SECTION 4: PROPOSED ACTIVITY AND ALTERNATIVES

4.1 PROJECT BACKGROUND

[Regulation 31 (2)(b)& (f)

4.1.1 Background

[*Extracted Metroplan town planning Memorandum*]

The relevant farm portions came into the possession of the Republic of South Africa during 1980. Since 1982, a training facility for the South African Police Services has been in operation on portions of the site, known as the Verdrag SAPS Training Institute. The operations of the training institute are currently dispersed over all five (5) of the farm portions, which all vest in ownership of The Republic of South Africa.

The training facilities currently consist of five (5) separate training camps, two shooting ranges, a landing strip, an ammunition safe and two sewage works for the training camps. These facilities are all scattered over the expanse of the five farm portions, which measure 7467.1204 hectares in total. The total footprint of the existing camps equates to approximately 240 hectares, which converts to a coverage of only 3%. The impact of the training facilities on the total farm portions is therefore very limited. It should be noted that this footprint was calculated based on a boundary drawn for each camp. The entire camp area is not developed as is evident from the photographic record. The structures and site clearance is limited and large undeveloped natural open space remains within these camp boundary confines.

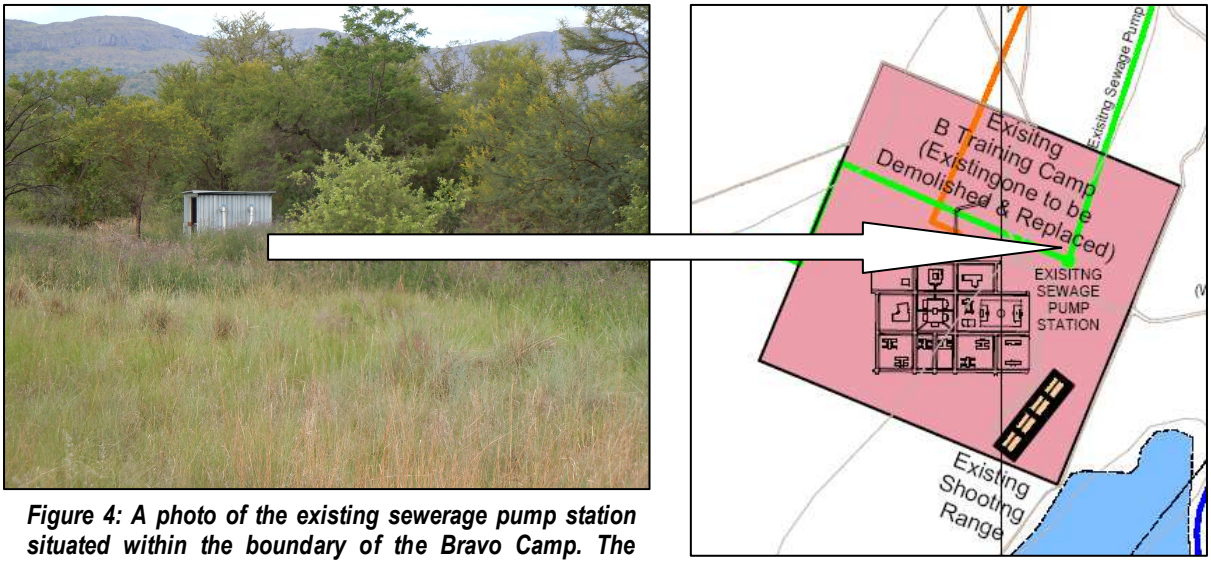


Figure 4: A photo of the existing sewerage pump station situated within the boundary of the Bravo Camp. The developed area inside the 64 hectares measures approximately 20% [±13ha], where the remainder of the camp consists of natural bushveld

The subject properties are zoned "Agricultural" in terms of the Modimolle Land Use Scheme, 2004.

Due to the valuable role that the existing training institute plays in the training of SAPS Special Forces, the Department of Public Works of the Republic of South Africa decided to upgrade and expand the existing facilities. The expansions will include the upgrading of the existing Administration, Bravo and Delta camps, as well as a new Alpha and Echo camp, additional landing strip, shooting range and ammunition safe.

The land development areas will accommodate the existing training facilities and proposed extensions with ancillary uses, which will include, but will not be limited to, buildings for administrative purposes, conference facilities, accommodation and mess facilities, recreation facilities, shooting range, ammunition safes, landing strips, sewage works and other training-related facilities.

The total area of the five farm portions constitutes 7467.1204 hectares, while the portions to be rezoned as per the specifications of the Town planning application measure approximately 362.176 hectares in total, thus leaving the residual 7104.9444 hectares to remain under an "Agricultural" zoning.

4.2 PROPOSED ACTIVITY

[Regulation 31 (2)(b)& (c)]

4.2.1 PROPOSED UPGRADES

The proposal consists of the construction of the following new infrastructure including replacement and upgrading of existing defunct infrastructure [***Refer to Appendix 4 for the proposed lay out***]

(i) UPGRADING OF THE EXISTING ADMINISTRATION CAMP:

Table 1

LAND USE PROPOSAL		
	ACTIVITY	**AREA**
1	Renovation and maintenance of existing structures	The site boundary extends to 84,959m² [This includes existing developed areas and fenced cemetery area]
2	Construction of new residential units	The site boundary extends to 62,938m² [This includes existing developed areas]
3	Upgrading storage capacity of water reservoir with additional 5000kl – This reservoir will also supply water to the new Camp A through the existing gravitation feeder line towards Camp B [250mm dia Gravity Feed Line]. The new reservoir is to be constructed adjacent to the existing reservoir in areas where vegetation has been cleared and disturbed.	900m² area for reservoir
4	The existing water feed line will be replaced with new uPVC reticulation in same location.	Replacement in same location as existing pipelines

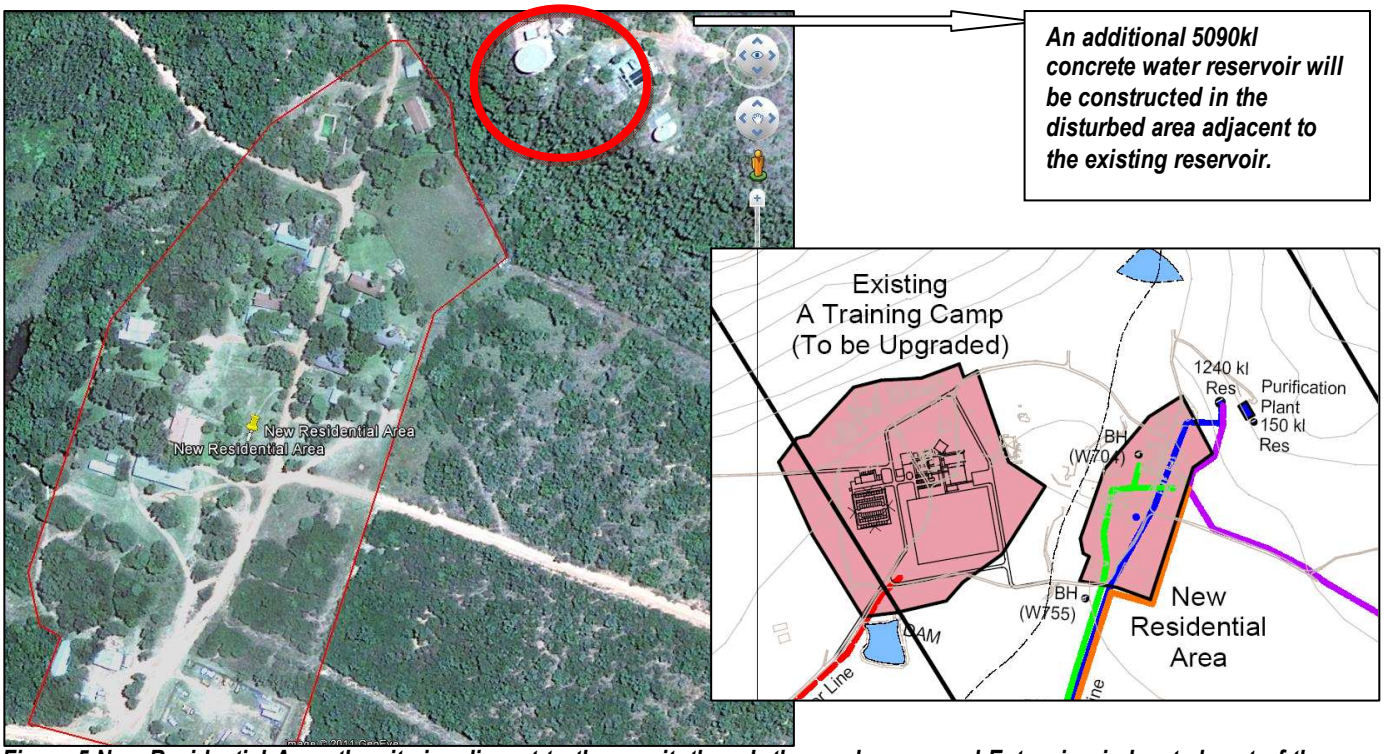


Figure 5:New Residential Area, the site is adjacent to the spruit, though the newly proposed Extension is located east of the existing houses, away from the spruit into bushveld.

The area at the existing Administration camp is already developed and the natural vegetation has partly been cleared and altered.

(ii) NEW ALPHA CAMP [A TRAINING CAMP]

This new camp is situated on an existing tented camp, south of the Thabazimbi-Alma road, on Buffelskloof, at approximately 24° 33' 48"S; 27° 45' 36"E.

Table 2

LAND USE PROPOSAL		
	ACTIVITY	**AREA**
1	Trainers accommodation, student accommodation, lecture facilities, recreation facilities and gym, admin block, tactical training area, ablution facilities	Developable area boundary measures 99,830m^2

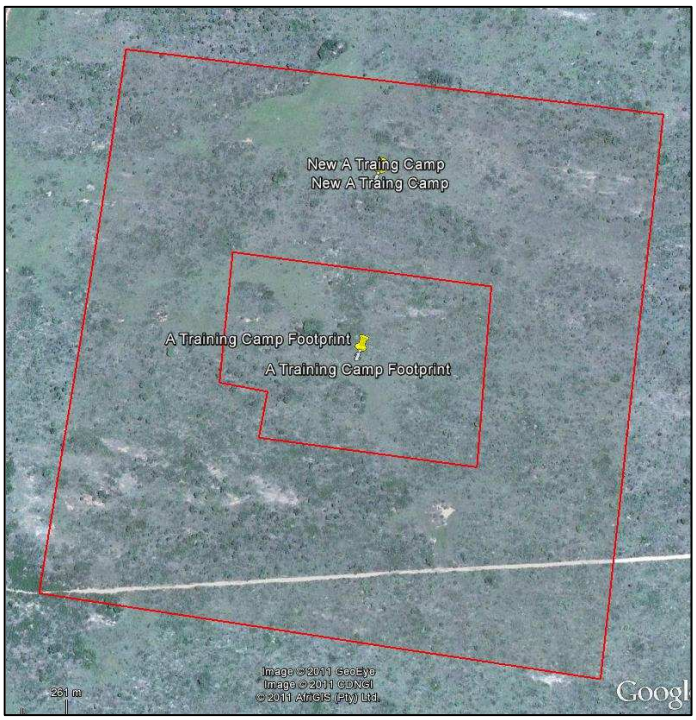


Figure 6:The vegetation has partly been cleared for the existing tented facility, though the new camp will extend into natural bush

(iii) Existing Bravo Camp [B Training Camp]

All existing structures to be demolished and replaced with similar facilities.

Table 3

LAND USE PROPOSAL		
	ACTIVITY	**AREA**
1	Trainers accommodation, student accommodation, lecture facilities, recreation facilities and gym, tactical training area, ablution facilities	104,224m^2
2	Existing sewerage pump station to be demolished as sewerage will no longer require pumping to the oxidation ponds situated west of Camp B.	N/A

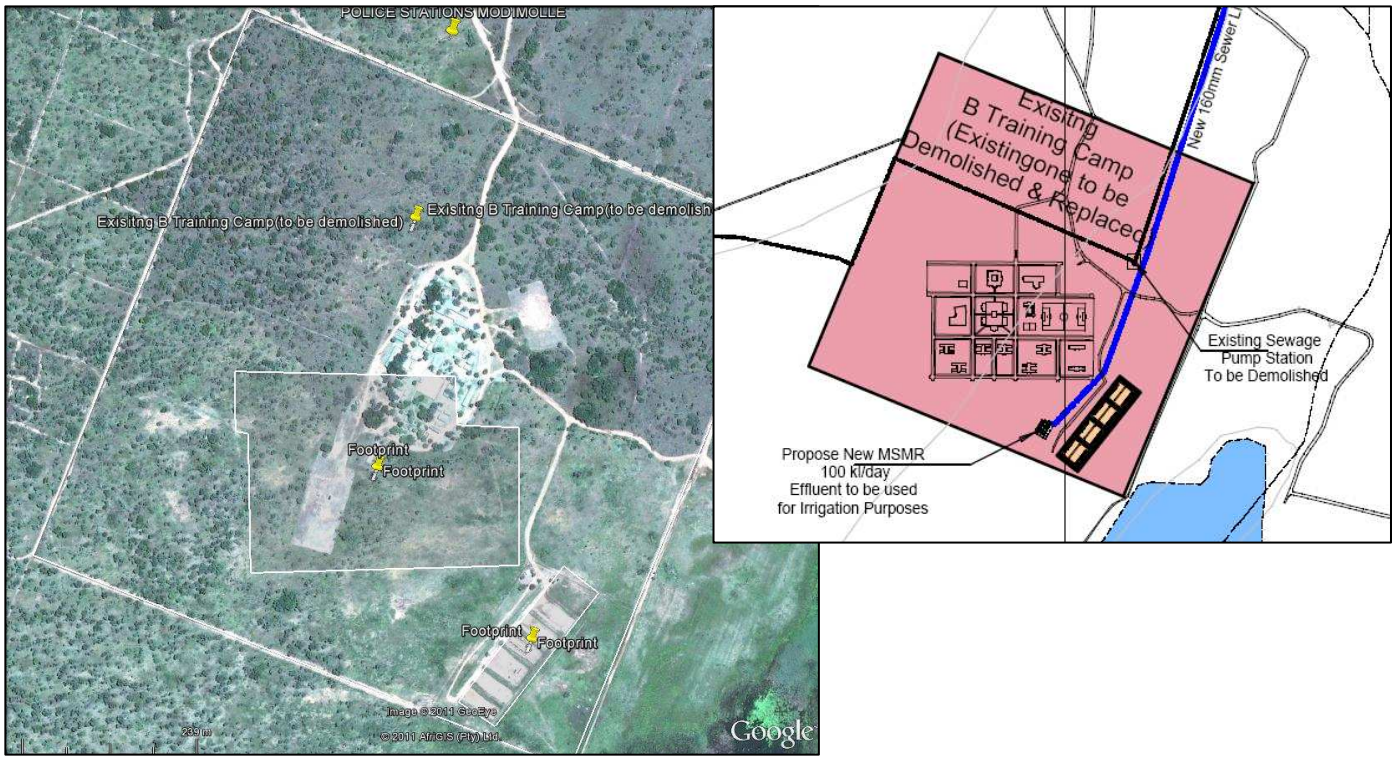


Figure 7:The vegetation has partly been cleared for the existing facility, though the new camp will extent into natural bush.

