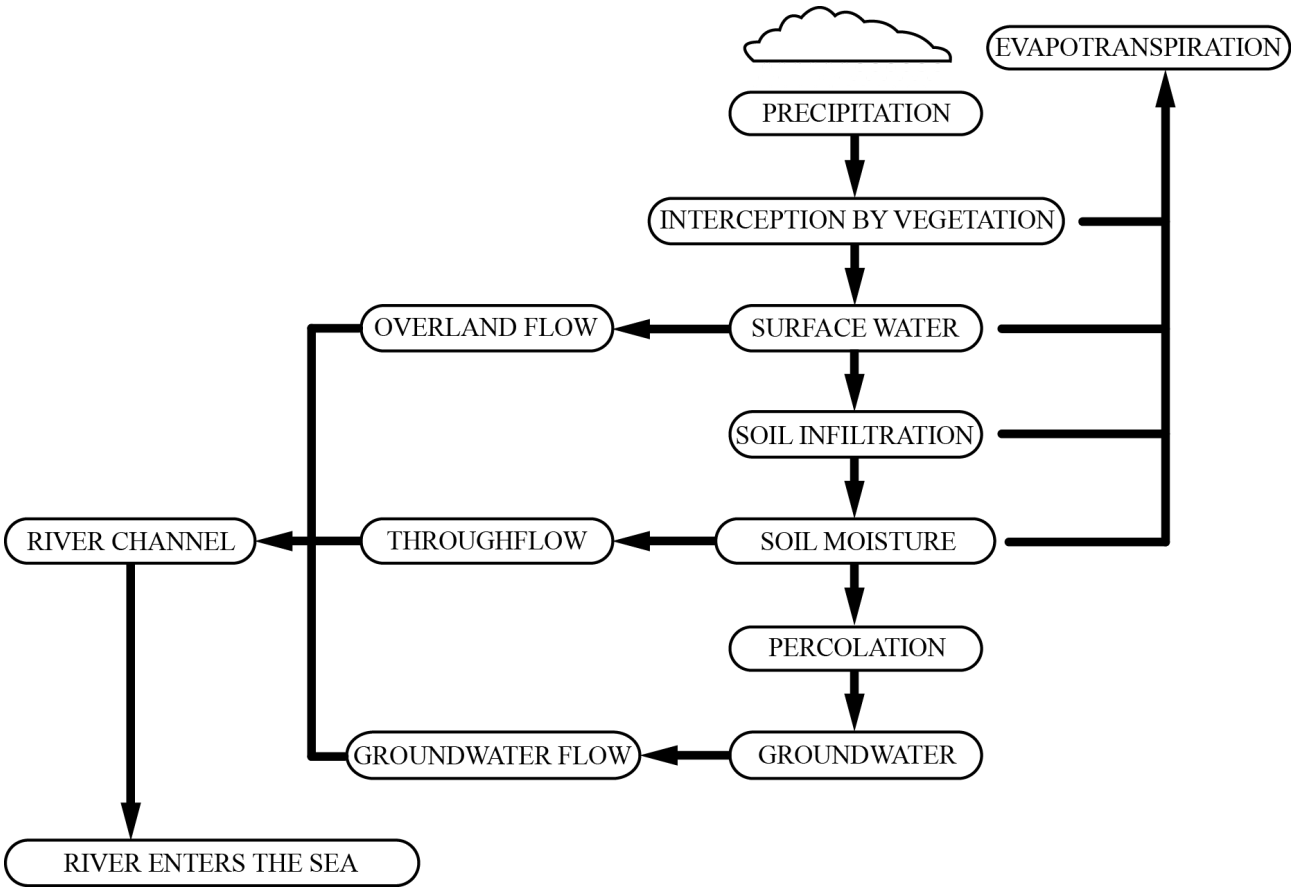
HL Paper 2

The diagram shows the inputs, outputs, stores and transfers that occur within a drainage basin as an open system.



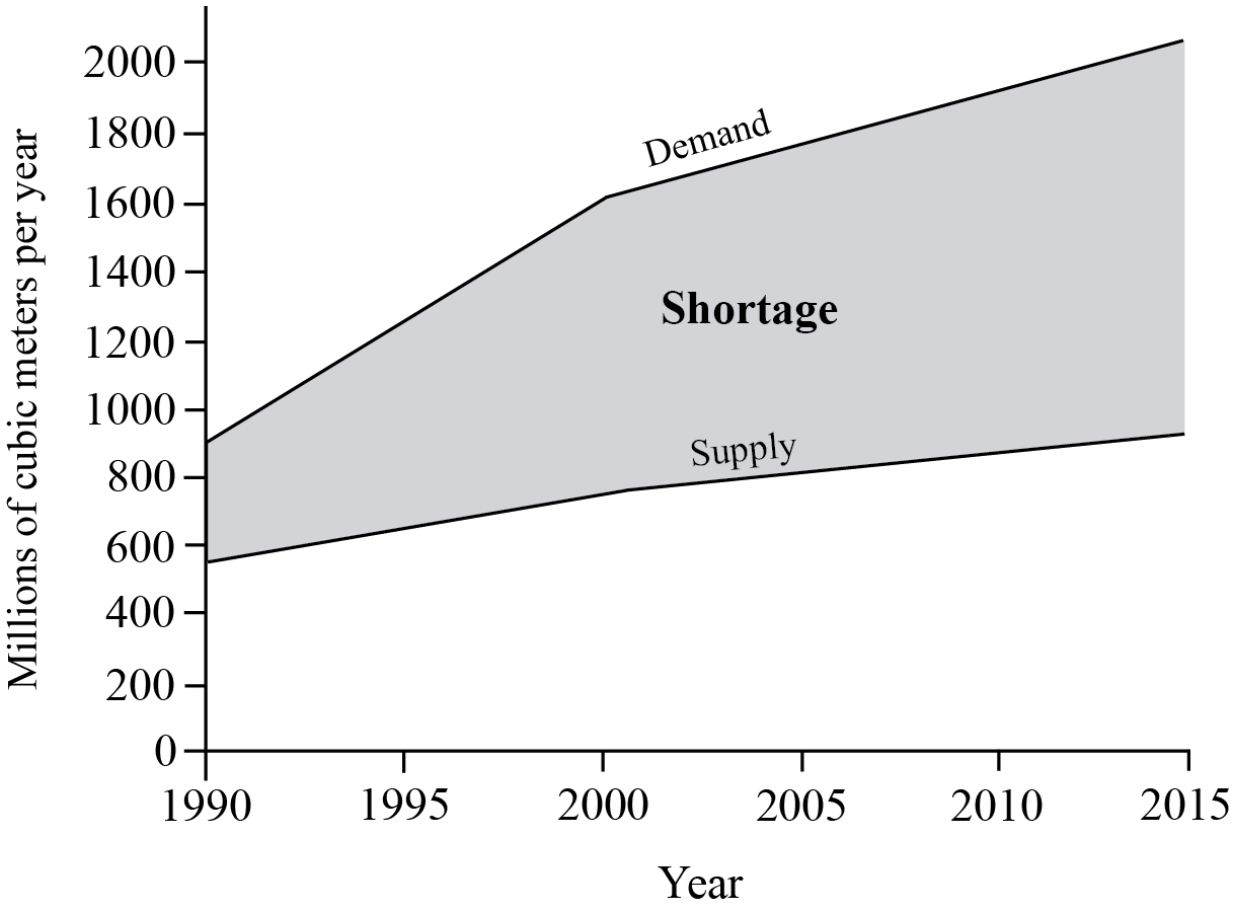
[Source: adapted from http://www.bbc.co.uk/scotland/education/int/geog/rivers/images/basin/diag_processes.gif]

a. Identify **two** transfers and **two** stores shown in the diagram. [2+2]

b. Explain **three** ways in which human activity can reduce the time taken for water to pass through the system. [2+2+

c. Examine how an international conflict has arisen as a result of competing demands for freshwater. [10]

The graph shows the supply and demand for water in an unnamed country from 1990 to 2015.



