

GENERAL INFORMATION ON CULLINAN

Cullinan is situated in the Highveld region of South Africa. The town has an elevation of 1 476 m. The closest city is Pretoria, which is 40 km away, while Johannesburg is 100 km away. On 25 June 1905 the famed Cullinan Diamond, the largest in the world at 3 106 carats (621 g), was discovered by Frederick George Stanley Wells, a surface manager at the Premier Diamond Mining Company. The town of Cullinan owes its existence to diamond mining in the area. Cullinan's opencast mine is among the biggest in the world, three times the size of the more famous Kimberley Diamond Mine.

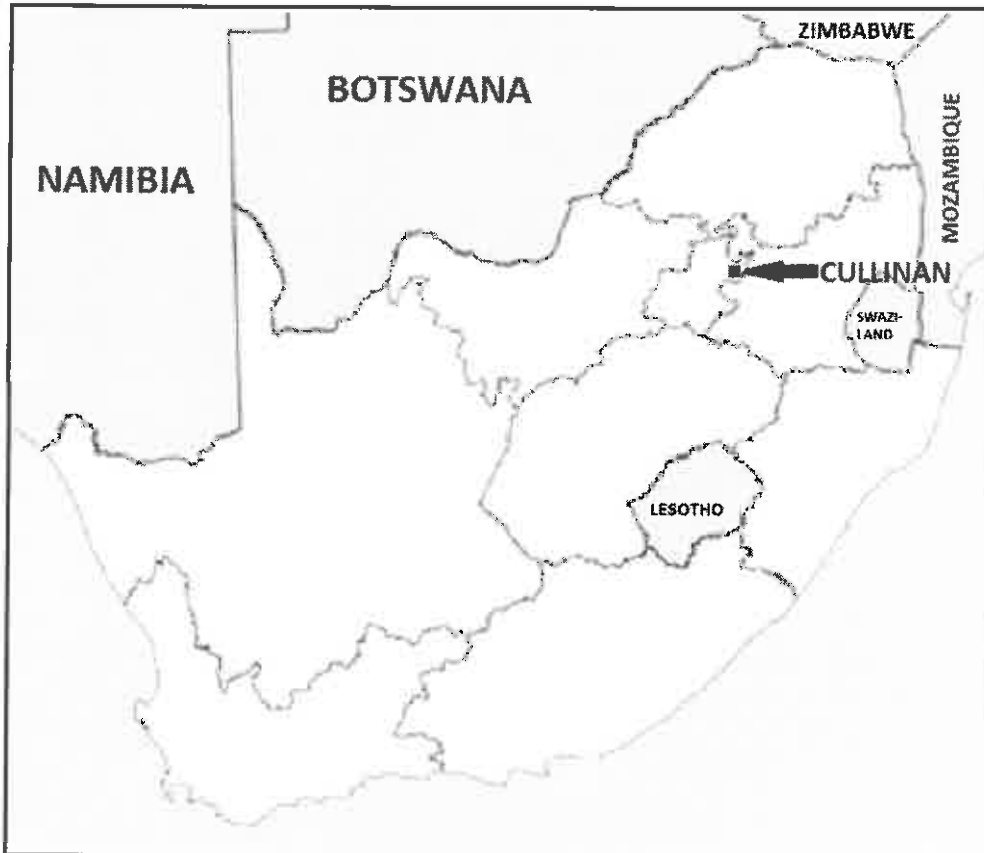
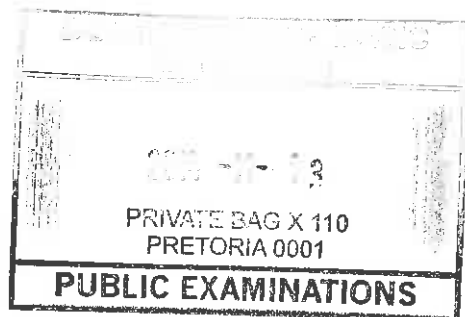


FIGURE 1



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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

The questions below are based on the 1 : 50 000 topographical map 2528DA CULLINAN, as well as the orthophoto map of a part of the mapped area. Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) in the block next to each question.

