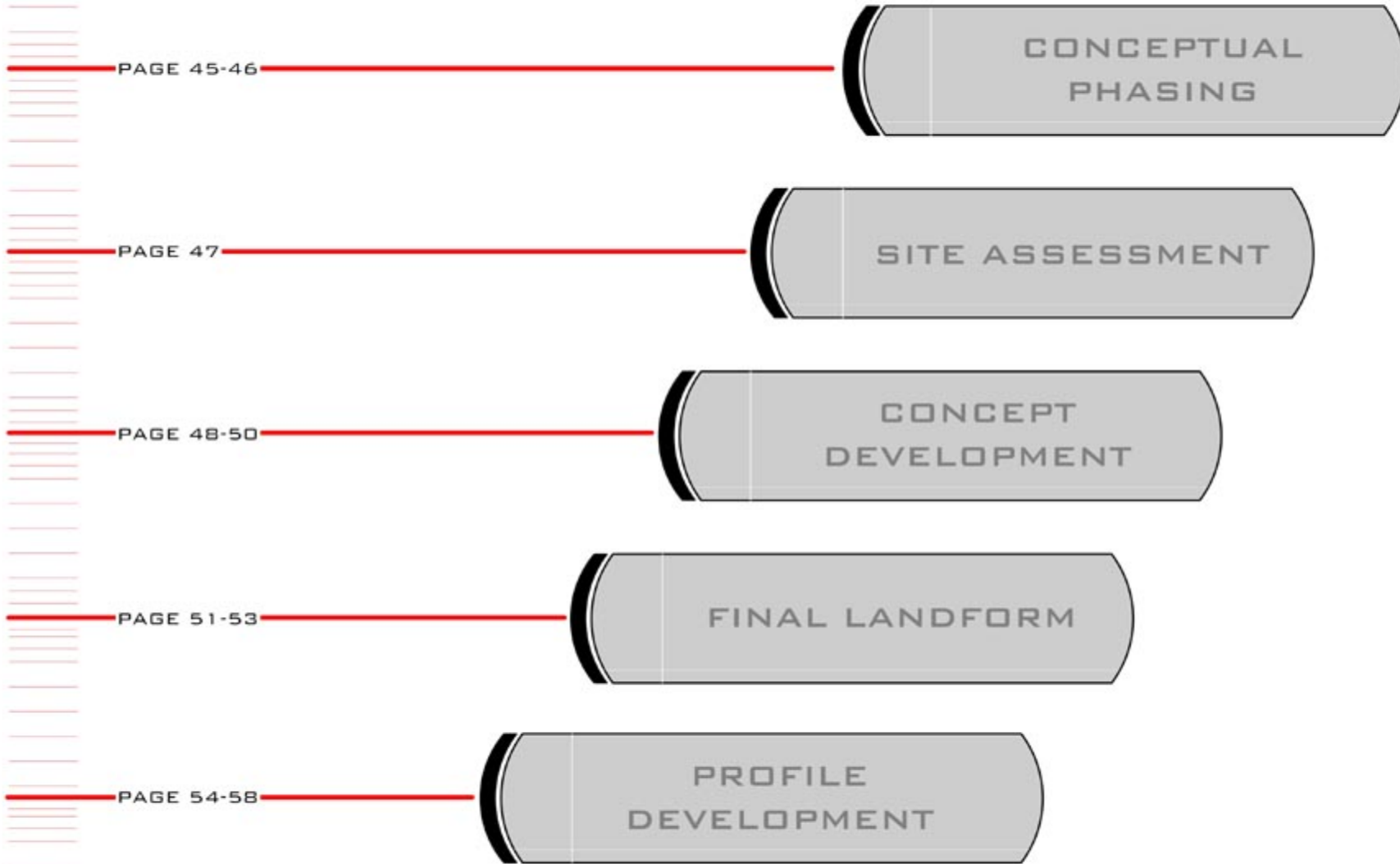


# CONCEPT DEVELOPMENT



CONCEPTUAL PHASING

SITE ASSESSMENT

CONCEPT DEVELOPMENT

FINAL LANDFORM

PROFILE DEVELOPMENT

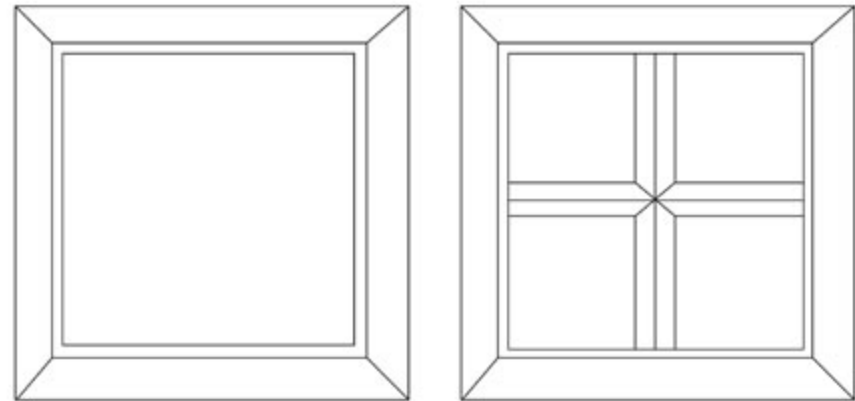
**Introduction**

The possibility of compartmentalising one impoundment (fig 5-1), creates the opportunity for an irregular final landform. The conventional construction methods still apply, but it is exploited to achieve the desired rehabilitated state within the parameters of structural safety and stability.

