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Soil Management Framework Strategy: Cornubia Phase 2

November 2014

ETHEKWINI MUNICIPALITY

Tongaat Hulett DEVELOPMENTS

CORNUBIA
Building Tomorrow

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1 Introduction

1.1 Objectives

A fundamental objective of the Greater Cornubia Development is *stakeholder value creation*. Within this value creation approach is the need to make sure that Cornubia is developed and managed in a sustainable and resilient manner. To ensure the most effective and sustainable means of protecting the core environmental assets, whilst ensuring the provision of the basic needs and developmental capacity of the new community within Cornubia and those who will come to rely on Cornubia for their livelihood, there is an inherent need to look more closely at, and adequately plan and design for environmental challenges.

This document will address the management of surplus soil (fill) material generated during the construction phase of Cornubia Phase 2, but which may be applied to, in theory, to the preceding and coming phases of Cornubia.

The intention is to revise this document through the project life-cycle to present a framework strategy for the Greater Cornubia Development in its entirety.

The main aim of a Soil Resource Management Plan (SRMP) is to provide a guideline for the responsible management of soil resources within the development footprint during the life-cycle of the development. Since construction activities are expected to have the greatest impact on soil resources, and through experience to date poses possibly the most significant strategic decision-making dilemma, it is viewed as imperative that the necessary planning is undertaken pre-construction to ensure the likely adverse impacts to soil resources and related environmental assets such as available land, water, flora and fauna, are kept to a minimum, as far as practicable. This document is not a SRMP but rather is a Soil Management Framework Strategy – that is, the framework, principals and controls within which a future SRMP will fit – and thus the document is a first significant step towards ensuring suitable management of the soil resources, particularly surplus fill material. It is the intention that this document will be updated / elaborated on as further detail becomes available and will eventually detail a plan of action, thus becoming a SRMP.

1.2 Background

Significant quantities of surplus soil material (i.e. otherwise surplus fill material) are expected to be produced during construction activities for Cornubia Phase 2, due to a number of factors. These factors include, *inter alia*, the topography and poor soil quality (for construction purposes) within the area.

The challenge within the context of the development lies in how to ensure the amount of surplus soil/fill material can be minimised through re-use, reduction and/or recycling, so as to make it easier and more cost effective for the joint Developers (Tongaat Hulett Developments and the eThekwini Municipality) to deal with, whilst taking cognisance of the natural environment and environmental legislation in South Africa.

It is neither feasible nor practical to transport surplus fill material off-site due to the prohibitive cost and also because nearby landfill sites simply do not have the capacity (or desire) to cater for the significant volumes of surplus material that needs to be accommodated.

The amount of surplus fill material expected is directly related to the amount of developable land to be transformed to accommodate new land-uses, through major earth-works (cut and fill) to create platforms suitable for the construction of top-structures. It can therefore be assumed that based on experience to date and calculations based on preliminary design, that Cornubia Phase 2 will produce significantly more surplus fill material than has been encountered to date. A more strategic and proactive approach would therefore be required to reduce the need for a significant number of Surplus Fill Material Sites (SFMS), colloquially referred to as 'spoil sites'.

SFMS were previously considered to be the most suitable means of dealing with surplus soil material, however this was as the volumes were not envisaged to be as great as it has become clear that they would be if this were the only disposal methodology used.

1.3 The Framework Strategy as a 'Live' Document

This guideline document intends to provide a framework strategy for reducing the amount of, re-using and/or recycling surplus soil material within the greater development. The strategy will for all intents and purposes form part of the Environmental Management Programme (EMPr), which as a living document undergoes necessary changes to accommodate site-specific conditions as these become evident during the development progress.

It is emphasised that this document is a preliminary framework strategy rather than a formal management plan and will be revised once further detailed design is undertaken and detailed geotechnical investigations are undertaken. The quantities of surplus fill material can only be estimated at this stage, and therefore, this document will need to be revised through the life-cycle of the project.

The approach adopted for this framework strategy is derived from the Deming Cycle (**Figure 1**), a cycle of continuous improvement that entails the reiterative actions of plan, do, check, act, and critically to then return to the planning phase.

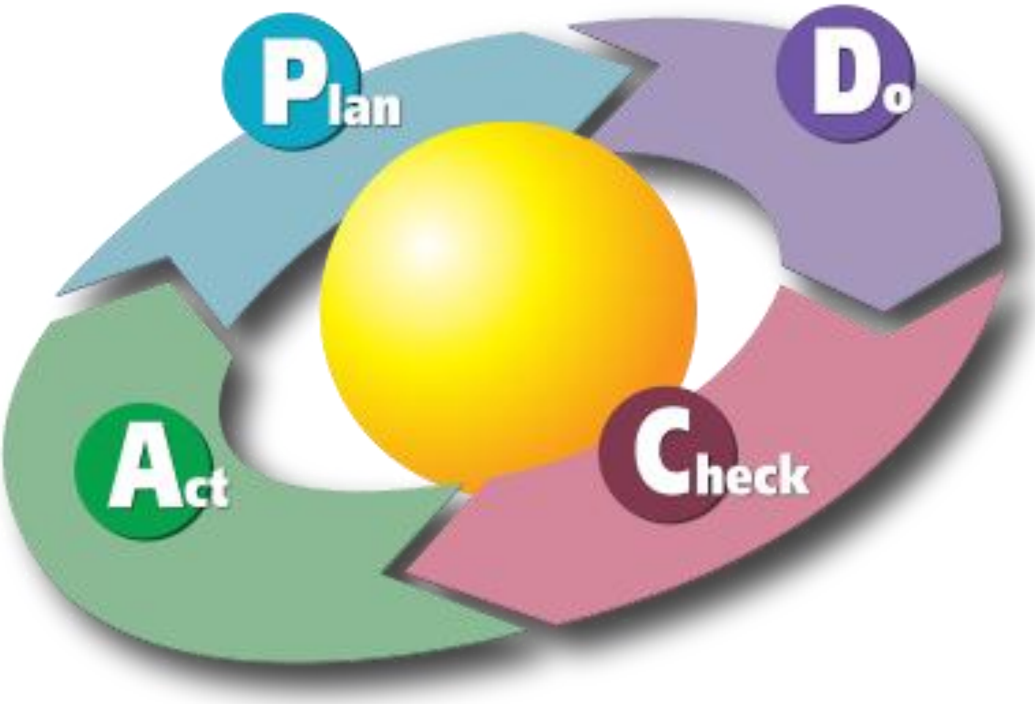


Figure 1: Deming Cycle of Continuous Improvement

It must be noted that this Soil Management Framework Strategy is a dynamic document that should be continually updated, as and when required. Any amendments made must be submitted to the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) Control Environmental Officer: EIA Component for approval prior to implementation.