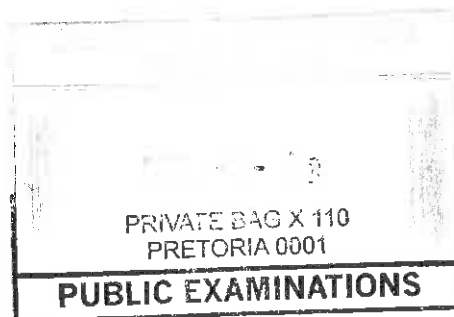
1.1 The map index/reference of the topographical map to the south-east of Cullinan is ...

- A 2528BD.
- B 2528AD.
- C 2528DD.
- D 2528DB.

C

1.2 The direction of P in block B8 from O in block C6 is ...

- A north-east.
- B north-north-east.
- C east-north-east.
- D east.



C

1.3 Cullinan is a/an ... town.

- A industrial
- B recreational
- C dormitory
- D mining

D

1.4 The street pattern at Refilwe in block B2 is ...

- A unplanned.
- B irregular.
- C radial.
- D a grid iron.

B

1.5 The contour interval on the orthophoto map is ... metres.

- A 5
- B 10
- C 15
- D 20

A

1.6 The orthophoto map is an example of a ... photograph.

- A high-angle oblique
- B low-angle oblique
- C horizontal
- D vertical aerial

D

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1.7 The dam wall (Y) in block F8 is ... metres above sea level.

- A 1 500
- B 20
- C 150
- D 1 400

A

1.8 The human-made feature at 4 on the orthophoto map is a ...

- A park.
- B cemetery.
- C golf course.
- D conservation area.

C

1.9 The natural feature at 7 on the orthophoto map is a ...

- A valley.
- B spur.
- C gorge.
- D gap.

B

1.10 The row of trees in block H5 is used as a ...

- A firebreak.
- B farm boundary.
- C plantation.
- D windbreak.

D

1.11 The true bearing of spot height 1452 (K) in block F1 from trigonometrical station 44 (J) in block E2 is ...

- A 24°.
- B 294°.
- C 204°.
- D 94°.

C

1.12 The major land-use zone in block E4 is the ...

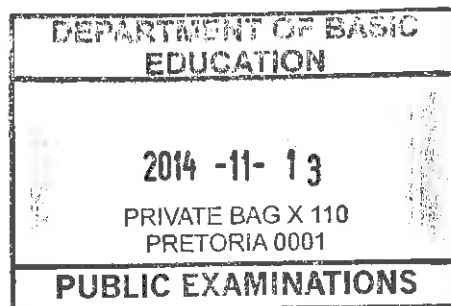
- A rural-urban fringe.
- B heavy industrial area.
- C residential area.
- D light industrial area.

A

1.13 Feature 6 on the orthophoto map is a ...

- A mine.
- B dam.
- C excavation.
- D mine dump.

B



[Handwritten signatures and initials]

1.14 The stream order at X in block C5 is ...

- A 4.
- B 3.
- C 1.
- D 2.

D

1.15 The grid reference/coordinates/position of the dam in block F7 is ...

- A 25°42'48"S 28°36'30"E/25°42,8'S 28°36,5'E.
- B 28°42'30"S 25°36'48"E/28°42,5'S 25°36,8'E.
- C 25°42'30"E 28°36'48"S/25°42,5'E 28°36,8'S.
- D 25°42'30"S 28°36'48"E/25°42,5'S 28°36,8'E.