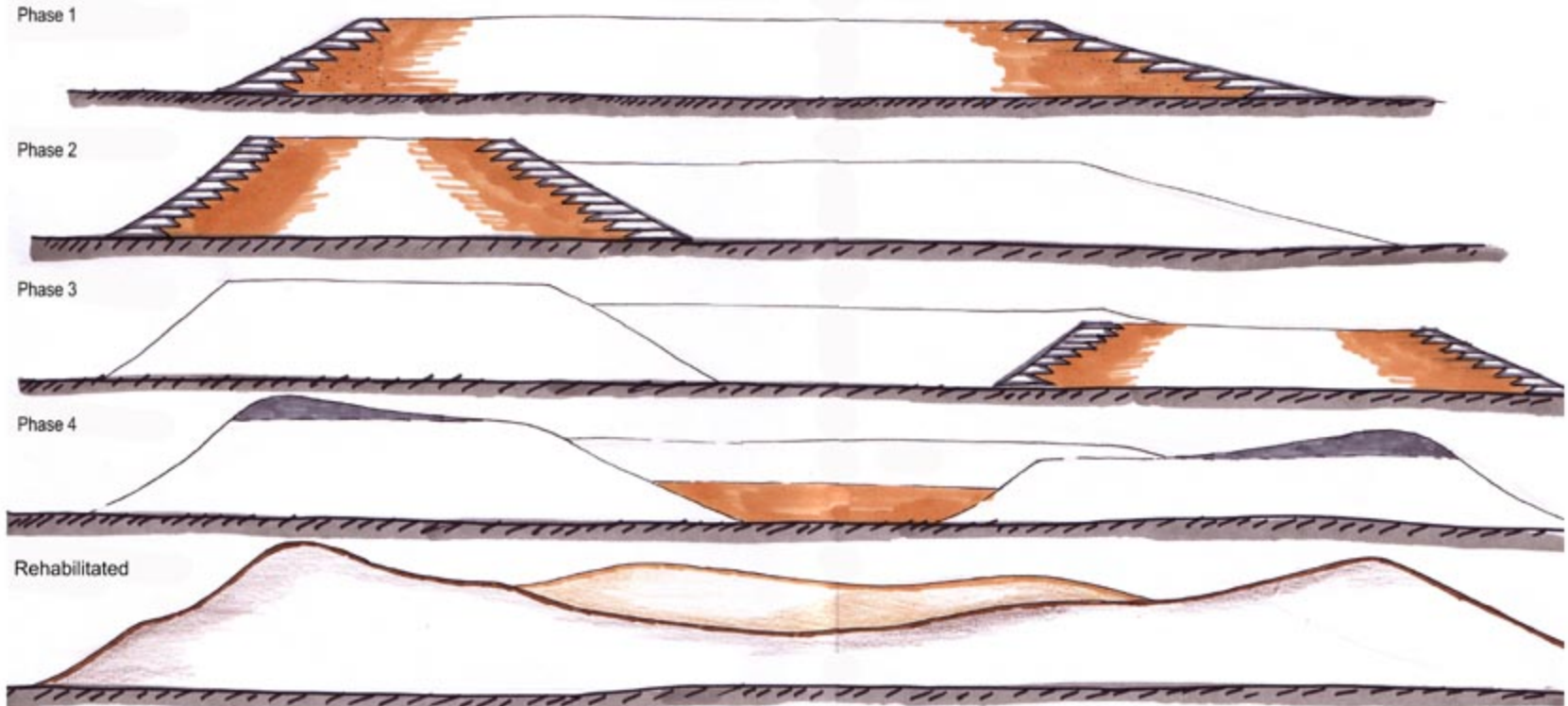
Benefits of compartment-construction:

- Smaller footprint areas per phase, thus better control over environmental impacts.
- Rehabilitation can start as soon as first phase is complete.
- First phases can act as visual buffers for future expansion
- A height difference between compartments is possible, thus creating level changes and subsequent irregularity of the profile (Vick 1983).

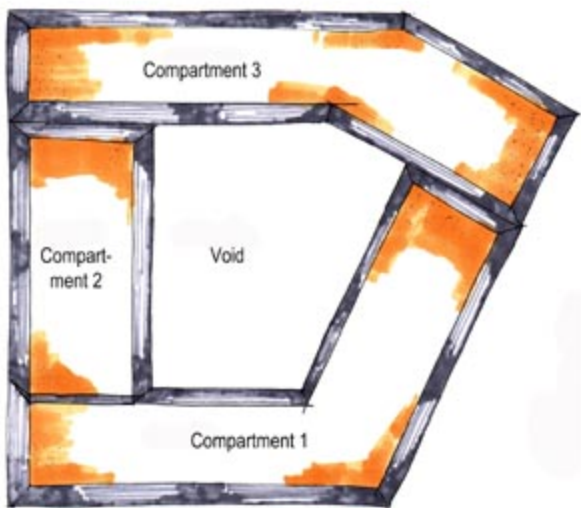
(i) COMPARTIMENTALISING OF TDFs (VICK 1983)



(j) CONCEPTUAL PHASING



### 3 CONCEPTUAL PHASING



### Conceptual phasing

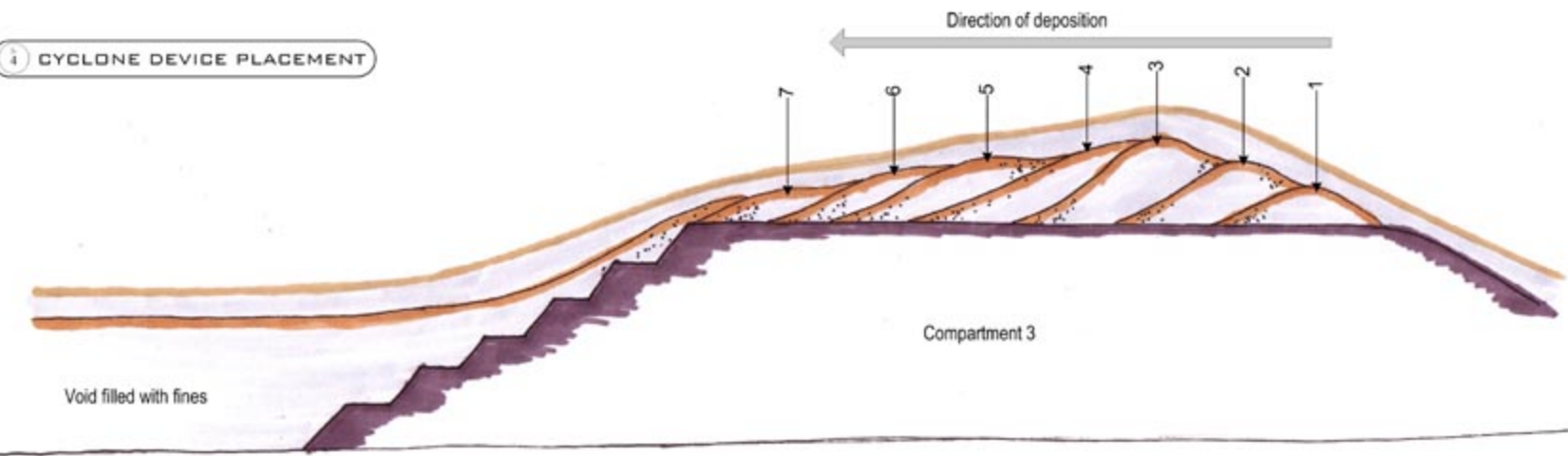
Compartment 1,2 and 3 is constructed in order to create a void in the centre. Compartment 1,2 and 3 can be operated simultaneously if the deposition rate is high. Either cyclone or spigot deposition can be used.

After completion of the first 3 stages, cyclone deposition must be implemented in order to fill the void with the fine fraction (overflow). The coarse fraction (underflow) is applied on the flat surfaces of phases 1,2 and 3 to create an irregular top surface. The cyclone devices can be positioned at any point on the surfaces to build an outcrop to the specified height. It must be mentioned that progression of phase 4 are only possible once compartment 1,2 and 3 is declared stable.