2 Motivation and Context

Following the issue of the Environmental Authorisation (EA) for the Cornubia Mixed-Use Phased Development: Phase 1 (reference number: DM/Amend/0189/12), Tongaat Hulett Developments (THD) as a joint developer of the Cornubia Mixed Use Phased Development, identified the need for SFMS's due to surplus fill material being generated from construction activities at the Cornubia Industrial and Business Estate (CIBE) Phase 1.

A request for approval of the identified SFMS's was submitted to the Department of Agriculture, Environmental Affairs and Rural Development (DAEA&RD) – now the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (KZN EDTEA) – in October 2012 and was subsequently approved, together with a site specific EMPr.

The first site identified as a designated SFMS within the CIBE was located at the Old Polo Field, and catered for 44 500 m^3 (cubic meters) of fill material. The second site, also located at the Old Polo Field, catered for an additional 74 500 m^3 of fill material. The commitment made by THD for these sites was that they would be leveled and rehabilitated on completion of construction activities.

In an effort to proactively cater for the surplus fill material at the Cornubia Retail Park, a site was assessed during the Environmental Impact Assessment (EIA) study. However, subsequent to the completion of the of the EIA study, Royal HaskoningDHV were requested by the Consulting Engineer (SMEC South Africa) to request an additional site adjacent to the approved site for further surplus fill material. Combined, the original site together with the additional area requested, are 4.5 ha in extent. Both sites are located at the Flanders Quarry. Portions of the Flanders Quarry are presently operational with mining on-going, however, portions are no longer operational and these portions are presently accepting surplus fill material from the Cornubia Retail Park. The intention is to accumulate 130 000 m^3 of fill material at the Old Flanders Quarry SFMS. Upon the completion of construction activities, these sites will also be leveled and rehabilitated. Approval for the additional site was obtained from the KZN EDTEA in May 2014, subject to a minor revision of the existing EMPr for the Cornubia Retail Park.

Thereafter, the eThekwini Municipality (eTM) (joint developer of the Cornubia Mixed Use Phased Development and the Developer responsible for the housing portion of the Phase 1 authorisation) found that the amount of surplus fill material for the development of the Cornubia Integrated Housing Development: Phase 1 *(b)* was considerable. Consequently, a fifth site within Cornubia was requested in June 2014, and later approved by the KZN EDTEA. This site caters for 100 000 m^3 of fill material and is 4 ha in extent. It is also the intention that this SFMS will be leveled and rehabilitated once deposition of surplus material thereto is complete.

In July 2014 a Strategic Environmental Forum, attended by the Developers (i.e. THD and eTM), their respective Consultants, as well as the KZN EDTEA, was established for the Greater Cornubia Development. At this forum it was decided that the reactive approach to the management of surplus soil/fill material and subsequent allocation of these to surplus fill material sites was not feasible. The KZN EDTEA therefore requested a framework management plan for SFMS for the Greater Cornubia Development and Cornubia Phase 2 specifically, to be authorised as part of the EIA. As such, the development of the document at hand and the on-going process thereafter.

3 Soil Management Strategy

Soil is a finite resource, and is therefore vulnerable to being lost through mismanagement where there is not enough consideration given to planning and supervision of the handling, transportation, storage, and placement of this precious resource. Where there is insufficient planning it is likely that the Developers may not realise what is lost until it is too late. Since all environmental resources have a use-value, it is imperative to undertake investigations at the outset, prior to construction, in order to determine the full value of the resources that may be impacted by activities within the development.

Some of the most significant impacts of soil resources occur as a result of activities associated with construction. Some of these construction related impacts are unavoidable in order for development to take place. It should however be noted that some impacts are in fact avoidable *if* management guidelines are established before and are then enforced during the course of construction.

This guideline therefore establishes the following objectives related to the construction phase:

- Avoid reducing soil quality due to mixing soil types (limits options for allocation);
- Avoid contamination with construction waste;
- Avoid damaging through compaction or any loss of soils due to poor handling, haulage and stockpiling methodology;

- Avoid contaminating soil as a result of accidental spillage; and
- Avoid loss of soils due to erosion.

If the above-mentioned objectives can be successfully achieved, the avoidable impacts to soil resources would be mitigated against. As such the full use-value of the resource would be maintained, so as to allow for the resource to have the best chance of being allocated to a specific use. This in turn would limit the amount of unallocated or surplus material.

An investigation into international best-practice guidelines for Greenfield developments, in the management of soil resources, dictates that a definite starting point would be pre-construction planning – the document at hand thus being a step in the pre-construction planning process. In each instance this guideline will be applied to the various stages of site development of Cornubia Phase 2 specifically. With the generation of additional information the guideline will be enhanced into a full rehabilitation plan – that is, currently available to the Developers information will be added to through on-site investigations and estimates based on on-going experience gained on the preceding phases of the development, as well as this phase as it is implemented.

3.1 Pre-construction Planning

3.1.1 *Resource Investigation*

A lack of identification of clean soil resources places these resources at risk of becoming diminished or reduced in quality due to unnecessary mixing, and thereby restricting or limiting their suitability for re-use and subsequent allocation.

Identification of topsoil and subsoil resources is a necessary exercise as part of a construction site's SRMP in the pre-construction phase. A Soil Resource Survey is the prescribed identification process that would be undertaken to the fullest extent possible across the developable portions of the site, as far as is practicable, given the time and cost involved in the exercise.

A Soil Resource Survey is a separate identification process to a geotechnical survey, and must ultimately provide the necessary information to reasonably delineate, quantify and characterise the topsoils and subsoils of the developable area, prior to these materials being excavated for re-use on or off-site.

This survey must, as far as practicable, include appropriate analysis of representative soil samples to adequately characterise the different soil materials such as *inter alia*: pH, particle size analysis, salinity, nutrients, organic matter and potential contaminants).