(iv) <u>New Echo Camp [E Training Camp]</u>

Table 4

LAND USE PROPOSAL		
	ACTIVITY	**AREA / DISTANCE**
1	Trainers accommodation, student accommodation, lecture facilities, recreation facilities and gym, tactical training area, ablution facilities, admin block	103,456m^2
2	Construction of a new 110mm dia sewer line to connect to main feeder line	Estimated distance approximately 250m

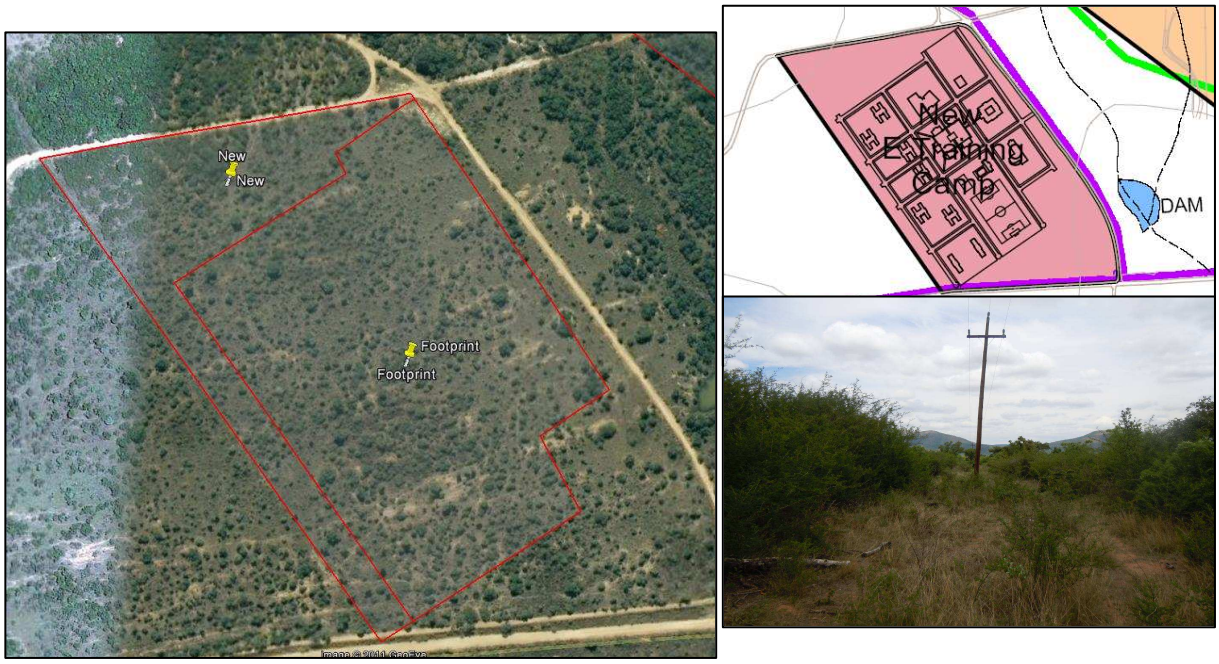
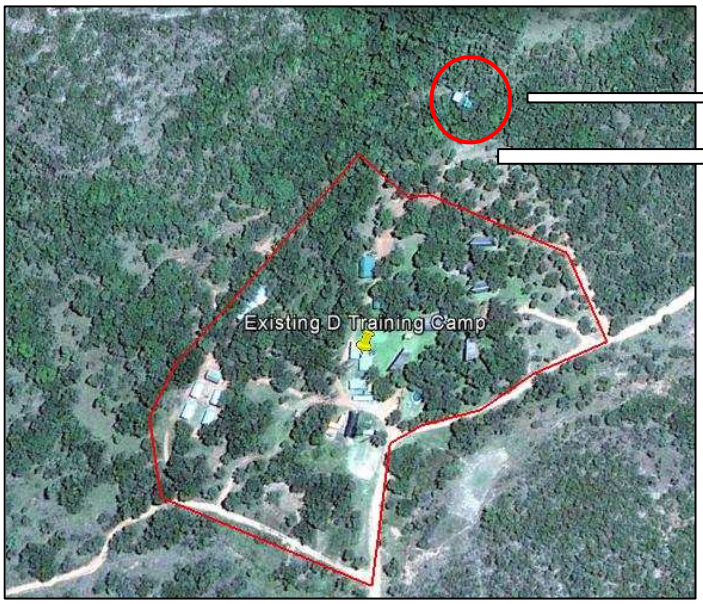


Figure 8: The dense bush is degraded and encroached by Dichrostachys cinerea

(v) **Existing Delta Camp [D Training Camp]**

Table 5

LAND USE PROPOSAL		
	ACTIVITY	**AREA / DISTANCE**
1	Additional accommodation units, lecture facilities, admin block	3500m²
2	Upgrading storage capacity of water reservoir with additional 5000kl – This reservoir will also supply water to the new Camp A through the existing gravitation feeder line towards Camp B [250mm dia Gravity Feed Line]. The new reservoir is to be constructed adjacent to the existing reservoir in areas where vegetation has been cleared and disturbed.	900m² for new reservoir



The additional reservoir will be constructed adjacent to the existing reservoir. An area of approximately 900m² is required for the construction of the reservoir. Areas where vegetation has already been disturbed should be considered for construction of the reservoir.

Figure 9: This Camp is located in a small kloof into the mountain. A small spruit drains down the kloof. The area in general would be regarded as sensitive, though the existing facilities are already in use for a long time


Photos 7 & 8: The existing D Training Camp – developed area and natural vegetation surrounding the camp

(vi) <u>New landing strip and admin building</u>

The existing landing strip is situated south of the Thabazimbi-Alma road, between the existing C Training Camp and the proposed new A Training Camp, on Buffelskloof, at approximately 24º 33' 20"S; 27º 47' 00"E. This landing strip stretches north-west to south-east. The new proposed extension will stretch north-east to south-west, at a right angle to the existing strip. The proposed administration building is close to the junction of the two landing strips.

Table 6

LAND USE PROPOSAL		
	ACTIVITY	**AREA**
1	Clearance of vegetation to provide a new landing strip	30 570m^2
2	Construction of an administration building	7109m^2

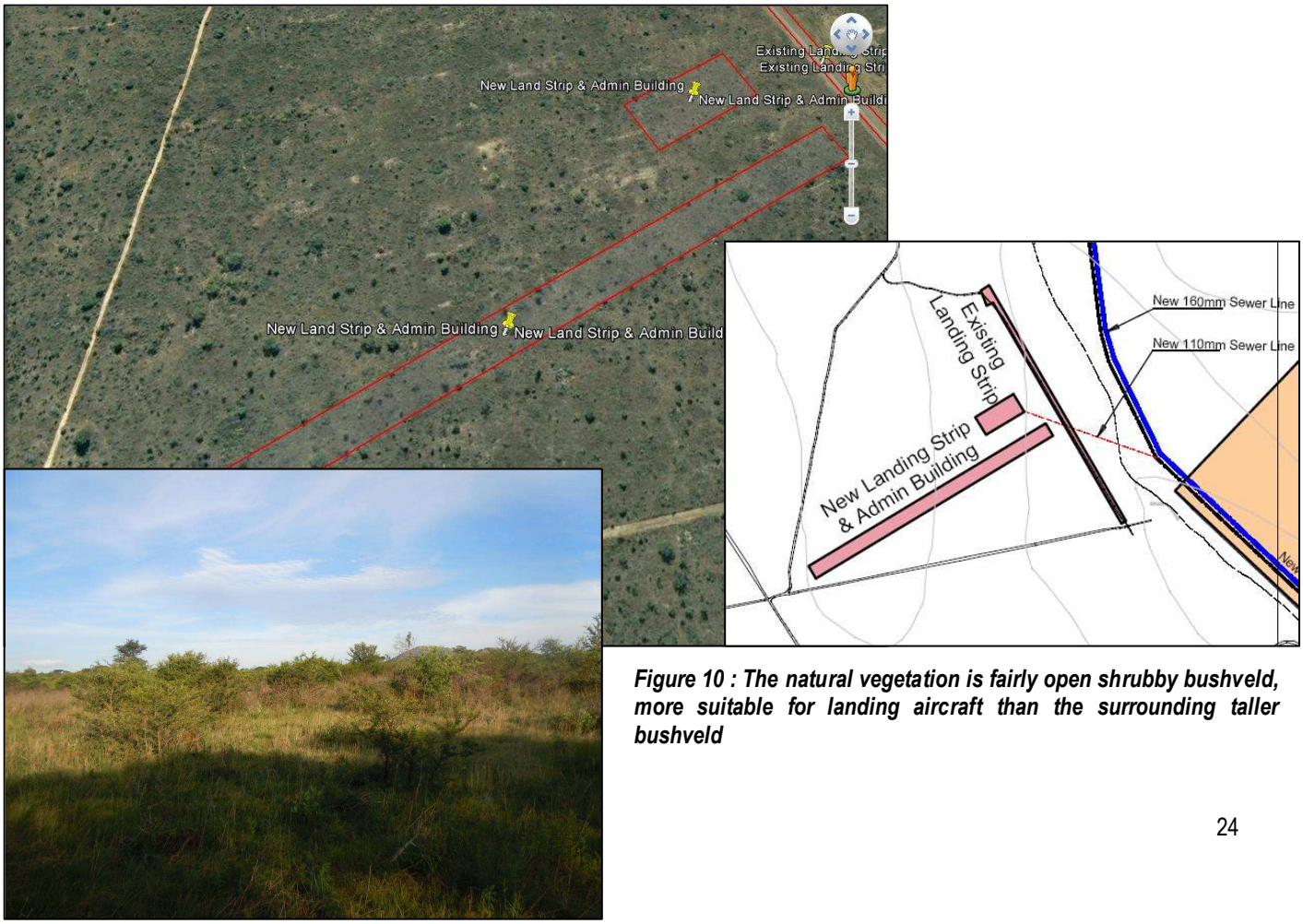


Figure 10 : The natural vegetation is fairly open shrubby bushveld, more suitable for landing aircraft than the surrounding taller bushveld

(vii) New shooting range and admin block

This area is situated at approximately 24° 34' 59"S; 27° 45' 36"E, on Buffelspoort, at the foot of the north-facing slopes of the mountain. The mountain forms a safe background for the shooting

Table 7

LAND USE PROPOSAL		
	ACTIVITY	**AREA**
1	Construction of a new shooting range which will replace existing shooting ranges	105 569m^2
2	Construction of an administration building	4000m^2
3	The existing septic tank and French drain at the existing urban training facility will be demolished	N/A

(viii) New Ammunition safe.

There is an existing ammunition safe towards the west of the main A Camp. This area is situated at approximately 24° 33' 10"S; 27° 43' 43"E, on Buffelskloof. A new additional safe is planned directly east of the existing safe. The vegetation is tall tree veld 5-7 m tall and covering about 50%. For this facility all vegetation will have to be cleared (safety measures). Ammunition safe coverage measures 33462m^2.

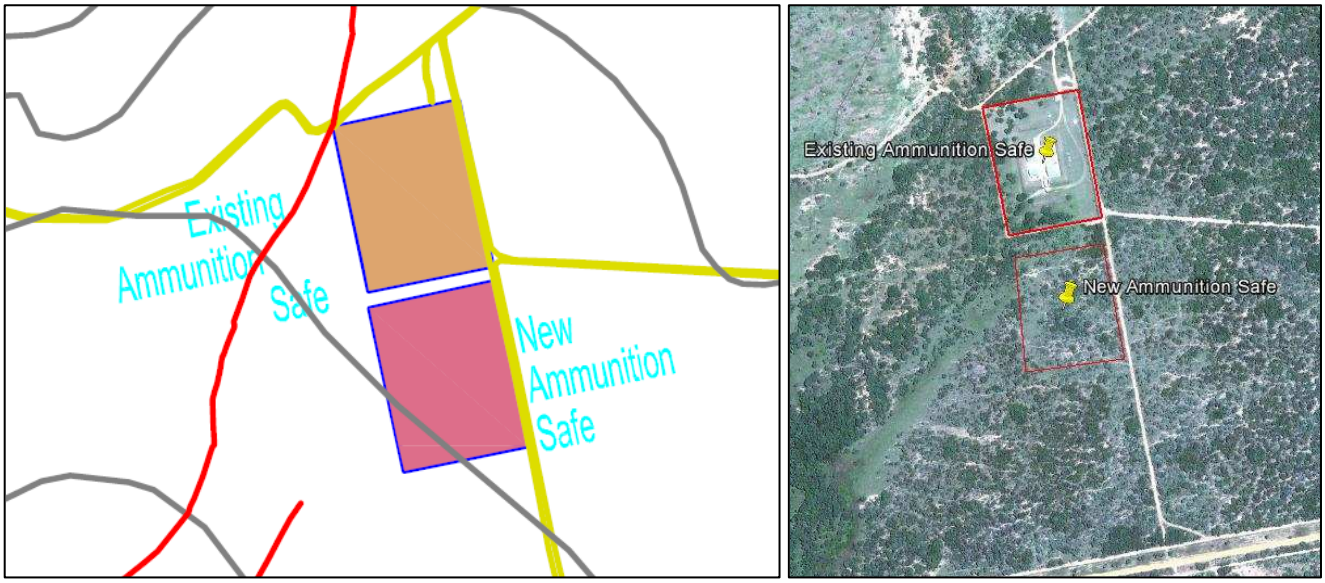


Figure 10: A view of the existing safe and new area proposed for construction of an additional safe

(ix) New Modular Submerged Media Reactor [MSMR], Sewerage Treatment Plant

Two more treatment plants will be constructed at Camp B and at the new shooting range. Details of these have been included under the specifications for the B Camp and the new shooting range.

Table 8

CAMP SITE	SEWER NETWORK
South of existing C Camp	A new 140kl/day sewerage treatment plant is proposed to be constructed adjacent to the existing oxidation ponds south of the existing C training camp. Effluent is proposed to be used for irrigation purposes. The Wastewater Treatment Works can be classified as very small (< 500 kl/day), and according to the "Process Design Manual for Small Wastewater Works", WRC report TT 389/09, no head of works (screens, degritters or flowmeter) is required. The design will however allow for a course hand raked screen with 40mm openings and drying platform enclosed in a concrete structure. The area of disturbance is estimated at maximum 1200m^2
Campsites B	Construction of Waste Water Treatment Works to deal with sewerage for the

	Administration camp, the new residential area and Camp B. The facility is proposed at a capacity of 100kl/day. Effluent to be used for irrigation purposes. The area of disturbance is estimated at maximum 1200m^2
New shooting range	Construction of Waste Water Treatment Works to deal with sewerage for the new shooting range and the existing urban training facility. The facility is proposed at a capacity of 6kl/day. Effluent to used for irrigation purposes Estimated area of disturbance ± 200m^2

(x) Replacement of existing sewer pipelines

Table 9

CAMP SITE	SEWER NETWORK
Administration Camp and Camp B	The sewer reticulation systems for both Camp sites A and B consist of a 110mm Ø vitro clay pipe network from where it is collected into a 160mm Ø clay pipe and disposed into a sewer sump of approximately 12 m^3 in volume. The sewer sump location is east of Camp site B next to the soccer field. The 160mm Ø mainline discharged directly into the sump without any screening of the effluent and without a grit chamber that cause heavy particles such as sand to enter the sump that may affect the sewer pumps negatively. ➢ The existing sewer pump line is to be discontinued and replaced with a new 160mm dia sewer line in the same location. ➢ The existing sewer pump line feeding sewerage to the oxidation ponds west of Camp B will be discontinued as the oxidation ponds will be replaced by the new Sewerage Treatment Plant to be constructed at Camp B.
Campsites C, D and E	The sewer reticulation systems for Camp sites C, D and E consist of a 110mm Ø vitro clay pipe networks from where it is collected into a 160mm Ø clay pipe and disposed into the Reed bed oxidation ponds just south of Camp site C. According to the maintenance division of the institute, the sewer pipelines need to be upgraded as most of it is very old and due to the deterioration of the joint rubber seals of the pipes, large sections thereof are blocked due to root intrusions ➢ The existing sewer pump line is to be discontinued and replaced with a new 160mm dia sewer line in the same location.