[Source: adapted from an edited version of *Water Pollution Control – A Guide to the Use of Water Quality Management Principles* (1997), WHO/UNEP]

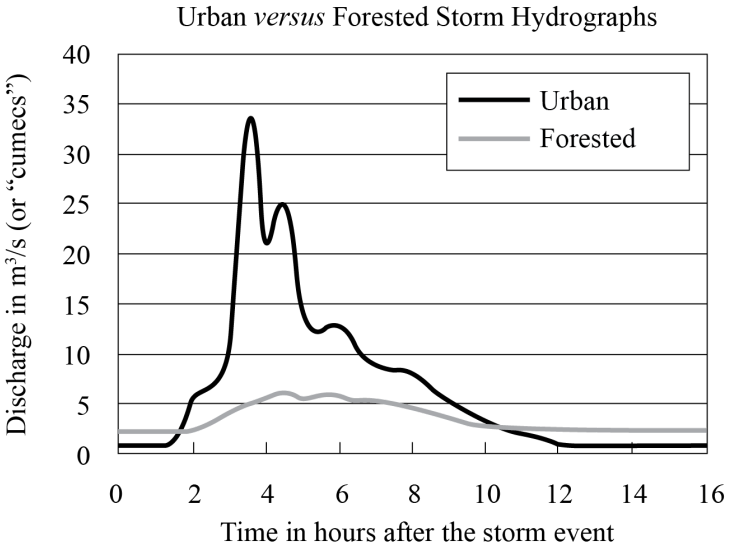
a. Describe the trend in water shortage between 1990 and 2015 shown on the graph. [2]

b. Suggest possible reasons for the changes in supply between 1990 and 2015 shown on the graph. [2]

c. Analyse **two** competing demands for water in a named river basin. [6]

d. Referring to **one or more** examples, examine the environmental effects of ground water abstraction and irrigation. [10]

The diagram shows the response of a stream in an urban area compared with that of a stream in a neighbouring forested area after the same rainstorm event. (The basins are of similar size and drainage density.)



[Source: www.mdsg.umd.edu/images/uploads/siteimages/CQ/V07N2/urban_forest_hydrograph]

a. Describe **four** differences between the two hydrographs shown on the diagram. [4]

b. Suggest reasons why the urban and forested hydrographs show different responses to the storm event. [6]

c. With reference to a named river flood event, examine the relative importance of natural and human causes. [10]

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a. Draw a labelled diagram to show the main features of an artesian basin. [4]

b. Explain the environmental impacts caused by groundwater abstraction. [6]

c. Evaluate the success of the management strategies used in **one** named wetland area. [10]

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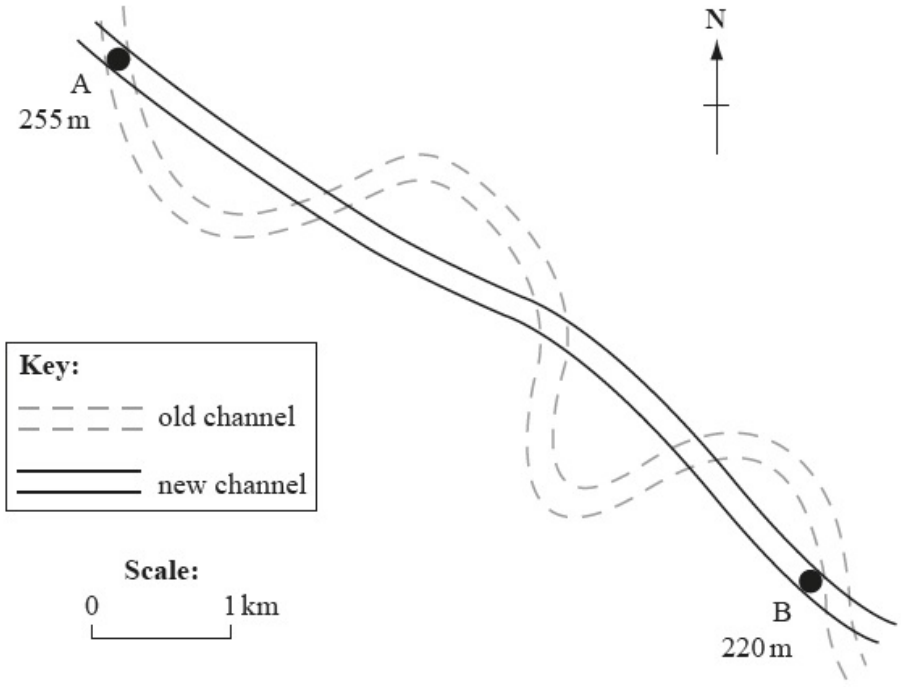
a. Define the terms *drainage divide* **and** *wetlands*. [4]

b. Explain how stream discharge is related to channel size **and** shape. [6]

c. Using examples, examine the hydrological impacts that can result from the construction of a dam and reservoir across a river channel. [10]

The diagram shows the changes in a river channel following implementation of a management strategy.



a. Define the term *stream discharge*. [2]

b. (i) State the direction towards which the river is flowing at B. [8]

(ii) State **three** changes to the river channel that result from this management strategy.

(iii) Explain **one** benefit **and one** problem for people that might result from this management strategy.

c. Examine the benefits **and** problems of different river management strategies (**other than** that shown in the diagram). [10]

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a. Draw a labelled diagram of a hydrograph. [4]

b. Explain how hydrographs are used to forecast floods. [6]

c. "Dams and reservoirs create as many problems as they solve." Discuss this statement with reference to multi-purpose schemes. [10]