The results of the survey and analysis thereof must be presented in a manner that allows for interpretation, including delineated maps, a description of the characteristics of each soil resource, the suitability of the different soil materials for re-use and also include recommendations to this affect, for the handling, transportation, storage and placement of the identified soil resources.

It would be valuable to compare results of the survey with any geotechnical studies undertaken, and co-ordinate outcomes accordingly.

Expected Outcomes:

- Determine soil types;
- Delineate soil types;
- Quantify soil types;
- Analysis, including: pH, salinity, particle size analysis, organic matter, nutrients, potential contaminants;
- Determine site-specific plans for the handling, transportation, storage and placement of the identified soil types; and
- Determine potential uses.

The reality is that the magnitude of the Cornubia Phase 2 site (some 895 ha) is considerable and any extensive Soil Resource Survey would likely be impossible due to the exorbitant costs of such an exercise.

Based on the principles outlines above, it is therefore proposed that for each developable portion of Cornubia Phase 2, the Contractor excavate a number of trial pits, where on an *ad-hoc* basis the Engineer, Contractor, and Environmental Control Officer (ECO) (if required) can determine the potential soil types and attempt to quantify each soil type. As such leading to a characterisation of the soil resources represented within the developable portion of the site.

3.1.2 *Preparation of Soil Budget*

As the planning of the development progresses, preparation of a Soil Budget – showing the extent of the surplus soil resources (if such exists) – would become possible.

The budget would also allow the Developer to determine if any surpluses or deficiencies exist for the transportation and storage of surplus soil resources. Further interpretations may be possible during the course of the development, hence the need for the SRMP to form part of the EMPr, as a live document.

Expected Outcomes:

- Identification of any surpluses or deficiencies in identified soil resources for use specifically within the construction phase, and storage requirements for surplus materials; and
- Adjustments to the soil budget based on site-specific conditions for the duration of the development.

For Cornubia Phase 2 the Engineer has already prepared a Soil Budget based on limited geotechnical investigations, this is based on experience from the first phase of the development and a preliminary design for the Cornubia Phase 2 development layout.

None of the topsoil from the developable portion of the site is suitable for use in the engineering design, other than that allocated for reinstatement of topsoil to open space areas, embankments and roadside verges.

The Engineer has also determined that approximately 10% of the material that is ear-marked to be cut and fill would, due to poor soil quality, actually be unsuitable for use as fill and would therefore be deemed surplus to requirements.

Based on the Engineer's preliminary design, suitable fill material has a positive balance and therefore requires allocation as with topsoil and unsuitable fill material.

The Soil Budget[1] for Cornubia Phase 2 could be estimated as follows:

- Suitable Fill Material (Surplus) = 293 700 m³
- Unsuitable Material (Surplus) = 1 969 300 m³
- Topsoil (Surplus) = 2 250 960 m³
- **Total Surplus Material = 4 513 960 m³**

As recorded above, the surplus material is presented as unallocated soil resources that require allocation based on their suitability for re-use according to the options to be detailed in this document.

In order to maintain or reduce the soil budget as above, and not create further surplus material due to poor management practices, a site-specific soil management method statement must be implemented to guide the handling, transportation, storage and placement of the broadly-identified soil resources.

3.2 Soil Management during Construction

For each portion of the development there must be a site-specific soil management method statement that must be approved by the ECO and form part of the EMPr. This soil management method statement must clearly show (a) the area to be stripped and the area to be left *in-situ* (if such exists), (b) methods for stripping, stockpiling, ameliorating and placement (both where applicable), and (c) the location of each of the temporary

[1] Figures above all represent approximate values based on limited geotechnical investigations, experience on Phase 1 and the preliminary design for the Phase 2 development

stockpiles or SFMS's, and the specific stockpiling areas therein – this should be based on soil type, volume and intended allocation. Finally, crucially the method statement must give (d) the person responsible for supervising the management of these soil resources.

Any changes to the site-specific method statement must be approved by the ECO in consultation with the Engineer.

All site-specific method statements must be made readily available to site supervision.

The expected outcome is to reduce the risk of losing, damaging or contaminating soil resources by implementing a site-specific method statement including:

- Defined responsibilities (oversight, etc.);
- Maps showing topsoil and subsoil types, areas to be stripped and areas to be left unstripped (areas to be protected or simply not ear-marked for construction);
- Site-specific methods for stripping, hauling, stockpiling and ameliorating and placement of soils (where applicable);
- Location of soil stockpiles per soil type;
- Schedules of volumes for each material (verified once stockpiled – keeping in mind bulking factor; up to 20% more volume once stockpiled);
- Expected after-use for each soil resource (only once allocated); and
- Site specific method statement will also be developed specifically for the rehabilitation of existing spoil sites (where applicable).

3.2.1 *Topsoil Stripping*

The following protocols must be followed when stripping topsoil:

- Topsoil must be stripped to a depth of at least 400 mm (on average) from all areas to be impacted by construction activities and any significant vehicular movement over the topsoil must be restricted.
- Under no circumstances may topsoil and subsoil be mixed.
- Surface vegetation must be removed first, by blading off, by scarification and/or raking.
- Strip topsoil from all areas to be impacted upon by construction and any significant vehicular movement.
- Topsoil stripping must consider specific recommendations found within the Soil Resource Survey and/or Site-specific Soil Management Method Statement.
- Selection of appropriate equipment and technique for topsoil stripping includes: tracked plant preferable on topsoil with wheeled plant standing on subsoil below the cut.
- Topsoil preferably to be removed in sequential strips (up to 6 m wide).
- Stripping of topsoil must only occur in the right weather conditions (not in adverse weather conditions).
- The handling of topsoil must be minimised as far as practicable; preferably handle topsoil only twice.
- The stripping of topsoil must be supervised by a competent person who has read and acknowledged that he understands the requirements detailed within the SRMP and any other relevant documents.
- Appropriate training must be undertaken with relevant site-staff.

3.2.2 *Subsoil Stripping*

The following protocols must be followed when stripping subsoil:

- Subsoil stripping depths depend on the correct identification of the sub-soil types on an *ad-hoc* basis, where no formal survey data exists.
- Subsoil stripping must consider specific recommendations found within the Soil Resource Survey and/or Site-specific Soil Management Method Statement.

