

General Environmental Management Guidelines

GUIDELINE GEM 01**GEM 01 - GENERIC REGISTER OF ENVIRONMENTAL IMPACTS**

Table below provides summary of the standard environmental aspects, impacts and mitigation measures for a typical construction project. This is a tool to assist the project manager in completion of the site specific Register of Environmental Impacts. It must be noted that the impact and mitigations outlined in this document should be review for applicability and suitability for implementation on the project. Only mitigations/controls that can be realistically implemented on site should be included in the site specific Register of Environmental Impacts.

The list is not exhaustive. Specific aspects, impacts and mitigation measures may also be identified during the Environmental Review/Environmental Impact Assessment or design review. The applicable aspects should be also included in the Site Specific Register of Environmental Impacts.

Category	Aspect	Impact	Mitigation/Control Measures
Water	Excavation, water runoff during excavation carrying sediment	<ul style="list-style-type: none"> • Siltation of local waterways • Flooding neighbouring properties and roads and damage to them • Damage to marine life • Blocked storm water systems 	<ul style="list-style-type: none"> • Minimised exposed soil areas • Cover over bare soil with mulch, grass, planting or materials such as geotextile • Excavation stock piles to be located away from water runoff, channels or kerbs. Stockpiles to be covered. • Excavated material stockpiles to be bunded – use sand bags • Divert upstream runoff away from the site • During construction diverting roof and other structures run off via temp pipe work • Use of sedimentation tanks • No pumping from bottom of sediment tank or directly from tank into kerb or catch pit • Filter cloth used as a temporary emergency basis • Never hose down concrete/material spillage into natural or storm water systems. • Locate wheel wash or truck wash areas away from the natural and storm water drain systems
Water	Water contaminated	<ul style="list-style-type: none"> • Pollution of natural waterways - harm to aquatic life 	<ul style="list-style-type: none"> • Never hose down concrete/material spillage into natural or storm water systems.

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	by concreting works, demolition, and cleaning of structures	<ul style="list-style-type: none"> • Pollution of the natural waterways via surface water drain 	<ul style="list-style-type: none"> • Where possible plan to pump/ deliver concrete away from drains and natural waterways. • Sweep or shovel spills and allow residue to set before moving • Use of spill mats and sandbagging in drains • Use of sand bags, baffles, settlement tanks to encourage settlement of fine particles • Use filter cloth to filter water at the outlets • Implement regular monitoring of the watercourse incl. water quality testing
Water	Rainfall creating mud	<ul style="list-style-type: none"> • Pollution of the roads – mud spread by the construction vehicle movement • Nuisance to the neighbourhood • Potential H&S hazard contributing to accidents caused by trips, slips and falls 	<ul style="list-style-type: none"> • Truck tyres to be washed before leaving site – establish designated wheel wash (bunded and drained) • Use road sweeper to clean roads • Limit the excavation activities during the rainy season • Establish designated areas for truck wash downs • Use high pressure and low volume equipment if possible
Water	Washing of the concrete or oil/fuel during trucks washing	<ul style="list-style-type: none"> • Potential contamination of the water and ground from the concreting/concrete truck washing • Potential contamination to ground and water with the oil/fuel from washing of the vehicles 	<ul style="list-style-type: none"> • Set the concrete truck wash out, ensure that it is set in the bunded, impermeable surface • Use settlement tanks • Use oil separator for the settlement tanks
Water	Waste water from site facilities (sewerage) and from site cleaning activities e.g. painting and plastering	<ul style="list-style-type: none"> • Waste water/washed toxic solvents, heavy metals entering natural and storm water systems causing pollution and potential harm to aquatic life and H&S hazard for human and livestock 	<ul style="list-style-type: none"> • Waste water from site facilities will be connected to local authority sewer system • Waste water from site facilities stored and removed from site to approved sewerage/waste water collector • Establish cleaning stations for small tool use. Sinks with water piped into storage tanks. Tanks sized to meet site requirements. • Provide spill kits in the area of the painting/plastering • Establish regular checking regime of the condition of the sewer connection/sewage storage facilities

