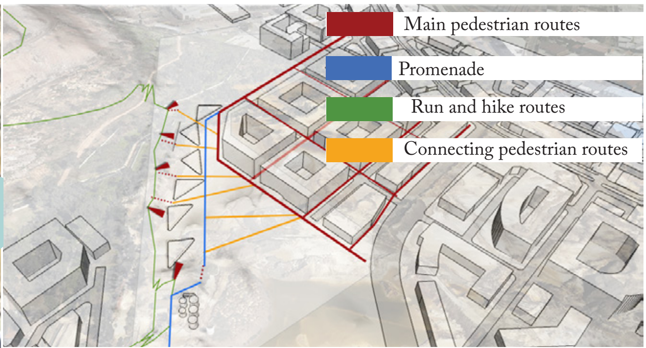


Figure3.9 Main movement on proposed site (Author 2017)

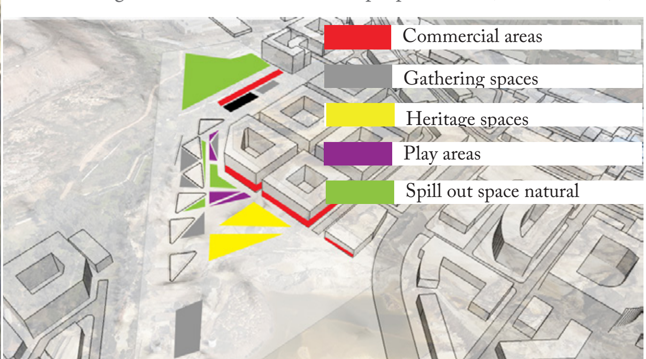


Figure3.10 Proposed activity areas (Author 2017)

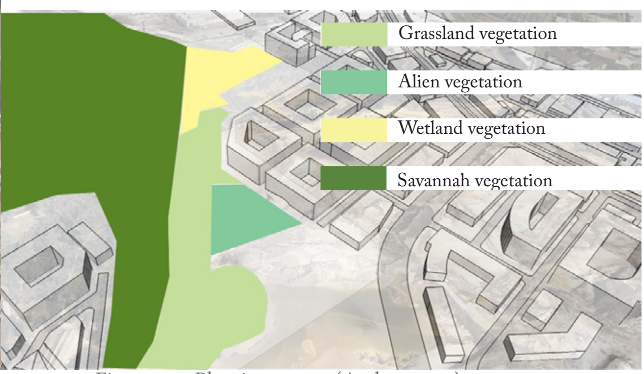


Figure3.11 Planting zones (Author 2017)

3.3.3 Recreation areas

The site will assist as a transitions area from the train station to the landfill park and event/park space on the southern part of the site. The park space on the edge will also feature sports facilities and vehicle parking lot.

The main walk way on the western side of the site is edged by commercial activities. The promenade walkway from the station through the site has various spill out spaces. The user is led from the northern side, unprogrammed, to the southern side that is more programmed. The third walkway is for runners and walkers to use and leads to viewing decks that overlook the water system.

3.4 Sub-programs and functions

The entrance space to the proposed landfill reserve is linked to the transport node with the site forming the threshold for the reserve. This land fill park is closed and an entrance fee will be charged to ensure the safety of the users. Proceeds will go to the upkeep of the land fill park. Play spaces on the urban edge cater for families to use the commercial side of the park where parents can keep watch over their children.

The introduction of key indigenous species to the park will create habitat and green areas that are connected to the Wemmer pan green fingers as proposed by the Turffontein Development corridor framework (City of Johannesburg: Johannesburg Development Agency 2014).