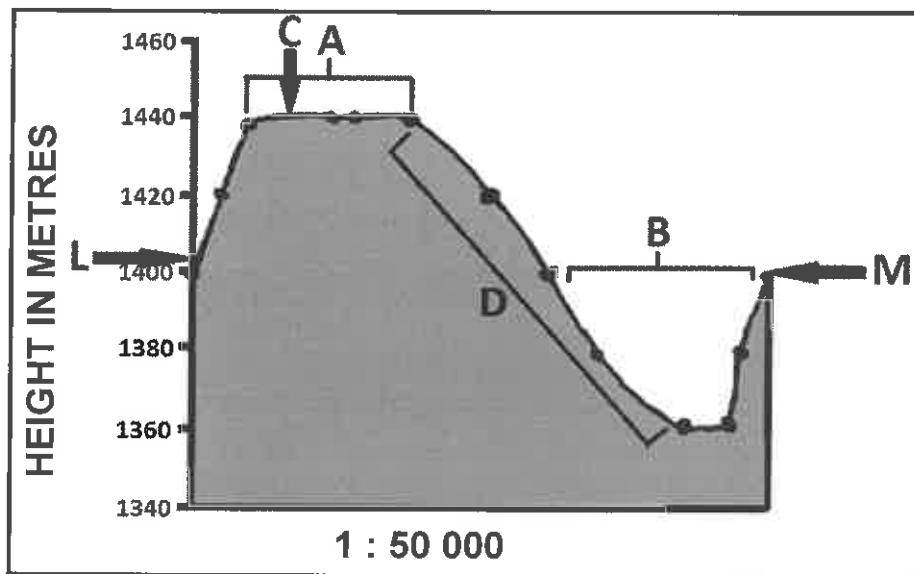
A

(15 x 1)

[15]

QUESTION 2: MAP CALCULATIONS AND TECHNIQUES

2.1 Refer to the cross-section below from L in block A2 to M in block B5 on the topographical map and answer the questions that follow. The vertical scale for the cross-section is 1 cm represents 20 m.

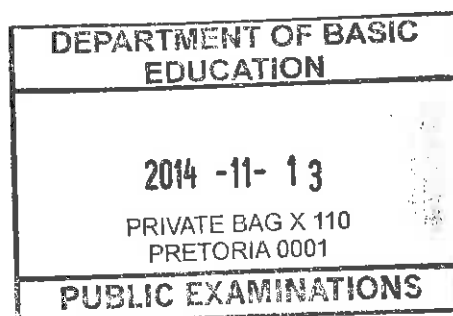


2.1.1 Identify landforms A and B on the cross-section above.

A: Ridge/Butte/Hill/Flat topped hill ✓

B: Valley/River valley ✓

(2 x 1) (2)



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- 2.1.2 (a) Identify the conventional sign at **C** that shows height.
Trigonometrical station ✓ (1 x 1) (1)
- (b) State the height of the conventional sign at **C**.
1 453.3 (m) ✓ (1 x 1) (1)
- 2.1.3 (a) Which average gradient will apply to slope **D** on the cross-section? Circle the correct answer (**A** or **B**) below.
(A) 1 : 22 (1 x 1) (1)
- (b) Give a reason for your answer to QUESTION 2.1.3(a).
Steep gradient because the contour lines are close together ✓
1 : 122 indicates that the slope is gentle/1 : 22 indicates a steep slope ✓
*The cross-section shows slope **D** as a steep slope* ✓
Rise is over a shorter distance
For every 22 units in horizontal distance, height increases by 1 unit ✓
[Any ONE] (1 x 1) (1)

2.1.4 Calculate the vertical exaggeration of the cross-section. Show ALL calculations. Marks will be awarded for calculations.

$$\text{Vertical exaggeration} = \frac{\text{vertical scale}}{\text{horizontal scale}}$$

Vertical scale: 1 cm represents 20 m (2 000 cm)

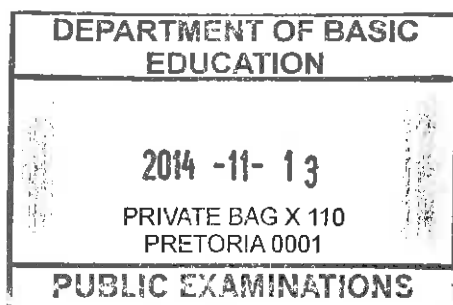
$$= \frac{1:2000}{1:50\,000}$$

$$= \frac{1}{2\,000} \times \frac{50\,000}{1}$$

$$= \frac{25}{1}$$

$$= 25 \text{ times}$$

(Learner must indicate unit) (4 x 1) (4)



2.2 Calculate the magnetic declination of topographical map 2528DA CULLINAN for 2014. Show ALL calculations. Marks will be awarded for calculations.