(xi) Construction of new sewer and water pipelines pipelines

Table 10

CAMP SITE	SEWER NETWORK	
New Alpha training Camp	➢ A new 160 mm dia sewer line will be installed to connect the training camp to the sewerage treatment plant. This sewage line is proposed to run from the new A Training Camp (currently the tented camp) directly eastwards, all along the Groenfontein-Buffelspoort boundary line, to the new waste water treatment works	➢ ±2246m
New landing strip and admin building	➢ A new 110mm dia sewer line will be installed	➢ ±390m
New shooting range	➢ New 110mm dia sewer line	➢ ±220m
New shooting range	➢ New 160mm dia sewer line	➢ ±620m
CAMP SITE	**WATER NETWORK**	
New Alpha training Camp	➢ Construction of a new 110mm dia water line to connect to the line serving Administration Camp and Camp B	➢ ±2000m
New Echo Camp	➢ Construction of a new 110mm dia water line to connect to the line serving Camps C, D and existing E	➢ ±250m

(xii) Decommissioning of existing shooting ranges

Once the new shooting range has been constructed as proposed on the lay out, the existing shooting ranges situated at Bravo Camp, east of Delta Camp and just west of the oxidation ponds serving Camps, C, D and E will be decommissioned. The vegetation cleared for the purpose of the shooting ranges must be re-established in these areas.

(xiii) Decommissioning of existing sewerage works serving Camps A& B and Camps C,D,E

It is proposed to construct modular type submerged media reactor wastewater treatment works with final effluent to comply with DWA General Limits that can be used for irrigation purposes. The modular plant will enable a phased implementation approach to coincide with the development progress. Once the new Waste Water Treatment Works have been established at Bravo Camp and south of Charlie Camp the existing oxidation ponds will be decommissioned.

(xiv) Upgrading of roads

Table 11

MAIN ACCESS ROADS	
It is proposed to utilize the existing two main access roads from the provincial road P240/1 towards each campsite of the training institution, located as follows; - Access 1: 24º33'33.8 S & 27º43'49.2 E [Approved access 2 as per the Limpopo Roads Agency Plan refer ***Figure 11*** - Access 2: 24º33'01.5 S & 27º46'46.7 E [Approved access 5 as per the Limpopo Roads Agency Plan refer ***Figure 11 And Appendix 7 for comments from the Roads Agency]*** These access roads were originally proposed to be paved but it has since been confirmed that these roads will only be re-gravelled are proposed to be paved.	
Upgrade access road to Administration camp	Re-gravel
Upgrade access road to Bravo Camp	Re-gravel
Upgrade access road to Echo Camp	Re-gravel
OTHER INTERNAL ROADS	
Other access roads between the camp sites, shooting ranges, indoor training facility, magazine and Urban centre consist of only graded roads with a total length of approximately 9km. All existing graded roads will be re-graded. Refer ***Figure 12*** for the location of existing internal roads which will be re-graded.	

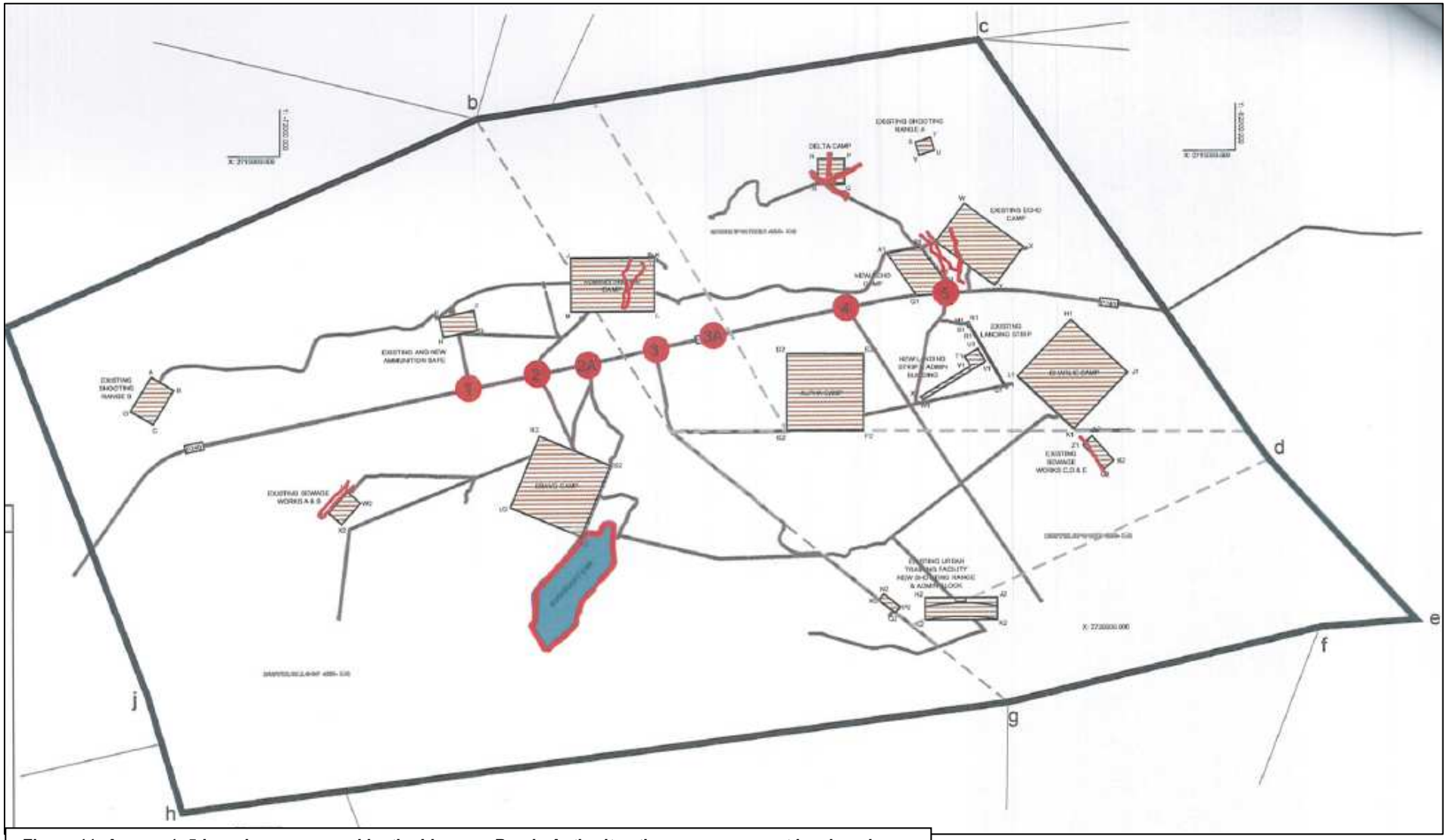


Figure 11: Access 1- 5 have been approved by the Limpopo Roads Authority other accesses must be closed

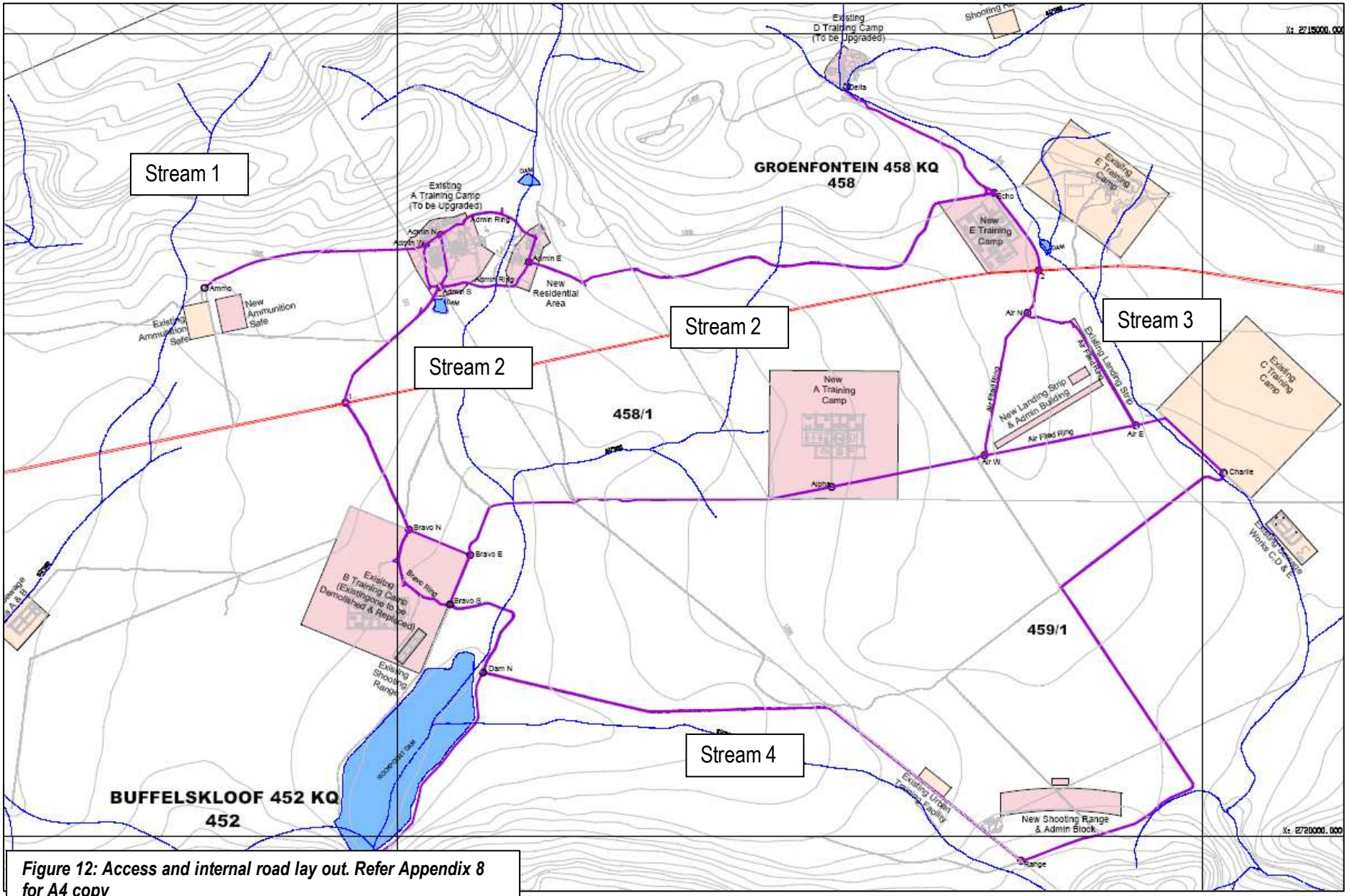


Figure 12: Access and internal road lay out. Refer Appendix 8 for A4 copy

(xv) Upgrade and maintenance of existing stormwater infrastructure

Presently, all storm-water mainly consist of surface drainage. Stormwater management at all road crossings require upgrading as the existing infrastructure is not adequate to deal with stormwater flows effectively and some of the road crossings have been compromised as a result.

The non-perennial streams within the area that influence some of the developments could be listed as follows [Refer Appendix 9 for location of streams]:

Stream 1:
Situated on the western side and flowing from north to south – passing the existing Ammunition Safe, crossing the P240/1 provincial road and passing the existing Sewage oxidation ponds for Campsites A & B;

Stream 2:
Situated in the middle of the area and flowing from north to south – passing the existing Administration Camp Site, crossing the P240/1 provincial road towards Campsite B. This stream is also the main supply towards the Rookpoort Dam;

Stream 3:
Situated on the eastern side and flowing from north to south – passing the existing Campsites D (Waterval); E and C; crossing the P240/1 provincial road towards the Sewage Oxidations Ponds serving these campsites. A small weir within the area of Campsite E that did collapsed during heavy rains causes no further access towards Camp E and alternative access were made from the provincial road.

Stream 4:
Situated in the southern area of the site and flowing from east to west towards the Rookpoort Dam.

During the investigation conducted by the project Civil engineers the following drainage structures were identified:

- Major Culverts categorized because of road strategic importance, flood magnitude and size of stream crossing, with a design flood peak return period of 10 years.
- Minor Culverts located at stream crossings, with a design flood peak return period of 5 years.
- Lesser Culverts located along road for erosion prevention measures.

Stormwater run-off was calculated and stormwater infrastructure will be upgraded as follows:

Table 12

STORMWATER MANAGEMENT	
LOCATION	**ACTIVITY**
Access road to Administration camp	The road serves as a main access road; it is recommended that stormwater management measures be implemented along the alignment of the road to limit erosion risks. A stormwater management plan must be prepared by an engineer which is to accommodate and manage stormwater. Proposals which can be considered include the implementation of grassed swales should soil conditions be suitable for such. Run-off should be allowed to exit the road at regular intervals and disperse as sheet flow. At the points where run off is directed off the road buffers of vegetation must be provided in order to break speed of run off and to restrict scouring and associated erosion. The SMP must be approved by the DEA and DWA prior to construction commencing.
Upgrade access road to Bravo Camp	The road serves as a main access road; it is recommended that stormwater management measures be implemented along the alignment of the road to limit erosion risks. A stormwater management plan must be prepared by an engineer which is to accommodate and manage stormwater. Proposals which can be considered include the implementation of grassed swales should soil conditions be suitable for such. Run-off should be allowed to exit the road at regular intervals and disperse as sheet flow. At the points where run off is directed off the road buffers of vegetation must be provided in order to break speed of run off and to restrict scouring and associated erosion. The SMP must be approved by the DEA and DWA prior to construction commencing.
Upgrade access road to Echo Camp	The road serves as a main access road; it is recommended that stormwater management measures be implemented along the alignment of the road to limit erosion risks. A stormwater management plan must be prepared by an engineer which is to accommodate and manage stormwater. Proposals which can be considered include the

	implementation of grassed swales should soil conditions be suitable for such. Run-off should be allowed to exit the road at regular intervals and disperse as sheet flow. At the points where run off is directed off the road buffers of vegetation must be provided in order to break speed of run off and to restrict scouring and associated erosion. The SMP must be approved by the DEA and DWA prior to construction commencing.
Other roads	All other internal roads are proposed to be re-graded. It is recommended that a SMP be prepared by the project engineer to indicate how run off from these roads will be managed to prevent erosion and sedimentation of waterways.
CULVERT UPGRADES [Refer to Appendix 10 Civil Services Report for visual reference of locality]	
LOCATION	**ACTIVITY**
Admin S-Admin E	Culvert category - Major
Admin E – Admin N	Culvert category - Major
Admin E -Echo	Culvert category - Minor
Echo - Delta	Culvert category - Major
Echo - Delta	Culvert category - Minor
Air E - Charlie	Culvert category - Minor
Alpha – Bravo E	Culvert category - Minor
Alpha – Bravo E	Culvert category - Minor
Bravo S – Bravo N	Culvert category - Minor
Bravo S – Dam N	Culvert category - Minor

4.2.2 PROVISION OF SERVICE INFRASTRUCTURE

Dux Consulting Engineers together with ADI Consulting Engineers were appointed to attend to the necessary investigations as to the availability of engineering services and for compilation of Preliminary Design Report.

The project entails the development and upgrading of the existing facilities inclusive of all civil related services for the following:

(i) Structural component for Camps A,B,C,D and E;
(ii) Water, fire water and sewer supply and treatment and delivery for each Camp Site;
(iii) Street and stormwater infrastructure, and access between the camps;
(iv) Upgrading of the airstrip;
(v) Upgrading of the magazine storage facility;
(vi) New shooting range.