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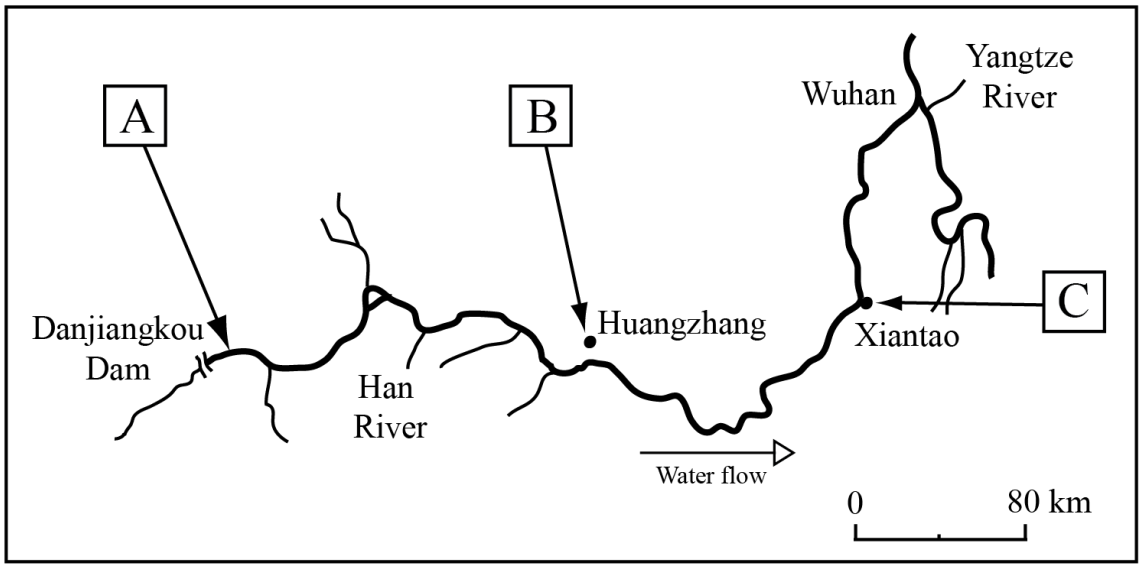
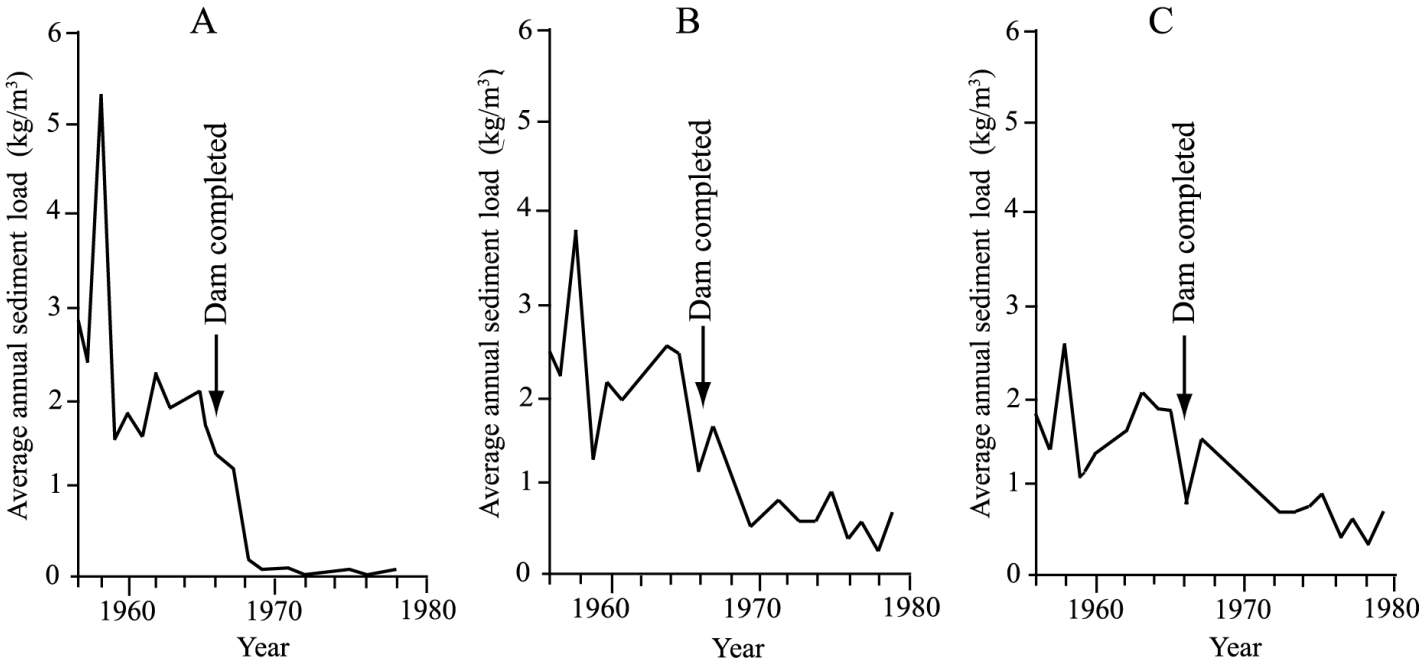
b. Explain **three** factors that may produce a short time lag on a storm hydrograph. [6]

c. Compare the effectiveness of alternative stream management strategies, **other than** dams. [10]

The map shows the location of the Danjiangkou Dam on the Han River in China. The graphs show the sediment loads at three places (A, B, C) downstream of the dam.





[Source: Nick Middleton (1999), *The Global Casino*, Arnold]

ai. State the year when the highest sediment load occurred. [1]

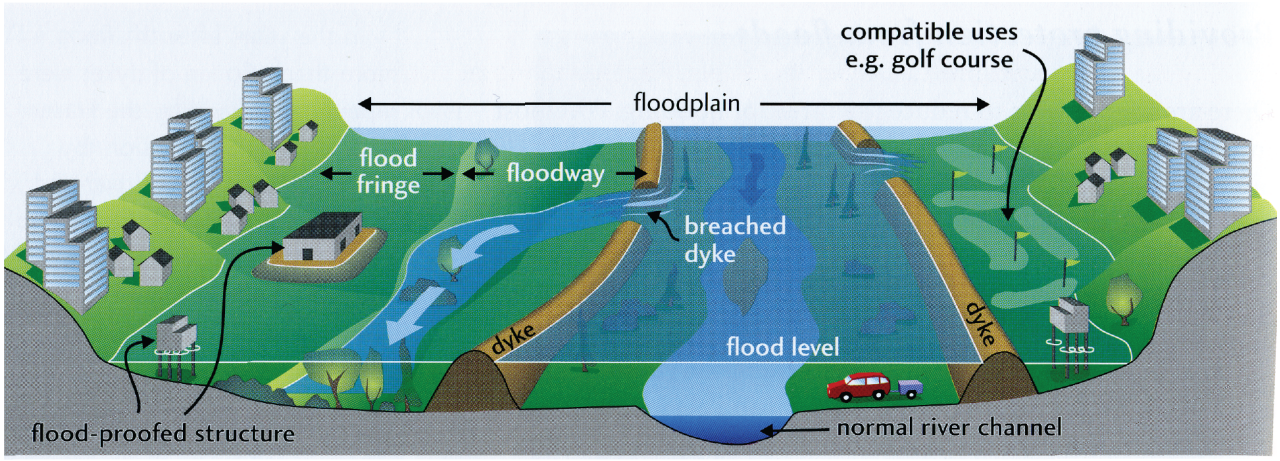
aii. State the volume of sediment load in that year at Huangzhang. [1]

b. Identify **three** ways in which the load of a river is transported and briefly describe **one** of these ways [3]

c. Referring to the map and graphs, explain how the construction of the Danjiangkou Dam affected sediment loads along the Han River. [5]

d. Examine the influences of physical factors and human activity on a specific river flood. [10]

The diagram shows a river floodplain.



