

## Section A

## Theme 4: Geographical Investigations

- 1 A class of 25 18-year old students were tasked to investigate the influence of land use on infiltration rates in Singapore. After splitting into groups of 5, one of the groups selected Labrador Nature Reserve as their study area, and decided to carry out their primary fieldwork at two sites – Sites A and B – in the nature reserve.

The group crafted the following hypothesis for their investigation:

***“The higher the level of urbanisation of the site, the lower the infiltration rate in the site.”***

The following equipment were provided to measure infiltration rate at the two different land use sites:

- A tin can, about 30cm in height and a diameter of 10cm, with both ends removed
- A 1.5-litre bottle of water
- A ruler
- Hammer
- Wooden plank
- Stopwatch

The investigation was conducted on a weekday afternoon in June. They were given 3 hours to complete their investigation, from 2 pm to 5 pm. At the respective sites, the tin can was driven into the soil to about 10cm deep by using a hammer onto a wooden plank placed on the rim of the can. A ruler was placed vertically inside the tin can to record the fall in water level. Water was poured to a depth of 20 cm. Measurements of the remaining depth of water was taken every 1 minute to compute the infiltration rate. At the same time, constant top-ups of water were carried out to maintain a regular head of water above soil.

Resource 1 shows a map of Labrador Nature Reserve, which indicates the locations of Sites A and B. Resource 2 shows data collected on infiltration rates at Sites A and B.

- (a) Explain why the hypothesis crafted by the group is not suitable for the investigation at Labrador Nature Reserve. [2]

**Answer Guide:**

- Not **specific** – does not specify the sites delineated for investigation and/or the different land uses required
- Not **measurable** – variations in **land use** cannot be measured by level of urbanisation

*Point-marked – 1m for identification of reason, and 1m for explanation of reason.*

- (b) Explain how the impacts of the investigation could be minimised. [4]

**Answer Guide:**

- **Minimisation of impacts on the ecosystem in the area**, through measures such as:
  - Minimising the removal of vegetation when hammering the tin can into the soil to measure infiltration rates, especially at Site B
  - Avoiding littering at the park
- **Minimisation of social impacts in the nature park**, given that it is a weekday afternoon in June where there might be members of the public in the area,

through measures such as:

- Conducting investigation away from pathways, especially at Site A given that Site A is a road / next to a carpark
  - Reduce noise levels when conducting investigation, as the nature park is an area of leisure and recreation for members of the public.
- Any other impacts & corresponding suggestions – list is non-exhaustive

*Point-marked.*

- (c)** With reference to Resource 2, sketch a line graph to represent the infiltration rates for Site A and Site B over time respectively. Suggest **one** reason why this method may be better than the one depicted in Resource 2. [6]

**Answer Guide:**

- Sketch of line graph:
  - 2 marks for Site A and B respectively. Marks are allocated based on:
    - Accuracy of data points
    - Use of appropriate x- and y- axes
- Possible reasons for line graph being an improvement over the table (1m for identified reason, 1m for explanation):
  - Easier **visualization** of change of infiltration rates over time at each site
  - Easier **comparison** of difference in change in infiltration rates between Sites A and B
  - *Any other appropriate reason accepted.*

*Point marked.*

- (d)** With reference from Resources 1 and 2, account for the differences in infiltration rates between Sites A and B. [4]

**Answer Guide:**

- Infiltration rates at Site A are lower than at Site B.
  - Site A: Being located at a car park / road, the ground is therefore likely to be concretised and largely impermeable. This hence reduces infiltration rates at the area.
  - Site B: Being located directly within the gazetted nature reserve area in Labrador Nature Reserve, it is likely that vegetative cover is high. This means that soil will be more permeable owing to the presence of plant roots that provide fissures, thus enhancing infiltration rates.

