

Urban waste and its disposal

3.2.3.6 Urban environments

What you need to know
How waste is generated in an urban area
How lifestyle and attitudes within cities can affect the amount and type of waste being disposed of
How the different approaches to waste management affect the environment

Introduction

Waste is unwanted material disposed of into the environment. In urban areas, waste is an issue as there is a limited amount of space in which to dispose of waste so it can become an environmental problem. The growing population in urban areas also emphasises the problem as there is a demand for more consumer goods and limited available space within the city to sustainably deal with the resultant waste. The World Bank has estimated that by 2100 the growing global urban population will be producing three times as much waste as it does today. That level of waste carries serious consequences – physical, environmental and economic, for cities around the world.

How waste is generated

Waste is generated from many sources:

Residential waste

In both developed and developing world cities, large volumes of waste are created daily. This mainly consists of food waste, plastics, cardboard and paper. In the developed world this is becoming a bigger issue as the growth of a consumer society leads to the purchase and, therefore, disposal of more goods. In the developing world this is also an issue, but rising rural-urban migration leading to an urban population increase of an underclass is a major concern. Growth of squatter settlements for these migrants are unplanned, illegal and ignored by city authorities and consequently waste disposal is not catered for. Mounds of waste are left on the streets and these often contain chemicals and metal elements from myriad unregulated industrial workshops. The organic waste within it attracts vermin and leads to an increase in disease. Sewage is also an issue due to a lack of effective sanitation systems and this adds to the waste.

Industrial waste

Industrial waste is defined as waste generated by manufacturing or industrial processes. Industrial waste can include dust and gravel, masonry and concrete, scrap metals, oil, solvents, chemicals, wood and scrap lumber, and similar wastes. Industrial solid waste, which may be physically solid, or liquid or gases held in containers, can be hazardous. Hazardous waste such as cleaning fluids, paints, chemicals or pesticides are sometimes released straight into water courses or left illegally on waste ground.

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E-waste:

This is discarded electrical waste. The rise of the 'throw-away' society and the pace of technological innovation means consumer items such as computers, screens, printers, mobile phones, computer gaming machines etc. are disposed of after a few years as new developments make them outdated and/or unfashionable. Much of the developed world's e-waste is exported to the developing world on returning container ships where the lowest-paid workers extract valuable metals to earn a living. Electronic scrap components, such as CPUs, contain potentially harmful components such as lead, cadmium, beryllium, or brominated flame retardants. Recycling and extraction of valuable commodities from e-waste may involve significant health risk to workers and communities in developing countries but is carried out as a form of **unregulated recycling**. Whatever remains after that of value is extracted, ends up in landfill.

Lifestyles and attitudes and their impact upon waste

Waste is an issue in both developed and developing world urban areas. The type of waste is the main difference. In the developed world where many people are wealthy, people produce large volumes of consumer waste, notably packaging from goods, food waste, domestic and e-waste. The disposal sites of this waste are then usually outside the urban area, but the economics of waste disposal means sites close to urban areas are required to minimise transport costs. Disposal may be to a different country where an economic value can be extracted from the waste. As space for landfill is limited, there are strict regulations at refuse sites regarding the amount of waste that people can get rid of. Companies and individuals are expected to pay penalties for going over the limit and this leads to fly tipping in some areas, which is a problem for city authorities. The EU sets limits on the percentage of waste that can go to landfill for member countries, operating on a sliding scale of increasing tightness over the next decade. Countries that dispose of more waste in landfill than their targets permit are liable to significant fines.

In developing world cities, for many of the population, waste is not regarded as an environmental problem but as a potential resource. In squatter settlements for example, where waste is left on the street and people live their lives surrounded by this waste, the economic potential of waste is greater than concern for the environmental and health implications that it holds. On municipal waste tips whole communities of 'rag-pickers' sort through waste brought by refuse lorries to extract whatever is of value in the waste, from recyclable metal, plastic and cotton, to paper and cans. This is another form of unregulated recycling.

Approaches to waste management

Unregulated disposal

Unregulated waste disposal is an issue in many cities across the world. In developing world cities where environmental laws and policing of the law is less structured, many large organisations will release liquid and solid waste into local water courses. Equally, waste will be left abandoned on wasteland. Lack of an enforcement agency (or some

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would say 'political will') by the government means that this happens regularly and the impact on the environment is a problem. Large areas of land become contaminated and then this can lead to ill-health for local people, and for those city dwellers on the edge of poverty, who have smallholdings to grow crops on, this can be fatal as they may ingest dangerous chemicals. Water quality is equally poor due to the waste being released into it. This can be a lethal transfer of poisons and bacteria-rich infections and can cause diseases that impact on life expectancy. For freshwater species this can be an issue too. Many species will die out and eutrophication could occur which would leave the water as dead zones.