Extracts from the report by Dux Consulting is included below Refer to ***Appendix 10*** for a copy of the Report.

4.2.2.1 EXISTING INTERNAL SERVICES

Included below is the *status quo* of the existing infrastructure on site.

4.2.2.2 EXISTING BULK WATER SUPPLY

(i) RAW WATER AND CLEAR-WATER AVAILABILITY

The Rookberg dam with a full storage capacity of 3,5 million m^3 is located on the site and is the main source for water supply to the area. Raw water is pumped at a yield of 18 l/s (64,8 m3/hr) from the Rookberg dam site via an alternate ouble pump system through a 150 Ø Klambon steel pipe that serve automatically as a standby pump system towards a 150 m3 raw water reservoir located just north of Camp A. Pressure Control Valves located at the Raw Water reservoir controls the pumps at the dam site and switch off automatically once the reservoir is full. Raw water is then purified through a 1,3Ml/day Slow Sand Filter purification plant that feeds the main 1240kl clear-water reservoir adjacent to the purification plant.

The Clear water reservoir at Camp A feeds the reticulation networks towards the existing Camps A & B and water is pumped towards the existing reservoirs at Camps D & E.
Other supplies consist of four boreholes (W703,W704,W755 & W754 – Refer to Appendix 5. For a copy a location of the boreholes), within the vicinity of Camp sites A & B with a combined yield estimated at 56,5kl/day. Another two boreholes exist (W751 & BH1), equipped with centrifugal pumps, pumping water toward the Clearwater reservoirs located at Camp D (55kl) and E (260kl) with a combined yield of 58,5 kl/day.

Other supplies consist of three boreholes equipped with centrifugal pumps, pumping water towards the Clearwater Reservoirs located at Camps D and E.

(ii) WATER PURIFICATION

The water purification plant consists of a 1300kl/day per slow sand filter system complete with chemical dosing, backwash and aeration pumps to enable the maintenance team to supply clean water towards the end users and to clean the sand filter system on a regular basis. Clearwater is stored via the purification plant in an additional 35m^3 reservoir located below the raw water reservoir for backwash purposes.

The chemical dosing plant consists of the following:
Lime dosing – Normally added to remove high phosphor content or for sedimentation purposes;
Alum dosing – Sedimentation purposes;
Chlorination – Disinfections

Both the raw water pump-station and the purification plant is in working order and maintained by trained personnel from the Training Institution. Presently the purification plant operates for less than 9/24 hrs per day (38%) from where clean water gravitates to a 1240m^3 reservoir that directly serves Camp sites A & B and via the clear water pump station can serve Campsites C,D and E. Campsites C,D and E's main water sources at this present moment consists of two boreholes with a combined yield of 58,5kl/day and purified water from the 1240m^3 reservoir is only used as an alternative supply during borehole maintenance and electricity breakdowns.

The existing bulk water supply capacity measures 910kl/day.

4.2.2.3 REQUIRED UPGRADING OF BULK WATER INFRASTRUCTURE

The upgrading of the bulk water infrastructure supply system will include:

- Construction of new reinforced concrete storage reservoirs at Admin Camp and Delta Camps;
- Construction of required bulk rising and gravity uPVC mains;
- Construction of uPVC water distribution reticulation networks.
- It will be necessary to provide additional storage capacity in order to provide sufficient fire water supply. The following is recommended. The existing 1240kl reservoir that supplies the existing Camp A and Camp B sites through a gravitational feeder line, must be upgraded with an additional 5090kl reservoir. This reservoir will also supply water to the new A Camp through the existing gravitation feeder line towards Camp B. It is also recommended that the storage facility at Camp D be upgraded with an additional 5095 kl reservoir that will ensure enough capacity for Camps C,D and E inclusive of fire water. Location of reservoirs to be confirmed, possible locations to be identified based on sensitivity and location of existing reservoirs.

4.2.2.4 EXISTING WATER RETICULATION NETWORK

(i) CAMPSITES A AND B

The 1240 m^3 reservoir located next to the purification plant supply water directly via a 250mm Ø pipeline to the reticulation networks at Campsites A (Admin Camp)& B. An automatic pressure control valve located at the reservoir switches off the purification plant once it reached its full capacity. Four boreholes within the area of Campsites A & B with a combined yield of 1,96 litres per second tested for eight hours pumping per day is available as a possible alternative or standby system if required.

Presently the reservoir serves as the storage facility for both domestic and fire water usage.

(ii) CAMPSITES C, D AND E

Two boreholes with a combined yield of approximately 2,03 litres per second tested for a eight hour pumping period per day (58kl/day) currently serve both the 75m^3 and the 260m^3 reservoirs at Campsites D and E. Both boreholes are connected to a 75mmØ rising main from the clear water pump station at the purification plant that pumps water to the reservoirs located at Campsites D and E. The storage facility at Campsite D consists of a 55m^3 reservoir and 4 elevated JoJo Tanks. The storage facility at Campsite E consists of a 260m^3 concrete reservoir. The reservoir at Campsite E also supplies water via a 150mmØ gravity pipeline to Campsite C. From Campsite C the pipe reduces to a 65mmØ pipeline which gravitates to the Indoor Training Facility located approximately 2km east of the Rookpoort Dam. Water pressure at this facility is very low and requires upgrading.
Presently the two reservoirs mentioned above serve as the storage facilities for both domestic and fire water usage at Campsites C,D and E.

4.2.2.5 REQUIRED UPGRADING OF WATER RETICULATION NETWORK

New uPVC reticulation networks will be constructed for all Camps, refer to ***Appendix 6.***Pipeline routes must following existing infrastructure routes. New pipelines to follow road infrastructure.

4.2.2.6 EXISTING BULK SEWERAGE INFRASTRUCTURE

(i) Oxidation Ponds

The training facility currently treats its sewerage through the use of two Aerobic-Anaerobic Stabilization Pond systems.
The treatment ponds situated near the western boundary of the property services the existing Admin Camp, Alpha Camp and Bravo Camp as per the following specifications:
Admin Camp : 108.43
Alpha Camp: 78.37 ⇨ 265.17kl/day ADWF ⇨ 96 725 kl/year ADWF
Bravo Camp 78.37
The treatment ponds situated near the eastern boundary of the site services the Charlie Camp, Delta Camp and Echo Camp as follows
Charlie Camp: 78.37
Delta Camp: 30.55 ⇨ 187.29 kl/day ADWF ⇨ 68 361 kl/year ADWF
Echo Camp: 78.37
As the sewage enters the pond most of the solids settle to the bottom to form a sludge layer. At temperatures greater than 15°C intense anaerobic digestion of the sludge solids occurs: as a result, the thickness of the sludge layer depth is rarely more than about 250mm and often much less. Desludging is only required, possibly once every 10 to 15 years.

Both the Aerobic-Anaerobic Stabilization Ponds were not working at full capacity at the time of the investigation causing the dry sludge to accumulate within the primary ponds of the treatment plants. A reed bed pond system acts as the secondary pond of the treatment plant and it is evident that it was not in use for quite some time and most of the reeds were destroyed due to a lack of water and animals feeding from it.

The embankments of the pond system need some maintenance as trees started to grow on it and it can cause the embankment to collapse once filled with water.

Both treatment plants were fenced-off but animals such as cattle and other wild animals are allowed to enter the sites through the open gates.

Figure 13: Existing sewerage works flow chart

4.2.2.7 REQUIRED UPGRADING OF BULK SEWERAGE INFRASTRUCTURE

The following two alternatives have been identified which is being considered as part of this EIA Process:

(i) MAINTENANCE TO EXISTING OXIDATION PONDS

It was noted during the site investigation conducted by the project engineers that the current facility is not functioning effectively. The embankments require rehabilitation, the area must be fenced and access should be controlled to prevent animals from entering the facility. Proper wetland vegetation must be established to assist with the removal of pollutants from the effluent. It is assumed that the facility is not receiving enough water [in the form of effluent] due to several leakages and blockages in the sewer pipe network serving the oxidation ponds. Furthermore the facility is too big [ground coverage, ±5ha for Camp A&B and ±4.5 ha for Camp C,D & E] to allow it to function optimally. The facility serving Camps A & B will be decommissioned and the facility serving Camp C, D and E will only remain in use until such time that the new facility becomes operational. Therefore the required maintenance must be implemented at this facility for the time it remains in operation.

(ii) REPLACEMENT OF EXISTING FACILITY

The project engineers have identified an alternative system which will replace the oxidation ponds. During the engineering investigation it was confirmed that water for irrigation of earthworks banks, communal parks and road reserves was required. This alternative would utilise the purified effluent for such irrigation purposes. This alternative proposes the construction of a modular type submerged media reactor wastewater treatment works with final effluent to comply with DWA General Limits that can be used for irrigation purposes.

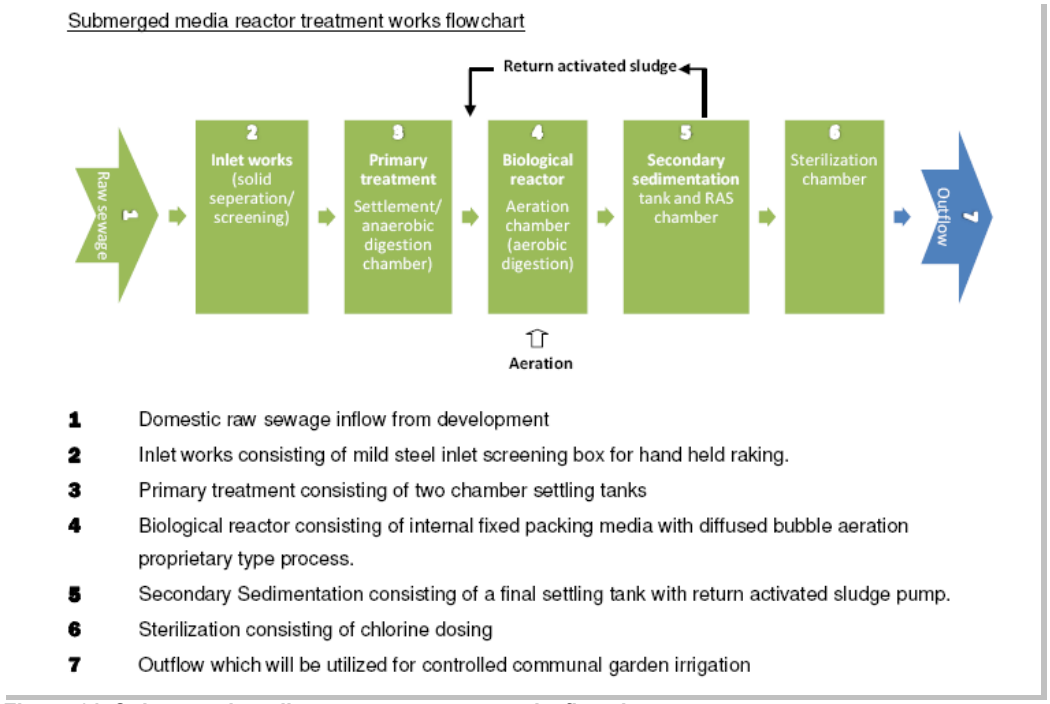


Figure 14: Submerged media reactor treatment works flowchart

DESIGN FLOW

The proposed Wastewater Treatment Works will be designed based on the Average Daily Dry Weather Flow [ADWF] and could be subdivided as follows:

Admin camp + Camp B : 100.8kl/day ADWF
Camp A, C,D & E: 104.5kl/day ADWF
Shooting range: 6kl/day ADWF

Each plant will further be subdivided to consist of similar modular units as follows:

Admin Camp + Camp B: 25 x 4 = 100kl/day plant
Camp A,C,D & E: 35 x 4 = 140kl/day plant
Shooting range: 3 x 2 = 6kl/day plant

The modular plant will:

- Enable a phased implementation approach to coincide with the development progress;

- Assist with maintenance whereby any module could be closed off;
- Assist with emergency pump breakdowns in any module whereby effluent can be redirected.

Provide water for irrigation purposes.

The proposed treatment plant operates as follows:

First Phase: Screening takes place at the point of entrance in the Waste Water Treatment Plant [WWTP]. This can be done manually on a daily basis.
Second Phase: There are two anaerobic tanks. The first tank allows for digestion of sewerage and the separation of solids, i.e. those that settle and those that float. The middle cut of the effluent then flows through to the second tank. The second tank breaks down the fine sewerage particles and alters to carbon dioxide and water. This effluent then passes into the aerobic chamber for polishing. The de-nitrification cycle takes place in this phase. This function is responsible for the breaking down of nitrates to nitrogen gas.
Third Phase: In this phase the digestion takes place in an aerated environment. This phase is called aerobic digestion. Smaller solids are bio-degraded further Aerobic bacteria operates in this environment. The bacteria perform at their optimum in an oxygen enriched environment. Nitrification takes place in this phase.
Fourth Phase: Secondary settling takes place. The cell material and settle able solids settle in this phase and form the so-called 'sludge blanket'. When the blanket matures it is re-circulated to the primary settling tank in phase one to 'seed' or inoculate the raw sewerage entering into the plant and to alter the nitrates to nitrogen gas. This cycle is called the re-activated sludge and de-nitrifying cycle. This technology improves the efficiency of the process of the plant.
Fifth Phase: In this phase the final effluent is prepared for final discharge. The effluent is disinfected or sterilised to prevent any dangerous or harmful bacteria from entering the environment. Disinfection takes place by way of a chlorine contact tank with level control. The final effluent is discharged through a chlorine contact channel which is exposed to ozone to further enhance disinfection. The final effluent is stored in an irrigation chamber from where it is proposed to be utilised for irrigation purposes.

POWER FAILURE

The plant is designed to be isolated in 4 separate working extensions. In case of complete power failure:

- All flow must be diverted to the 1st sub-system which must be manually supplied by power through operating a stand-by generator;
- Flow is diverted to 1st sub-system by closing pen-stock gates to chamber 2,3,4 and closing butterfly valves linking sub-system.

PUMP FAILURE

In the event that pump failure occurs at any one of the sub-systems the following is proposed as part of the design:

- Isolate the sub-system where pump failure occurred by closing the pen-stock gate in the dividing chambers and closing the butterfly valves linking the sub-system;
- Repair broken pump as soon as possible.

OPERATOR

An operator will be appointed for the treatment plant. The main duties of the operator will be to:

- Manually rake and clean the inlet grid;
- Ensure that the pumps are working and are in order and that there are no leakages at the system;
- Monitor chlorine levels.

MAINTENANCE

The system has a low maintenance schedule. The float switches and pumps will be checked on a regular basis and will be removed for maintenance on a one-three year cycle/

SAFETY

The plant will be fenced and locked to prevent unauthorised entry.

4.2.2.8 EXISTING SEWER RETICULATION NETWORK

(i) SEWER PIPELINE NETWORK

CAMPSITES A AND B

The sewer reticulation systems for both Camp sites A and B consist of a 110mm Ø vitro clay pipe network from where it is collected into a 160mm Ø clay pipe and disposed into a sewer sump of approximately 12 m3 in volume. The sewer sump location is east of Camp site B next to the soccer field. The 160mm Ø mainline discharged directly into the sump without any screening of the effluent and without a grit chamber that cause heavy particles such as sand to enter the sump that may affect the sewer pumps negatively.
According to the maintenance division of the institute, this sewer pipelines need to be upgraded as most of it are very old and because of the deterioration of the joint rubber seals of the pipes, large sections are blocked due to root intrusions. During the investigation at certain sections of the pipeline between Camp sites A and B, sewer spillages were found where manholes overflowed due to these blockages.