[Source: John Clague and Bob Turner, (2003), *Vancouver, City on the Edge*, Tricouni Press, page 74]

a. Referring to the diagram, briefly describe **two** floodplain management strategies. [2+2]

b. Explain how human activities on a floodplain can increase the probability of flooding. [6]

c. "Eutrophication is the most damaging agricultural impact on water quality." Discuss this statement. [10]

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a. Outline how water is transferred through a drainage basin by: [4]

(i) infiltration;

(ii) throughflow.

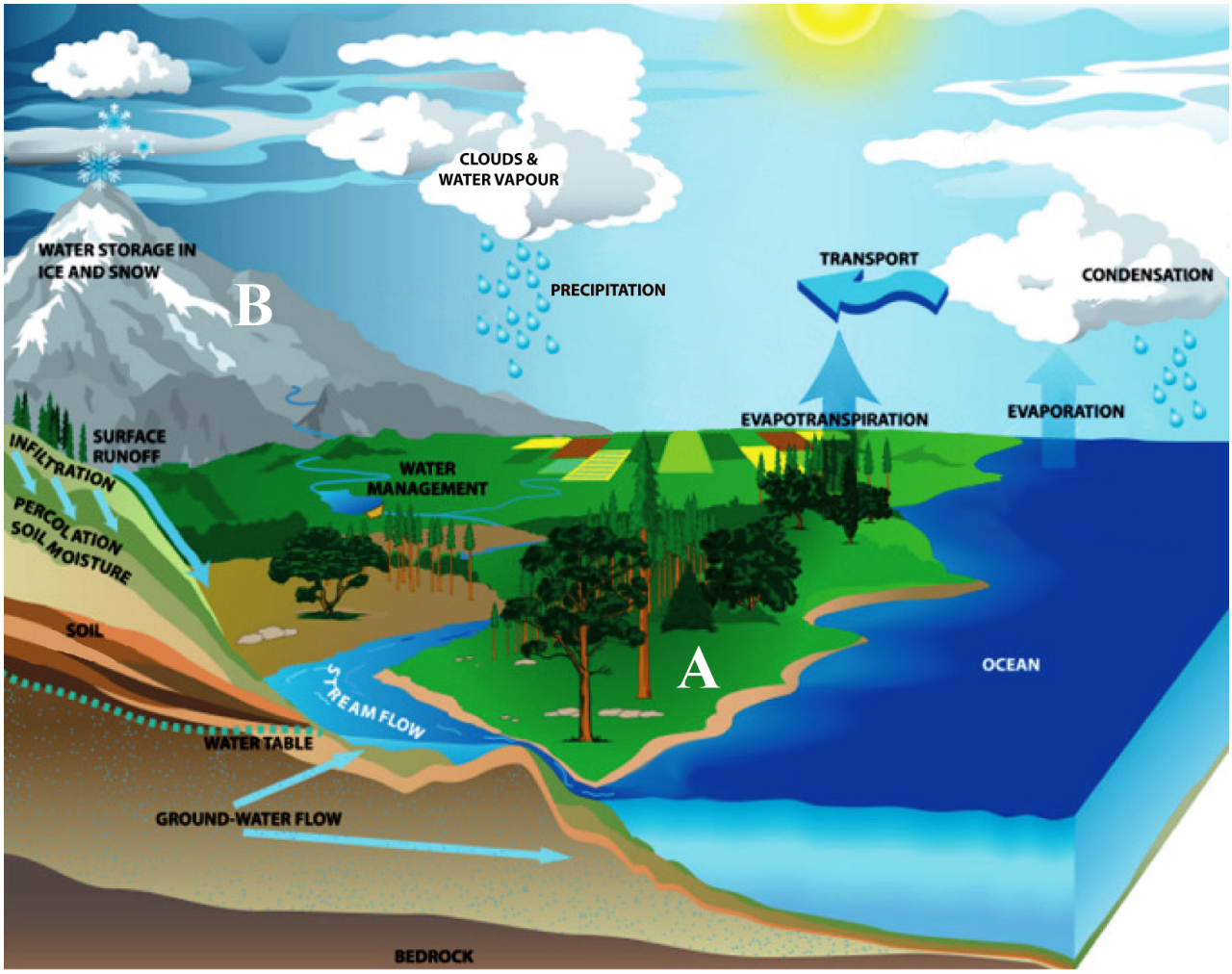
b. Suggest how a change in the balance of water stored in oceans and ice could result in: [6]

(i) **one** environmental consequence with **positive** effects for people;

(ii) **one** environmental consequence with **negative** effects for people.

c. "The benefits gained from the construction of large dams outweigh any costs." Discuss this statement with reference to **one or more** major dams. [10]

The diagram shows the main features of the hydrological cycle.



[Source: http://allritewaterconditioning.com/prosite/Whats_In_your_Water]

a. Describe **two** conditions at point A which would make infiltration rates higher than at point B. [2x2]

b. Explain the consequences of a decrease in the amount of water stored in ice in the hydrological cycle at any stage. [6]

c. "Strategies adopted to meet the competing demands for water are not always effective." Discuss this statement with reference to **one** named river basin. [10]

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a. Describe **two** characteristics of natural levées. [4]

b(i) Define the term *wetlands.* [2]

b(ii) Explain **two** reasons why some wetlands are protected. [4]

c. "Multi-purpose schemes result in more benefits than problems." Discuss this statement, referring to both physical **and** human impacts. [10]

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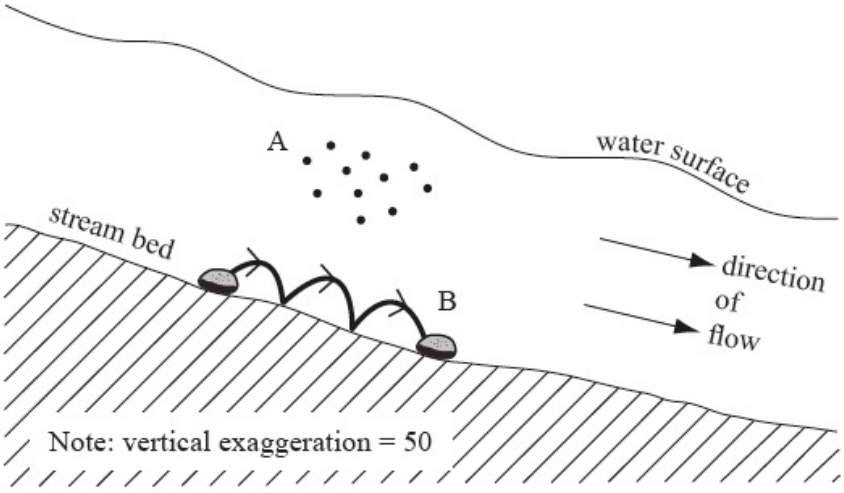
a. (i) Define the term *stream discharge*. [5]

(ii) State **two** river transport processes **and** outline how each process operates.

b. Explain how hydrographs can be used to forecast **and** manage flooding. [5]

c. Examine the possible impacts of the mismanagement of groundwater resources. [10]

The diagram shows two transport processes that operate in a river channel.



a. Identify **and** describe process A **and** process B shown in the diagram. [4]

b. Draw a labelled diagram to show the main input, outputs, transfers and stores of the hydrological cycle for an **un-vegetated** drainage basin. [6]

c. "Of all the impacts of agriculture on water quality, salinization is the most damaging." Discuss this statement. [10]

---

a. Outline **two** ways in which sediment is transported by a river. [4]

b.i. Using **one named** example of an international conflict related to freshwater, briefly explain **one** cause of the conflict. [2]

b.ii. Using **one named** example of an international conflict related to freshwater, briefly explain **two** consequences of the conflict. [4]

c. Examine how human activity influenced the severity of **one named** river flood event. [10]

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a. Outline **two** environmental problems that may occur downstream from multi-purpose dams. [4]

b. Define the concept of "maximum sustainable yield" of freshwater. [2]

c. With reference to **one named** river basin, explain **two** strategies that have been adopted to meet competing demands for water. [4]

d. "The negative consequences of river flooding always outweigh the benefits." Discuss this statement. [10]

a. Describe **two** processes involved in the transport of a river's load. [2+2]

b. Explain **two** environmental impacts of agriculture on water quality. [3+3]

c. "Floodplain management strategies have more costs than benefits." Discuss this statement. [10]

The map extract shows an area in western Mexico. The scale of the map is 1:250 000 and the contour interval is 100 metres.