In the developed world, illegal dumping from industrial sources in cities is still an issue but not to the same extent as in the developing world due to the better regulated and enforced environmental laws. Most companies dispose of their waste in the appropriate way, not only to avoid heavy fines but to maintain a high perception of environmental stewardship with their customers – a key contractual obligation in many commercial agreements. Polluting is becoming to be viewed as 'bad for business'.

Fly-tipping is illegal, bad for the environment and could be a health hazard if it involves asbestos waste. It is more often carried out by irresponsible self-employed small-scale businesses involving household and industrial waste. Leftover DIY material and abandoned electrical goods, such as fridges, account for half of all fly-tipped rubbish in English cities.

As well as irresponsible householders, organised criminal gangs carry out illegal waste disposal for profit. This not only looks unsightly, but again, contaminants such as chemicals and metals can seep out of fly-tipped products and contaminate soil and water sources. Around Naples, Italy, it is suspected that much waste-disposal has been organised by notorious criminal gangs that make high charges to city businesses for waste disposal, which is then illegally dumped.

Recycling

In the developed world cities there has been an increase in the amount and range of materials that are being recycled rather than being sent to landfill – in part a response to potential fines by central government if recycling targets aren't met. Materials such as paper, cardboard, plastics, aluminium and food waste are regularly recycled. This has a positive environmental effect due to the reduced landfill space required and also reduces the need to exploit additional natural resources. Organised local authority recycling schemes operate with facilities available for people to deposit recyclable materials or, in many cities, for recycled waste to be collected.

In the developing world, unregulated recycling takes place. Working on city waste tips has become a key element of the informal tertiary sector and some city authorities have gone as far as to establish schemes whereby those who recycle are paid, both in money and food for recycling. The level of recycling however could be higher across all cities and the next step is to incentivise recycling or penalise irresponsible waste disposal to increase the rate of recycling further.

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Recovery

In developed world cities in particular, recovery takes place. This is where instead of disposing of waste, the original material is reused for another purpose. An example of this is where a business creates more crushed concrete than it can use in its construction activities, and a nearby farmer needs to adapt his/her farm. The construction waste may then be used to fill in hollows on the farm, instead of going to disposal. On a larger scale, the coal ash from coal-fired power stations is used to create breeze-blocks (Concrete Masonry Units – CMUs), reducing the disposal of waste ash into landfill and providing a valuable construction material.

Incineration

Incineration is a waste treatment process that involves the combustion of organic substances contained in waste materials. Incineration is described as "thermal treatment". Incineration of waste materials converts the waste into ash, gas, and heat. The ash may be in the form of solid lumps or particulates carried by the flue gas. The flue gases must be cleaned of gaseous and particulate pollutants before they are dispersed into the atmosphere. Some of these particulates are toxic so it's important that the waste disposal process after incineration is equally well organised to avoid secondary environmental and health impacts. In some cases, the heat generated by incineration can be used to generate electric power and this can be a positive impact as it reduces the need for fossil fuel powered stations.

Sheffield city council operates a widely regarded waste incineration project through a commercial French company – Veolia. City waste is taken to the central city plant where Veolia removes recyclable material and incinerates what is left. The energy-recovery system uses the thermal energy from the combustion to heat water which is then piped to over 44 public buildings in the central area of Sheffield, including Sheffield University and local authority-run housing blocks, where it supplies central heating and hot water for a variety of uses.

In some countries, incinerators built just a few decades ago often did not include a materials separation to remove hazardous materials before combustion. These facilities tended to risk the health of the plant workers and the local environment due to the release of particulate matter into the atmosphere.

This type of waste management is therefore more likely in developed world cities due to the expense of the process.

Burial

This is the most common waste management strategy. Disposing of waste has huge environmental impacts and can cause serious problems. Most waste is buried in existing landfill sites – holes in the ground, sometimes old quarries, sometimes disused

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mines. Some waste will eventually decompose, but not all, and in the process it may smell or generate methane gas, which is explosive and contributes to the greenhouse effect. Surrounding land may be contaminated by the leached chemicals and toxins emerging from the waste. Badly managed landfill sites may attract vermin, too, which causes problems for local health.

Many landfill sites, particularly in the developed world, now recognize that the decomposition of organic waste leads to the release of methane gas, which is now more likely to be collected and used as an energy source.