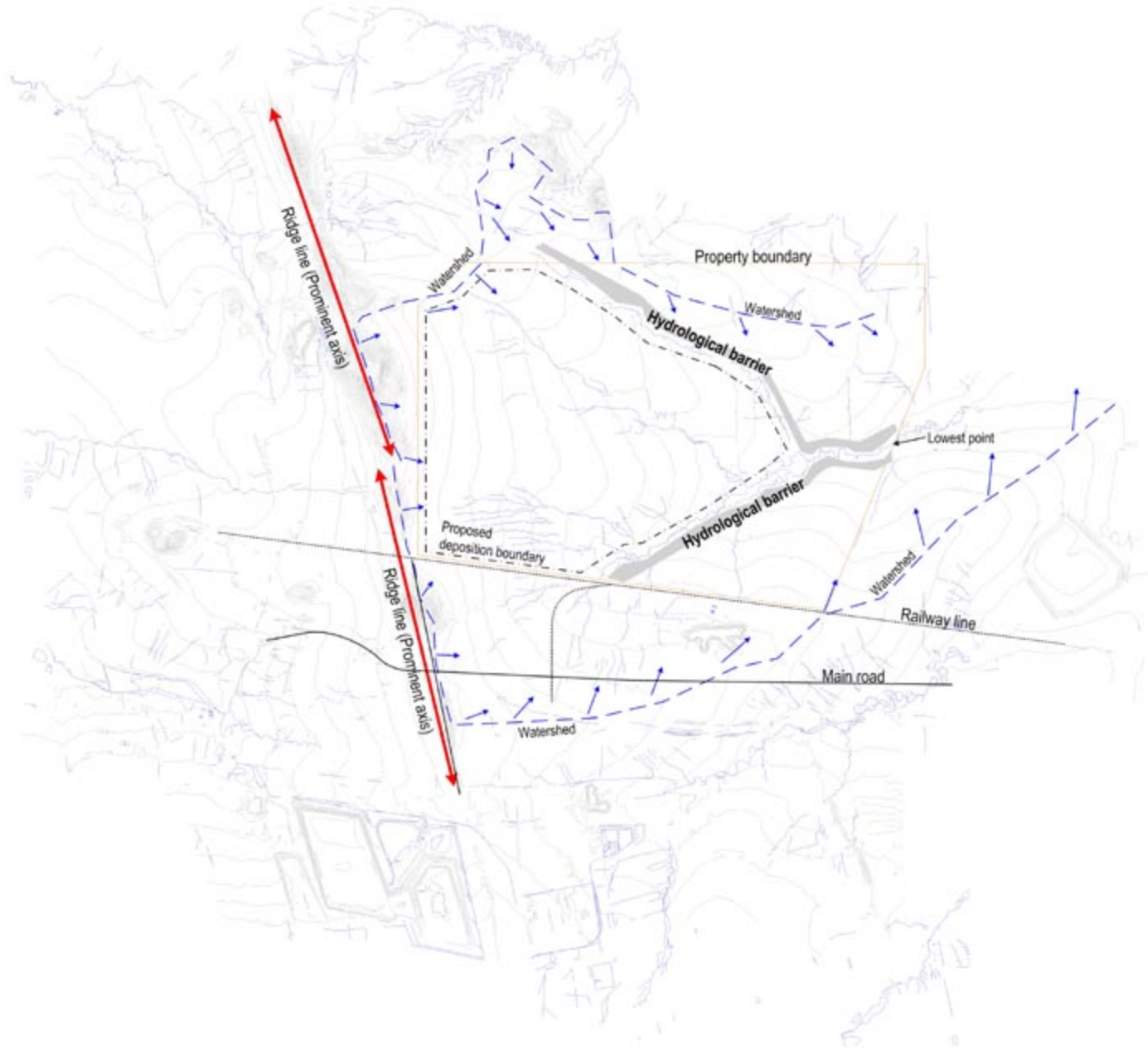
This method of deposition enables one to achieve a wide variety landform profiles. The emphasis is on creating habitats that will function in harmony with the associated surface covering and context. Safety and stability is still the primary concern and sufficient planning and design must focus on drainage patterns on the landform.

Stabilisation of the slopes must occur as soon as possible. For this reason, access routs must be present in the design.