- The stripping of subsoil must be supervised by a competent person who has read and acknowledged that he understands the requirements detailed within the Soil Resource Management Plan and any other relevant documents.
- Appropriate training must be undertaken with relevant site-staff.

3.3 Haulage during Construction

The following protocols must be followed when hauling surplus soil material:

- Haul vehicles must not be overfilled, and must only carry one type of soil to a designated temporary surplus fill material site. It is essential to ensure the driver knows precisely where the material needs to be stockpiled within the temporary surplus fill material site.
- Haul vehicles are to keep to designated haul roads only.
- Speed limits must be set in order to ensure road safety, and this in turn, will aid dust suppression along haul roads. Where speed limits prove ineffective in reducing the amount of dust, routine dust suppression must be undertaken on all active haul roads.
- Haulage must consider specific recommendations found within the Soil Resource Survey and/or Site-specific Soil Management Method Statement.
- Appropriate training must be undertaken with relevant site-staff.

3.4 Soil Stockpiling

The following protocols must be followed when stockpiling soil material:

- The amount of stockpiling of surplus material must be limited as far as practically possible, to avoid unnecessary handling of soil resources. Only if the surplus material cannot be allocated directly from site, to a particular option for re-use, is the material allowed to be stockpiled in designated areas identified for surplus fill material sites. These designated stockpile areas, referred to as SFMSs, are to be viewed as temporary. If it should become evident that the material cannot be allocated to a particular option for re-use over a reasonable period of time or unless a permanent site has been identified for stockpiling with a beneficial end use intended (e.g. to be rehabilitated into a soccer field, park, mountain bike track, etc.) only then would such a site be deemed permanent. If amended to a permanent status this would need to be approved by the EDTEA.
- Soil resources may be stockpiled in temporary SFMSs for a significant period of time due to the phasing of the development. As such, temporary SFMSs must be evaluated according to the likely environmental impacts associated with where they are situated. Temporary SFMSs must not present a risk to any sensitive environments such as wetlands, but may occupy undevelopable land and wetland buffers – but only where strict mitigation measures are implemented to avoid or minimise environmental impacts. If these temporary SFMSs are to be located within designated open space areas, they are to maintain and/or re-establish an equivalent degree of ecological value once they are rehabilitated.
- The main goal therefore must be to maintain soil quality and minimise damage to the soil resource's structural condition during the time the material is stockpiled within these temporary SFMSs.
- Separate sites must be allocated for different types of soil resources (if possible). If space constraints do not allow for completely separate sites, then areas for separate stockpiling must be allocated within stockpile areas. If separate sites are to be allocated, it is preferable that these are located near likely options for allocation, in order to reduce the distance to haul the material.
- Minimise the length of time soil resources are stockpiled before allocation.
- Appropriate training and signage must be implemented.
- Stockpiling must not cause soil erosion, pollution of any watercourses or stormwater inlets or increase the risk of flooding.

- Minimise the length of time soil resources are stockpiled before allocation.
- Stockpiling must consider specific recommendations found within the Soil Resource Survey and/or Site-specific Soil Management Method Statement.
- Stockpile heights are to be guided by the recommendations contained within the Soil Resource Survey and/or Site-specific Soil Management Method Statement. Generally 2 – 4 m maximum height is deemed acceptable, depending on space limitations as this sets the viable degree of the stockpile side slopes (see below). Wet soils must be stockpiled to a minimum height due to risk of compaction.
- A period of drying and possibly cultivation may be required in order to aerate wet soils.
- Restrict the amount of water that can get into dry stockpiles during the storage period by covering stockpiles, where practicable.

3.5 Temporary Stabilisation of Stockpile Areas

The following protocols must be followed to stabilise stockpile areas:

- As soon as practicably possible, temporary surplus fill material sites are to be stabilised to avoid erosion and related loss of soil resources. Appropriate compaction must exist for subsoil layers, so as to avoid excessive settlement (subsidence), slumping and channelling of stormwater.
- Stabilisation includes ensuring slope stability by battering embankments to 1:3 slopes. Slopes must be benched or terraced for additional stability; thus creating platforms that run on contour and are between 2 – 4 m wide.
- Slopes shall thereafter be vegetated as the preferred means of erosion control. Note that stockpiles may only be left un-vegetated if they are to be moved within 3 months. If left un-vegetated such stockpiles must be covered in some other manner so as to ensure no wind erosion impacts.
- Where a significant risk of erosion exists, suitable erosion control measures must be installed. These may include the use of: (hessian) jute matting, straw bales, and/or geotextile silt fencing. All erosion control measures must be installed according to best practice, and must suit the intended purpose of holding back run-off in areas prone to erosion.
- In principle water must be allowed to collect long enough behind erosion controls, to allow sediment to settle out of suspension. As such, careful design consideration must be given to the implementation of adequate stormwater control measures on these sites.

3.6 Post-construction Allocation

By maintaining the full use-value of the surplus soil resources, as far as practicable, the resource would have the best chance of being allocated to a specific use, which in turn, would limit the amount of unallocated or surplus material.

In reference to the Soil Budget for Cornubia Phase 2 (summarised above), which is estimated based on the Engineer's preliminary design, the current total of unallocated surplus soil resources is equivalent to approximately **4 513 960 m³**. To place this amount of surplus material in context, Cornubia Phase 1 has to date produced a total of 599 000 m³ of surplus material, 349 000 m³ of which is / will be accommodated in 5 approved SFMSs and the balance of which (250 000 m³) is still awaiting a suitable location for temporary stockpiling until it may be allocated (if possible).

To summarise, if the average size of the potential SFMSs were therefore maintained for Cornubia Phase 2 as well, the Developers could require approximately 65 surplus fill material sites within Cornubia Phase 2. Therefore, options for reducing, re-using and recycling are critical to the success of the Greater Cornubia Development.