[Source: Extract from a map of Tepic, Mexico (F13 – 8), produced by Instituto Nacional de Estadística y Geografía (INEGI), www.inegi.org.mx
]

CONTOUR INTERVAL 100 METRES

SCALE FOR MAP 1:250 000

5 4 3 2 1 0 Kilometres 10 20

KEY/LEGEND FOR MAP

POPULATIONS

LOCALITY ○

WITH MORE THAN 500 000 INHABITANTS

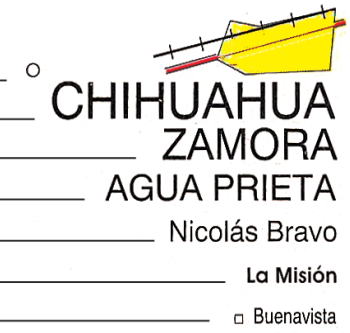
50 001 TO 500 000 INHABITANTS

15 001 TO 50 000

2501 TO 15 000

LESS THAN 2501 INHABITANTS

TEMPORARY LOCATION OR NAME OF PLACE



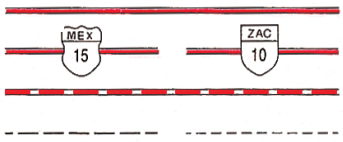
TERRESTRIAL ROUTES

PAVED ROAD

STATE OR FEDERAL ROAD NUMBER SIGNPOSTING

UNPAVED ROAD/DIRT TRACK

BREACH, PATH



REPRESENTATION OF THE RELIEF

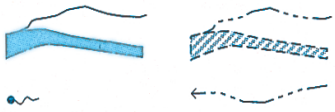
CONTOUR LINE IN METRES

NORMAL CONTOUR LINE

HYDROGRAPHIC CHARACTERISTICS

BODY OF WATER: PERENNIAL, INTERMITTENT

SPRING, DISAPPEARING CURRENT



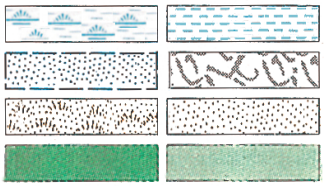
OTHER AREAS

MARSH, LAND SUBJECT TO FLOODING

SALT MINES, MALPAIS

DUNES, SANDY AREA

DENSE VEGETATION, GREEN URBAN AREA



OTHER CULTURAL CHARACTERISTICS

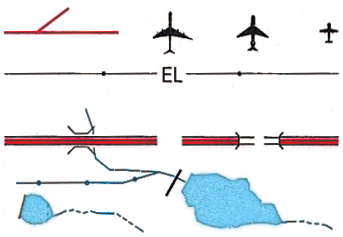
RUNWAY, AIRPORT: INTERNATIONAL, NATIONAL, LOCAL

ELECTRIC TRANSMISSION LINE WITH ELECTRICITY PYLONS

BRIDGE, TUNNEL

CANAL, DAM

BORDER (EARTH RIDGE FOR CONTROLLING FLOW OF IRRIGATION)



a. Describe the geographical characteristics of the Río Grande de Santiago downstream from La Presa. [4]

b. Analyse how the freshwater resources shown in box A on the map could be used for different purposes. [6]

c. "People should not try to prevent rivers from flooding." Discuss this statement. [10]

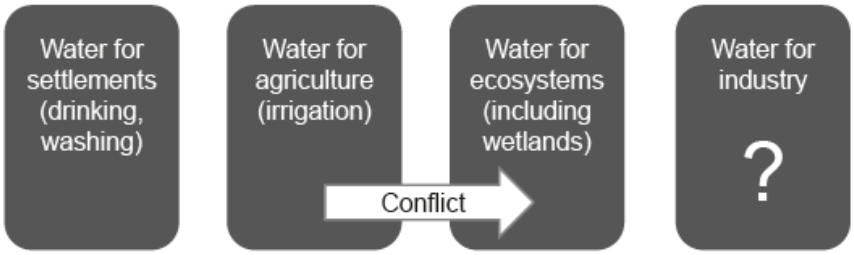
a. (i) Briefly outline how the natural recharge of an aquifer takes place. [4]

(ii) State **two** methods that can be used to artificially recharge an aquifer.

b. Suggest how **three** human modifications of a floodplain can help to reduce flooding. [6]

c. Evaluate the strategies that have been used to resolve competing demands for water in **one named** river basin [10]

The diagram shows competing water demands and water conflict in a river basin.



[Source: © International Baccalaureate Organization 2015]

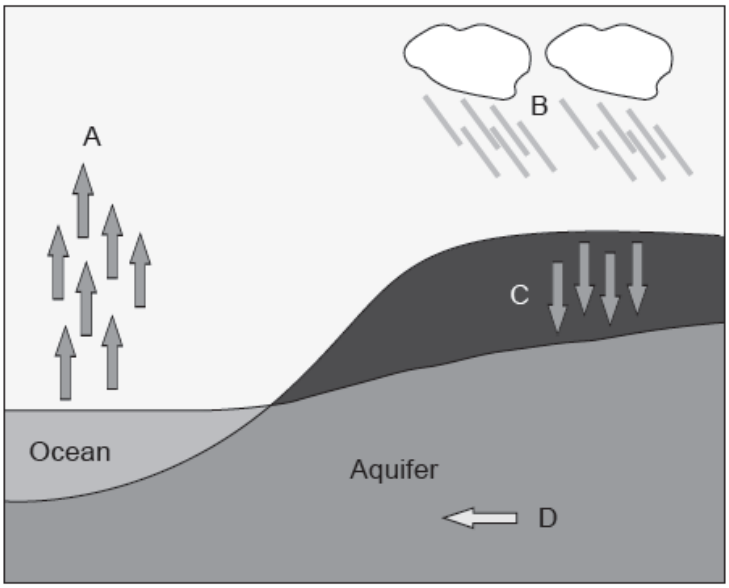
a. State **two** possible uses of water for industry. [2]

b. Outline **two** possible reasons for the conflict shown. [4]

c. Explain how a drainage basin functions as an open system. [4]

d. Compare the importance of river erosion and deposition in the development of floodplain landforms. [10]

The diagram shows some possible water movements in the hydrological cycle.