*Point marked.*

- (e)** Evaluate the usefulness of the investigation in understanding the influence of land use on infiltration rates, and suggest how the investigation could be improved. [9]

**Answer Guide:**

*Possible points for evaluation of usefulness of the investigation:*

- Arguments supporting the view that the investigation has been useful:
  - Does allow for a conclusion to be drawn that variations in land use do impact infiltration rates in the area.
  - Sites selected for investigation are very clearly of two different types of land use, contributing to the validity of the investigation in meeting its aims

- Arguments against the view that the investigation has been useful:
  - Accuracy of the investigation is unclear, given:
    - The use of a single-ring infiltrometer rather than a double-ring infiltrometer, which means that the lateral flow of water is not controlled in the investigation
    - Investigation was not repeated in the same session
  - Reliability of the investigation is unclear, given that:
    - Only one session of the investigation was conducted, and on only one day

*Possible suggestions on how to improve the investigation:*

- Improve reliability and accuracy of the investigation through:
  - Using a double-ring infiltrometer to control lateral flow of water during the investigation
  - Choice of more sites of different land uses to corroborate findings further
  - Repetition of investigation on the same day, near to Sites A and B respectively, and taking the average result
  - Having multiple sessions across several days and taking the average result.

*Levels marked using H2 Generic Level Descriptors for 9m DRQ on Theme 4.*

## Section B

## Theme 1: Tropical Environments

## Geomorphic Processes and Landscapes in Bohol, Philippines and Paracas, Peru

- 2 Resource 3 shows climographs for Bohol, Philippines and Paracas, Peru. Resource 4 shows Chocolate Hills, a limestone landscape in Bohol, Philippines, before and after an earthquake in 2013. Resource 5 is a map of ocean currents. Resource 6 shows landforms in Paracas National Park.

- (a) With reference to Resource 3, identify the climate classification of Bohol and Paracas.

[2]

Answer Guide:

- Bohol – Am/ tropical monsoon climate
- Paracas – Bwh/ tropical desert

*Point marked.*

- (b) With reference to Resources 3 and 4, explain how the landscape in Bohol, before the 2013 earthquake, may have been formed.

[8]

Indicative content:

- Landscape identification: cone and cockpit karst
- Why the Am climate contributes to landscape formation:
  - An abundance of rainfall is required as water is a key agent for the chemical weathering processes of carbonation and solution, and a sufficient amount of water is required to dissolve part of the rock. This therefore allows intense vertical solution to occur.
  - Also supports dense vegetation, hence providing an abundance of humic acids from decaying vegetation.
- Geological characteristics that favour landscape development – the nature of limestone:
  - Well-bedded and jointed → allowing for drainage of water along fractures and thus localised (concentrated) solution along these fractures
  - Comprises of calcium carbonate which is highly soluble
- Process of formation:
  - Cone karsts generally develop first from **dolines**, which are surface conical depressions formed essentially by the solution and/or collapse of underlying limestone strata.
  - Due to intense chemical weathering in the form of carbonation and solution, the dolines develop into **cockpits**. Neighbouring cockpits may ultimately overlap and merge.
  - Over time, the low residual hills marking the boundary of a cockpit are converted into cone-shaped rises by the expansion of cockpits from various sides.

Level	Marks	Descriptors
3	6 - 8	<ul style="list-style-type: none"> <li>• Response considers both the role of climate and geology in the formation of the landscape.</li> <li>• Detailed explanation of identified factors and how they</li> </ul>

		contribute the process of landscape formation. • Accurate identification of the landscape in Resource 4.
2	4 - 5	• Response considers <u>only</u> the role of climate <u>or</u> the role geology in the formation of the landscape. • Explanation of identified factors and how they contribute the process of landscape formation is provided, but weaker responses may lack depth in explanation. • Weaker responses may not accurately identify the landscape in Resource 4.
1	1 - 3	• Response may consider the role of climate <u>or</u> the role geology in the formation of the landscape, but response generally lacks depth, or appears descriptive. • Weaker responses may not accurately identify the landscape in Resource 4.
0	0	No creditworthy response

Levels marked.

- (c) Using evidence from Resource 4 and your own knowledge, suggest how the 2013 earthquake might have affected the landform shown in Resource 4. [6]

**Indicative content:**

- In general, earthquake has caused mass movements to occur on the slopes of the cone karst.
- In particular, based on the centre middleground of Resource 4 (after earthquake), it appears that a slide/ rotational slide/ slumping has occurred as there seems to be an arcuate or crescent-shaped head scarp at the top of the slope.
- Process:
  - Considering that the slopes of the cone karst are relatively steep, the effect of the tangential pull of gravity on slope materials is expected to be a significant, and accounts for a relatively high amount of shear stress.
  - Earthquake causes ground-shaking which may cause the slope materials to be loosened/ lose cohesiveness hence resulting in a reduction in shear strength.
  - The Am climate of Bohol also suggests that slope materials are likely to contain some amount of water content, thus increasing the likelihood of lubrication along the slide plane, reducing friction and shear strength.