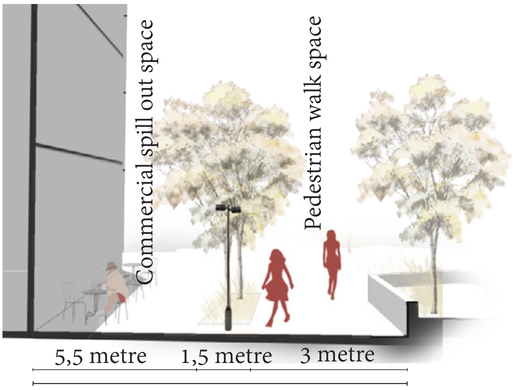


Figure3.12 Main route archetype (Author 2017)

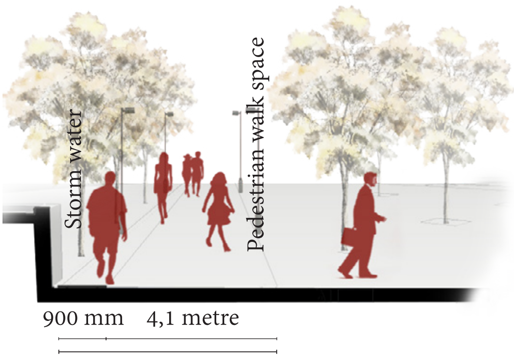


Figure3.13 Promenade route archetype (Author 2017)

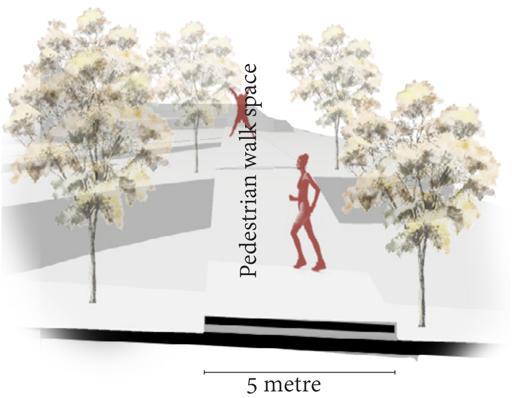


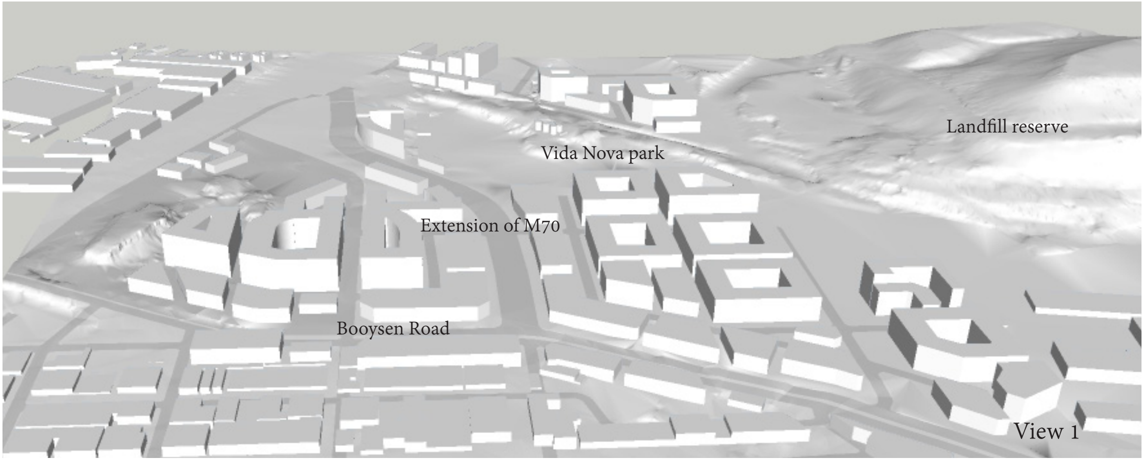
Figure3.14 Ridge route archetype (Author 2017)