Submergence

This is where waste is placed into water to dispose of it. Obvious environmental issues may occur relating to an increase in toxins in water which can impact on habitats. Some isolated waste which can be containerised prior to submergence can be more effective, but there are concerns over corrosion of the containers which could have long term effects. However, where land is at a premium, the submergence of waste can help alleviate the problem by creating new artificial islands. Tokyo Bay is gradually being encroached into by a multitude of man-made islands composed largely of the city's waste. The eventual dry land is used by freight, warehousing and manufacturing companies rather than for residential developments but helps ease the pressure on land elsewhere in the megacity to a certain extent.

Trade

This strategy happens more than is realised when disposing of developed world waste. This waste is a commercial transaction that is sent to the developing world where it will be sorted and disposed of by poor residents. Some of the waste will go into landfill and have the impact on the land and air pollution as mentioned earlier. Large volumes of e-waste form significant parts of this trade and this is damaging to human health and local air quality will decline. There is a concern that disposal companies don't enquire too closely into what happens to the waste once it leaves the shores of the waste-generating country and as long as they have been told it will be disposed of 'responsibly', don't check up too closely to see if it actually is.

Urban waste issues in Accra

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Accra, Ghana

Waste, particularly solid waste, is a major environmental concern in Accra, the capital of Ghana in West Africa, with over 4000 tonnes of solid waste being generated daily by its 2.3 million population. Solid waste refers to items such as household refuse, including packaging and food waste and the issue regarding the waste arises due to weak waste disposal arrangements. Waste management services are largely inefficient and ineffective at removing the waste from many neighbourhoods in Accra and it is estimated that approximately 83% of Accra's population dump their refuse in authorised and unauthorised sites in their neighbourhoods, rather than sorting the waste and recycling where possible.

The main reason for the issues regarding solid waste is due to the level of poverty in many areas. In residential areas such as Nima, the amount of waste is increasing. The influx of rural migrants to this area has led to rapid population growth and an inability by city authorities to provide suitable services. The people living in such areas have a very specific attitude towards the waste. They identify and utilise areas within their neighbourhood where waste can be dumped and are happy to leave it there. The lack of organised waste collection, coupled with the attitude of local people has led to a huge problem. Many of the landfill sites are in the distant suburbs, far away from poorer neighbourhoods and too far for potential private waste collectors to get to weigh in their waste. As a result, much waste is dumped. Local people don't believe that it is their responsibility to tackle the waste. The city authorities are working alongside communities to educate them about the hazards that ill-disposed waste could pose to the environment and to themselves.

Another problem regarding waste in these neighbourhoods is human waste. Insufficient communal facilities can lead to open defecation along beaches, drains, and open spaces and the likelihood that faecal materials will become intermixed with household refuse is high. Resulting diseases, such as typhoid, then spread rapidly.

Much of Accra's solid waste ends up in The Korle Lagoon in Accra, which has become one of the most polluted water bodies on earth. It is the main outlet through which all major drainage channels in the city empty into the sea. Large amounts of untreated industrial waste emptied into surface drains has led to severe pollution in the lagoon and disrupted its natural ecology. As large amounts of solid waste are dumped straight into water bodies, there is also an issue during periods of heavy rainfall, as many areas flood due to blockages. Drainage is therefore affected by the poor management of the waste.

Agbloboshie, in Ghana's capital Accra, has been ranked in the top 10 most polluted places in the world, thanks to toxic fumes, which are a result of consistent dumping of electronic goods, mainly from western European countries. About 215 000 tons of second hand consumer items

Urban waste issues in Accra

land in Agbloboshie every year, generating 129 000 tons of electronic waste. Of the total waste, half is refurbished and sold on. The remaining waste is recycled with the valuable parts removed. In order to get to the copper within many of the electrical/electronic products, cables are burnt to remove the copper inside them and this process releases toxic fumes. Food containers and tyres are often added to the burning piles by local recyclers to keep the fires going. In doing so, highly toxic materials are released, including lead and mercury. As well as containing one of Accra's largest food markets, some 40 000 people are said to live in the neighbouring area and are at risk of being directly affected by the e-waste. It is likely, however, that 250 000 people over the wider city region are likely to be affected to some extent by fumes being released from the site.