Level	Marks	Descriptors
3	5 - 6	• Response makes reference to the mechanisms of shear stress and shear strength. • Specifies the effects of the earthquake on the landscape, and higher level responses would identify the type of mass movement accurately. • Detailed explanation of factors and how they lead to the occurrence of mass movements.
2	3 - 4	• Response may not make reference to the mechanisms of shear stress and shear strength consistently.

		<ul style="list-style-type: none"> <li>Specifies the effects of the earthquake on the landscape in general.</li> <li>Explanation of factors and how they lead to the occurrence of mass movements may be lacking in depth or breadth.</li> </ul>
1	1 - 2	<ul style="list-style-type: none"> <li>Response does not make reference to the mechanisms of shear stress and shear strength.</li> <li>Lack specification of the effect of the earthquake on the landscape or may be inaccurate.</li> <li>Explanation of factors may be lacking, or may contain errors.</li> </ul>
0	0	No creditworthy response

*Levels marked.*

**(d)** With reference to Resource 5, account for Paracas' rainfall characteristics. [4]

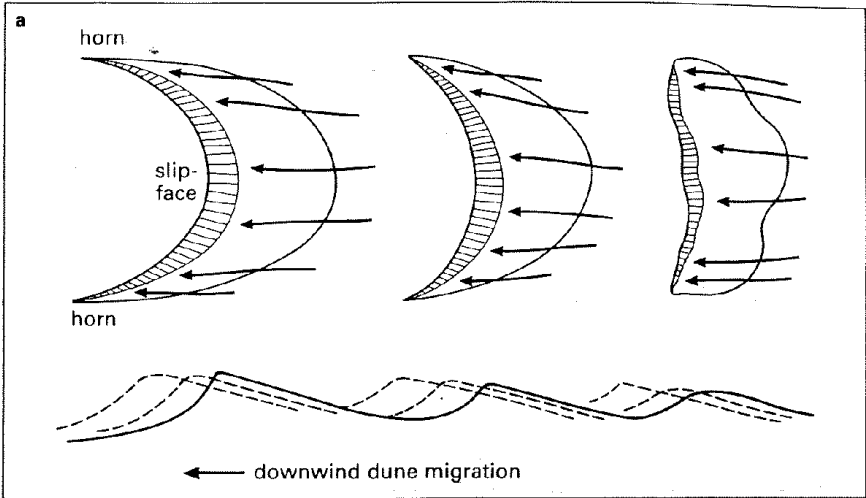
**Answer Guide:**

- Rainfall characteristic: low/ no rainfall throughout the year.
- Locational characteristic: coastal location, proximity to cold current
  - Cold current tends to cool the air above, lowering the capacity of the air to hold moisture (i.e. evaporation might be lower), hence, air tends to be dry and saturation is hard to be achieved. This limits the amount of rainfall received throughout the year.

**(e)** Explain how the landforms shown in in Resource 6 may have come about. [5]

**Answer Guide:**

- Landforms: barchan dunes
- Climatic conditions: aridity → limited presence of vegetation, hence allowing sand particles to be easily transported by wind, before they are eventually deposited to form various depositional features.
- Formation of barchans dunes:
  - Usually occurs where the wind blows consistently from one direction.
  - The dune begins as a small mound of sand, formed either by chance or on the lee side of an obstruction such as a rock or bush.
  - Once in existence, the dune will trap more sand blown in by the wind. The fresh sand will be transported up the gentle windward slope, over the dune crest, and onto the steep lee face of the dune – this will cause downwind migration of the dune. The rate of migration will be slowest at the centre of the dune (where it is highest) and more rapid at its extremities; as a result it will develop horns.



**Theme 2: Development, Economy and Environment****Wages of workers in the garment industry in Bangladesh**

- 3 Resource 7 shows wages in the garment industry for selected Asian countries. Resource 8 is an article on efforts to increase workers' wages in Bangladesh. Resource 9 is an extract from the website of Clean Clothes Campaign, the largest global alliance of labour unions and non-governmental organisations (NGOs) fighting for the improvement of working conditions and empowering garment industry workers.