CAMPSITES C, D AND E

The sewer reticulation systems for Camp sites C, D and E consist of a 110mm Ø vitro clay pipe networks from where it is collected into a

160mm Ø clay pipe and disposed into the reed bed oxidation ponds just south of Camp Site C. According to the maintenance division of the institute, the sewer pipelines need to be upgraded as most of it is very old and due to the deterioration of the joint rubber seals of the pipes, large sections thereof are blocked due to root intrusions. Part of this mainline has been replaced with new pipes due to the blockages that appeared because of root intrusions or because of broken pipes in the system.

(ii) SEWER PUMP STATION AT CAMP SITE B

A 4,5 liters per second sewer dry-pump station with standby motor and pump have been installed at the sewer sump, pumping the effluent to the reed bed oxidation pond system that is situated south west of Camp site B. At the time of the investigation the sewer pump system was not working as both pumps were in default and the institute was waiting for the maintenance division from the Department of Public Works to rectify it. The sump was overflowing and the sewer flowed into the veld.

4.2.2.9 REQUIRED UPGRADE OF SEWER RETICULATION NETWORK

New PVC, solid wall heavy duty drainage networks will be installed for all camps.

4.2.2.10 EXISTING ROADS AND STORMWATER INFRASTRUCTURE

(i) ACCESS ROADS

Four main access roads from the Provincial Road P240/1 leading to each Campsite with a total length of 5,6km exits and has been constructed with a single layer of material (approximately 100mm thick) that serve as wearing coarse. Other access roads between the camp sites, shooting ranges, indoor training facility, magazine safe and urban centre consist of only gravel roads with a total length of approximately 9km. Provision for storm-water drainage were made at stream crossings consisting of pipe culverts, but most of these require urgent maintenance or replacement. [Refer ***Appendix 8*** for a copy of the road lay out]

(ii) STORMWATER

Presently all stormwater mainly consists of surface drainage. Several non-perennial streams are located within the property boundary and these are identified as follows [Refer Appendix 8 for the location of site floodlines]:

Stream 1: Situated near the western boundary flowing from north to south –passing the existing ammunition safe, crossing the P240/1 provincial road and passing the existing sewerage oxidation ponds.
Stream 2: Bisecting the existing Admin Camp and the new residential area flowing from north to south crossing the P240/1 provincial road towards Campsite B. This stream is also the main supply to the Rookpoort Dam.
Stream 3: Situated on the eastern side and flowing from north to south, passing the existing D Campsite as well as C and E, crossing the P240/1 provincial road towards the sewerage oxidation ponds serving these Campsites. A small weir within the area of Campsite E collapsed during a heavy rainstorm which restricted access to Campsite E. Campsite E can now only be reached from the Provincial Road.

4.2.2.11 UPGRADING OF ROADS AND STORMWATER INFRASTRUCTURE

(i) ACCESS ROADS

At this point in time the proposal only makes provision for the re-gravelling of access roads. Location of these roads and their lengths are included below. Please refer to ***Appendix 10*** for a copy of the preliminary design report which indicates the structural design standards unpaved rural roads.

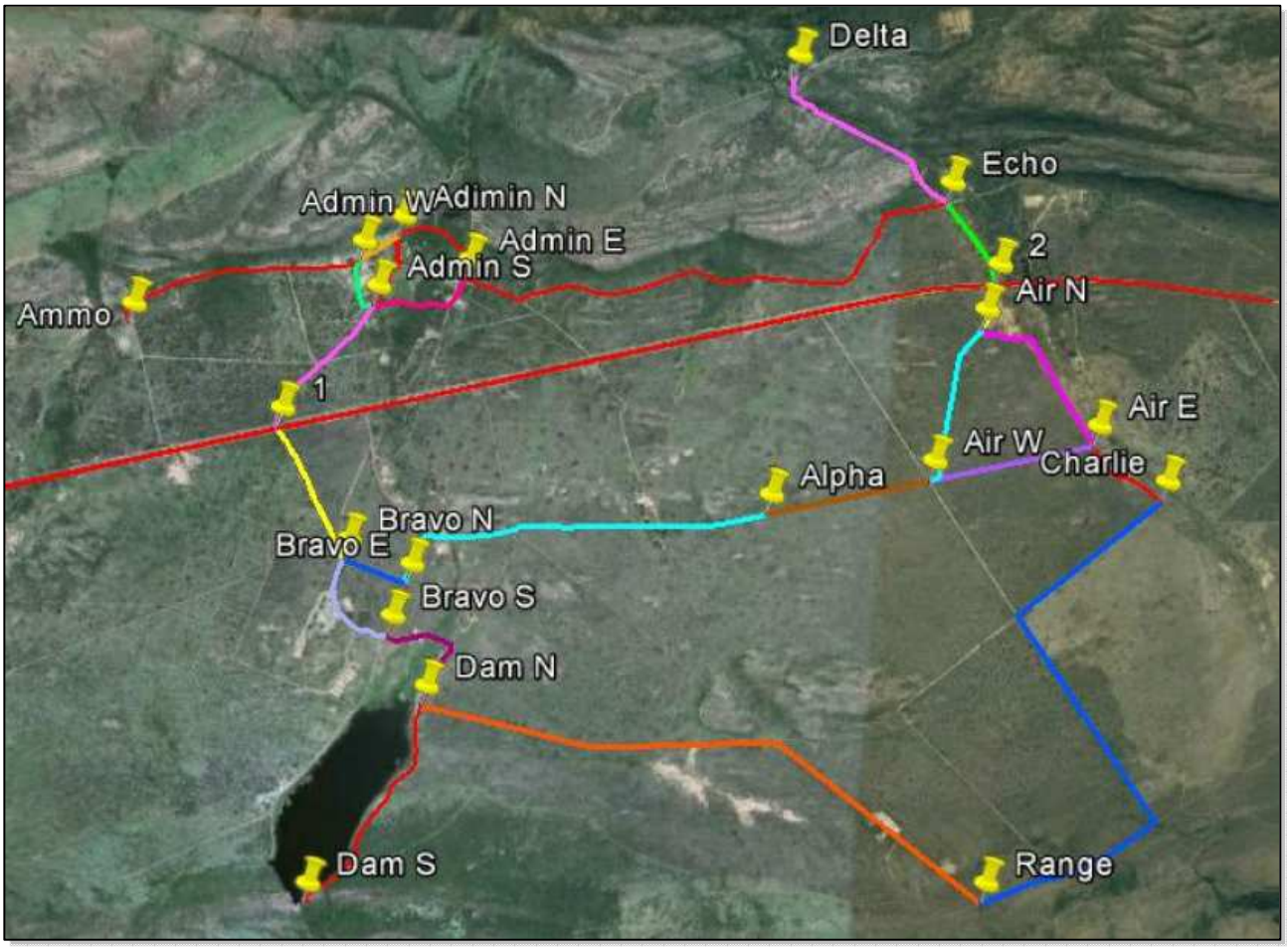


Figure 15 & 16: Access Roads and distances

Verdrag Road links

Road Name	Distance (m)
1 - Admin S	954
Admin S - Admin E	641
Admin E - Admin N	671
Admin N - Admin W	282
Admin W - Admin S	335
Admin N - Admin S	484
Admin W - Ammo	1537
Admin E - Echo	3213
Echo - Delta	1264
Echo - 2	561
2 - Air N	278
Air N - Air E	1062
Air E - Air W	1010
Air E - Charlie	557
Air W - Alpha	1000
Alpha - Bravo E	2403
1 - Bravo N	872
Bravo N - Bravo E	413
Bravo E - Bravo S	336
Bravo S - Bravo N	673
Bravo S - Dam N	833
Dam N - Dam S	1454
Dam N - Range	3711
Range - Charlie	3773
Total	28317

(ii) STORMWATER MANAGEMENT FOR CAMPS

A formal stormwater management plan is not available at this stage. Preliminary guidelines provided include the following: Stormwater provision must be made for two stormwater management systems. The major and minor systems with recurrence intervals as given below.

Table 13

DESIGN STORM FREQUENCIES		
Land Use	Design storm recurrence interval	
Camp sites	Minor Storm	Major storm
	2 years	50 years

Since no detailed storm water plans are available at present, the following proposals should be considered in the design:

- Runoff is to be controlled as close to the source as possible.
- A formal stormwater master plan must be submitted to DWA for approval prior to construction commencing;
- Adequate vegetated buffers should be allowed for next to the internal roads to deal with run off as well as surrounding paved areas;
- Feed off points should be incorporated into the road (outlets) at least every 100 metres to prevent erosion from stormwater runoff from the compacted road ;
- General surface water must be prevented from ponding;
- Erosion control measures such as gabion/reno mattresses must be implemented at outlet points as well as energy dissipaters.

(iii) STORMWATER DRAINAGE FOR ROADS

Three types of drainage structures have been identified for the project:

- Major culverts categorised because of road strategic importance, flood magnitude and size of stream crossing with a design flood peak return period of 10 years;
- Minor culverts located at stream crossings, with a design flood peak return period of 5 years;
- Lesser culverts located along road for erosion prevention measures.

4.2.2.12 WASTE DISPOSAL

Domestic waste is removed by an independent contractor 'Goudveld Bottel Beurs en Afval' on a weekly basis. The waste is disposed of at the Thabazimbi landfill site. An agreement to use the lanfill site is in place between the Department of Public Works and the Municipality. ILA is in the process of obtaining a copy of this agreement letter. Skips are removed on a weekly basis. These skips are located at the Admin, Bravo and Delta Camps. Additional skips will be provided at all the new facilities. It is also recommended that a recycling system be implemented at the point of disposal on site. During the site visit conducted on 6 August it was noted that some waste was being burnt on site. Measures for waste management have been included in the EMPr. No burning of waste is allowed on site. The current temporary waste storage facilities have several shortcomings such as lack of controlled access. These shortcomings are addressed in the EMPr.

4.2.3 MANAGEMENT OF SERVICES

The municipality will not undertake the provision of bulk services; therefore, all services will be installed and maintained by a management company acting on behalf of the SAPS training facility appointed by the Department of Public Works.

4.2.4 ELECTRICAL ENGINEERING SERVICES

Pano JB Electrical Engineering Consultants were previously involved with the planning of the proposed expansions, and provided the following information with regard to bulk electrical supply:

- Electricity is currently provided by Eskom from the Vaalwater sub-station to the respective camp areas, and there are currently 14 transformers that feed the existing facilities.
- These transformers will be consolidated and it is proposed that a new 2MVA substation be constructed for the expanded facilities, as the expected demand will be in the range of 1,439,107VA. This supply figure is below the specified threshold of the listed activities. However ILA is in the process of trying to obtain information from Messrs Pano JB to determine the location of the substation and to determine the coverage that the facility will require. Only preliminary proposals have been made by the engineers and no formal drawings are available currently. ILA is awaiting feedback from Messrs Pano JB regarding the afore-mentioned as well as confirmation on provision of additional cabling [underground / overhead] to new A training camp. It was confirmed by the engineers that existing facilities will make use of existing electrical supply infrastructure.

4.3 INVESTIGATION OF ALTERNATIVES

[Regulation 31 (2)(g)]

The purpose of this section is to present and motivate the process of selecting possible alternatives to the proposed activity. The identification of alternatives is an important component of the EIA process. In terms of the EIA Regulations feasible and reasonable alternatives are required to be considered within the EIA Process. Identified alternatives have been considered in terms of both environmental and socio economic acceptability as well as economic feasibility.

The 'no-go' alternative has also been described and has been considered as the baseline against which all alternatives are measured. The preferred option with respect to the alternatives considered has been highlighted.

4.3.1 LOCATIONAL ALTERNATIVES

No location alternatives exist as the upgrades and additional facilities relate to the existing training facility which has been operating on the subject properties for the past 20 years. The land belongs to the Applicant.

4.3.2 LAND USE ALTERNATIVES

The location of the subject property in a remote rural area with very limited development makes it ideal for the purposes of the SAPS Training Institute, which requires a secluded and private setting. The nature of the training facilities for the SAPS furthermore requires that the respective camps on the site must be situated well apart and in dense vegetation, in order to prevent visual contact between the camp areas. The site is therefore extremely desirable in terms of its size, locality and nature for purposes of the SAPS training facilities.

The land use proposal is considered in line with the objectives of the Environmental Management Zones of the Waterberg EMF as there is a strong parallel between the site and a conventional nature reserve. No land use Alternatives are being considered.

4.3.3 LAY OUT ALTERNATIVES

Discussion of the lay out alternatives revolves around the specific lay out composition's capability to provide a sustainable development through consideration of both anticipated beneficial and adverse impacts to the biophysical and socio economic environments. Sustainable land-use planning also considered the provision of services and related infrastructure.

4.3.3.1 ALTERNATIVE LAY OUT NO. 1 [Refer *Appendix 11* for Lay out 1]

Factors that influenced this proposed lay out were as follows:

- Existing facilities
- Requirements of specialised training offered at the facility [visibility, safety, privacy etc.]
- Engineering services
- Existing roads
- Topography
- Adjacent land uses;

i) BIOPHYSICAL ENVIRONMENT

ECOLOGICAL COMPONENTS

This was the initial concept for formalising and upgrading the SAPS facility. The lay out was prepared prior to the site sensitivity investigation by the fauna, avi-fauna and flora specialists and no floodline determination had been undertaken.

Existing A training camp: The area is already developed and the impact on natural vegetation will be minimal. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat. The Camp is situated near the spruit. No floodline detail was available at the time to determine whether existing and future expansions were affected by the floodline or associated riparian buffers. Drainage lines are considered as having a high sensitivity.

New residential extension to existing housing [East of the A training camp]: Most of the area is already developed with the current housing on the site. Expansion was proposed toward the East of the existing housing where vegetation is still natural but disturbed. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat.The Camp is situated near the spruit. No floodline detail was available at the time to determine whether existing and future expansions were affected by the floodline or associated riparian buffers. Drainage lines are considered as having a high sensitivity.
Upgrade to existing D training camp: The area is already developed and the impact on natural vegetation will be minimal.No floodline detail was available at the time to determine whether existing and future expansions were affected by the floodline or associated riparian buffers. Drainage lines are considered as having a high sensitivity. The camp site is situated on the mountain slopes and the taller denser woodlands provides bird habitat and is considered as having a high sensitivity.
New ammunition safe: This area has tall tree bushveld in good condition and the sensitivity in terms of bird habitat is considered high. However as the vegetation is widespread and not endangered the significance of removal is considered low.
Existing B training camp to be demolished and replaced: The area is already developed and the natural vegetation has partly been cleared and altered, though the new camps will extent into natural bush. The species richness of this area is high although dense bushveld is degraded. The low dense woodlands surrounding the developed area is considered as having a high sensitivity for bird habitat.
New Shooting range and Admin Block: The shooting range is located at the foot of the mountain, which is ecologically more sensitive. The intensity on the natural mountain slope vegetation is high and the significance medium. A slight shift toward the north to avoid development on the mountain slope will lower the significance.
New A training Camp: Although this is considered a new development, there is an existing tented camp on the site. This site is partially located within a dense bush clump with a particular plant species composition, including the protected Tamboti trees. The impact can be minimised by moving the position of the new camp slightly into the surrounding bushveld in order to protect the tall tree bush clumps of Tamboti trees. The low shrubby woodlands is considered as having a low sensitivity for bird habitat.
New Admin building and landing strip: The species richness of this area is medium, with no protected tree species and no red data species present. The low shrubby woodlands has a low sensitivity in terms of bird habitat.
Addition of a new gravity feed sewer line: from the new A training camp eastward to connect to the sewerage works situated below the Charlie Camp. Bird habitat sensitivity is considered low along the alignment. The species richness of this area is medium, with no protected tree species and no red data species present.
Addition of another gravity feed sewer line: from the existing Administration Camp to the sewerage works situated to the west of the B Camp. Where-as this is a linear development, many species will be encountered, though this is a narrow transect and most larger trees can be avoided. Bird habitat sensitivity is considered high.
Addition of a water pipeline: Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B. Where-as this is a linear development, many species will be encountered, though this is a narrow transect and most larger trees can be avoided

GEOTECHNICAL COMPONENTS

From a surface geotechnical viewpoint there are no fundamental flaws or limitations that prevent the proposed upgrade of the Verdrag facility. Detailed geotechnical investigation needs to be undertaken to verify and refine the findings of this feasibility study prior to proceeding with construction.