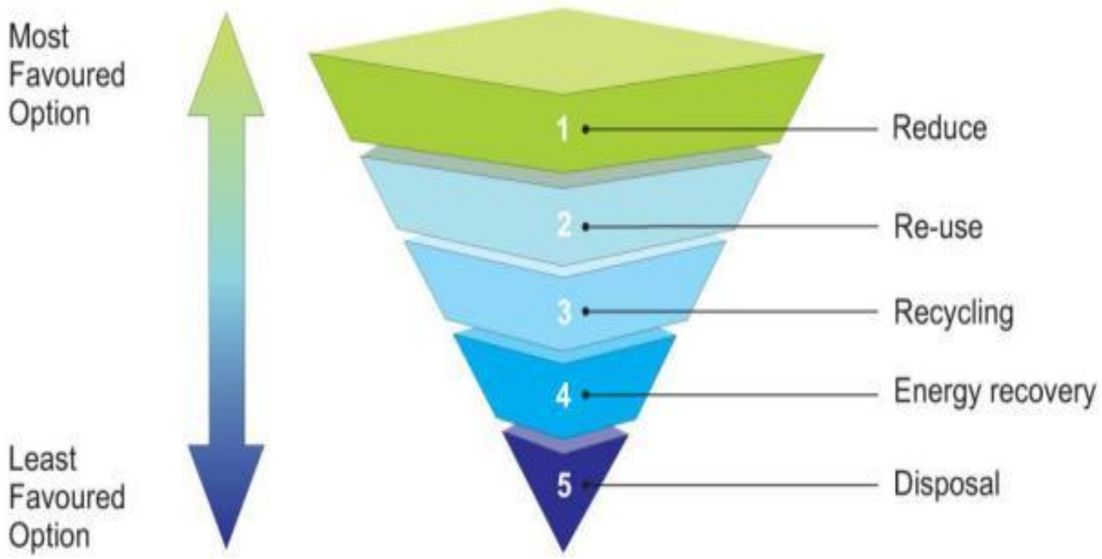


Figure 2: Surplus Fill Management Hierarchy

Options for re-use, recycling and disposal have been identified and must be critically evaluated per area and nature of the soil type to determine a suitable allocation for the identified surplus soil resources, keeping in mind that it is neither feasible nor practical to allocate all surplus soil resources to SFMSs within the development, nor to transport all surplus soil resources off site.

Critical in determining whether or not an allocation to a particular option is feasible, is the legality of such options, the cost of allocation, the demand for the soil resource, the available suitable land and the social considerations.

An overview of the identified options is presented below.

3.6.1 *Options for Spoil Reuse, Recycling and Disposal*

3.6.1.1 Engineering (Design) Changes and Incorporation of Surplus Soil Resources

This option proposes altering the design and construction methodology, where practicable, to include the use or incorporation of additional quantities of surplus soil resources. Platforms could potentially be increased in height, to accommodate more fill material. However, by raising the height of the platforms the developable area would reduce in size. This may thus be an option for the Developers to significantly reduce the amount of surplus soil material, but would come at great cost and at a certain point would render the development economically unfeasible.

Furthermore, it is noted that if the quality of surplus fill material is graded above a G10 type, it is unsuitable for engineering fill, thus reducing the viable quantity that can be used.

Additional quantities of unsuitable fill material may potentially be included in the design by 'wedging' or 'sandwiching' – which is the practice of alternating layers of good- and poor- fill material as platforms are constructed. This practice requires careful selection of materials, close supervision and much time and likely additional costs.

It is further noted, that this option also depends on the quality of material as not all soil material can be wedged. A conservative estimate indicates that the 10% estimated as surplus fill material is of poor quality that cannot be used as engineering back-fill.

3.6.1.2 Creating Arable Land – in Degraded Open Space – for Nurseries and/or Other Urban Agriculture

This option proposes that historically degraded areas in the open space, previously impacted upon by agricultural activities (e.g. remnant sugarcane lands), may be rehabilitated for the purpose of establishing nurseries and/or other forms of urban agriculture. These areas would benefit specifically from additional topsoil where topsoil is lacking or is of poor quality.

Additional quantities of topsoil could potentially be allocated to raised beds, pots and/or bags for the cultivation of plants.

Another advantage of this option is that it would allow for an additional, if relatively small, revenue stream from sale of plants or produce that could help to offset the costs of the development thereof. The nurseries would also crucially allow for growth of landscaping plants for the greater site thus reducing the cost of purchasing of such materials over the lifespan of the greater site.

3.6.1.3 Creating Arable Land – Generally in Open Space – for Nurseries and/or other Urban Agriculture

This option is a variant of section 3.6.1.2.

This option proposes that areas within the less sensitive open space areas to be identified as potentially suitable for creation of arable land.

These areas are noted as being generally outside of historically degraded areas and may for instance include areas such as the slopes of platforms – by lengthening the slopes to create a more gentle slope (perhaps 1:5 – 1:10) and which can be benched or terraced to accommodate the establishment of nurseries and/or other forms of urban agriculture.

These areas would benefit specifically from additional topsoil to allow for a gentler slope from platform sites and deeper soils that would assist root establishment.

Additional quantities of subsoil and topsoil could potentially be allocated to creating stormwater features such as berms. Furthermore additional quantities of topsoil could potentially be allocated to raised beds, pots and/or bags for the cultivation of plants.

3.6.1.4 Creating Wetland Habitats

This option proposes using suitable soil resources, especially clay material, to potentially artificially create wetland habitats. The artificial creation of wetland habitats will be used to off-set impacts on existing wetlands within the development. These artificially created wetland habitats would include the establishment of stormwater attenuation facilities, especially as sediment traps below areas assigned to urban agricultural use (where applicable).

Additional (mainly inert) materials that could potentially be re-used through ‘soft-engineering’ in the artificial creation of wetland habitats, including, tree stumps and branches, wetland vegetation ear-marked for destruction due to approved infilling of wetlands, wetland buffer vegetation that may be otherwise removed, and, rock material from excavations. The aim being to reuse as much material on the greater site in such a way that it has value and further does not incur a disposal cost.

The aim would be to produce more natural appearing wetland areas thus enhancing the greater site’s functionality and ecological value.

3.6.1.5 Wetland Rehabilitation

This option proposes using suitable soil material, especially clay material, to potentially improve upon existing structures within wetlands that have been rehabilitated as part of Cornubia Phase1. The additional allocation of material could potentially improve these existing wetland footprints and thus bolster the wetland off-set calculation.

As in section 3.6.1.4, additional materials (as specified above) can potentially be re-used as ‘soft-engineering’ in the artificial creation of wetland habitats.

3.6.1.6 Creating Other Habitats

This option proposes using suitable soil material to create habitats that could potentially accommodate various fauna and flora. These habitats could be strategically located away from possible disturbance, where suitable soil material could be utilised to artificially create and/or enhance existing habitats for birds and reptiles, amongst others.