- (a) With reference to Resource 7, compare the wage level of Bangladesh to the other Asian countries. [4]

**Answer Guide:**

Bangladesh	Basis of comparison	Other Asian Countries
<ul style="list-style-type: none"> <li>Lowest minimum wage level – US\$68</li> </ul>	<b>Lowest wage level</b>	<ul style="list-style-type: none"> <li>All above US\$68 – US\$70 – 165.</li> </ul>
<ul style="list-style-type: none"> <li>No/ little variation – appears to only be at US\$68.</li> </ul>	<b>Range of wage levels</b>	<ul style="list-style-type: none"> <li>Besides Cambodia, all display a range of wage levels.</li> <li>China has the largest range.</li> </ul>

- (b) Suggest reasons why transnational corporations (TNCs) in the garment industry may locate their operations in the countries listed in Resource 7. [5]

**Answer Guide:**

Context of Country/ Objective of TNC	Asset-orientation approach: TNCs aim to profit maximize by lowering cost of production	Market-orientation approach: TNCs aim to profit maximize by lowering cost of production
<b>Lower cost of production</b>	<ul style="list-style-type: none"> <li>TNCs locate functions in these LDCs/ emerging economies as labour cost/ land cost, etc., is relatively cheaper than their home countries or more developed countries.</li> <li>In addition, there might also be cost savings as state policies might incentivize investment by TNCs in the form of low corporate taxes, subsidies, etc.</li> </ul>	
<b>Large potential</b>		<ul style="list-style-type: none"> <li>The emerging</li> </ul>



market		economies in particular e.g. China/ India offer large markets as well as rising incomes which increases their potential as a viable market. Hence, TNCs locate in these countries to better meet the needs and improve sales to these markets.
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- (c) With reference to Resource 8 and your own knowledge, suggest possible impacts TNCs may have on their host economies. [6]

**Indicative content:**

- Impacts suggested from Resource 8:
  - Unsafe working conditions – collapse of factory building, leading to death of workers
  - Low wages for workers – partly due to desire of host economies to attract investments, state may keep minimum wage levels low. The dependence of the economies on these TNCs may also imply a lack of willingness to impose policies that would require TNCs to ensure safer conditions or increase wages, for fear that these TNCs would disinvest.
- Other impacts:
  - Capital injections
  - Technological and knowledge diffusion
  - Competition with domestic firms
  - Creation of employment opportunities
  - Environmental degradation

Level	Marks	Descriptors
3	5 - 6	<ul style="list-style-type: none"> <li>• Response makes good reference to Resource 8 in suggesting impacts.</li> <li>• Detailed explanation of how these impacts come about, both in relation to the objectives of the TNCs, as well as the context of the host economies.</li> </ul>
2	3 - 4	<ul style="list-style-type: none"> <li>• Response makes some reference to Resource 8 in suggesting impacts.</li> <li>• Explanation of how these impacts come about may lack depth or may be limited in considering the objectives of the TNCs, or the context of the host economies.</li> </ul>
1	1 - 2	<ul style="list-style-type: none"> <li>• Response makes limited reference to Resource 8 in suggesting impacts.</li> <li>• Largely descriptive response – little attempt to explain how these impacts come about.</li> </ul>
0	0	No creditworthy response

Levels marked.

- (d) With reference to Resource 8, explain why raising wages may not be necessarily beneficial for Bangladesh. [3]

**Answer Guide:**

- May lead to disinvestment of TNCs → revenue losses for Bangladesh; loss of employment
- May cause bankruptcy of local factories/ companies:
  - As local factories are likely to be small-scale operations with a small profit margin, they are unable to sustain high costs of production.
  - Also, some local companies serve as suppliers to TNCs → increasing wages would make them less competitive as they might need on to pass on these increases in cost of production to the TNCs → being footloose, TNCs may choose to switch suppliers, causing local companies to lose the partnership.

- (e) With reference to Resource 9 and your own knowledge, explain the role of non-state actors in influencing the global economy. [7]

**Indicative content:**

- Non-state actor in Resource 9: Clean Clothes Campaign
- Role in influencing global economy – in general:
  - As watchdog: holding institutions to account, promoting transparency and accountability → in this case, institution is H&M
  - As advocate: raising awareness of societal issues and challenges and advocating for change → in this case, highlighting the fact that H&M has not kept to the promise to ensure “Living Wages” for its workers
  - As representative: giving power to the voice of the marginalized or under-represented → in this case, Clean Clothes is fighting for the under-paid workers in H&M’s global production networks
- How global economy might be influenced:
  - Initiates and encourages social movements of collective action – in this case, to prompt TNCs to commit to and implementing a reasonable minimum wage for their workers.
  - By tapping on social media and “organizing” social media communities, efforts are not limited by physical or legal structures, hence increasing scope of influence.
  - Hence, overall impact on global economy might be to improve the impacts of TNCs on its host economies.