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			<ul style="list-style-type: none"> Implement regular monitoring of the watercourse incl. water quality testing
Water	Discharge of the site drainage to the watercourse or local drainage	<ul style="list-style-type: none"> Risk of causing flood downstream of the discharge from site 	<ul style="list-style-type: none"> Estimate volume of the discharge from site Review condition/capacity of the drain/watercourse Agree discharge volume with local authority 2 or more discharge points storage on site monitoring of the discharge form site
Water	Damaging existing live sewerage lines	<ul style="list-style-type: none"> Spillage of the waste to site, potential pollution, harm to aquatic life and H&S hazard for human and livestock Risk of flooding 	<ul style="list-style-type: none"> Locate all existing services lines before excavation, mark out and hand dig if required Use permit to dig
Water	Damaging existing live water lines	<ul style="list-style-type: none"> Risk of washing out the material stored on site Disruptions in the water supply to people and livestock Risk of flooding 	<ul style="list-style-type: none"> Locate all existing services lines before excavation, mark out and hand dig if required Use permit to dig
Water	Steel/Roof works with steel off cuts and swarf Material cutting of brick, tiles, block cutting	<ul style="list-style-type: none"> Storm or natural water systems contaminated with metals Swarf in the natural water systems - pollution, potential hazard to human and livestock Toxic water and dust runoff with heavy metals, petroleum products and alkalinity – pollution, potential hazard to human and livestock 	<ul style="list-style-type: none"> Set up cutting equipment away from drains and natural waterways Use wet cutting if possible and control water run off All hazardous dust omitting machines should be fitted with dust suppression kits Enclose areas of the cutting to capture residue cutting Collect residue cutting /material waste and dispose appropriately Prevent debris from falling into watercourse
Waste	Waste generated by	<ul style="list-style-type: none"> Potential pollution to the ground and water Increase landfill deposits 	<ul style="list-style-type: none"> Prepare site specific waste management plan Care planning (i.e. purchase planning) and sequencing to reduce excess waste on the project

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	<p>site activities</p> <p>General site housekeeping and waste storage/removal</p>	<ul style="list-style-type: none"> • Increase in transportation needs – contribution to pollution and increase of the carbon footprint • Potential attraction to vermin – sanitary issues 	<ul style="list-style-type: none"> • Review disposal options prior commencement of the work • Segregate materials as they are generated • Segregate hazardous from non-hazardous waste • Remove organic waste at regular intervals • Provide bins and skips for site • Identify reclaim and reuse materials where possible – implement recycling scheme • Dispose materials in accordance with the waste management plan/agreement with the local authority • Use licensed waste carriers • Do not landfill liquid hazardous waste • Use covered/secured bins to minimize risk of vermin and pollution from the rain fall
Spillages	<p>Leakages of chemicals, oil, fuels and fluids from storage tanks and containers</p> <p>Uncontrolled disposal of above and spillage during application of chemical treatments and finishes.</p>	<ul style="list-style-type: none"> • Contamination of the water and ground • Damage to vegetation and wildlife through contamination of water supply, watercourses, ground and possible food chain 	<ul style="list-style-type: none"> • Fuel, oil, chemicals of fluids stored in the designated hard standing areas, with bunding, spill trays • Use double skinned tanks/containers • Spill kits available on site – located in the areas with the high risk of spillage like re-fuelling area, oil storage area • Suitable training provided to site operatives • Ensure material data sheets are read and understood with correct handling methods used and emergency procedures ready to be carried out • Implement proper maintenance of the storage containers • Implement regular checks and monitoring of the condition of the storage areas incl. storage containers
Spillages	Uncontrolled disposal/spilla	<ul style="list-style-type: none"> • Contamination of the water and ground 	<ul style="list-style-type: none"> • Refuelling to take place at a designated location – hard standing area • No refuelling of vehicles/plant and equipment near to storm water, natural water