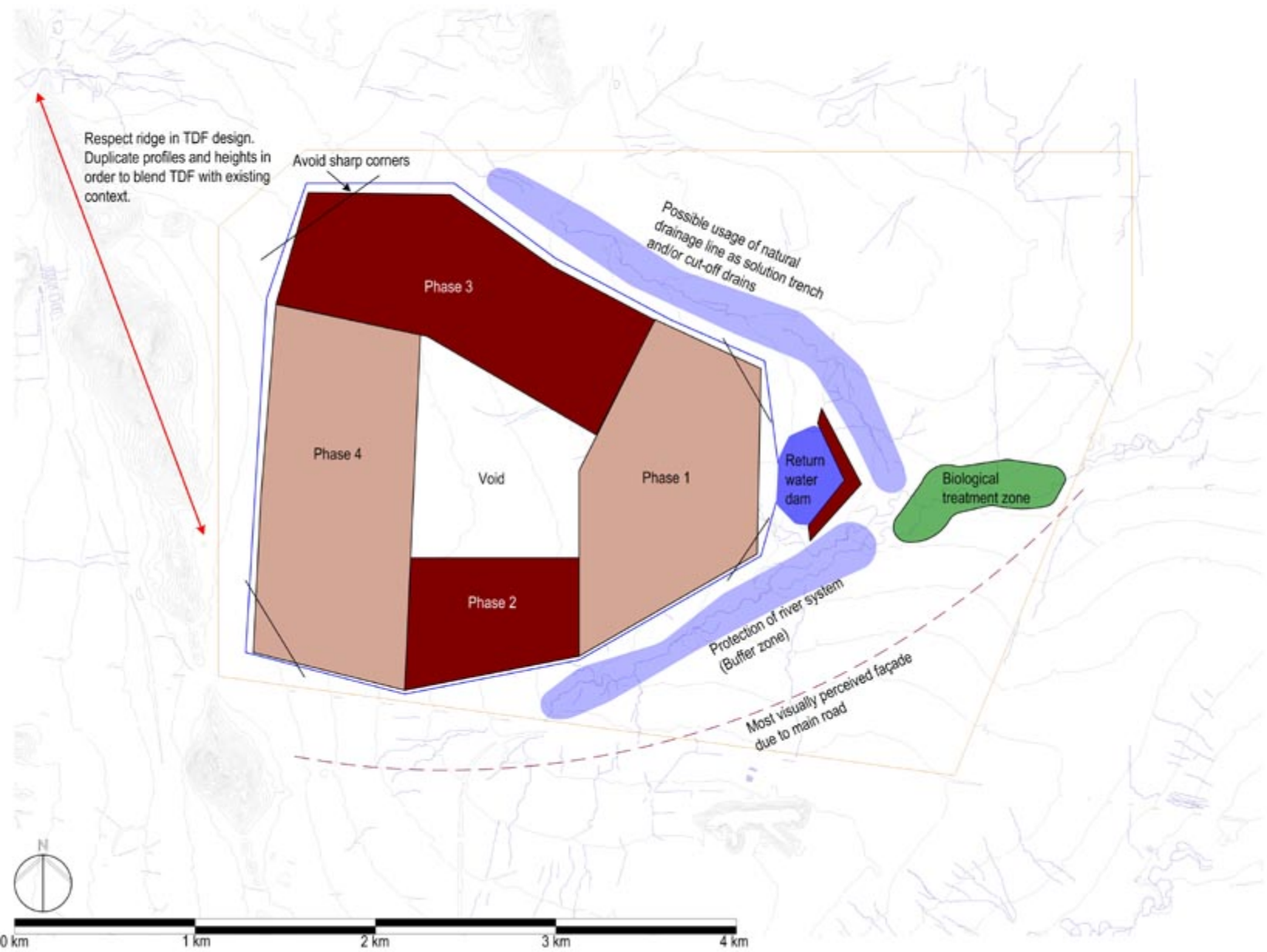
### 4 CYCLONE DEVICE PLACEMENT



- CONCEPTUAL PHASING
- SITE ASSESSMENT**
- CONCEPT DEVELOPMENT
- FINAL LANDFORM
- PROFILE DEVELOPMENT



(fig 5-6)



- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT**
- FINAL LANDFORM
- PROFILE DEVELOPMENT

CONCEPTUAL PHASING

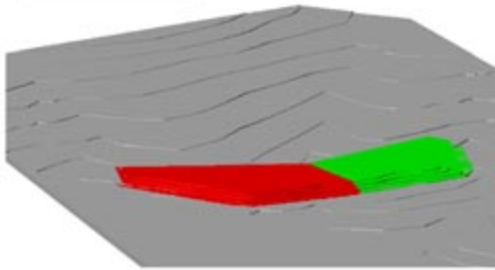
SITE ASSESSMENT

CONCEPT DEVELOPMENT

FINAL LANDFORM

PROFILE DEVELOPMENT

## PHASE 1 &amp; 2

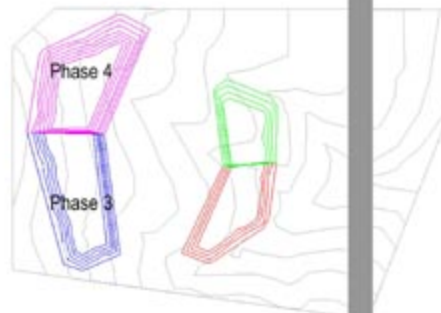
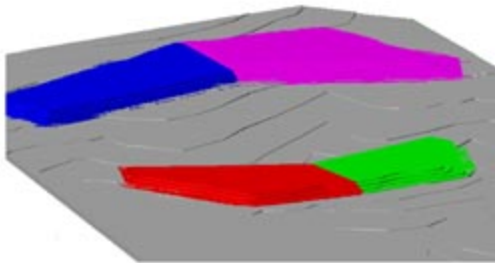


## Phase 1 &amp; 2

Phase 1 and 2 is the construction and operation of 2 TDFs in the eastern corner of the deposition boundaries as determined by the natural drainage lines. Phase 1 and 2 can be operated simultaneously or separately depending on the rate of deposition.

To accommodate a 400 tons per month (tpm) deposition rate, phase 1 and 2 need to be operated simultaneously. A safe rate-of-rise of 2.5 m per year is achieved, thus implying that spigot deposition must be implemented. A 12 year operation period is required in order to reach a height of 30 m for phase 2.

## PHASE 3 &amp; 4



## Phase 3 &amp; 4

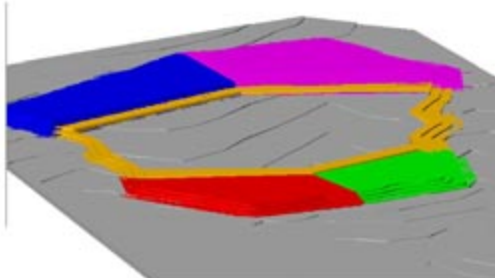
Phase 3 and 4 consist of the construction of 2 larger impoundments near the western boundary of the site. These TDFs will define the western embankment of the void.

A rate of 450 tpm deposition is achievable. Spigot deposition must be implemented in order to maintain a safe rate-of-rise if phase 3 and 4 is operated simultaneously. Phase 3 and 4 will each reach a height of 30 m and 40m respectively. A 14 year operation period is required to complete and decommission the impoundments.

It must be noted that all four phases can be operated simultaneously thus implying that deposition rate can be increased to almost double the current rate of 400 tpm - 450 tpm. Economically, it is a viable option. From an environmental point of view, area of impact is much higher.

## Phase 5

## PHASE 5



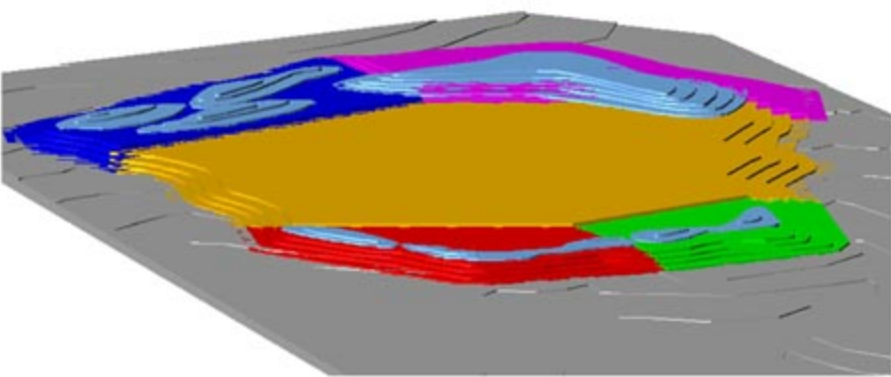
Effectively, the filling of the void can start as soon as phase 1-4 provides a sufficient embankment height to contain tailings. This is not recommended as geo-technical stability of phase 1-4 can be jeopardised.

The first stage requires the construction of embankments in order to completely close the void on the northern and southern façade, making use of cyclone deposition. Within a short period of time the embankments will provide a sufficient freeboard to contain a large volume of tailings.