Solutions to Accra's waste issues are slowly emerging. The main strategy has been a move from 100% landfill use to a recycling programme for key materials, such as plastics. The opening of ACARP (Accra Compost and recycling plant) has meant that paper, steel and plastics are now being recycled and the growth of collaboration between ACARP and local businesses has led to this increase in recycling. Waste food is also being recycled with compost being produced and then sold to local businesses. Finally, waste water treatment processes handle and effectively process 1000m³ of liquid waste per day. This is then turned into highly dried compacted sludge and over 95% clean water produced can then be used for irrigation and construction.

The most important solution appears to be the education of residents to recognise why waste is an issue to health and the environment. Many of the problems now facing Accra are due to illegal dumping and a failure by people to dispose of waste in a more sustainable way. With many Ghanaians struggling to feed their family, waste is the least of their worries.

Exam style questions

1. Evaluate the extent to which government strategies can improve waste disposal (9 marks)
2. 'Addressing socio-economic issues is more important than dealing with environmental challenges in the management of urban areas.' How far do you agree with this view? (20 marks)

Urban waste issues in Accra

1. Evaluate the extent to which government strategies can improve waste disposal (9 marks)

The use of Accra as a case study allows the candidate to address a range of strategies to deal with waste and whether they are successful.

Three strategies should be discussed and the impact that the strategy has should be mentioned:

- ACARP – recycling paper, steel and plastics.
- Sewage systems in slums, including public toilets.
- Education of the people living in Accra – inform through school, NGOs and community, meetings how waste impacts upon health

By completing the “Educating the people” strategy last, this will enable the candidate to construct an argument. The first two strategies will work for commercial businesses, but local communities won’t start to use ACARP etc. as it is located far away from where the slums are and the people don’t see the importance of it. With an increase in the size of these slums as a direct result of rural-urban migration, education is at the core of effective strategies the city authorities need to carry out if they wish to completely tackle the waste issue.

Overall, the conclusion should discuss how effective the strategies are.

2. ‘Addressing socio-economic issues is more important than dealing with environmental challenges in the management of urban areas.’ How far do you agree with this view? (20 marks)

Using Accra and the waste issue as a case study here is ideal as there is an issue regarding the extent to which the environmental challenges are actually as a result of socio-economic issues.

The key focus of this question is to show understanding of:

1. What the socio-economic issues are – poverty, informal work, crime, slum housing and disease. Describe the issues and explain why they occur.
2. What the environmental challenges are – poor waste disposal and rise in vermin levels, contaminated water supply and localised air pollution (particularly from burning e-waste). Again, describe the challenges and explain why they occur.
3. The links between socio-economic issues and the environmental challenges in Accra needs to be covered next. Most of the environmental problems occur due to poverty and lack of education. EXAMPLE – Whilst waste disposal is an environmental challenge in terms of the contamination to soil and water supplies, the scale of the problem lies within the society living within Accra. Many of the migrants are living in extreme poverty and on a daily basis have to focus on finding food to eat; so waste disposal is not a concern to them. The people would not have the time or interest in clearing up their neighbourhood. Education regarding the impact of waste on health would empower people to take more care of their environment.
4. Your opinion – is it more important to deal with the environmental challenges or to deal with socio-economic issues first? Refer back to arguments within the response.

Urban drainage issues and management 3.2.3.5

Q1	<i>True or False?</i>	
A	Urban areas experience more flash floods than rural areas.	
B	Urbanisation leads to a decrease in vegetation.	
C	Urban surfaces absorb water quicker than in rural areas.	
D	In developing countries, urban drainage systems are often blocked by waste.	
E	Sustainable urban drainage systems (SUDS) can help to reduce flooding risk	

Q2	Match the correct term to the correct definition	
A	The system by which water circulates between the atmosphere, oceans and land.	
B	Not allowing fluid to pass through.	
C	The collection of water over a natural drainage area.	
D	The area of land that supplies water to a river via its tributaries	
E	A management project to improve a degraded river.	
Select from: Catchment Drainage basin Water cycle River restoration Impervious		

Q3	One sentence is incorrect in each of the explanations below. Identify the wrong one.	
A	Tarmac and concrete in urban areas changes the ability of the catchment area to deal with precipitation. They ensure water is absorbed into the ground and is transferred by throughflow underground. The rivers in cities fill up quickly and cause floods.	
B	Land use changes in a city to accommodate the growing population. Traditional land use, such as farming and forestry makes way for housing. This reduces flooding as the ground can't fill up with water and therefore is removed from the area rather than causing a flood.	
C	Man-made drainage channels are created in an urban area to remove water from the system. They are efficient and are able to completely eradicate the risk of flooding within the area. Some are called Storm Drains.	
D	Sewage and waste is a problem within urban areas. It often clogs up drainage systems and causes blockages which can increase flooding. This occurs more so in developed world cities.	
E	Flood hydrographs in urban areas show that the lag time is longer than in rural areas. The impact of flooding can be worse in urban areas due to the larger population living in cities than in rural areas.	