HYDROGEOLOGICAL COMPONENTS

There is a small risk of pollution of the groundwater from the existing oxidation ponds and it is recommended that when the sewage system is refurbished consideration should be given to establishing a proper sewage treatment works.

Table 14

ADVANTAGES	DISADVANTAGES
Rehabilitation of disturbed areas;	The lay out proposes placement of the shooting range and ammunition safe in areas where vegetation is sensitive and in a good condition. The intensity of the impact is considered High although the significance is Medium as vegetation is not endangered and is widespread;
Conservation of Open Space [there is a strong parallel between the site and a conventional nature reserve];	Without identification of areas affected by floodlines the impact on watercourses and riparian habitat cannot be mitigated;
Smaller footprint and reduced area of disturbance as this lay out proposes that the existing E Camp be demolished and the new camp be constructed in its place;	The lay out proposes installation of an additional sewerage gravity feedline from the Administration camp which passes through an area with a high species richness and where bird habitat sensitivity is high. This will result in additional areas being cleared for construction and the length of the linear clearance of vegetation will be at risk of erosion if area is not

	rehabilitated.
➢ Replacement of defunct pipelines will reduce risk of environmental impacts such as sewerage leaks and water wastage.	➢ Small pollution risk to groundwater with the continued use of the existing oxidation ponds. The ponds are not operating efficiently as their design is inadequate to meet the needs of the current demand. The ponds are too big and does not receive enough water. Furthermore no measures are in place to manage floodwaters with specific reference to the pond system situated below the existing C Camp. From the lay out it is clear that it is situated directly adjacent to the spruit and it is likely to be affected by the 1:100 year floodline. In the event of a flood the risk of surface water pollution in the spruit is high.

Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the possible risk of pollution to surface water. However the proposal has not taken site sensitivities into consideration and is therefore not the preferred proposal.

ii) SOCIO ECONOMIC ENVIRONMENT

The location of the subject property in a remote rural area with very limited development makes it ideal for the purposes of the SAPS Training Institute, which requires a secluded and private setting. The nature of the training facilities for the SAPS furthermore requires that the respective camps on the site must be situated well apart and in dense vegetation, in order to prevent visual contact between the camp areas. The site is therefore extremely desirable in terms of its size, locality and nature for purposes of the SAPS training facilities.

CULTURAL HERITAGE RESOURCES

The cultural historical features recorded on site are not impacted on by this lay out.

VISIBILITY FROM ADJACENT PROPERTY

The development entails largely upgrade to existing development [area already disturbed] and replacement of existing defunct infrastructure. With implementation of the mitigatin measures provided in the EMPr pertaining to lighting design, colour selection, structure design and rehabilitation of disturbed areas visual impacts are anticipated to be minimal.

NOISE

With implementation of the new shooting range the existing shooting ranges will be decommissioned. The new shooting range is located in an area where surrounding property owners will have minimal exposure to noise.

Table 15

ADVANTAGES	DISADVANTAGES
Provision of additional facilities and improved quality facilities for SAPS training;	Increased traffic generation on the P240/1 with associated noise and dust;
Heritage sites will be preserved;	
Low visual impact [with implementation of EMPr mitigation]	
Impact of noise on surrounding properties will be reduced with decommissioning of existing shooting ranges and the construction of the new shooting range.	

iii) INFRASTRUCTURE

- Electricity is currently provided by Eskom from the Vaalwater sub-station to the respective camp areas, and there are currently 14 transformers that feed the existing facilities.These transformers will be consolidated and it is proposed that a new 2MVA substation be constructed for the expanded facilities, as the expected demand will be in the range of 1,439,107VA. This supply figure is below the specified threshold of the listed activities.
- Administration Camp and Camp B reservoir storage capacity to be upgraded with the construction of an additional reservoir [water abstracted from the Rookpoort Dam]
- Camp C, D and E reservoir capacity to be upgraded with the construction of an additional reservoir.

- Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B
- The training facility currently treats its sewerage through the use of two Aerobic-Anaerobic Stabilization Pond systems. It was noted during the site investigation conducted by the project engineers that the current facility is not functioning effectively. The embankments require rehabilitation, the area must be fenced and access should be controlled to prevent animals from entering the facility. Proper wetland vegetation must be established to assist with the removal of pollutants from the effluent. It is assumed that the facility is not receiving enough water [in the form of effluent] due to several leakages and blockages in the sewer pipe network serving the oxidation ponds. Furthermore the facility is too big [ground coverage, ±5ha for Camp A&B and ±4.5 ha for Camp C,D & E] to allow it to function optimally. This proposal includes rehabilitation of the existing ponds in order to improve functionality.
- Presently, all storm-water mainly consist of surface drainage. No design detail for stormwater management is available at this stage. Stormwater management at all road crossings require upgrading as the existing infrastructure is not adequate to deal with stormwater flows effectively and some of the road crossings have been compromised as a result. Erosion control measures such as gabion/reno mattresses must be implemented at outlet points as well as energy dissipaters as part of the upgrade of the crossings. Erosion is recorded throughout the site and the project engineer will be required to prepare a plan which promotes green design to prevent erosion along internal roads and other surfaced areas [e.g. the use of grassed swales should be considered if soil conditions are found suitable for such design] .
- The access roads to the Administration Camp and Camp B will be re-gravelled. All other internal roads to be re-graded.

iv) CONCLUSION

Refer to Section 7 for significance rating associated with this lay out

- Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the possible risk of pollution to surface water. However the proposal has not taken site sensitivities into consideration and is therefore not the preferred proposal.
- Socio Economic impacts associated with this proposal are considered as having a low significance

4.3.3.2 ALTERNATIVE LAY OUT NO. 2 [Refer ***Appendix 12*** for Lay out 2]

Factors that influenced this proposed lay out were as follows:

- Existing facilities
- Requirements of specialised training offered at the facility [visibility, safety, privacy etc.]
- Engineering services
- Existing roads
- Topography
- Adjacent land uses;
- Floodlines
- Site sensitivity

(i) BIOPHYSICAL ENVIRONMENT

ECOLOGICAL COMPONENTS

This lay out was included in the Scoping Report. Developable areas within site boundaries were refined and amended to accommodate area affected by floodlines.

Existing A training camp: The area is already developed and the impact on natural vegetation will be minimal. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat. The upgrades do not encroach into this area. The Camp is situated near the spruit. The proposed development area is situated above the 1:100 year floodline.

New residential extension to existing housing [East of the A training camp]: Most of the area is already developed with the current housing on the site. Expansion is proposed toward the East of the existing housing where vegetation is still natural but disturbed. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat. The new development is not proposed within this area. The Camp is situated near the spruit. The development area is situated above the 1:100 year floodline.

Upgrade to existing D training camp: The area is already developed and the impact on natural vegetation will be minimal. The camp site is situated on the mountain slopes and the taller denser woodlands provides bird habitat and is considered as having a high sensitivity. The proposed areas of development are situated above the 1:100 year floodline.

New ammunition safe: This area has tall tree bushveld in good condition and the sensitivity in terms of bird habitat is considered high. However as the vegetation is widespread and not endangered the significance of removal is considered low. A shift of the location to be situated directly south of the existing ammunition safe will reduce the impact.

Existing B training camp to be demolished and replaced: The area is already developed and the natural vegetation has partly been cleared and altered, though the new camps will extent into natural bush. The species richness of this area is high although dense

bushveld is degraded. The low dense woodlands surrounding the developed area is considered as having a high sensitivity for bird habitat.

New Shooting range and Admin Block: The shooting range is located at the foot of the mountain, which is ecologically more sensitive. The intensity on the natural mountain slope vegetation is high and the significance medium. A slight shift toward the north to avoid development on the mountain slope will lower the significance.

New A training Camp: Although this is considered a new development, there is an existing tented camp on the site. This site is partially located within a dense bush clump with a particular plant species composition, including the protected Tamboti trees. The impact can be minimised by moving the position of the new camp slightly into the surrounding bushveld in order to protect the tall tree bush clumps of Tamboti trees. The low shrubby woodlands is considered as having a low sensitivity for bird habitat.

New E training Camp: The vegetation of this area is disturbed. Bird habitat sensitivity is low.

New Admin building and landing strip: The species richness of this area is medium, with no protected tree species and no red data species present. The low shrubby woodlands has a low sensitivity in terms of bird habitat.

Addition of a new gravity feed sewer line: from the new A training camp eastward to connect to the sewerage works situated below the Charlie Camp. Bird habitat sensitivity is considered low along the alignment. The species richness of this area is medium, with no protected tree species and no red data species present.

Addition of a water pipeline: Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B. Where-as this is a linear development, many species will be encountered, though this is a narrow transect and most larger trees can be avoided

Existing oxidation ponds will be decommissioned: The existing ponds will be decommissioned, and the area rehabilitated.

Discontinuation of sewer line: The existing sewerage line between the Bravo Camp and the western sewerage works will be discontinued and area can be rehabilitated;

GEOTECHNICAL COMPONENTS

From a surface geotechnical viewpoint there are no fundamental flaws or limitations that prevent the proposed upgrade of the Verdrag facility. Detailed geotechnical investigation needs to be undertaken to verify and refine the findings of this feasibility study prior to proceeding with construction.

HYDROGEOLOGICAL COMPONENTS

The existing oxidation ponds pose a small pollution risk. The dams have not been properly maintained and will be decommissioned. The new sewerage system treatment works will utilised purified effluent for irrigation purposes at the shooting ranges, and in gardens and will also provide fire water. There is a risk of surface and groundwater pollution if purified effluent does not meet DWA standards.

Table 16

ADVANTAGES	DISADVANTAGES
Rehabilitation of disturbed areas;	The lay out proposes placement of the shooting range and ammunition safe in areas where vegetation is sensitive and in a good condition. The intensity of the impact is considered High although the significance is Medium as vegetation is not endangered and is widespread;
Conservation of Open Space [there is a strong parallel between the site and a conventional nature reserve];	Pollution risk to groundwater if new submerged media reactor sewerage system is not maintained and regular monitoring of purified effluent is not implemented.
Sensitive riparian habitat will be conserved within open space corridors as per the 1:100 year floodline demarcation	
Replacement of defunct pipelines will reduce risk of environmental impacts such as sewerage leaks and water wastage.	
The new sewerage system will limit pollution risks as regulating and monitoring effluent becomes easier.	
The existing sewerage line between the Bravo Camp and the western sewerage works will be discontinued and area can be rehabilitated;	
No additional gravity feed line is required from the Administration camp to the western sewerage works. Less disturbance to vegetation.	
Oxidation ponds will be decommissioned and area rehabilitated.	
Provision of water for fire and irrigation through use of purified	

effluent [recycling of water will save water]	

Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the possible risk of pollution to groundwater if the sewerage system and ground water is not monitored for possible contamination.
The shooting range is proposed close to the slope of the mountain which is ecologically sensitive. The ammunition safe in its current position will require removal of vegetation which is in a good condition. An alternative location should be considered.

(ii) SOCIO ECONOMIC ENVIRONMENT

The location of the subject property in a remote rural area with very limited development makes it ideal for the purposes of the SAPS Training Institute, which requires a secluded and private setting. The nature of the training facilities for the SAPS furthermore requires that the respective camps on the site must be situated well apart and in dense vegetation, in order to prevent visual contact between the camp areas. The site is therefore extremely desirable in terms of its size, locality and nature for purposes of the SAPS training facilities.

CULTURAL HERITAGE RESOURCES

The cultural historical features recorded on site are not impacted on by this lay out.

VISIBILITY FROM ADJACENT PROPERTY

The development entails largely upgrade to existing development [area already disturbed] and replacement of existing defunct infrastructure. With implementation of the mitigatin measures provided in the EMPr pertaining to lighting design, colour selection, structure design and rehabilitation of disturbed areas visual impacts are anticipated to be minimal.

NOISE

With implementation of the new shooting range the existing shooting ranges will be decommissioned. The new shooting range is located in an area where surrounding property owners will have minimal exposure to noise.

Table 17

ADVANTAGES	DISADVANTAGES
Provision of additional facilities and improved quality facilities for SAPS training;	Increased traffic generation on the P240/1 with associated noise and dust;
Heritage sites will be preserved;	
Low visual impact [with implementation of EMPr mitigation]	
Impact of noise on surrounding properties will be reduced with decommissioning of existing shooting ranges and the construction of the new shooting range.	

(iii) INFRASTRUCTURE

- Electricity is currently provided by Eskom from the Vaalwater sub-station to the respective camp areas, and there are currently 14 transformers that feed the existing facilities.These transformers will be consolidated and it is proposed that a new 2MVA substation be constructed for the expanded facilities, as the expected demand will be in the range of 1,439,107VA. This supply figure is below the specified threshold of the listed activities.
- Administration Camp and Camp B reservoir storage capacity to be upgraded with the construction of an additional reservoir [water abstracted from the Rookpoort Dam]
- Camp C, D and E reservoir capacity to be upgraded with the construction of an additional reservoir.
- Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B
- The training facility currently treats its sewerage through the use of two Aerobic-Anaerobic Stabilization Pond systems. This proposal includes decommissioning of the existing ponds and implementation of a submerged media reactor system at Camp B and C and at the new shooting range.
- Presently, all storm-water mainly consist of surface drainage. No design detail for stormwater management is available at this stage. Stormwater management at all road crossings require upgrading as the existing infrastructure is not adequate to deal with stormwater flows effectively and some of the road crossings have been compromised as a result. Erosion control measures such as gabion/reno mattresses must be implemented at outlet points as well as energy dissipaters as part of the upgrade of the crossings. Erosion is recorded throughout the site and the project engineer will be required to prepare a plan which promotes green design to

prevent erosion along internal roads and other surfaced areas [e.g. the use of grassed swales should be considered if soil conditions are found suitable for such design] .

- The access roads to the Administration Camp and Camp B and the new Camp E will be re-gravelled. All other internal roads to be re-graded.

(iv) CONCLUSION

- Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the risk of groundwater pollution if purified effluent used for irrigation and fire water does not meet the quality standard as specified by DWA.
- Socio Economic impacts anticipated are expected to be mitigated successfully with this proposal.

4.3.3.3 ALTERNATIVE LAY OUT NO. 3 [PREFERRED PROPOSAL] [Refer ***Appendix 4*** for Lay out 3]

Factors that influenced this proposed lay out were as follows:

- Existing facilities
- Requirements of specialised training offered at the facility [visibility, safety, privacy etc.]
- Engineering services
- Existing roads
- Topography
- Adjacent land uses;
- Floodlines
- Site sensitivity

(i) BIOPHYSICAL ENVIRONMENT

ECOLOGICAL COMPONENTS

This lay out was included in the Scoping Report. Developable areas within site boundaries were refined and amended to accommodate area affected by floodlines.

Existing A training camp: The area is already developed and the impact on natural vegetation will be minimal. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat. The upgrades do not encroach into this area. The Camp is situated near the spruit. The proposed development area is situated above the 1:100 year floodline.