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	ge during refuelling	<ul style="list-style-type: none"> • Damage to vegetation and wildlife through contamination of water supply, watercourses, ground and possible food chain 	<p>ways and marine environments</p> <ul style="list-style-type: none"> • Trained operators and emergency stop devices used in all refuelling exercises • Spill kits available in the refuelling location
Spillages	Leakages of chemicals, oil, fuels and fluids from equipment	<ul style="list-style-type: none"> • Contamination of the water and ground • Damage to vegetation and wildlife through contamination of water supply, watercourses, ground and possible food chain 	<ul style="list-style-type: none"> • Use electric equipment if practicable • Use drip trays underneath the equipment • Implement regular monitoring and inspection of the condition of the equipment, • Remove faulty, oil/fuel leaking equipment from site • Spill kits available on site • Undertake maintenance of the equipment in the designated, hard standing location – ideally away from the watercourse and drainage • Protect the drains
Contamination	Contaminated land discovered during excavation	<ul style="list-style-type: none"> • Danger from buried material e.g. asbestos, biological, explosives etc • If present contaminated material is disturbed by the construction activities, may cause pollution to the ground and water 	<ul style="list-style-type: none"> • Investigate site history prior to commencing works (¹) • Undertake the testing of the soil if the contaminated land is suspected (¹) • Stop work immediately, plan site cleanup and disposal
Dust	<p>Dust created by excavation, filling and piling activities</p> <p>Dust created by demolition activities</p> <p>Dust created by the general construction activities incl.</p>	<ul style="list-style-type: none"> • Nuisance to workers, neighbours and general public • Health risk to operatives • Loss of visual amenity • Potential damage to adjacent properties 	<ul style="list-style-type: none"> • Use water sprinklers on the site roads to reduce dust • Workers/operatives to use appropriate PPE • Use fine mist water spray on demolition • Minimize drop heights for loading and unloading operations • Introduce hard surfacing or paving of haul routes • Introduce external perimeter fencing/scaffold screening to contain dust • Cover loads during transport • Limit soil stockpile heights and slopes, protect from wind, cover if necessary • Re-vegetate cleared areas • Sequence of demolition works to minimise dust (internal first, then external structure/frame)

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	traffic		<ul style="list-style-type: none"> Consider speed limit on site
Dust	<p>Processing of materials, by sanding, cutting and the alike</p> <p>Dust created by cutting, blasting, drilling of concrete</p>	<ul style="list-style-type: none"> Nuisance to workers Nuisance to adjacent neighbours and general public Health risk to operatives Damage to finished surfaces 	<ul style="list-style-type: none"> Deliver pre-cut material where possible Protect existing finished works Use wet cutting/blasting/drilling where possible Workers/operatives to use appropriate PPE Consider enclosing the working area Consider extraction for the enclosed working area
Noise	<p>Earthworks, use of heavy machinery</p> <p>Breaking out, grinding, coring of concrete work</p> <p>Concrete pump pouring</p> <p>General site plant, tools and equipment use</p>	<ul style="list-style-type: none"> Hearing damage to workers on site Disturbance to adjacent neighbours and general public Potential disturbance to the wild life and livestock 	<ul style="list-style-type: none"> Appropriate selection of plant and equipment (consider plants with the acoustic enclosures) Maintenance and regular checking of the equipment condition Use mufflers on equipment and plant Liaison with neighbours if required to confirm appropriate time for noisy activity - Limit work within the night/sensitive hours Operatives to use appropriate PPE Introduce acoustic screening Consider enclosing plants in the acoustic box Identify noise levels prior to commencement Locate plant away from site boundaries If possible, locate the areas of noisy activities away from the sensitive receiver i.e. houses/livestock Turn off plant when not in use Regular monitoring of the 'noisy' activities and recording of noise levels For vehicles consider speed limit on site