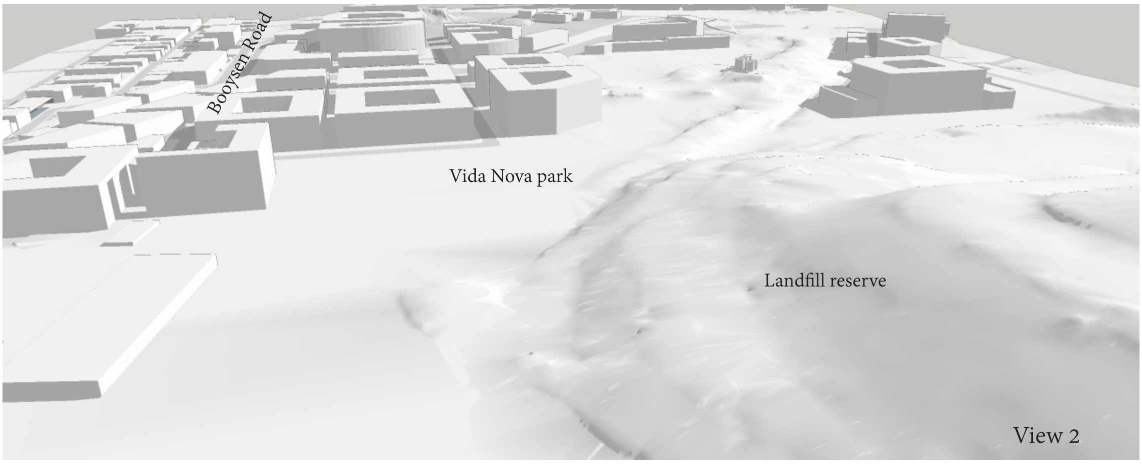
3.5 Conclusion

The park will serve predominantly as a threshold space for users to travel to and from the transit node and activities linked to the southern side of the park and the landfill reserve. The space will also provide the residents on site with a formal recreational area, i.e basketball courts, events area and playscapes.

The main structuring element will be the pattern of the systems for processing the toxins on site and the pattern of the user movement across site. These will be the main form drivers for the parkscape.

Figure3.15 Robinson deep site with proposed urban development overlay on a Google Earth image (Author 2017)





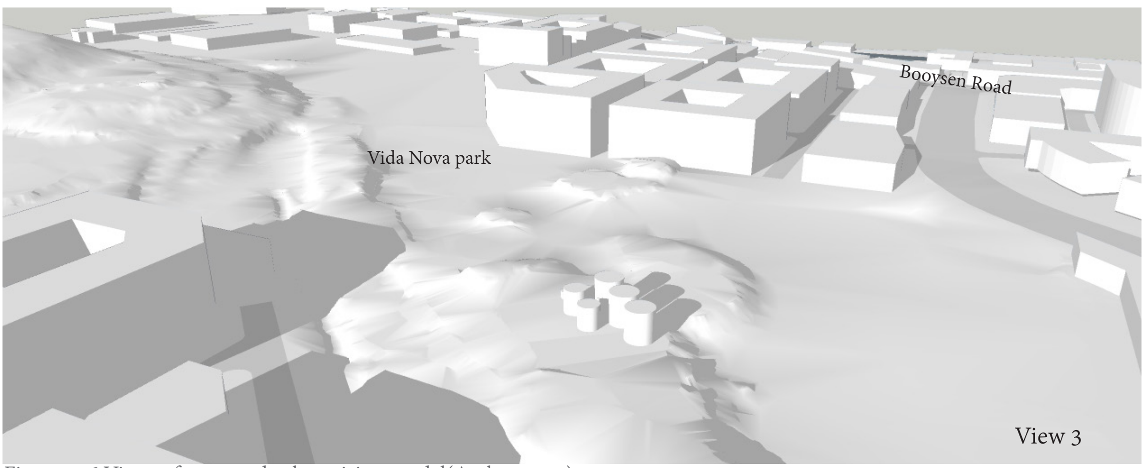


Figure3.16 Views of proposed urban vision model(Author 2017)