[Source: © International Baccalaureate Organization 2018]

a.i. State the **four** elements of the hydrological cycle labelled A–D. [2]

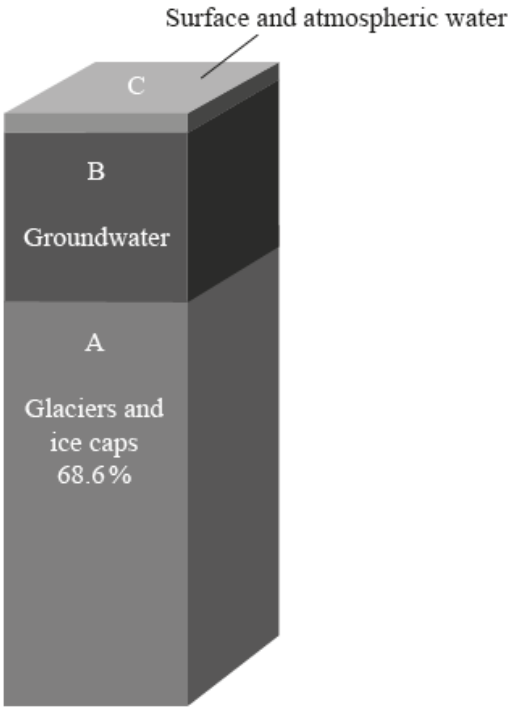
a.ii. State **two** possible methods of artificially recharging the aquifer. [2]

b. Explain **three** possible ways people may modify a river channel to increase the flow of water. [6]

c. To what extent has the management of **one** major wetland area been successful? [10]

Option A — Freshwater – issues and conflicts

1. The diagram shows the three main sources of freshwater on Earth.



[Source: *Water in Crisis to the World Fresh Water Resources* by Gleick (1993) Fig. "Distribution of Earth's Water" from Chp. "World fresh water resources" by Shiklomanov. By permission of Oxford University Press, Inc.]

a. (i) Define the term *groundwater*. [2]

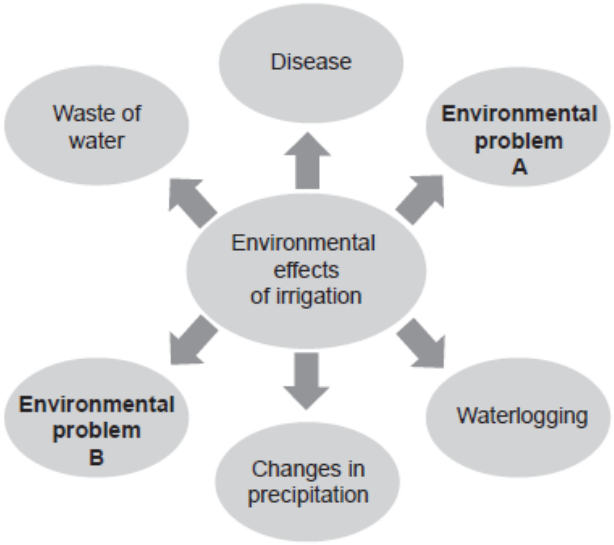
(ii) Estimate the percentage of groundwater shown on the diagram.

b. State **two** major types of natural surface freshwater (other than rivers). [2]

c. Explain **three** consequences of a reduction in the volume of ice caps. [6]

d. Discuss the relative importance of the factors affecting the characteristics of hydrographs. [10]

The diagram below outlines environmental problems for agriculture associated with the overuse of irrigation water.



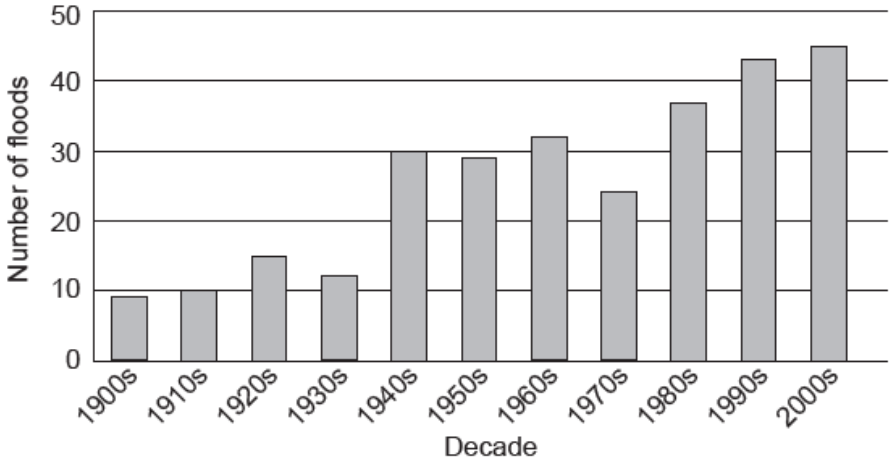
[Source: copyright International Baccalaureate Organization, 2015]

a. State **and** briefly outline what environmental problem A **and** environmental problem B could be. [4]

b. Using **one named** example, briefly explain **one** cause and **two** consequences of an international conflict related to freshwater. [6]

c. "Natural factors are always more important than human factors in causing a river flood." Discuss this statement with reference to **one named** example. [10]

The graph shows the number of floods per decade for a river.



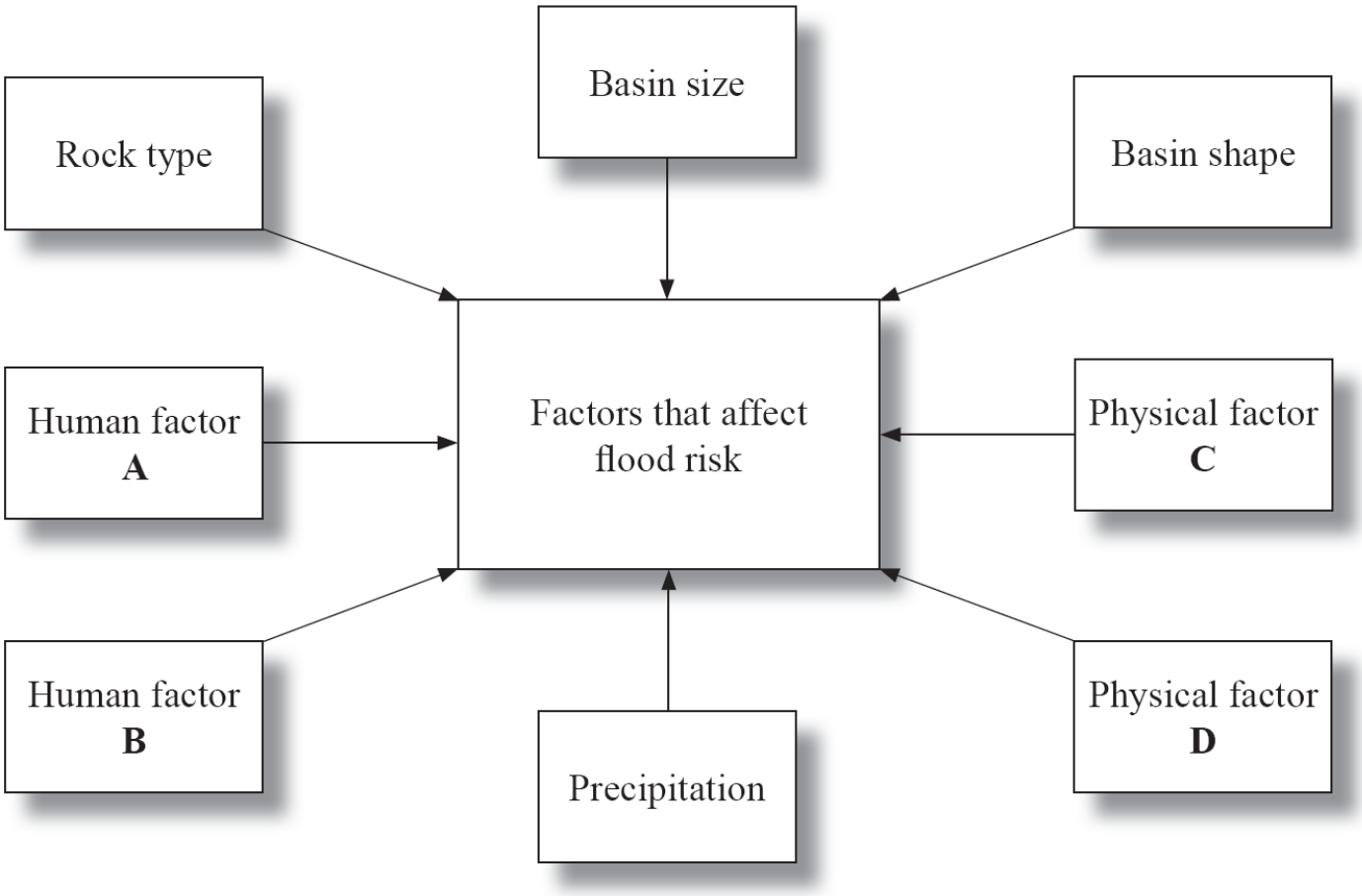
[Source: copyright International Baccalaureate Organization, 2016]