$$\begin{aligned} \text{Difference in years} &= 2014 - 2002 \\ &= 12 \text{ years } \checkmark \\ \text{Mean annual change} &= 8'W \checkmark \\ \text{Total change} &= 12 \times 8'W \\ &= 96'W / 1^\circ 36'W \checkmark \end{aligned}$$

$$\begin{aligned} \text{Magnetic declination for 2014} &= 16^\circ 52'W + 96'W / 1^\circ 36'W \\ &= 17^\circ 88'W \\ &= 18^\circ 28'W \checkmark \end{aligned} \qquad (5 \times 1) \quad (5)$$

2.3 Refer to the demarcated area in RED on the topographical map which represents the orthophoto map. Use the demarcated area to calculate the surface area of the orthophoto map in km². Show ALL calculations. Marks will be awarded for calculations.

Area = length × breadth

$$\text{Length} = 9,1 \text{ cm } \checkmark \times 0,5 = 4,55 \text{ km (Range 8.95 – 9.25) [Accept other formulas to calculate length]}$$

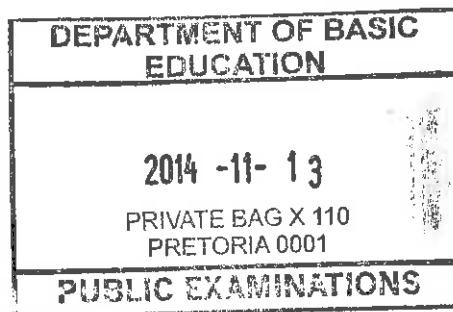
$$\text{Breadth} = 7,1 \text{ cm } \checkmark \times 0,5 = 3,55 \text{ km (Range } \overset{6.95 - 7.25}{\cancel{8.95 - 9.25}} \text{) [Accept other formulas to calculate breadth]}$$

$$\begin{aligned} &= 4,55 \text{ km } \checkmark \times 3,55 \text{ km } \checkmark \\ &= 16,15 \text{ km}^2 \checkmark \end{aligned}$$

Range: 15,75 km² – 16,56 km²

(If orthophoto map is used to calculate the area, 1 mark must be given for the final correct answer. No credit is given for steps)

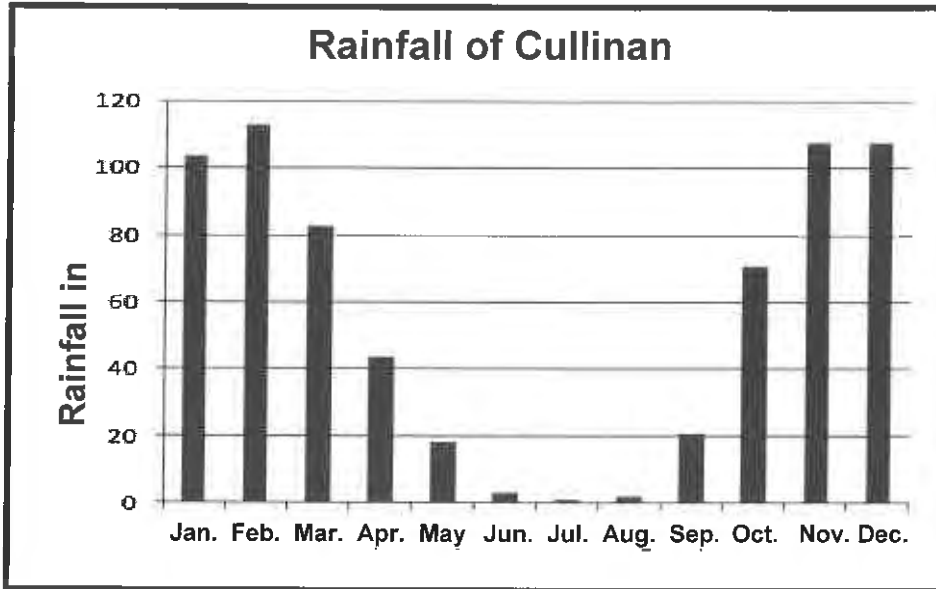
(Accept if line scale was used for determining distance) (5 x 1) (5) [20]



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QUESTION 3: APPLICATION AND INTERPRETATION

3.1 Refer to the graph below, the information on page 2 and the topographical map to answer the questions that follow.



3.1.1 Does Cullinan receive seasonal rainfall or rainfall throughout the year?

Seasonal ✓ (1 x 1) (1)

3.1.2 Give ONE point of evidence from the graph and ONE point of evidence from the topographical map to support your answer to QUESTION 3.1.1.