New residential extension to existing housing [East of the A training camp]: Most of the area is already developed with the current housing on the site. Expansion is proposed toward the East of the existing housing where vegetation is still natural but disturbed. Vegetation nearer the mountain foot slopes is considered as being of a high sensitivity for bird habitat. The new development is not proposed within this area. The Camp is situated near the spruit. The development area is situated above the 1:100 year floodline.

Upgrade to existing D training camp: The area is already developed and the impact on natural vegetation will be minimal. The camp site is situated on the mountain slopes and the taller denser woodlands provides bird habitat and is considered as having a high sensitivity. The proposed areas of development are situated above the 1:100 year floodline.

New ammunition safe: This area has tall tree bushveld in good condition and the sensitivity in terms of bird habitat is considered high. However as the vegetation is widespread and not endangered the significance of removal is considered low. The ammunition safe has been relocated to be situated directly south of the existing ammunition safe. Here the bush is less dense and the impact to vegetation is reduced.

Existing B training camp to be demolished and replaced: The area is already developed and the natural vegetation has partly been cleared and altered, though the new camps will extent into natural bush. The species richness of this area is high although dense bushveld is degraded. The low dense woodlands surrounding the developed area is considered as having a high sensitivity for bird habitat.

New Shooting range and Admin Block: The shooting range is located at the foot of the mountain, which is ecologically more sensitive. The intensity on the natural mountain slope vegetation is high and the significance medium. The shooting range has been shifted 200m northwards. This reduces the impact to the ecologically sensitive mountain slope.

New A training Camp: Although this is considered a new development, there is an existing tented camp on the site. This site is partially located within a dense bush clump with a particular plant species composition, including the protected Tamboti trees. The impact can be minimised by moving the position of the new camp slightly into the surrounding bushveld in order to protect the tall tree bush clumps of Tamboti trees. The low shrubby woodlands is considered as having a low sensitivity for bird habitat.

New E training Camp: The vegetation of this area is disturbed. Bird habitat sensitivity is low.

New Admin building and landing strip: The species richness of this area is medium, with no protected tree species and no red data species present. The low shrubby woodlands has a low sensitivity in terms of bird habitat.

Addition of a new gravity feed sewer line: from the new A training camp eastward to connect to the sewerage works situated below the Charlie Camp. Bird habitat sensitivity is considered low along the alignment. The species richness of this area is medium, with no protected tree species and no red data species present.

Addition of a water pipeline: Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B. Where-as this is a linear development, many species will be encountered, though this is a narrow transect and most larger trees can be avoided
Existing oxidation ponds will be decommissioned: The existing ponds will be decommissioned, and the area rehabilitated.
Discontinuation of sewer line: The existing sewerage line between the Bravo Camp and the western sewerage works will be discontinued and area can be rehabilitated;

GEOTECHNICAL COMPONENTS

From a surface geotechnical viewpoint there are no fundamental flaws or limitations that prevent the proposed upgrade of the Verdrag facility. Detailed geotechnical investigation needs to be undertaken to verify and refine the findings of this feasibility study prior to proceeding with construction.

HYDROGEOLOGICAL COMPONENTS

The existing oxidation ponds pose a small pollution risk. The dams have not been properly maintained and will be decommissioned. The new sewerage system treatment works will utilised purified effluent for irrigation purposes at the shooting ranges, and in gardens and will also provide fire water. There is a risk of surface and groundwater pollution if purified effluent does not meet DWA standards.

Table 18

ADVANTAGES	DISADVANTAGES
Rehabilitation of disturbed areas;	Pollution risk to groundwater if new submerged media reactor sewerage system is not maintained and regular monitoring of purified effluent is not implemented.
The ammunition safe and shooting range have been moved into areas where impacts to vegetation and sensitive habitats are reduced	
Conservation of Open Space [there is a strong parallel between the site and a conventional nature reserve];	
Sensitive riparian habitat will be conserved within open space corridors as per the 1:100 year floodline demarcation	
Replacement of defunct pipelines will reduce risk of environmental impacts such as sewerage leaks and water wastage.	
The new sewerage system will limit pollution risks as regulating and monitoring effluent becomes easier.	
The existing sewerage line between the Bravo Camp and the western sewerage works will be discontinued and area can be rehabilitated;	
No additional gravity feed line is required from the Administration camp to the western sewerage works. Less disturbance to vegetation.	
Oxidation ponds will be decommissioned and area rehabilitated.	
Provision of water for fire and irrigation through use of purified effluent [recycling of water will save water]	

Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the possible risk of pollution to groundwater if the sewerage system and ground water is not monitored for possible contamination.
The shooting range is proposed close to the slope of the mountain which is ecologically sensitive. The ammunition safe in its current position will require removal of vegetation which is in a good condition. An alternative location should be considered.

(ii) SOCIO ECONOMIC ENVIRONMENT

The location of the subject property in a remote rural area with very limited development makes it ideal for the purposes of the SAPS Training Institute, which requires a secluded and private setting. The nature of the training facilities for the SAPS furthermore requires that the respective camps on the site must be situated well apart and in dense vegetation, in order to prevent visual contact between the camp areas. The site is therefore extremely desirable in terms of its size, locality and nature for purposes of the SAPS training facilities.

CULTURAL HERITAGE RESOURCES

The cultural historical features recorded on site are not impacted on by this lay out.

VISIBILITY FROM ADJACENT PROPERTY

The development entails largely upgrade to existing development [area already disturbed] and replacement of existing defunct infrastructure. With implementation of the mitigatin measures provided in the EMPr pertaining to lighting design, colour selection, structure design and rehabilitation of disturbed areas visual impacts are anticipated to be minimal.

NOISE

With implementation of the new shooting range the existing shooting ranges will be decommissioned. The new shooting range is located in an area where surrounding property owners will have minimal exposure to noise.

Table 19

ADVANTAGES	DISADVANTAGES
Provision of additional facilities and improved quality facilities for SAPS training;	Increased traffic generation on the P240/1 with associated noise and dust;
Heritage sites will be preserved;	
Low visual impact [with implementation of EMPr mitigation]	
Impact of noise on surrounding properties will be reduced with decommissioning of existing shooting ranges and the construction of the new shooting range.	
Moving the ammunition safe a bit further south of the existing safe increases safety as it is now located further away from the Administration camp	

(iii) INFRASTRUCTURE

- Electricity is currently provided by Eskom from the Vaalwater sub-station to the respective camp areas, and there are currently 14 transformers that feed the existing facilities.These transformers will be consolidated and it is proposed that a new 2MVA substation be constructed for the expanded facilities, as the expected demand will be in the range of 1,439,107VA. This supply figure is below the specified threshold of the listed activities.
- Administration Camp and Camp B reservoir storage capacity to be upgraded with the construction of an additional reservoir [water abstracted from the Rookpoort Dam]
- Camp C, D and E reservoir capacity to be upgraded with the construction of an additional reservoir.
- Construction of a new 110mm dia water line to connect the new A training Camp to the line serving Administration Camp and Camp B
- The training facility currently treats its sewerage through the use of two Aerobic-Anaerobic Stabilization Pond systems. This proposal includes decommissioning of the existing ponds and implementation of a submerged media reactor system at Camp B and C and at the new shooting range.
- Presently, all storm-water mainly consist of surface drainage. No design detail for stormwater management is available at this stage. Stormwater management at all road crossings require upgrading as the existing infrastructure is not adequate to deal with stormwater flows effectively and some of the road crossings have been compromised as a result. Erosion control measures such as gabion/reno mattresses must be implemented at outlet points as well as energy dissipaters as part of the upgrade of the crossings. Erosion is recorded throughout the site and the project engineer will be required to prepare a plan which promotes green design to prevent erosion along internal roads and other surfaced areas [e.g. the use of grassed swales should be considered if soil conditions are found suitable for such design] .
- The access roads to the Administration Camp and Camp B and the new Camp E will be re-gravelled. All other internal roads to be re-graded.

(iv) CONCLUSION

- Adverse biophysical impacts associated with this proposal are not considered to be high with the exception of the risk of groundwater pollution if purified effluent used for irrigation and fire water does not meet the quality standard as specified by DWA.
- Socio Economic impacts anticipated are expected to be mitigated successfully with this proposal.
- The lay out includes new locations for the ammunition safe and shooting range which will further reduce impacts to the ecological integrity of the site

4.3.4 DESIGN ALTERNATIVES

4.3.4.1 STORMWATER MANAGEMENT

No formal Stormwater Management Plan is available at present.

(i) CONVENTIONAL DESIGN PRINCIPLES

The following design parametres have been provided by the engineer which highlights the standards to which the Stormwater Management Design should adhere.

Stormwater management for Urban centre's (camps):

Provision for Stormwater drainage must be made in accordance with the "Guidelines for Human Settlement, Planning and Design" as compiled by the CSIR building and construction technology, and prescribed by the Department of Public Works, as follows Stormwater Provision must be made for two stormwater management systems. The major and minor systems with recurrence intervals as given below.

Table 20

DESIGN STORM FREQUENCIES		
Land Use	**Design storm recurrence interval**	
	Minor Storm	**Major Storm**
Camp sites	2 years	50 years

The encroachment of runoff from the 100 year frequency design storm on primary roads at the crown of the road should not exceed a depth of 150mm to allow the operation of emergency vehicles such as ambulances and fire tenders. For flat areas and areas located below roads and areas of high runoff such as parking areas, special precautions should be taken to protect buildings from flooding. These may include the zoning of such areas for buildings to have ground floor levels above the design flood levels and the flood-proofing of buildings. The minimum grade of any pipe is 1:150 (0,67%) and the minimum diameter is 450mmø. The minimum gradient and minimum diameter should not be used on the same conduit. b. Stormwater drainage for roads Provision for Stormwater drainage will be made in accordance with the "Drainage Manual" published by the South African National Roads Agency Ltd.

Stormwater management at all road crossings require upgrading as the existing infrastructure is not adequate to deal with stormwater flows effectively and some of the road crossings have been compromised as a result. Erosion control measures such as gabion/reno mattresses must be implemented at outlet points as well as energy dissipaters as part of the upgrade of the crossings. Erosion is recorded throughout the site and the project engineer will be required to prepare a plan to prevent erosion along internal roads and other surfaced areas.

(ii) SUSTAINABLE DESIGN PRINCIPLES: RURAL SUSTAINABLE DRAINAGE SYSTEMS

It is recommended that the formal Stormwater Management Plan consider RSuDS in its design concept. RSuDS comprise individual or multiple linked component structures replicating natural processes, designed to attenuate water flow by collecting, storing and improving the quality of run-off water within rural catchments. Rural SuDS could provide structural measures, primarily to control surface run-off, by helping to buffer peak flows and thereby contributing to flood risk management.

The following RSuDS components must be investigated by the engineer for inclusion in the Stormwater Management Plan:

Table 21

1. Rural SUDS component **Grassed waterways and swales:** Swales are broad and shallow channels covered by grass or other suitable vegetation. To be considered for managing stormwater along roads and other hard surfaces.	
ADVANTAGES	**DISADVANTAGES**
Reduce runoff volume and velocity;	Not appropriate for sandy soils where it is difficult to establish dense vegetation – engineer to determine soil suitability
Traps sedimentation and other particulate pollutants	
Provides temporary storage encouraging infiltration of runoff into the ground	
Treats runoff through filtering by vegetation, through the subsoil and/or infiltration into the underlying soil	
Biodiversity benefits through provision of habitat and	

movement corridors	
Low cost and maintenance	
Treats runoff through filtering by vegetation, through the subsoil and/or infiltration into the underlying soil	
Rural SUDS component **Infiltration trench:** A narrow trench filled with stone or a commercial drainage material one to two metres deep with no outlet which encourages slow infiltration into the subsoil through the creation of an underground reservoir. To be considered for managing stormwater along roads and other hard surfaces.	
ADVANTAGES	**DISADVANTAGES**
Infiltration trenches perform well for the removal of fine sediment and associated pollutants	Higher material costs and more maintenance required [regular inspection required for possible clogging]
Groundwater recharge	Potential for clogging in areas with high sediment load
Rural SUDS component **Detention basin:**. Normally dry basins designed to temporarily store and slowly release runoff water. Water leaves the basin via a restricted outflow control leading to a longer detention time and improved particulate pollution sedimentation. To be considered for use in conjunction with the above prior to release into watercourse or as sheet flow.	
ADVANTAGES	**DISADVANTAGES**
Increases habitat diversity	High construction costs
Moderate maintenance required	
Encourages sedimentation and nutrient uptake by plants	
Long lifetime	
Suitable for most sites where space is available	
Can be used with almost all soils and geology with minor design adjustment for highly permeable sandy soils.	

4.3.4.2 MINIMISING VISUAL IMPACTS

(i) LIGHTING DESIGN

Obtrusive lighting or otherwise referred to as light pollution can occur as a result of excessive light spillage, which is both energy consuming and can cause disturbance to a level where major annoyance is experienced. Poor lighting design could result in:

- Light trespass where emitted light enters neighbouring properties with annoying consequences;
- Glare An excessive contrast between light and dark areas, which causes visual discomfort or disablesvision; or
- Sky glow the glow that is visible above extensively developed areas at night.

In this instance obtrusive lighting could be a potential concern for the following reasons:
This specific area bears limited built structures and is largely undeveloped. The study area is remote and therefore the vividness of celestial bodies in the night sky is considered a highly valued characteristic of the site. Any light spillage could potentially cause negative impact on this characteristic.

The following lighting design measures must be implemented to reduce the potential for obtrusive lighting in order to ensure minimal disturbance to residents, and tourists.[These mitigation measures were extracted from The Institution of Lighting Engineers – Guidance notes for the reduction of obtrusive light 2005];

- Use specifically designed lighting equipment (full cut-off lighting fixtures) that minimizes the upward spread of light near to and above the horizontal.

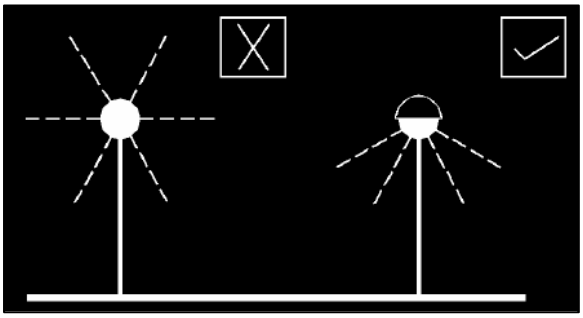


Figure 17: Example of full cut-off lighting

- Keep glare to a minimum by ensuring that the main beam angle of all lights directed towards any observer is not more than 70º. Higher mounting heights allow lower main beam angles, which can assist in reducing glare. In areas with low ambient lighting levels, glare can be very obtrusive and extra care should be taken when positioning and aiming light equipment.

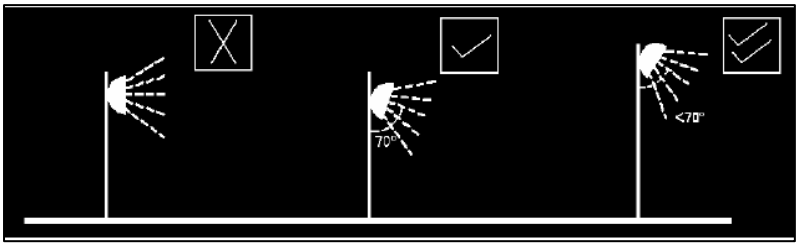


Figure 18: Higher mounting heights allow lower main beam angles

- Outside lighting required for decks or balconies at residential areas should be designed and strategically placed to only provide illumination to that specific area.
- Lighting will be provided to walkways between buildings. Low wattage luminaries should be used and to be directed only onto the path.
- Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.