a. (i) Describe the changes in flood frequency shown on the graph. [4]

(ii) Estimate how many more floods occurred in the 1990s than in the 1930s.

b. Suggest **one** physical reason **and one** human reason why the risk of a river flooding can change over time. [6]

c. To what extent are floodplain landforms the result of river deposition? [10]



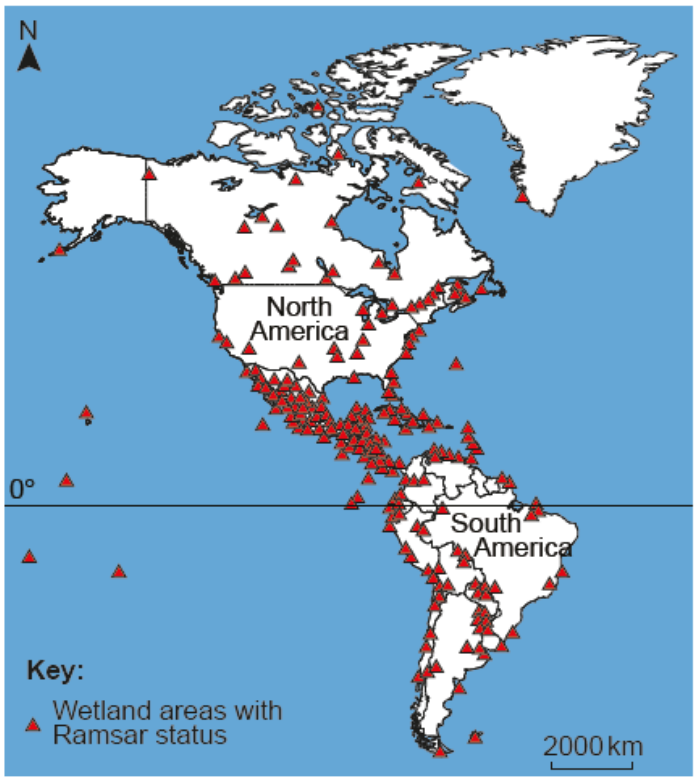
[Source: ©International Baccalaureate Organization 2013]

a. Identify possible human factors A and B and possible physical factors C and D. [4]

b. Explain how **two** physical factors other than precipitation can affect the magnitude of floods. [6]

c. "River management strategies always result in unwanted impacts." Using examples, discuss this statement. [10]

The map shows the distribution of wetland areas in the Americas that have been given Ramsar status. The Ramsar Convention is the convention on wetlands of international importance.



[Source: adapted from www.gislounge.com]

a. (i) Define the term *wetland area*. [5]

(ii) Describe the pattern of wetland areas shown on the map.

b. (i) State **one** component of agricultural run-off that contributes to the eutrophication of lakes and wetlands. [5]

(ii) Suggest **two** impacts of eutrophication that can have adverse effects for people.

c. "The drainage basin is an open system with inputs, outputs, transfers and stores." Discuss how this knowledge helps people to prevent flooding. [10]

Option A — Freshwater – issues and conflicts

The photograph shows the course of a river that flows into a lake.

[Source: ©International Baccalaureate Organization 2015]

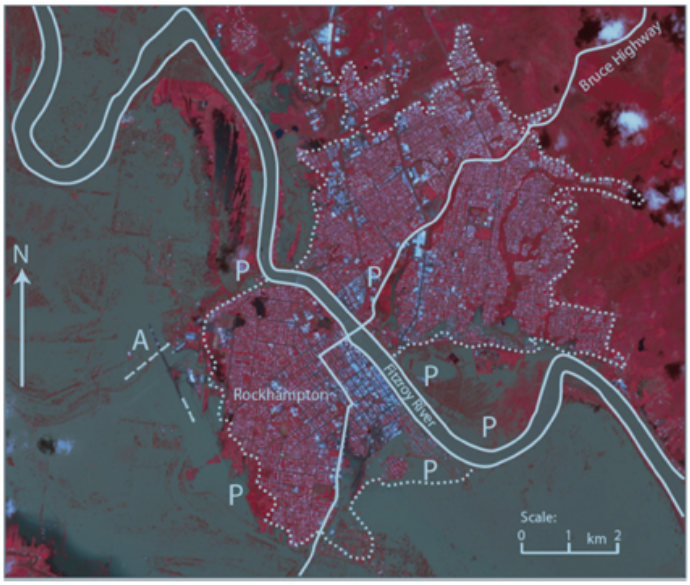
a. Referring to photographic evidence, identify **and** briefly describe **two** natural features of the river valley floor clearly shown in the photograph. [4]

b. Suggest **three** ways in which humans might modify the floodplain shown in the photograph to reduce flood risk. [6]

c. "Wetland management strategies are never a complete success." Discuss this statement, with reference to **one named** major wetland. [10]

Optional Theme A — Freshwater – issues and conflicts

1. The satellite image shows the area around the Australian city of Rockhampton flooded by the Fitzroy River in 2011.



Key to colours:

vegetation	Bruce Highway
water	normal channel of Fitzroy River
edge of city	A airport
airport runways	P park