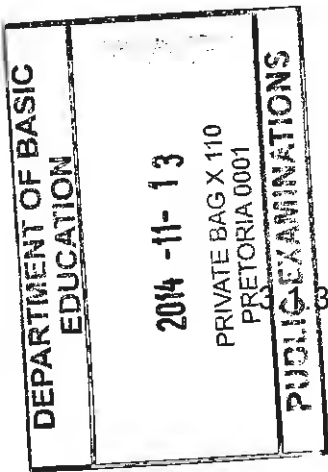
Graph: *Highest rainfall during summer months (November–March)* ✓
Lowest rainfall in the winter months (May–September) ✓
 [Any ONE]

Topographical map: *Non-perennial/ Periodic rivers/water* ✓
Many dams/Reservoirs/Windmills ✓
Irrigation implemented (accept example) ✓
 [Any ONE] (2 x 1) (2)

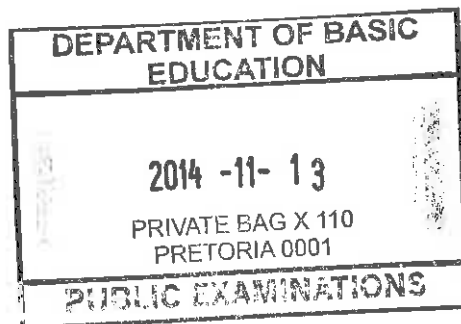
Taking your answer to QUESTION 3.1.1 into account, was the orthophoto map taken in summer or winter? Give a reason for your answer.

Answer: *Winter* ✓

Reason: *Limited/Lack of vegetation* ✓✓
Light shading of dams show little/no water ✓✓
Cloudless winter conditions ideal for taking a vertical aerial photograph ✓✓
 [Any ONE] (1 + 2) (3)



- 3.2 3.2.1 State the general flow direction of the Masokololo River in block **C8**.
North/Northwards ✓ (1 x 1) (1)
- 3.2.2 Give ONE reason from the topographical map for your answer to QUESTION 3.2.1.
*Dam wall found on the northern section of the dam ✓✓
Dam wall is downstream north of the dam ✓✓
Contour lines bend upstream ✓✓
Water collects south of the dam wall ✓✓
V-shaped contours that cut the river point towards increasing height to the south ✓✓
The non-perennial tributary in block **B8** that joins the river at an acute/small angle from the south ✓✓
Descends from **E8** at (1 508 m) to **A8** at (1 358 m) ✓✓
[Any ONE] (1 x 2) (2)*
- 3.3 Refer to the settlement at point **V** in block **D8** and answer the questions below.
- 3.3.1 Name the settlement pattern of the settlement at point **V**.
Nucleated/Clustered/Compact ✓ (1 x 1) (1)
- 3.3.2 State ONE disadvantage for a farm labourer living in the settlement in QUESTION 3.3.1.
*No privacy ✓✓
Few services ✓✓
Diseases can spread easily ✓✓
Fires spread easily from house to house ✓✓
Lower standard of living ✓✓
Conflicts between farm workers ✓✓
The farm labourers do not own the land ✓✓
[Any ONE. Accept other reasonable answers applicable to the question] (1 x 2) (2)*



3.4 Refer to blocks D1 and D2 indicating the Premier Diamond Mine, an opencast mine situated on the outskirts of Cullinan. Study it together with the orthophoto map and answer the questions that follow.

3.4.1 State ONE environmental injustice that this type of mining caused in the area surrounding the Premier Diamond Mine.