Level	Marks	Descriptors
3	6 - 7	<ul style="list-style-type: none"> <li>• Response demonstrates accurate knowledge of the role of non-state actors in the context of the global economy.</li> <li>• Response makes good reference to Resource 9 to illustrate the role of non-state actors.</li> <li>• Detailed explanation of how the global economy is influenced/ potentially affected by the actions of non-state actors.</li> </ul>

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<b>2</b>	<b>3 – 5</b>	<ul style="list-style-type: none"><li>• Response demonstrates knowledge of the role of non-state actors in the context of the global economy, but some inaccuracies may be present.</li><li>• Response makes some reference to Resource 9 to illustrate the role of non-state actors.</li><li>• Explanation of how the global economy is influenced/potentially affected by the actions of non-state actors is present, but weakest level responses may lack depth.</li></ul>
<b>1</b>	<b>1 - 2</b>	<ul style="list-style-type: none"><li>• Response is largely descriptive, listing facts from Resource 9 with little attempt to explain how these show the role of non-state actors in the context of the global economy.</li><li>• Response lacks clarity and focus on the question.</li></ul>
<b>0</b>	<b>0</b>	No creditworthy response

*Levels marked.*

### Theme 3: Sustainable Development

#### Urban Liveability in Ahmedabad, India

- 4 Ahmedabad, the former capital of the Indian state of Gujarat, is one of the most populous cities in the country as of 2011. It also houses a key urban reimagining project implemented along the Sabarmati River, an important source of water for the city.

Resource 10 shows the trends in slum population in various states in India from 2001 to 2011. Resource 11 shows the distribution of informal settlements in Ahmedabad. Resource 12 shows the main features of urban reimagining of the Sabarmati River in Ahmedabad. Resource 13 is an extract on impacts of urban reimagining of the Sabarmati Riverfront in Ahmedabad.

- (a) Compare the trends in slum population between Gujarat and Delhi from 2001 to 2011 with reference to Resource 10. [3]

#### Answer Guide:

Gujarat	Basis of comparison	Delhi
Gujarat experienced an <b>increase</b> in total slum population of 333,386 people.	<b><i>Change in total slum population from 2001 to 2011</i></b>	Delhi experienced a <b>decrease</b> in total slum population of 240,500 people.
Both states experienced a <b>decrease</b> in slum population as a proportion of total population: <ul style="list-style-type: none"> <li>Proportion of slum population in Gujarat experienced a drop from 11.7% to 2.8%.</li> </ul>	<b><i>Change in slum population as a proportion of total population</i></b>	Both states experienced a <b>decrease</b> in slum population as a proportion of total population: <ul style="list-style-type: none"> <li>Proportion of slum population in Delhi experienced a drop from 18.5% to 10.6%.</li> </ul>

- (b) Describe the distribution of the range of informal settlements in Ahmedabad in 2001 using Resource 11. [4]

#### Answer Guide:

- The **old city** is located in the **centre of the city**, **directly next to the eastern bank of the major water body** running through Ahmedabad.
- Informal developments** are **located within a 10km radius of the city centre**. These are mainly in the **eastern region** of the city, radiating outwards from the Old City.
- Gamtals** are distributed further afield, within a **6 – 12km radius from the city centre**.
- A number of **informal developments and gamtals** follow the major roads that radiate from the city centre.