At this stage, rehabilitation of the other phases will be at an advanced level, thus decreasing the visual and associated environmental impacts.

- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM
- PROFILE DEVELOPMENT

10 COMPLETION OF PHASE 5

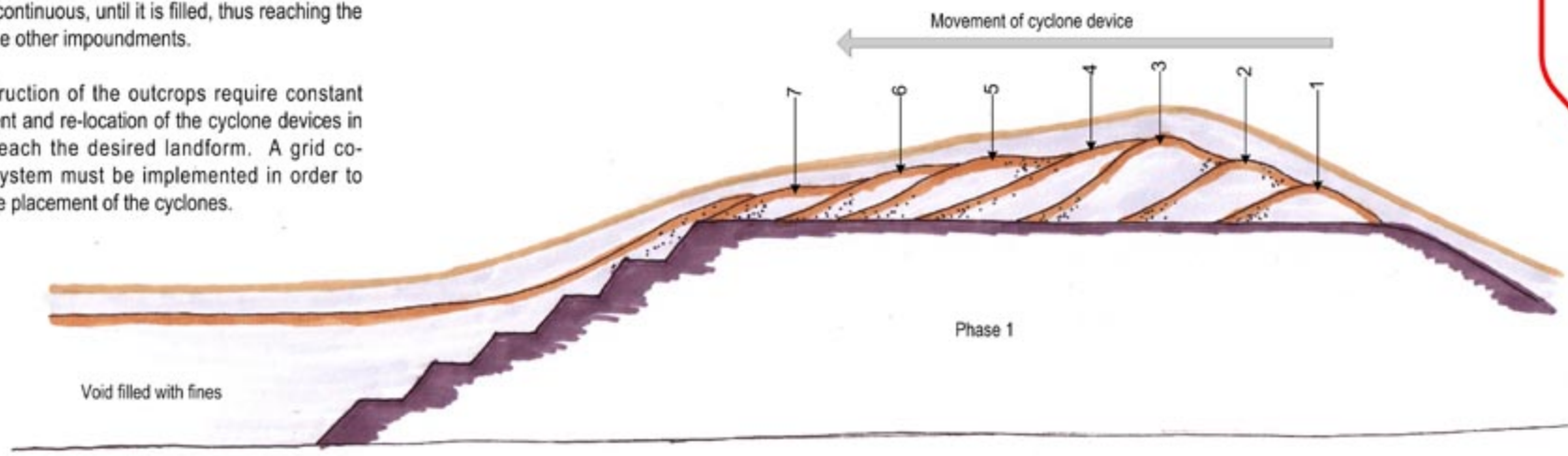


COMPLETION OF PROJECT

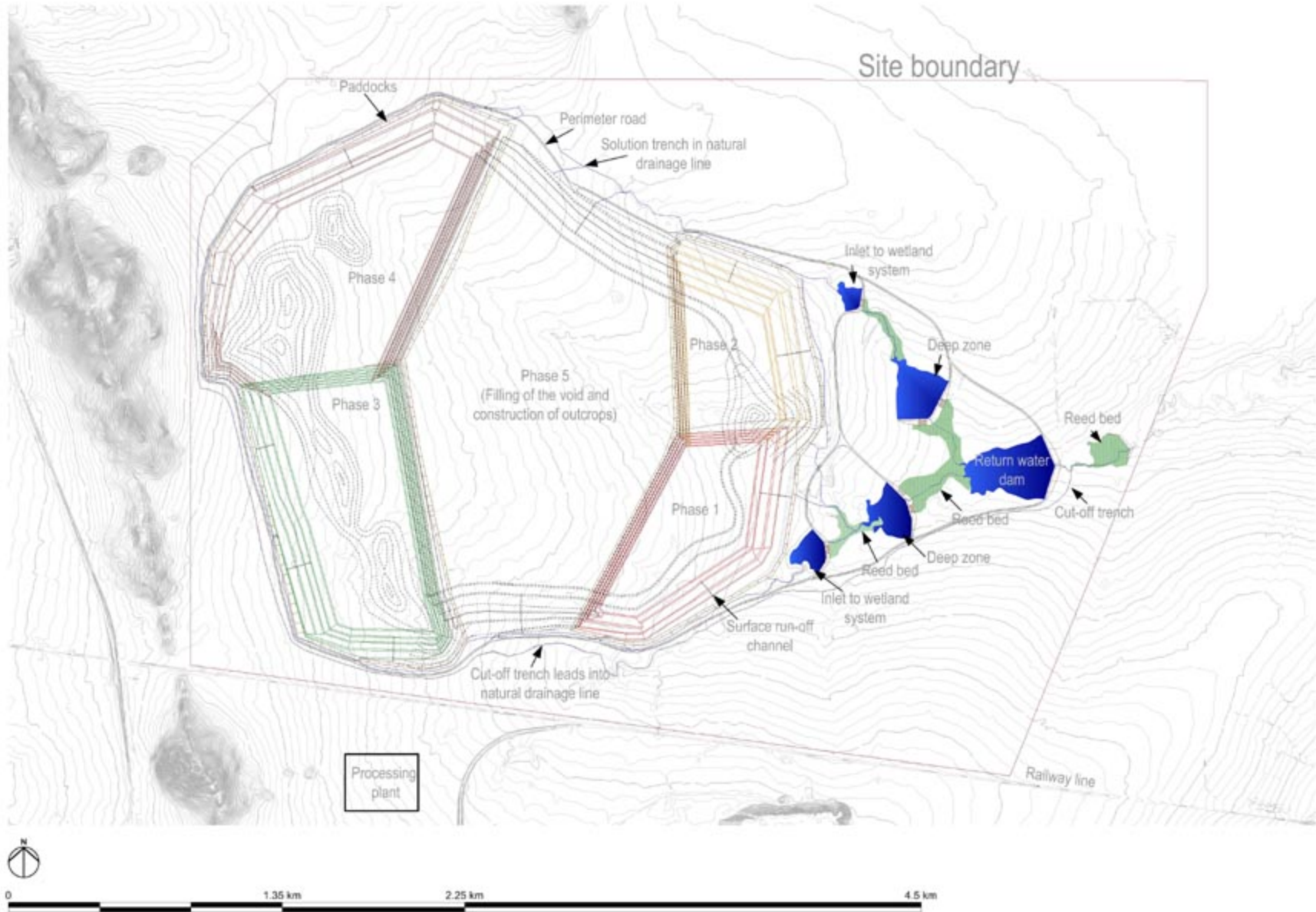
Subsequent completion of the embankments for phase 5 is completed, the cyclone devices can be re-located to the top of phase 1-4. The coarse fraction (underflow) is utilised to build outcrops on the flat surfaces in order to achieve an irregular profile. Deposition in the void with the fine fraction and water (overflow) continuous, until it is filled, thus reaching the height of the other impoundments.