As in section 3.6.1.4, additional materials (as specified above) can potentially be re-used through 'soft-engineering' in the artificial creation of other natural habitats.

3.6.1.7 Creating and/or Enhancing Gardens and/or Parks

This option proposes (a) creating additional gardens and/or parks, or (b) enhancing existing areas ear-marked for gardens and/or parks. The aim is thus to make putting in vegetation cover as cost-effective as possible, and to allow for potentially more extensive habitat creation than would otherwise be viable.

These landscaped areas would benefit specifically from additional topsoil where topsoil is lacking or of poor quality, and allow for deeper topsoil profiles which would assist with more effective root establishment.

Additional quantities of subsoil and topsoil could also potentially be allocated to creating stormwater features such as berms. Through the use of additional materials being re-used through 'soft-engineering', the landscaping and ecological value of the greater site is further enhanced with additional habitats being created. Such berms can also help in the potential separation of clean and potentially dirty stormwater streams, linked to stormwater attenuation, and further for noise attenuation both to those within the greater site, and to those outside of the site from activities on site.

3.6.1.8 Creating and/or Enhancing Roadside Verges

This option proposes creating additional roadside verge features, or allowing for additional topsoil within the existing design of roadside verges thus allowing better establishment of plant material in these areas. These landscaped areas would benefit specifically from additional topsoil where topsoil is lacking or of poor quality, and deeper topsoil profiles would assist with root establishment.

Additional quantities of subsoil and topsoil could potentially be allocated to creating stormwater features along the roadside, especially in areas prone to flooding nearby platform sites, where perhaps higher embankments would act as a suitable stormwater control measure. Where possible / feasible, such features can be developed as stormwater control and ecological habitat niche development sites – space constraints may not always make this a viable option in verge areas.

3.6.1.9 Restoring Landfills

This option proposes the sale of suitable surplus soil resources as lining or capping material at local or regional landfill sites. This option needs to be investigated further in order to gauge the present demand. It is known that materials most sought after at the present time by these sites for the restoration (on-going or moving towards final closure) of the known landfill sites are clays and topsoil. Sub-soil may also within certain parameters be used as daily capping and stabilisation material.

The landfill sites that will be investigated include: Bisasar Road and Buffelsdraai; especially as the former is believed to be reaching capacity and ready for final closure. The viability of this option depends on timing as demand and supply must correlate.

3.6.1.10 Rehabilitating Borrow Sites

This option proposes the placement within and rehabilitation of existing borrow sites within or near to the development.

More specifically, Flander's Quarry can potentially be ear-marked for placement (infill) of surplus subsoil and rehabilitation thereafter with surplus topsoil material. The most-suitable material for infilling within the

Flander's Quarry would be material that has been mixed (to a predetermined mix and distribution of soil grades, not merely material that has been accidently mixed) and as such, has the lowest use-value in the context of the development.

The availability of Flander's Quarry for infilling and rehabilitation would firstly need to be established by the Developers. It is noted that portions of the Flander's Quarry continue with mining operations at present and a separate EIA is underway for these portions. However, it is also noted that portions of Flander's Quarry are presently no longer operational and are collecting surplus fill material from the Cornubia Retail Park.

Additional quantities of subsoil and topsoil could potentially be allocated to creating stormwater features, such as berms, upon rehabilitation of the Flander's Quarry. Some additional materials could also potentially be re-used through 'soft-engineering' as detailed previously.

3.6.1.11 Rehabilitation of Erosion Features

This option proposes the placement within and rehabilitation of existing erosion features; this would include the potential rehabilitation of stormwater blow-outs, unstable embankments and other erosion features.

This option needs to be investigated further in order to gauge the present demand, however, depending on the haulage distance, this may provide a number of suitable locations for allocating surplus soil resources not only within the development footprint, but within the surrounding area.

The Developers will discuss this option with the relevant Departments at the eTM who may potentially have suitable areas, as described above, on land that they own that require such rehabilitation to be carried out.

3.6.1.12 Placement as Acoustic Bund

This option proposes that surplus soil resources potentially be allocated to an acoustic bund at the planned noise contour and/or incorporated elsewhere within the development as an acoustic bund, depending on the nature of the development; as a barrier between industrial and residential land-uses.

This option needs to be investigated further by the Engineer (SMEC) in order to determine feasibility.

3.6.1.13 Placement within Existing Servitudes

This option proposes that surplus topsoil material potentially be allocated to raising the profile of the soil within existing servitudes (e.g. electrical servitudes). Such profile raising should be limited to areas outside of wetland areas, but potentially in consultation with EDTEA extending into limited wetland buffers to an agreed degree only.

Additional quantities of subsoil and topsoil could potentially be allocated to creating stormwater features such as berms within the servitudes. These berms could double as noise attenuation mechanisms as well.

3.6.1.14 Placement within Future Servitudes

This option is as per section 3.6.1.13, but for future proposed servitude areas. Obviously any such landscaping would need to be planned taking the future servitude use into account and should be carried out accordingly (e.g. no trees in those servitudes that will include future power lines) and should allow for effective development of the infrastructure required to run via these servitudes with minimal disturbance.

3.6.1.15 Commercial Topsoil Sale Off-site

This option proposes that clean surplus topsoil material potentially be sold commercially off-site. Although the Developers are investigating the demand options to sell topsoil to other developers within the region, it is envisaged that the vast majority of surplus topsoil resources will be sold to commercial sources.

Major construction projects in the area include the Western Aqueduct, where additional quantities of topsoil could potentially be allocated to the rehabilitation of their construction servitude.

It is further noted that in order to allow for this beneficiation that a mining permit may be required for a 'sand mining' operation as this may well fall within the definition thereof. Even if it does not, confirmation should be obtained from the Department of Mineral Resources (DMR) as to how such an activity should be handled, and to ensure that any required permits are obtained timeously.

Note that, if the material is not sold but is given to another site for an approved use, that such mining approvals may not then be required. Given the amount of material that may be considered for such off-site sale and the related revenue that could be generated, the cost and time related to obtaining the DMR permits may well be worth the effort.

3.6.1.16 Commercial Clay Sale Off-site

This option proposes that surplus clay material potentially be sold commercially off-site. Although the Developers are still investigating the demand options to sell clay to other developers and commercial sources within the region, it is envisaged that the vast majority of surplus clay resources will be sold to commercial sources.