*Point marked – 2 marks awarded for each accurate observation-evidence pairing.*

- (c) With reference to Resource 11, suggest reasons for the distribution of the range of informal settlements in Ahmedabad in 2001. [5]

#### Answer Guide:

#### *Possible points that might be raised:*

Distribution	Reasons
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Location in centre of city	<ul style="list-style-type: none"> <li>• <b>Increased mobility and accessibility</b> around the city, especially to jobs which are located in the city centre</li> </ul>
Location near major transport networks	<ul style="list-style-type: none"> <li>• <b>Affordability of location</b>, as slum dwellers are likely not to be able to commute to and from distant locations each day for formal employment</li> </ul>
Location near major water body	<ul style="list-style-type: none"> <li>• Acts as a <b>source of (clean) water</b> for the slum dwellers for <b>daily activities such as cleaning, cooking and drinking</b>, as the slum dwellers may not have infrastructure for potable water within their dwellings.</li> </ul>
Gamtals' location further away from city centre	<ul style="list-style-type: none"> <li>• <b>Urban sprawl / expansion of urban areas over time</b> as the size of the city and the number of urban dwellers grow, such that even village areas have been incorporated into the city, as seen from Resource 4.</li> </ul>

Levels marked (see level descriptors below):

Level	Marks	Descriptors
3	4-5	<ul style="list-style-type: none"> <li>• Response identifies <b><u>at least 2 reasons</u></b> for distribution of informal settlements in Ahmedabad.</li> <li>• Response provides a detailed and appropriate explanation of the reasons for the distribution of informal settlements in Ahmedabad. In addition, reasons are clearly linked to specific described trend(s), rather than generic reasons.</li> <li>• Use of Resource 4 [specific trends identified in part (b) especially] to support identification of reasons throughout the response. Demonstrates understanding of reasons for distribution of informal settlements from own knowledge.</li> </ul>
2	2 – 3	<ul style="list-style-type: none"> <li>• Response identifies <b><u>at least 2 reasons</u></b> for distribution of informal settlements in Ahmedabad.</li> <li>• Response provides appropriate explanations of suggested reasons for the distribution of informal settlements in Ahmedabad. However, explanations may not be detailed. Reasons provided may be generic, instead of being referenced to a specific trend.</li> <li>• Use of Resource 4 to support identification of reasons in response is present, but not consistently. Demonstrates some understanding of reasons for distribution of informal settlements from own knowledge, but may not be fully accurate.</li> </ul>
1	1	<ul style="list-style-type: none"> <li>• Response only identifies 1 reason for distribution of informal settlements, OR may identify at least 2 reasons which are inappropriate. Reasons suggested are not elaborated on.</li> <li>• Reasons provided may be generic, instead of being</li> </ul>

		referenced to a specific trend. • Minimal reference to Resource 4, if at all.
0	0	No creditworthy response

- (d) With reference to Resource 12, explain **two** ways in which urban reimagining of the Sabarmati Riverfront might have helped enhance urban liveability in the area. [4]

**Answer Guide:**

- Environmental liveability:
  - Improves sanitation and waste management in the area with the incorporation of industrial sewerage outlets, the Pirana landfill site, and the Pirana sewage treatment plant along the Sabarmati River.
- Social liveability:
  - Provides public spaces for interaction and community gatherings to improve conviviality, as seen from upper level of Promenade which acts as a space to host various activities, and various parks and plazas along the Sabarmati Riverfront
  - Conservation and promotion of cultural heritage through conservation of traditional market (Ravivari, a 606-year old traditional flea market)
- Economic liveability:
  - Public spaces for gatherings to host events & activities (e.g. Ravivari – vendors are able to earn an income through the formal incorporation of the flea market into the riverfront)

*Point marked – 2 marks awarded for each well-developed explanation, with clear identification of the aspect of liveability that is improved.*

- (e) Using Resources 12 and 13 and your own knowledge, evaluate the extent to which urban reimagining along Sabarmati Riverfront has improved the lives of slum dwellers in Ahmedabad. [9]

**Answer Guide:**

*Possible points for evaluation:*

- Arguments supporting the view that the lives of slum dwellers have improved can point to any of the reasons seen in Resource 5 - especially the improvement of **environment liveability** through improved sanitation and waste management, and improvement of **economic liveability** through the conservation of the traditional flea market which some slum dwellers are likely to be engaged in. Some of these points are corroborated in Resource 6 – e.g. “cleaner waterway” and the incorporation of the “interceptor sewerage system” which enhances environmental liveability.
- Arguments against the view that the lives of slum dwellers have improved can point to the following that are evident in Resource 6:
  - Displacement of slum dwellers, which separates them from their homes, livelihoods and way of life (thus negatively affecting social and economic liveability)
  - Resettlement projects do not meet the need of slum dwellers, negatively affecting social and economic liveability as well (similar points to displacement of slum dwellers).

*Levels marked using H2 Generic Level Descriptors for 9m DRQ on Theme 1, 2 or 3.*