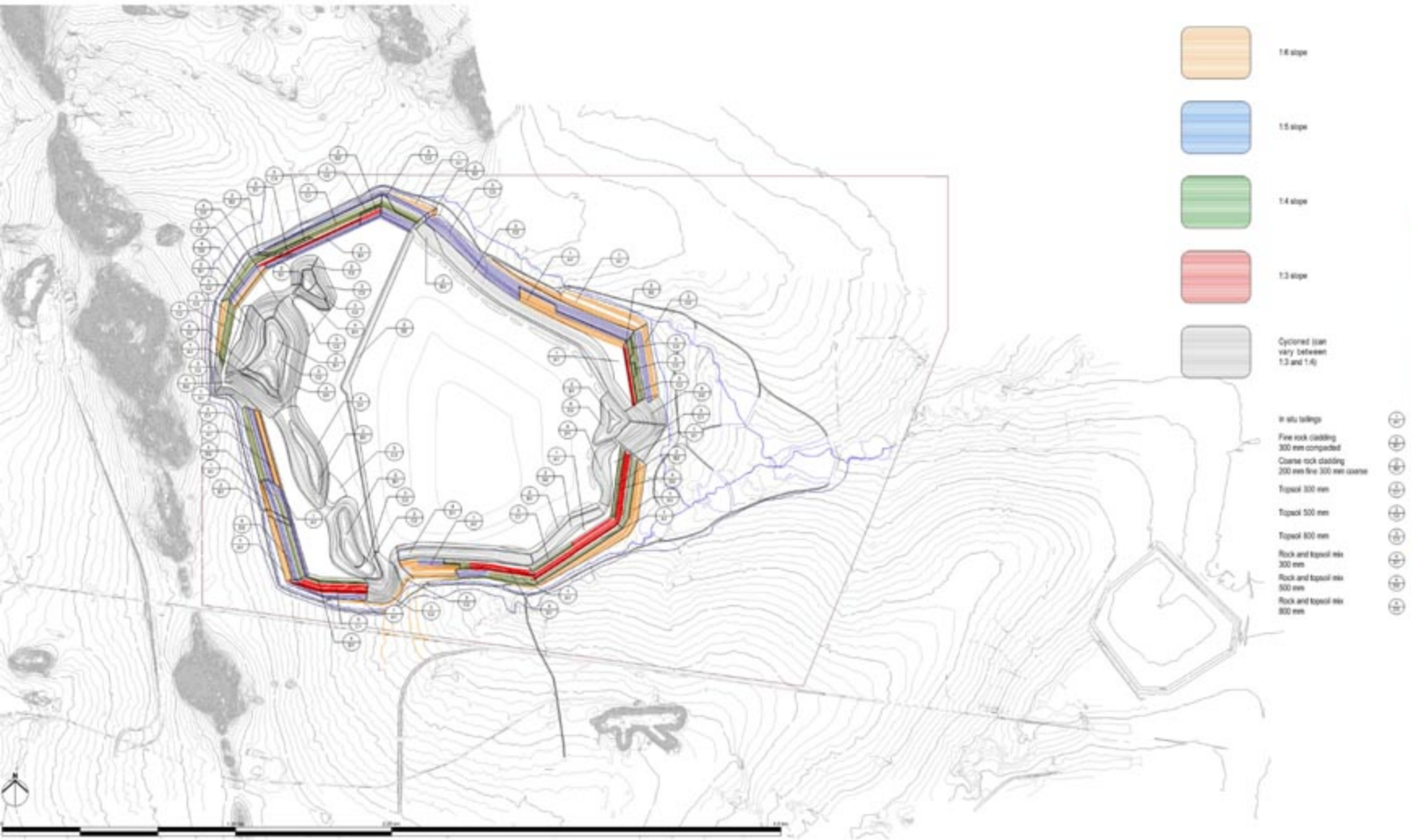
The construction of the outcrops require constant management and re-location of the cyclone devices in order to reach the desired landform. A grid coordinate system must be implemented in order to manage the placement of the cyclones.