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Noise and vibration	Piling activity Vibration through soil during construction works	<ul style="list-style-type: none"> Disturbance to adjacent property, neighbours and the public Hearing damage to workers on site 	<ul style="list-style-type: none"> Operatives to use appropriate PPE Bored piles instead of driven Hydraulic rig to be used if available Appropriate selection for plant and equipment Keep machines well maintained Use smallest machine that will achieve the operation/job/task
Archaeology ⁽²⁾	Presence of artefacts, cultural remains, bones, etc	<ul style="list-style-type: none"> Damage to items of historic importance during the construction activities (excavation, earthworks) 	<ul style="list-style-type: none"> Isolate the area identified as location of the archaeology presence Use trial pits before commencing substantial excavation Use permit to dig system Use hand digging In case of discovering any items – stop work immediately, inform supervisors (UNOPS), isolate the area Consult with the local authorities and experts as necessary
Ecology – wild life (flora and fauna) ⁽³⁾	Excavation works or other construction activities [define applicable]	<ul style="list-style-type: none"> Possible damage or growth reduction of plants and trees Possible disturbance to the wildlife habitat due to general construction activities 	<ul style="list-style-type: none"> Identify any wild species on site – liaise with the wild life organisations, inform the Client Identify the likelihood of the presence of livestock Identify the breeding and nesting season and avoid work during that period Provide screening (barriers/fencing) between the working area and area where the susceptible wild life has been identified Minimise disturbing activities in the areas where susceptible species have been identified Location of the invasive construction activities (i.e. hot work) or facilities (wash down facilities) away from sensitive areas (habitats, plants)
Ecology – wild life (flora and fauna)	Construction vehicles movement	<ul style="list-style-type: none"> Possible disturbance to the wild life habitat due to excessive vehicle movement 	<ul style="list-style-type: none"> Provide screening (barriers/fencing) between the construction area and area where the susceptible wild life has been identified Minimise traffic movement in vicinity of the area where the wild life has been identified

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Air	Fumes discharged from transportation and site vehicles	<ul style="list-style-type: none"> • Disturbance to adjacent properties, neighbours and public • Health and ecological risks from inhalation of fumes containing gasses 	<ul style="list-style-type: none"> • Introduce regular maintenance and service for vehicles • Use of electric plant • Use plants and equipment with the catalytic converters • Minimise traffic requirements by rationalising the traffic routes • Establish traffic management plan • Turn the engines off when plant not in operation • Remove plant with the excessive fumes from site
Air	Emissions of fumes, toxins and adhesives released into the air during painting, coating	<ul style="list-style-type: none"> • Pollution of air • Creation of fire hazard • Health risk to the operatives • Nuisance to neighbours and the public 	<ul style="list-style-type: none"> • No incineration of any waste materials allowed on site • All enclosed spaces to be well ventilated • Painting and liquid application activities undertaken in calm conditions • Provide adequate ventilation • Consider using of non-solvent (water) based paints
Air	Emission of fumes created by the work activities (hot work, waste burning)	<ul style="list-style-type: none"> • Risk to the human health – operatives and neighbourhood • Setting fire to landscape – loss of biodiversity • Smoke hazard – air pollution 	<ul style="list-style-type: none"> • Consider substitution for hot work activities • Use screening and fencing • No incineration of any waste materials allowed on site • Hot work permit system to be used • Fire fighting equipment available
Air	Odour from the organic waste, toilets	<ul style="list-style-type: none"> • Nuisance to the neighbourhood • Potential for the sanitary hazard 	<ul style="list-style-type: none"> • Implement the suitable waste management system • Ensure that organic waste are suitably stored • Ensure regular disposal of the waste
Air	Damaging existing live gas lines	<ul style="list-style-type: none"> • Pollution to the air, risk of explosion and fire 	<ul style="list-style-type: none"> • Locate all existing services lines before excavation, mark out and hand dig if required • Use permit to dig