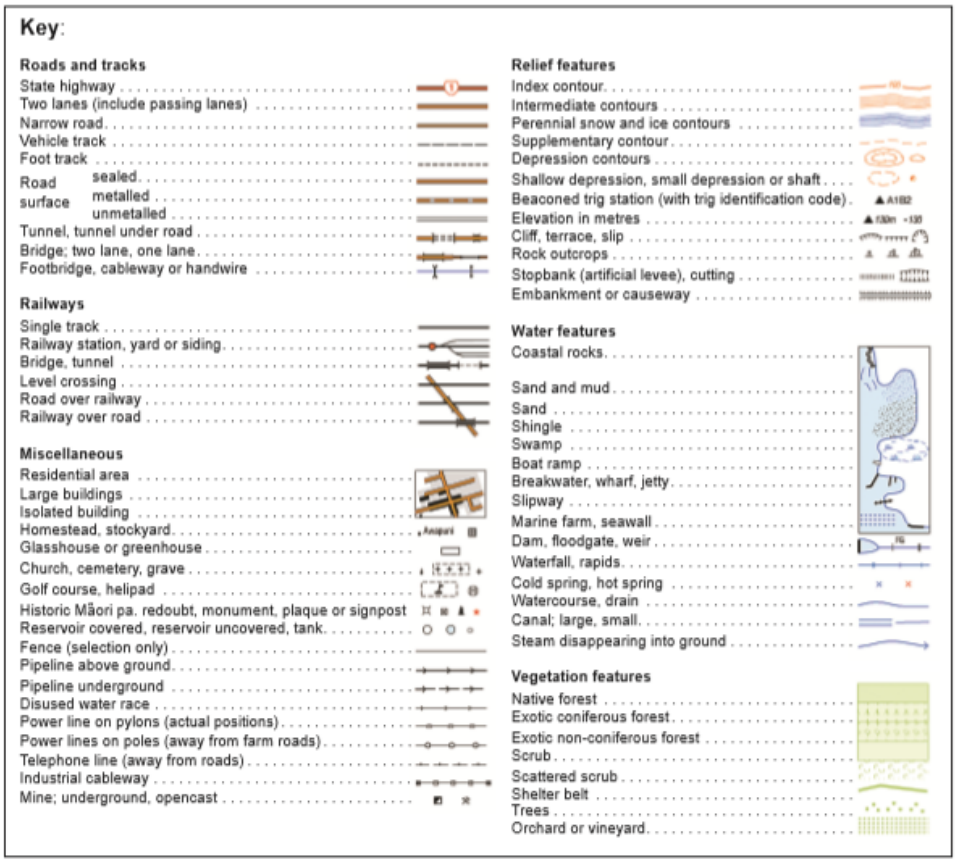
[Source of underlying image: www.earthobservatory.nasa.gov]

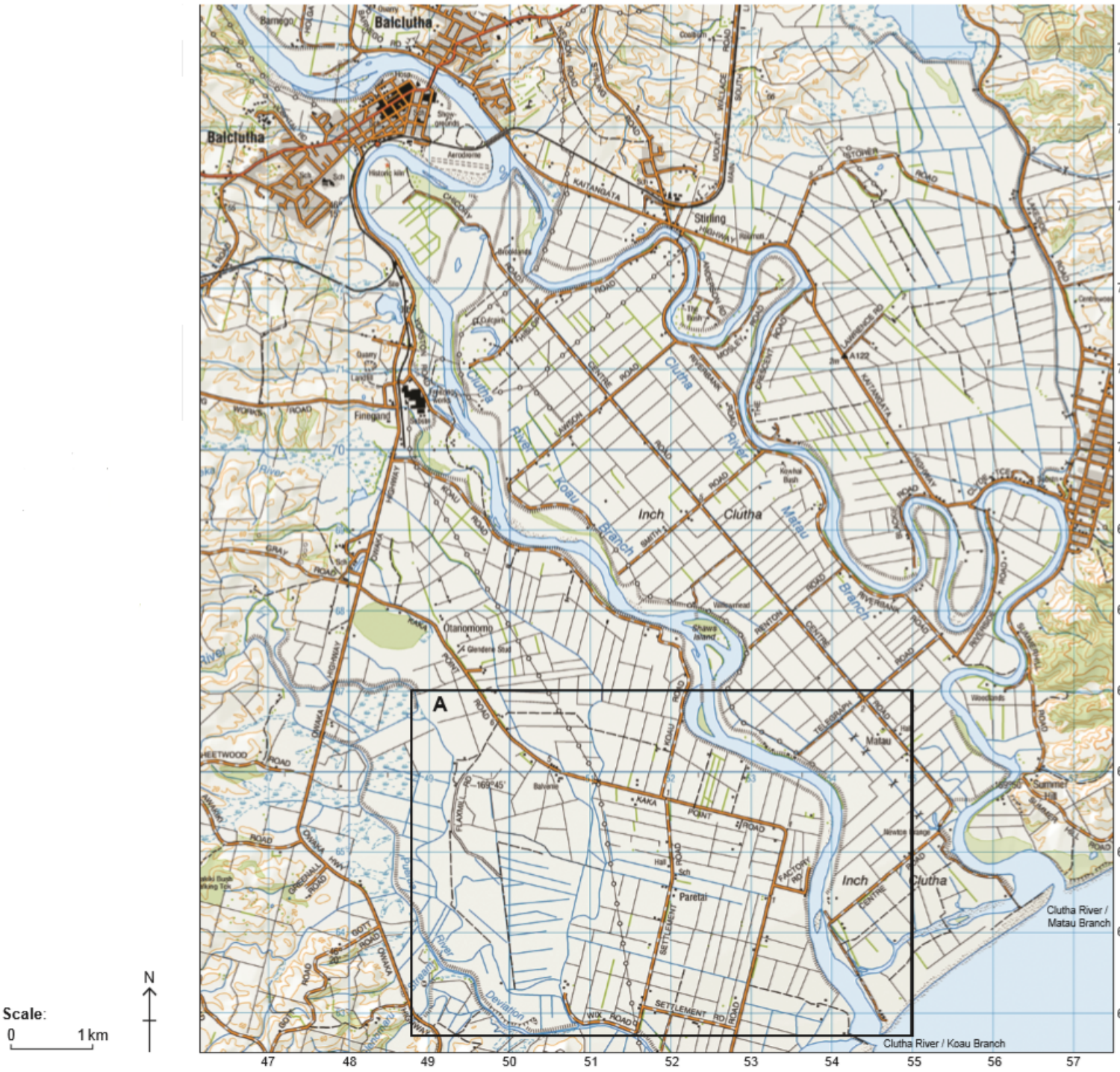
a. Briefly describe **four** possible impacts of the flood on different types of traffic movement in the area shown on the satellite image. [4]

b. Explain **two** ways in which agriculture and/or irrigation on flood plains can affect water quality. [6]

c. Examine the factors that affect the response of a stream hydrograph to a rainfall event. [10]

The map shows the Clutha River and the town Balclutha on the South Island of New Zealand. The scale of the map is 1:50 000 and the contour interval is 100 metres.





[Source: Sourced from NZTopo Database. Crown Copyright Reserved.]

a. Identify **and** locate **two** natural river landforms found on the Clutha River's floodplain. [4]

b. (i) Briefly explain how **one** human modification of the floodplain shown in area A (outlined in black) may reduce river flooding. [6]

(ii) Suggest **two** ways in which the settlement of Balclutha may have led to increased river flooding.

c. Examine how the environmental impacts of agriculture and irrigation on water quality vary from place to place. [10]