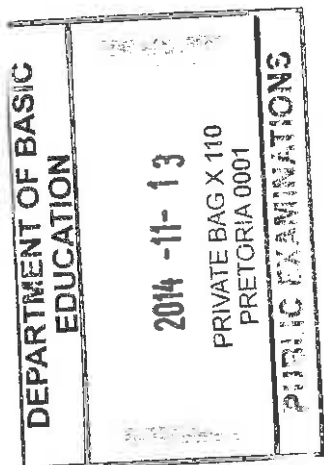
- Biodiversity being lost / Food chains will be destroyed ✓*
 - Ecosystems being destroyed/ destroying aesthetic appeal/scenic beauty ✓*
 - Groundwater and rivers being polluted ✓*
 - Environmental despoliation ✓*
 - Pollution/ Dust ✓*
 - Landscape being scarred ✓*
 - Acid Mine Drainage ✓*
 - Wind erosion ✓*
 - Sinkholes ✓*
- [Any ONE. Accept other reasonable answers applicable to the question] (1 x 1) (1)*

3.4.2 Discuss TWO measures that mining companies can implement to restore the environmental balance.

- Refilling of the excavation/ open cast mine ✓✓*
 - Filling with water for recreational purposes ✓✓*
 - Purification/Treatment of acid water ✓✓*
 - Rehabilitate the area by planting vegetation ✓✓*
 - Limit the amount of mining pollutants being dumped in the surrounding environment ✓✓*
 - Do research to establish the impact of mining on the environment ✓✓*
- [Any TWO. Accept other reasonable answers applicable to the question] (2 x 2) (4)*

3.4.3 Evaluate why mining companies choose not to restore the environmental balance you mentioned in QUESTION 3.4.2.

- Costs large amounts of money to restore the environmental balance ✓✓*
 - Decreases the potential profit of the mining company ✓✓*
 - It is time consuming ✓✓*
 - Environmental laws not strictly enforced/implemented ✓✓*
 - High costing for labour to implement rehabilitation ✓✓*
 - Cannot start rehabilitation as area is still being mined ✓✓*
 - Area is being remined due to improved technology ✓✓*
 - Most mines are owned by foreigners who are no longer interested in restoring balance ✓✓*
- [Any TWO. Accept other reasonable answers] (2 x 2) (4)*



[Handwritten signature]

3.5 Refer to the farm Uitzicht in block E7 and answer the questions that follow.

3.5.1 Does the farm Uitzicht practise small-scale or large-scale farming?

Large-scale ✓ (1 x 1) (1)

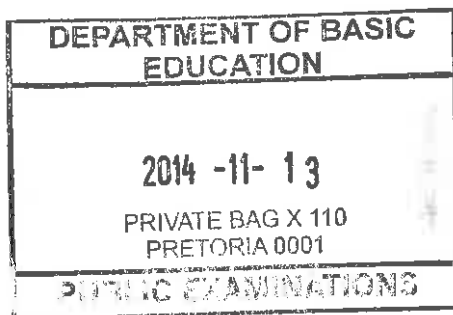
3.5.2 Give ONE reason from the topographical map to support your answer to QUESTION 3.5.1.

Farm boundaries ✓✓
The farm has a name ✓✓
Irrigation/Water supply/Reservoir/Dam found in D7 ✓✓
Farm area is large ✓✓
Area is accessible(roads) for the easy distribution of products ✓✓
Generally flat land ✓✓
Farm workers reside close-by in nucleated settlements ✓✓
 [Any ONE. Accept other reasonable answers] (1 x 2) (2)

3.6 The residential area at point 9 on the orthophoto map is a high-income residential area.

Give ONE piece of evidence from the orthophoto map to support this statement.