REPEAT OF FIGURE 9-4



- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM**
- PROFILE DEVELOPMENT

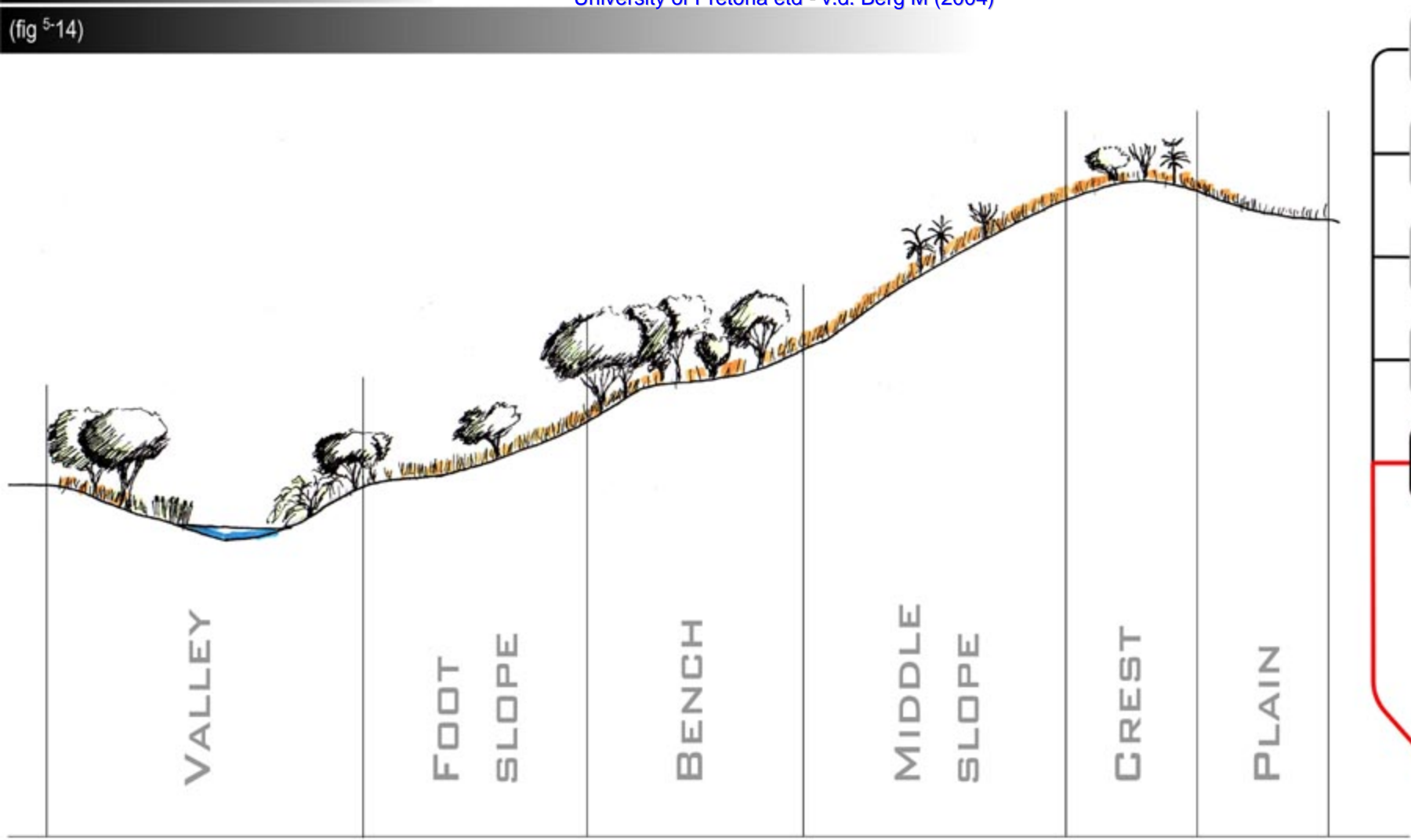




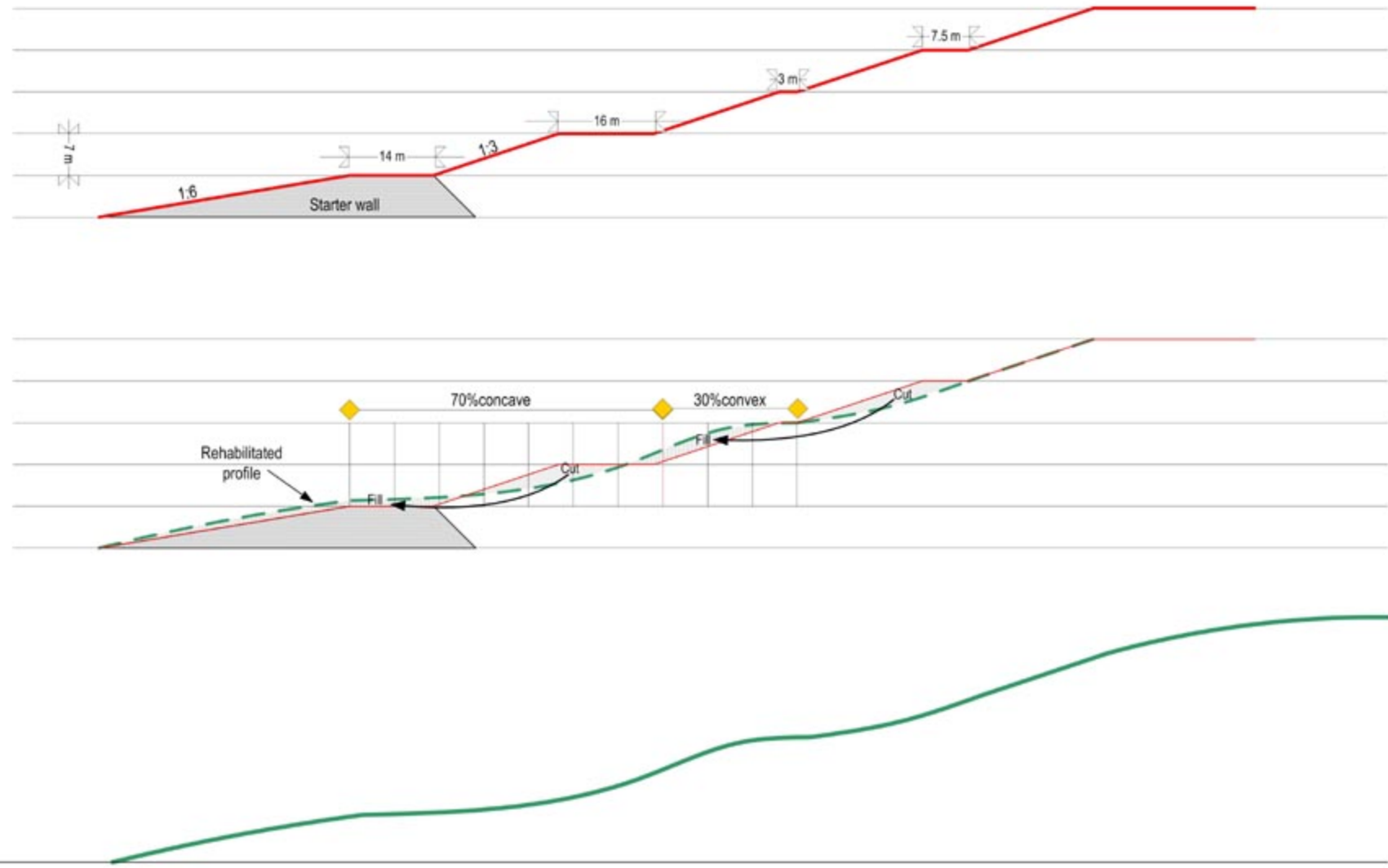
- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM**
- PROFILE DEVELOPMENT