Surplus clay material will potentially be sold as lining or capping material at local or regional landfill sites, such as Bisasar Road and Buffelsdraai.

The same constraints as detailed in section 3.6.1.15 are relevant to this option.

3.6.1.17 Commercial Shale Material Sale Off-site

This option proposes that shale material potentially be sold commercially off-site. The Developer has already established that there is a demand for suitable shale material for making bricks. It is envisaged that the vast majority of shale material will potentially be sold to commercial sources, such as COROBRIK.

The same constraints as detailed in section 3.6.1.15 are relevant to this option.

3.6.1.18 Construction of Sandbag Houses

This option proposes that surplus soil resources be utilised according to at least three alternative construction methodologies for building houses, namely, (a) Traditional Sandbag Houses; (2) Rammed Earth (earth within a shutter and compacted); and (3) Cob (which is a method comprising a mix of mud and straw/hay in building a structure).

The construction process is highly labour intensive, and therefore could provide a welcome source of employment to the local community which is aligned with the Developer's social development strategy – the Cornubia Social Sustainability and Innovation Programme (SSIP).

3.6.1.19 Manufacturing of Topsoil for Allocation on Site and/or Commercial Sale Off-site

This option proposes that suitable soil-forming material may potentially be blended with an appropriate source of organic matter, at the required mixing ratio, in order to effectively manufacture topsoil. Suitable soil-forming material may include: subsoil and mixed soils which would need to be analysed first to see what additions or processing would be required to make a useful (functional topsoil) for use on the greater site or for sale to commercial sources off-site.

The process for this option would need to be discussed with EDTEA and DMR to determine whether any permitting requirements are triggered – however, this is strongly dependent on the specific inputs needed.

3.6.1.20 Manufacturing of Suitable Fill Material for Allocation on Site and/or Commercial Sale Off-site

This option proposes that suitable soil-forming material may potentially be blended with appropriate materials, at the required mixing ratio, in order to effectively manufacture a suitable fill material (even if low-grade). Suitable soil-forming material may include: subsoil and mixed soils which would need to be analysed first to see what it would take to make a useful (functional fill material) for sale to commercial sources off-site.

The same constraints as detailed in section 3.6.1.15 may be relevant to this option and should be confirmed prior to being initiated.

3.6.1.21 All Surplus Soil Resources to Landfill

This option proposes (in theory only) that all surplus soil resources be removed from site to landfill.

This option is not considered viable due to (a) excessive cost, (b) a lack of capacity at local and regional landfill sites, (c) the undertaking of what would essentially equate to poor environmental practice and wastage of finite resources, and (d) a significant impact on the development's carbon footprint, amongst other reasons.

3.6.1.22 Creating Tracks and/or Trails

This option proposes creating additional recreational areas, specifically for mountain biking, horse-riding and/or walking. These landscaped areas consisting of tracks and trails would be transformed to create a degree of difficulty and also to stabilise areas which could potentially pose a hazard to the rider.

Additional quantities of subsoil and topsoil could potentially be allocated to creating stormwater features such as berms. Furthermore, additional materials that could potentially be re-used through 'soft-engineering'.

3.6.1.23 Placement of Surplus Soil Resource to SFMSs

This option proposes that only the surplus soil resources, remaining after all other options have been investigated and actioned as far as viable, are placed within designated SFMS and levelled, and rehabilitated so as to blend into the open space network. These sites may then be transformed to accommodate a prescribed activity such as urban agriculture, various recreational opportunities, and other applicable activities as described above.

3.7 Soil Placement

Once an option has been decided upon for the allocation of surplus soil resources, the reinstatement of the soil would need to be undertaken in a manner that provides a structured, un-compacted and well aerated soil profile upon placement.

Soil placement must consider specific recommendations found within the Soil Resource Survey and/or Site-specific Soil Management Method Statement.

The following protocols must be followed for soil placement:

- All soil resources to be reinstated must be handled only when dry or slightly moist (not saturated).
- Over-compaction must be strictly avoided by restricting movement of vehicles over the reinstated area.
- Soil placement must consider specific recommendations found within the Soil Resource Survey and/or site-specific Soil Management Method Statement.
- Selection of appropriate equipment for soil placement includes the use of tracked plant only.
- The receiving surface (in-situ layer of soil) must be de-compacted first prior to placement and spreading. In some instances this receiving layer may require deep ripping.
- Subsoil layers (where applicable) must be spread first, according to the depth detailed in the Site-specific Soil Management Method Statement, before topsoil is applied to the area as the final layer and spread.
- Topsoil depth may vary between 400 – 600 mm depending on the option material is allocated to, and as detailed in the site-specific Soil Management Method Statement.
- All compacted lumps/clumps of soil material (subsoil or topsoil) must be broken down by scarifying before adding additional layers of soil.
- Undesirable material that surfaces during any of these processes must be removed by picking or raking.

3.8 Soil Maintenance (Aftercare)

The following protocols must be followed for soil maintenance:

- The appointed Contractor or Landscape Consultant must consider the details presented in the EMPr and Wetland and Open Space Rehabilitation Plan for methods of grass establishment and fertiliser and maintenance regimes.
- Monitoring of soil conditions must be undertaken as part of the management of the open space areas, and must include early identification of settlement and self-compacted soils, consequently suffering from waterlogging and anaerobism (lack of oxygen), i.e. the identification of unsatisfactory growing conditions.
- In the event that unsatisfactory growing conditions are observed during the monitoring and maintenance period a Landscape Specialist is to be consulted to provide recommendations for corrective action.
- Monitoring of re-vegetation and retained vegetation needs to be undertaken routinely on a seasonal basis and as prescribed in the Wetland and Open Space Rehabilitation Plan.

4 Conclusion

Due to the magnitude of Cornubia Phase 2, as well as the underlying geology and topography, the project is expected to generate significant quantities of potentially re-useable soil material. It is reiterated that a large quantity thereof will be regarded as surplus fill material, much of which cannot be used as engineering fill.

Whilst this framework strategy has outlined the overall intention and options for the management of this surplus fill material at Cornubia Phase 2, it is noted that the framework strategy is not a detailed Soil Resources Management Plan. In order to become such a plan detailed geotechnical investigations and engineering designs to determine the surplus soil material and quantities, and hence, re-use options, will need to be carried out.