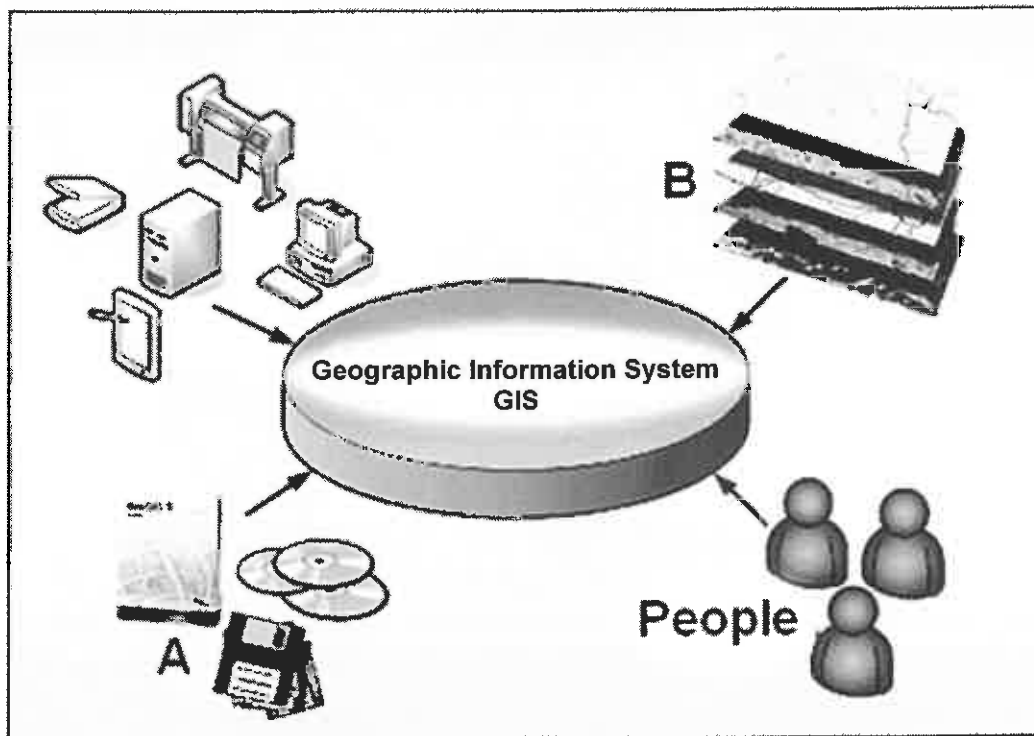
Large plots/ houses ✓
Low building density ✓
Far from CBD ✓
Near the golf course/Recreation ✓
Scenic beauty/Aesthetic appeal/view ✓
Accessible - Linked to a main road and other services for easy access (must qualify) ✓
Not accessible - Fewer entrances into the residential area (must qualify) ✓
Greenbelt ✓
Away from the mining activities ✓
 [Any ONE. Accept other reasonable answers] (1 x 1) (1)
[25]



AMT *zk*

QUESTION 4: GEOGRAPHICAL INFORMATION SYSTEMS (GIS)

4.1 The diagram below shows the different components of a GIS. Study the diagram and answer the questions that follow.



[Adapted from Google Images]

4.1.1 Identify components A and B.

A: Software/Programmes ✓

B: Data ✓

(2 x 1) (2)

4.1.2 Explain the role that people play in a GIS.

People collect the data ✓✓

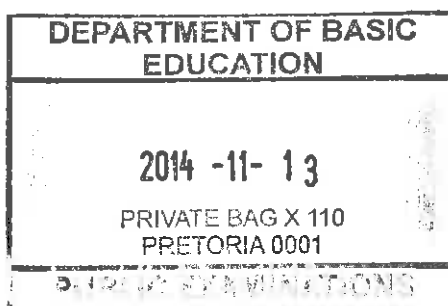
People manipulate and process the information ✓✓

People use the information ✓✓

People develop GIS programmes and capture data ✓✓

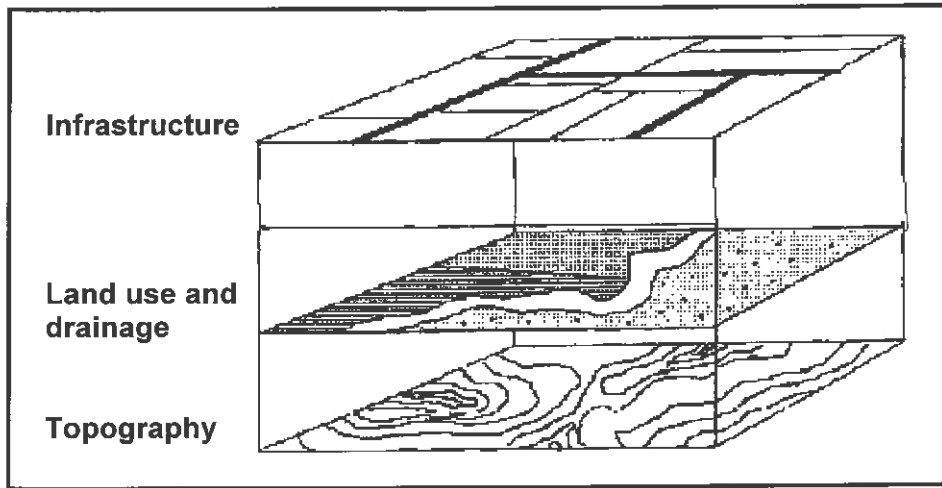
[Any ONE]