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General	Raw material depletion	<ul style="list-style-type: none"> • Resource intensive materials • Depletion of materials • Manufacturing environmental impact 	<ul style="list-style-type: none"> • Review and consider alternative products and materials where possible taking into consideration production techniques, raw material components and transportation emissions. • Carryout full life cycle analysis when comparing different materials and building systems • Use recycled aggregates, timber and steel where available and cost comparable • Minimise the use of materials with high VOC emissions, PVC and other undesirable building products
General	Site office operation (electricity, heating, air conditioning, waste, paper), workers transportation	<ul style="list-style-type: none"> • Contribution to increase of carbon footprint • Potential pollution from exhaust • Energy intensive processes, burning of fossil fuels, use of electricity on site, transportation and waste disposal 	<ul style="list-style-type: none"> • Source materials locally where possible • Use renewable building materials and products wherever possible • Purchase in bulks (quantity of material) to minimise transport needs, but to avoid unnecessary buys • Specific waste management plans with bins allocated for recycling • Use recycled/scrap paper for notes • Turn off equipment, tools, machinery, power, etc when not required or in use • Turn off heating (air-con) and light in rooms that are not in use • Use of public transport • Employ local labour • Use bus-crew transport
General	Unauthorised entry/wilful damage to site by trespassers	<ul style="list-style-type: none"> • Safety of intruder • Tampering with equipment/safety devices - damage to property • Spillage of hazardous materials - pollution • Fire 	<ul style="list-style-type: none"> • Site to be fenced and secured - alarm systems, live security guards • Lock chemicals, petrol, hazardous materials and substances storage
Landscape and visual	Loss of natural light due to	<ul style="list-style-type: none"> • Disturbance to tenants, neighbours and general public 	<ul style="list-style-type: none"> • Site accommodation, temp hoardings and support structures to be located in a way that minimises disruption to neighbours

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impact	construction		<ul style="list-style-type: none">• Undertake liaison with the community
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Notes:

- 1) Risk/likelihood of the presence of contamination of the ground should have been assessed and identified during Environmental Review/Assessment.
- 2) Likelihood of the archaeology presence on site should have been assessed during the Environmental Review/Assessment. Liaison with the local authorities and relevant specialists may be required.
- 3) Ecology presence and impact of the construction activities on it should have been established during the Environmental Review/Assessment.

GEM 02 - WASTE MANAGEMENT AND HAZARDOUS SUBSTANCES

The word '**SHALL**' in upper caps and bolded indicates a **mandatory requirement**.

1. Emphasis on hazardous waste

Hazardous waste is waste that is likely to cause substantial harm to the environment or to human beings. For UNOPS infrastructure operations, examples include, used oil, spillages of fuels and oils, asbestos waste, concrete/cement washings and fluorescent light fittings (containing mercury residues). These substances must be separated from other wastes and disposed of carefully to avoid release into the environment. Releases could be through leachates seeping into soil and/or water bodies, or vapours escaping into the atmosphere. Hazardous waste may be handed over to the local authority in line with local procedures if local capacity to handle the waste exists. The guidance of the Health, Safety and Environment Manager, Sustainable Infrastructure Practice Group (SIPG) should be sought where there are no local facilities to handle the waste.

2. General

The main principles of effective management of waste are:

- efficient use of resources to eliminate or reduce the generation of waste,
- diversion of waste from landfill by reuse or recycling,
- disposal of remaining waste.

In majority cases waste management in construction is governed by legislation which can be summarised as ensuring that disposal of waste is regulated (and traceable) and that the cost of waste disposal is borne by the waste producer (in-line with the Polluter Pays Principle).

Generally waste can be subdivided into the following categories:

- organic waste
- inactive waste - materials that do not cause environmental pollution or harm to human health or endanger the quality of any surface water or groundwater when deposited in a landfill under normal conditions. These include rocks, ceramics, concrete, masonry, and brick rubble.
- non-hazardous waste - include timber and bitumen
- hazardous waste - waste that is deemed to be dangerous to life and/or damaging to the environment. It may be corrosive, reactive, explosive, oxidising, carcinogenic or flammable i.e. asbestos, acids, alkaline solutions, oily sludges, waste oils and wood preservative.

3. Planning stage

Waste management should start with resource efficiency by using the raw materials wisely. To manage waste effectively, focus should be directed on ways to prevent materials becoming waste:

- If possible, developing standardised sizes or pre-cut materials to reduce off cuts (i.e. timber)
- If possible, arranging for the return of unused construction materials to suppliers,
- Control of purchasing of the materials – do not purchase unnecessary items, that would have to be disposed later on,
- Specifying/negotiating reduction in the amount of packaging used by suppliers, or packaging return schemes,

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- Specifying pre-cast units (i.e. concrete panels rather than on-site pours),
- Employing selective demolition - dismantling, often for recovery, selected parts of buildings to be demolished before the wrecking process is initiated,
- Storing materials delivered to site carefully to minimise potential damage and creation of waste (off-ground storage, maintain original packaging, covered protection from the weather and protection from collision by plant and vehicles).