(ii) REHABILITATING DECOMMISSIONED SHOOTING RANGES AND AREAS AFFECTED BY EROSION

Once the new shooting range becomes operational the remaining shooting ranges on site must be decommissioned. During the site visits conducted erosion was evident in areas across the site. These areas must be rehabilitated. Once the use of the oxidation ponds are phased out these areas must also be rehabilitated. It is therefore recommended that a rehabilitation specialist be appointed to implement a rehabilitation plan which is to be prepared by a qualified Landscape Architect and with inputs from an ecologist. Such rehabilitation plan must be approved by DEA. It is anticipated that decommissioning of the oxidation ponds servicing Camp C,D & E and the decommissioning of the existing shooting ranges will only commence in approximately 5 years. The Applicant should make budgetary provision in the next design stage phase for a Rehabilitation Plan to be prepared. Such plan should indicate the timeframe for implementation of the rehabilitation based on the construction schedule and also consider establishment of an on site nursery [search and rescue facility] in order to collect vegetation and seed from the natural environment during the construction phase.

4.3.5 TECHNOLOGY ALTERNATIVES

4.3.5.1 TREATMENT OF SEWERAGE

The following alternatives were identified for the treatment of sewerage.

(i) MAINTENANCE OF EXISTING OXIDATION PONDS

- Maintenance to existing oxidation ponds [***Applicable to the ponds servicing Camp C,D and E only***]. It was noted during the site investigation conducted by the project engineers that the current facility is not functioning effectively. The embankments require rehabilitation, the area must be fenced and access should be controlled to prevent animals from entering the facility. Proper wetland vegetation must be established to assist with the removal of pollutants from the effluent [specifications are provided in the EMPr]. The sewerage treatment works servicing Camps C, D & E will still be utilised in the interim until such time that the new submerged media reactor is installed at C Camp[± 5 years]. It is thought that the facility is not receiving enough water to function as the ponds are very dry. This is most probably due to the leaking sewer pipes servicing the ponds. It is anticipated that with replacement of the leaking pipes and installation of new sewerage pipelines that these ponds will operate more effectively. Rehabilitation specifications for these ponds are included in the EMPr and must be implemented until such time that the pond can be decommissioned. Erosion is evident near the reed bed ponds and must be rehabilitated as part of the maintenance phase.

Figure 19 :Erosion at the oxidation ponds servicing Camp C,D and E must be rehabilitated

(ii) DECOMMISSIONING OF OXIDATION PONDS

- **Ponds servicing Camp B and the Administration Camp**: The oxidation ponds servicing Camp B and the administration Camp is no longer in operation as the sewerage pump station has been out of order and the facility has not received any sewerage input. A new submerged media reactor will be installed at Camp B. This oxidation pond must be decommissioned. The oxidation pond has dried out and only a thin layer of sludge measuring approximately 250mm thick is present. The pollution risk associated with this sludge is minimal. It is therefore recommended that the sludge be removed during the onset of construction activities related to the upgrade of Camp B. The waste sludge must be classified and a hazard rating determined. HR2-HR4 waste may be delisted and disposed on a GLB or GMB site, HR 1 waste should be disposed on H:H or H:h sites. Sludge originating from domestic WWTP is a high volume, low hazard waste. The area should remain fenced and access must be controlled until such time as a rehabilitation plan has been approved and the area can be rehabilitated according to the rehabilitation plan specifications.
- **Ponds servicing Camps C,D & E:** The decommissioning of the oxidation pond servicing Camp C,D E will only commence once the new submerged media reactor is installed in about 5 years. After decommissioning the area must be rehabilitated as per the specification of an approved rehabilitation plan. It is anticipated that the decommissioning will entail the following. The reed ponds will remain and will be utilised for managing extra outflows from the submerged media reactor. The engineer will be required to prepare an operation plan indicating the design for pumping excess outflow into these ponds. Furthermore the design must make provision for the management of stormwater, to ensure that in the event of a flood, risks of surface water pollution is restricted as the ponds are situated adjacent to the spruit. Should the quality of effluent not meet the DWA standards there will be a small pollution risk to surface and groundwater. The remainder of the concrete oxidation pond banks must be removed. Sludge must be removed to a licensed facility. The area must be graded to the natural ground level and re-vegetated. The fence should be removed from the rehabilitated area and only the reed bed ponds must remain fenced. Areas affected by erosion must be rehabilitated.

(iii) REPLACEMENT OF EXISTING FACILITY WITH SUBMERGED MEDIA REACTOR

During the engineering investigation it was confirmed that water for irrigation of earthworks banks, communal parks and road reserves was required. This alternative would utilise the purified effluent for such irrigation purposes. This alternative proposes the construction of a modular type submerged media reactor wastewater treatment works with final effluent to comply with DWA General Limits that can be used for irrigation purposes. The following facilities will be constructed:

- A new 140kl/day sewerage treatment plant is proposed to be constructed adjacent to the existing oxidation ponds south of the existing C training camp.
- A new 100kl/day sewerage treatment plant is proposed to be constructed at the new B Camp to deal with sewerage for the Administration Camp and Camp B.
- A new 6kl/day sewerage treatment plant is proposed to be constructed near the new shooting range [near the existing urban training facility]. The existing septic tank at the urban training facility will be emptied and sewerage disposed of at a licensed sewerage treatment works in Thabazimbi. The concrete 'tank's' roof will be demolished and the area will be filled and compacted.

Table 22

Technology Alternatives			
Oxidation ponds		Submerged media reactor	
Advantages	Disadvantages	Advantages	Disadvantages

➢ Natural method of decomposition ➢ Operation and maintenance is simple ➢ Efficient in removing BOD if designed properly	➢ Odours ➢ Mosquito and other insect breeding ground ➢ During rainy season or in cloudy weather sewerage can become septic ➢ Difficult to predict control ammonia levels ➢ No water for irrigation ➢ Design flaw area too large to deal effectively with amount of effluent input [dried up]; ➢ Contamination monitoring difficult ➢ Potential contamination risk to waterbodies	➢ Low maintenance schedule ➢ Backup system provided in case of pump or power failure, ➢ Efficient in removing BOD ➢ Closed system no odour or insect infestations; ➢ Limited risk of contamination of water bodies; ➢ Regulating and monitoring effluent quality becomes easier; ➢ Provision of fire and irrigation water; ➢ Low use of electrical equipment save on electricity; ➢ Decommissioning of the existing oxidation ponds will lead to a large portion of the site being rehabilitated. The area measures approximately 8 hectares.	➢ Water table could be contaminated if effluent quality is not properly managed; ➢ Costs associated with decommissioning and rehabilitation of existing system

4.3.6 OPERATIONAL ALTERNATIVES

4.3.6.1 CREATION OF RECREATIONAL OPEN SPACE

It is recommended that the preparation of the formal rehabilitation plan include specification for the creation of formal recreational Open Space areas within the site. Areas affected by the 1:100 year floodline are to be included as open space corridors in which no development may take place. The rehabilitation plan should propose the use of these open space areas for use by trainees, employees and permanent residents on the site for activities such as hiking and bird watching. Information boards should be erected along hiking routes which inform individuals of the location of protected tree species and other flora and fauna species confirming their conservation status and importance, biology, habitat and management requirements.

Table 23

ADVANTAGES	DISADVANTAGES
With creation of a formalised Open Space area visitors to the facility can enjoy the outdoors and also be educated about their surrounding environment	Cost involved with preparation of rehabilitation plan and formalisation of Open Space Plan.
It will reduce random wondering in the veld which could contribute to reducing fire risks and random littering. This will simplify monitoring and controlling the movement of visitors to the site.	
Will contribute to conservation of sensitive habitats	
Will contribute to curbing indiscriminate off-road driving	

4.3.6.2 FORMAL PROTECTION OF THE SITE

It is recommended that the land owner apply for the formal protection of the site as a Protected Natural Environment as per the specifications of Section 21 (1) (a) of the Limpopo Environmental Management Act (Act 7 of 2003).

4.3.7 TEMPORAL ALTERNATIVES

➢ The construction process should be phased so as to limit the extent of exposed areas at any one time, and so that for any specific

area, the time between initial disturbance and completion of construction is as short as possible;
- Construction activities must take place within the dry season, specifically construction of the stream crossings [replacement of pipes and installation of new pipes].

4.3.8 THE NO-GO ALTERNATIVE

In essence, the no-go alternative would ultimately imply that the state of the environment would be retained as it is presently, with obvious advantages and disadvantages to the natural environment.

The Department of Environmental Affairs (DEA) stresses that the no-go alternative should be considered in cases where the proposed development will have a significant negative impact that cannot be effectively or satisfactorily mitigated against.

The no-go alternative means that the current status-quo is maintained. In the case of the development proposal, this would imply the following;
- The training institute cannot be upgraded to provide additional training facilities and as such the demand for an increase in the facilities capacity to provide training to the SAPS National Forces will not be met;
- Additional employment opportunities will not be available;
- If the newly proposed shooting range is not developed the other shooting ranges will remain in operation;
- Defunct pipelines will not be replaced;
- Oxidation ponds will continue being operated without the necessary license and associated monitoring;
- The current application provides an opportunity to formalise Environmental Monitoring and management of the site through implementation of of the EMPr and conditions of the licenses to be issued [Waste Management License and Water Use License]
- No monitored clearing of vegetation will take place;
- Stormwater infrastructure which is currently in a poor condition will not be upgraded.

Authorisation is being sought for the expansion of existing activities. The site provides the perfect conditions required for the specialist training provided. Alternatives relating to the design lay out and technology associated with the expansion and maintenance activities have been identified. The assessment of Alternatives has resulted in a recommendation of a proposal which will have limited impact on the environment and provides opportunity for conservation and management of the site. Based on the findings of this Environmental Impact Assessment the No Go Option can justifiably be dismissed as the proposal is not fatally flawed and provides an opportunity for conservation of a large Open Space area.

4.3.9 RECOMMENDATION FOLLOWING COMPARATIVE ASSESSMENT OF ALTERNATIVES

A detailed description of each of the above alternatives considered have been provided, ILA herewith recommends the following:

(i) PREFERRED LAY OUT ALTERNATIVE 3

ILA is of the opinion that potential impacts identified resulting from Alternative lay-out 3 can be successfully mitigated and that the lay-out can be supported with implementation of the following environmental management measures:
- An ecologist must be present during the site pegging to finalise placement of structures and to ensure limited disturbance to indigenous vegetation with particular reference to the New A training camp and sensitive bush clumps and protected Tamboti trees. The purpose of the ecologist will also be to clearly mark protected trees within construction boundaries which may not be removed without a permit;
- As indicated previously the Applicant will still be obtaining budget for a design stage. The Applicant will be required to ensure budget is available during the design stage to appoint a qualified Landscape Architect and ecologist to prepare a rehabilitation plan. The rehabilitation plan should provide information on formalisation of recreational open space areas and measures for rehabilitation of decommissioned shooting ranges and oxidation ponds. Furthermore the rehabilitation plan should address rehabilitation of areas affected by erosion and construction activity [including drainage lines and associated riparian areas].
- The measures provided for management of Open Space as provided in the EMPr must be adhered to;
- A formal Stormwater Management Plan must be prepared by the project engineer which provides detail on the management of stormwater on site. Erosion prevention measures should be included and how run off from roads will be dealt with. The design should prevent the release of stormwater below the 1:100 year floodline. Energy dissipaters must be implemented at stormwater outlets channelling storm water run off through open spaces. It is recommended that the design includes a combination of RSuDS as follows, grassed swales and detention basins. It is recommended that pervious surfaces be utilised for the following areas which may contribute to contaminating runoff:
  - Vehicle maintenance yards;
  - Vehicle parking areas;
  - Waste storage areas;

- Landscaping specification as included in the EMP for the landscaping of residential gardens and sports and playing fields are to be

adhered to;

- Pipes should be installed and the area closed up immediately. Drainage line crossings should not be left exposed for days on end. Installation should also not impede the flow of water through the wetland. The detailed design drawings should contain measures which will allow for proper drainage of water through the stream crossings. Installation should not take place during the rainy season. Measures to restrict impacts related to temporary stream diversion have been included in the EMPr;
- A detailed geotechnical investigation needs to be undertaken to verify and refine the findings of the Geotechnical feasibility study prior to proceeding with construction.

(ii) TREATMENT OF SEWERAGE : PREFERRED TECHNOLOGY SUBMERGED MEDIA REACTOR

- The existing oxidation ponds are to be decommissioned and will be replaced by a submerged media reactor at Bravo Camp, at the new shooting range and situated below the Charlie Camp. The new facility will contribute to the provision of water for irrigation and fire water. The facility will provide discharge water which meets the specifications regulating the quality of discharge water as regulated by the Department of Water Affairs. The new sewerage treatment facility will required to be licensed in terms of Section 21(g) of the National Water Act. A license must be issued for the facility by the Department of Water Affairs prior to the construction of the facility commencing. Monitoring of the submerged media reactor system is a condition of the DWA license. Should the system not be maintained and monitored to the satisfaction of the DWA the license will be revoked.
- The oxidation pond servicing the Bravo Camp will be decommissioned as it is not functioning effectively. The waste sludge must be classified and a hazard rating determined. HR2-HR4 waste may be delisted and disposed on a GLB or GMB site, HR 1 waste should be disposed on H:H or H:h sites. The area should remain fenced and access must be controlled until such time as a rehabilitation plan has been approved and the area can be rehabilitated according to the rehabilitation plan specifications.
- The decommissioning of the oxidation pond servicing Camp C,D E will only commence once the new submerged media reactor is installed in about 5 years. After decommissioning the area must be rehabilitated as per the specification of an approved rehabilitation plan. It is anticipated that the decommissioning will entail the following. The reed ponds will remain and will be utilised for managing extra outflows from the submerged media reactor. The engineer will be required to prepare an operation plan indicating the design for pumping excess outflow into these ponds. Furthermore the design must make provision for the management of stormwater, to ensure that in the event of a flood, risks of surface water pollution is restricted as the ponds are situated adjacent to the spruit. Should the quality of effluent not meet the DWA standards there will be a small pollution risk to surface and groundwater. The remainder of the concrete oxidation pond banks must be removed. Sludge must be removed to a licensed facility. The area must be graded to the natural ground level and re-vegetated. The fence should be removed from the rehabilitated area and only the reed bed ponds must remain fenced. Areas affected by erosion must be rehabilitated;
- A Groundwater Management Plan with relevant monitoring and reporting protocol should be prepared prior to implementation of the new facility.

(iii) DESIGN ALTERNATIVES : REDUCE VISUAL IMPACTS

- Existing shooting ranges must be decommissioned once the new shooting range becomes operational. The decommissioned shooting ranges must be rehabilitated as per the specifications of a formal rehabilitation plan;
- Oxidation ponds are to be decommissioned and areas rehabilitated as per the specifications of the rehabilitation plan;
- The final architectural design for new buildings must make provision for specifically designed lighting to limit obtrusive lighting as per the mitigation measures in this Section and the EMPr. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.
- A rehabilitation plan is to be prepared by a qualified landscape architect with inputs from an ecologists which formalises a recreational open space area and also provides rehabilitation measures for areas disturbed by construction and other human activity and areas affected by erosion;

(iv) DESIGN ALTERNATIVES: STORMWATER MANAGEMENT

- The stormwater management plan should promote the use of a combination of Rural sustainable drainage systems. Should soil conditions be suitable the use of grassed swales along roads is recommended to prevent erosion and sedimentation of water ways.

(v) OPERATIONAL ALTERNATIVES: DECLARATION AS PROTECTED NATURAL ENVIRONMENT

It is recommended that the land owner give serious consideration to declaring the application site as a Protected Natural Environment in terms of Section 21 (1) (a) of the Limpopo Environmental Management Act (Act 7 of 2003), as this will contribute to the long term conservation of the site.