The greatest potential for recycling surplus fill material generated from the construction works would be to use the material excavated as backfill. This material is likely to contain large rocks in excess of 300 mm in diameter and would need to be crushed into pieces of less than 50 mm in diameter to be suitable for reuse as backfill material. Options to improve the quality of material will also need to be investigated in greater detail.

The Developers are committed to the beneficial reuse of clean soil material wherever possible. For most infrastructure projects, disposal of surplus fill material is seen as an avoidable cost, and efforts are made to find locations where it can be accepted as engineering fill.

In surplus material management, the order of magnitude and timing are also important in determining the viable and feasible options. Small quantities can be used on a large number of construction projects or accepted at other disposal sites (e.g. landfills or mining voids), but larger quantities often require special arrangements to be negotiated.

The available options are strongly linked to and dependent upon the timing of major construction projects that require fill coinciding with the period when spoil is being produced.

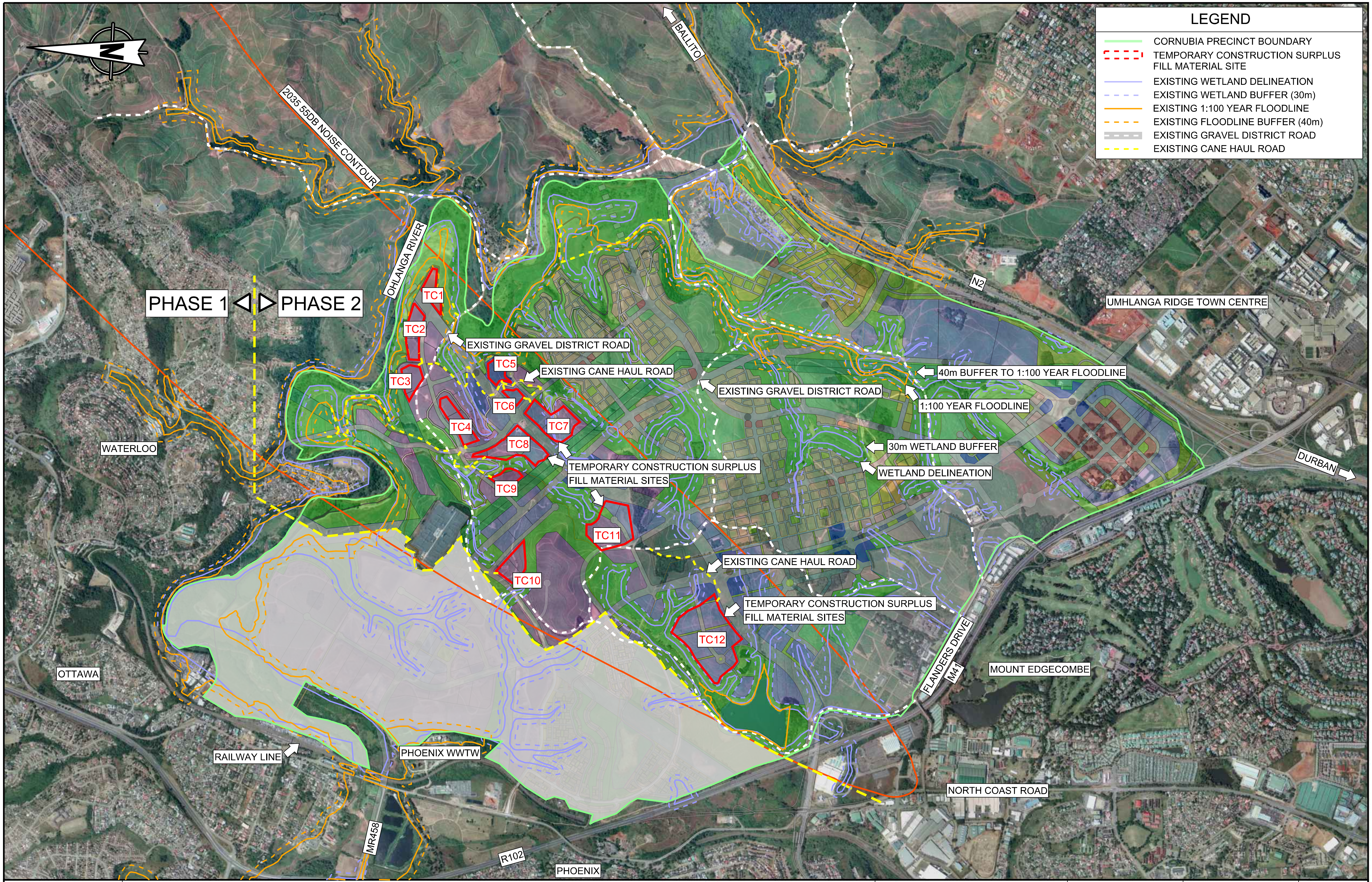
It is noted that a number of the alternatives considered may require other permits – be these either mining or water related. Any such required permits should be timeously obtained to limit any possible delays, as well as allowing for alternative options to be considered if rejected.

It is noted that disposal of the material to landfill incurs excessive transportation costs, and the capacity of the landfills is limited. This is further considered to not be best practice and definitely not a preferred alternative, but rather a last resort for a small remaining portion after all other options have been used.

As a result of preliminary discussions with the Developers, the Developers have indicated their interest in using any surplus fill material remaining after construction to support rehabilitation activities as a beneficial end use.

A detailed investigation of these areas would be undertaken as part of the construction programme to assess the viability of the options presented in this framework strategy for the re-use of surplus fill material. This would require on-going liaison with the specialist team and Contractor during the construction process. Any commitments to assist with surplus fill material would be developed and documented before construction commences. These options would depend on the actual quality of the spoil. All materials would need to be audited and classified prior to reuse, with formal approval to be provided by the Developers.

Appendix A: Map of Proposed Surplus Fill Material Sites at Cornubia Phase 2



SMEC
Local People Global Experience

CORNUBIA PRECINCT - PHASE 2

PROPOSED TEMPORARY SURPLUS FILL MATERIAL SITES

Client: Tongaat Hulett DEVELOPMENTS

Scale	Sheet	Figure
1:20 000	1	1
Drawing No		
DH0003-PHASE2-SURPLUS-01		

Royal HaskoningDHV

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