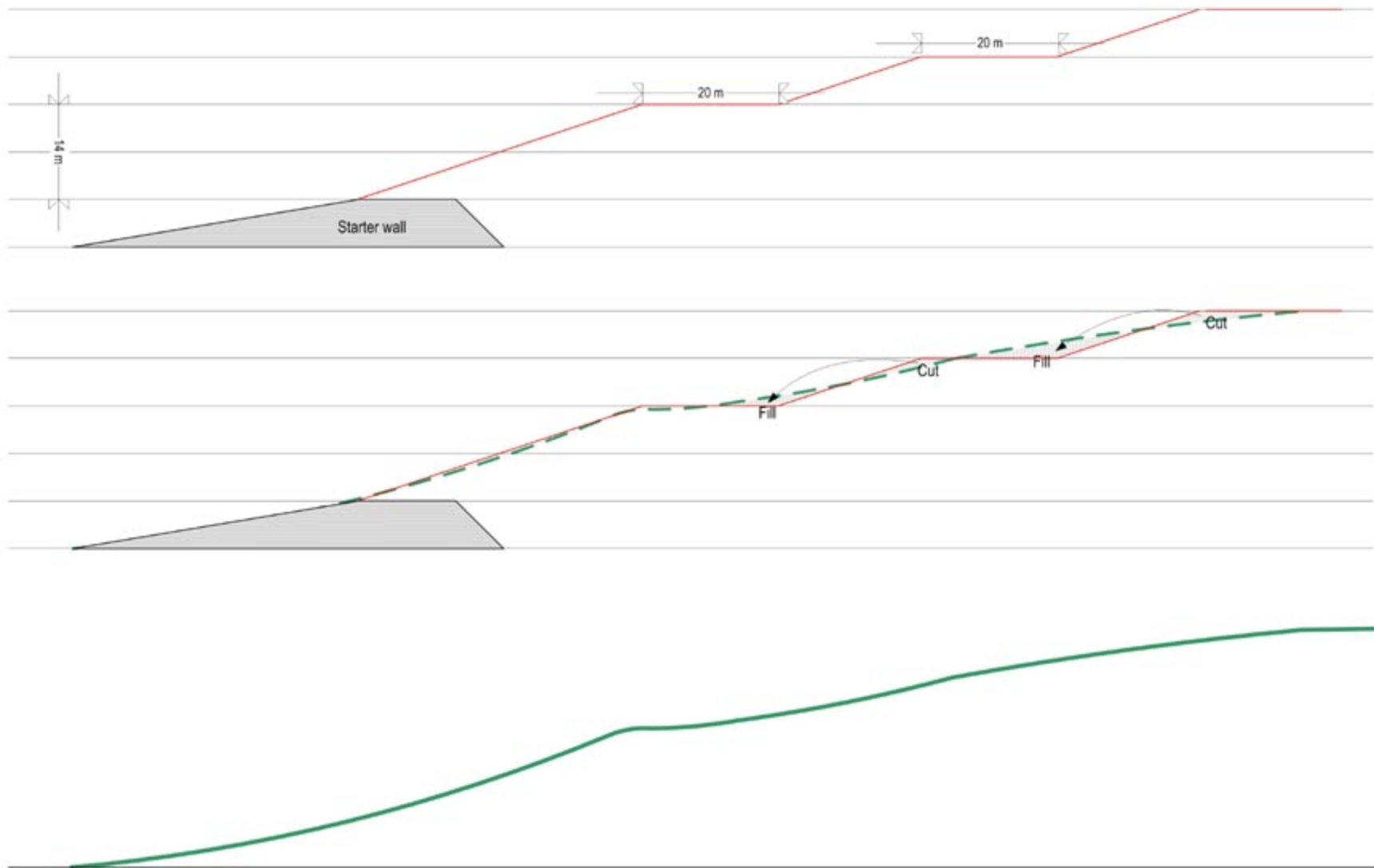
(fig 5-14)



- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM
- PROFILE DEVELOPMENT**

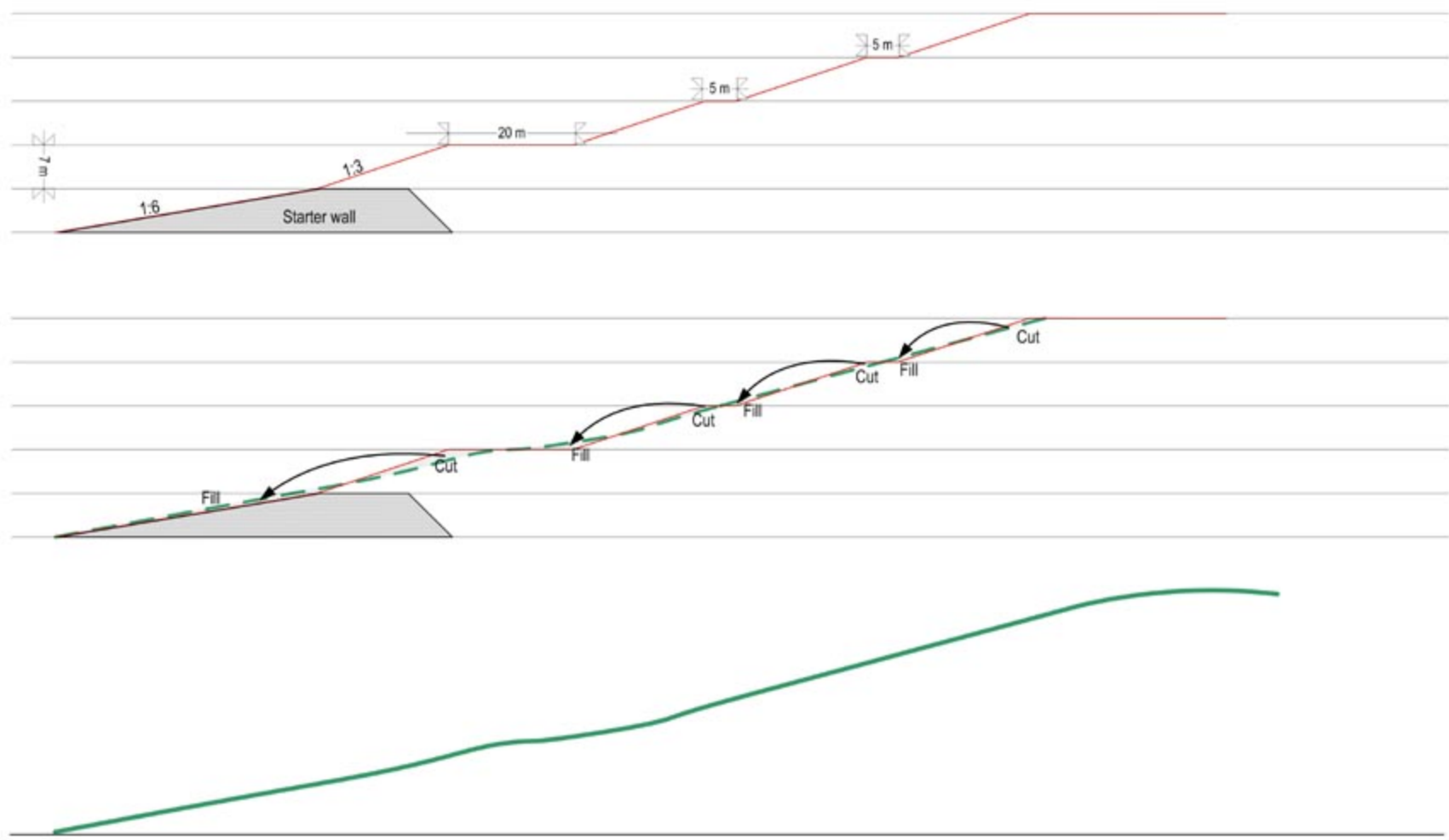


(fig 5-16)



- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM
- PROFILE DEVELOPMENT**

- CONCEPTUAL PHASING
- SITE ASSESSMENT
- CONCEPT DEVELOPMENT
- FINAL LANDFORM
- PROFILE DEVELOPMENT**



(fig 5-18)