Urban drainage issues and management 3.2.3.5

Q4	<i>Decide which heading the various factors would match with, in regards to urban drainage.</i>		
	<i>Urban drainage causes</i>	<i>Urban drainage issues</i>	<i>Urban drainage management</i>
	Pedestrianising areas	Demand for transport	River restoration
	High building density	High population	Urban planning
	Rural-urban migration	Increased runoff	Flash flooding

Q5	<i>Think about the implications of attempting to manage urban drainage</i>
A	What are some of the future negative implications?
B	What are some of the future positive implications?

Urban drainage issues and management 3.2.3.5 ANSWERS

Q1	<i>True or False?</i>	
A	Urban areas experience more flash floods than rural areas.	True
B	Urbanisation leads to a decrease in vegetation.	True
C	Urban surfaces absorb water quicker than in rural areas.	False
D	In developing countries, urban drainage systems are often blocked by waste.	True
E	Sustainable urban drainage systems (SUDS) can help to reduce flooding risk	True

Q2	Match the correct term to the correct definition	
A	The system by which water circulates between the atmosphere, oceans and land.	Water cycle
B	Not allowing fluid to pass through.	Impervious
C	The collection of water over a natural drainage area.	Catchment
D	The area of land that supplies water to a river via its tributaries	Drainage basin
E	A management project to improve a degraded river.	River restoration
Select from: Catchment Drainage basin Water cycle River restoration Impervious		

Q3	One sentence is incorrect in each of the explanations below. Identify the wrong one.	
A	Tarmac and concrete in urban areas changes the ability of the catchment area to deal with precipitation. They ensure water is absorbed into the ground and is transferred by throughflow underground. The rivers in cities fill up quickly and cause floods.	In urban areas water can't be absorbed into the ground; runoff increases instead.
B	Land use changes in a city to accommodate the growing population. Traditional land use, such as farming and forestry makes way for housing. This reduces flooding as the ground can't fill up with water and therefore is removed from the area rather than causing a flood.	Housing land use will increase flooding as runoff will increase and the water will go straight into the river which will cause a flood.
C	Man-made drainage channels are created in an urban area to remove water from the system. They are efficient and are able to completely eradicate the risk of flooding within the area. Some are called Storm Drains.	Drainage channels will remove some water, but it can't stop flooding completely.
D	Sewage and waste is a problem within urban areas. It often clogs up drainage systems and causes blockages which can increase flooding. This occurs more so in developed world cities.	Sewage and waste is a problem in both the developed and developing world; however, it is worse in the developing world as the infrastructure is basic and there are fewer environmental laws in place to monitor sewage disposal.
E	Flood hydrographs in urban areas show that the lag time is longer than in rural areas. The impact of flooding can be worse in urban areas due to the larger population living in cities than in rural areas. The impact of a flood can last for years as property insurance costs rise.	The lag time is shorter in urban areas as runoff occurs and water reaches the channel quickly, whereas in a rural area, water is absorbed into the ground and takes longer to reach the channel.

Urban drainage issues and management 3.2.3.5 ANSWERS

Q4	Decide which heading the various factors would match with, in regards to urban drainage.		
	Urban drainage causes	Urban drainage issues	Urban drainage management
	Pedestrianising areas High building density Demand for transport High population Urban planning (initial growth of city) Rural-urban migration	Increased runoff Flash flooding	River restoration Urban planning (planning new drainage systems and storm drainage)
	Pedestrianising areas High building density Rural-urban migration	Demand for transport High population Increased runoff	River restoration Urban planning Flash flooding

Q5	Think about the implications of attempting to manage urban drainage
A	<p>What are some of the future negative implications?</p> <p>Population growth will increase the pressure on land use. More natural areas will be changed into urbanised areas which will cause an increased flood risk.</p> <p>In developing countries, urban growth is rapid and squatter settlements are increasing. Lack of waste disposal will result in drain blockage and increase flood risks and health issues.</p> <p>Global climate change will increase rainfall in some areas and this will put pressure on drainage systems.</p>
B	<p>What are some of the future positive implications?</p> <p>Global climate change will reduce rainfall in some areas so urban areas that currently experience floods may see a reduction in the future.</p> <p>SUDS – this management system will be at the heart of all urban planning and many cities will improve their drainage which will reduce flooding.</p>