(1 x 2) (2)



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4.2 In order to do a paper GIS it is important to familiarise oneself with the different layers of information. Refer to block F6 on the topographical map and the diagram below to answer the questions that follow.



[Adapted from Google Images]

4.2.1 Give ONE example of each of the following layers in block F6:

Infrastructure: *Other road/Reservoir/Buildings/Dam wall/
Hiking trails ✓
[Any ONE]*

Land use: *Settlement/Cultivated land/Crop farming/Rows of
trees/Hiking trails/Reservoir/Dam/Excavation/
Farms/Other road/Diggings/Buildings ✓
[Any ONE]*

Drainage: *Non-perennial river/Newman's
Spruit/Dam/Reservoirs/River valley ✓
[Any ONE]*

(3 x 1) (3)

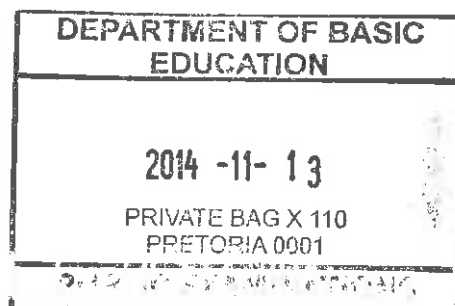
4.2.2 Why is data layering (information layers) important in a GIS?

*Different sets of data can be compared ✓✓
Integrated picture of landscape ✓✓*

*Relationships between different sets of data can be established ✓✓
Analyse different sets of information ✓✓
Comparisons can assist with future developments ✓✓
Helps with querying ✓✓*

Any ONE. Accept other reasonable answers]

(1 x 2) (2)




Mut -ck
[Signature]




Please turn over

4.3 The area around the marsh and vlei in block E5 is a flood risk. Hydrologists have recommended that a buffer zone of 250 m be created around the marsh and vlei where no development may take place. Refer to the extract of block E5 on the topographical map below and answer the questions that follow.

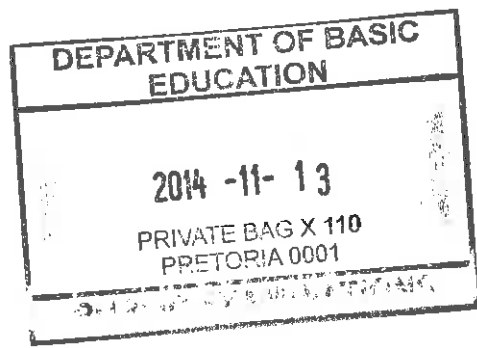
4.3.1
Buffer zone must be 5 mm from the end of the marsh and vlei. (ONE mark) ✓
Candidates should draw a curved line. (ONE mark) ✓



Scale 1 : 50 000

Marsh and vlei	
Perennial river	
Non-perennial river	

- 4.3.1 Draw in the buffer zone recommended by the hydrologists on the above extract of block E5.
- See sketch above. (2 x 1) (2)
- 4.3.2 Identify ONE human-made buffer zone and ONE natural buffer zone in block E5.
- Human-made: *Row of trees* ✓
- Natural: *Gradient/Slope/Contour lines/Flood plain* ✓ (2 x 1) (2)
- 4.3.3 State ONE site factor that determined the location of the settlement Erica in blocks E4 and E5.
- It is built on a dry point settlement/On higher ground away from the marsh and vlei/river/flood plain* ✓✓
Contour lines are far apart indicating a gentle slope ✓✓
Soil fertility ✓✓
In the inversion layer/thermal belt ✓✓
Aspect ✓✓
 [Any ONE] (1 x 2) (2)



TOTAL: 75