Measures to minimize volume of waste generated **SHALL** be recorded in the Project Environmental Management Plan.

The planning stage can also consider opportunities for reuse and recycle waste generated on site.

4. Waste Reuse/Recycle

As much as possible construction and demolition debris should be prevented from disposal into the landfills. This can be achieved by reuse and recycle materials on site. Following examples present how materials can be re-used on the project:

- excavated stone can be used to build retaining wall in place of the gabions; this allows for cost saving on installation of gabions and disposal of the stone,
- concrete from demolition of existing structures can be crushed and then used as general fill material – i.e. concrete can be used on haul roads and when these are removed, it can be used as a capping layer for the new footpaths.
- trees removed as part of construction can be shredded and reused as mulch, which is used for landscaping and promoting the growth of new habitats
- excavated material can be reused for backfilling, this eliminates the need to import other material onto site saving time and money.
- Excavated material (gravel, stone, sand) or other suitable construction waste (brick, concrete) can be used as cover material at the landfill, backfill at new construction sites, for the reclamation of wetlands, for the filling of low-lying areas subject to regular flooding or can be sold to other engineering contractors.
- Scrap metal - has a residual value and can be sold to the scrap metal dealers

The local waste market should be investigated - there may be potential for recovery and reuse of materials from the waste such as recycling of paper, metals, glass, and plastic.

5. Site Waste Management Plan

Each construction project **SHALL** prepare Waste Management Plan (**Form EM 02**). The Plan **SHALL**:

- identify each type of waste that is expected to be produced, including identifying wastes that are inactive, non-hazardous, hazardous and organic,
- estimate the quantities of waste that are expected to be generated,
- for each waste stream consider how the waste will be disposed – take into account availability of facilities in the area of the site,
- demonstrate how reductions in overall waste expected to be generated and the reductions in waste to be sent to landfill can be achieved,

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- define facilities on site and outline an action plan: i.e. construction of waste storage area, liaison with local government, communication plans, training,
- identify person responsible for waste management on site.

The plan **SHALL** be regularly reviewed to evaluate performance against action plan including targets and records shall be updated.

The waste management should consider the most suitable (practical, financial, technical) solutions.

6. Storage of hazardous substances and wastes**Storage and handling of hazardous substances**

Substances that may harm people or the environment shall be handled and stored in a way that prevents accidental release.

- Drip trays shall be placed under leaking under generators, vehicles and other equipment to prevent spills of hydrocarbons reaching the soil or watercourses.
- Storage tanks shall have secondary containment, so that leaking liquids may be collected in the event of a failure. Secondary containment should ideally have a capacity of at least 110% of the holding capacity of the tank it is protecting.
- To avoid leaks, proper funnels should be used when decanting to other containers. It is recommended to use a hand pump rather than a funnel and smaller containers for frequent/routine transfers from one container to another (or to a vehicle tank).

Waste storage areas **SHALL** be provided on site:

- Sufficient space should be allocated on site for the waste expected to be generated,
- Storage areas **SHALL** be indicated on site plans for communication purposes,
- Storage areas **SHALL** have clear signage to ensure different wastes are stored in the correct place,
- Storage area **SHALL** be enclosed to prevent waste escaping – i.e. spread of waste by wind-blown; if possible covered skips are suggested to be used,
- If possible waste should be protected from the rain fall/water ingress,
- Waste storage **SHALL** not be located in the area prone to flooding or on the slope,
- Location of the waste storage should be away (min 30 m) from human settlements, animal pastures, water bodies, water sources etc
- Hazardous wastes **SHALL** not be mixed with non-hazardous waste,
- Organic waste **SHALL** not be mixed and stored with non-organic waste,
- Hazardous wastes **SHALL** be stored in suitable containment, on impermeable surface

Practical advice:

Store waste in one place and segregate immediately. In such way you will avoid piles of waste scattered throughout the site, which is dangerous and double-handling waste.

7. Waste Segregation

As much as possible waste on site should be segregated - that will help recovery of reusable or recyclable materials:

- Make segregation easy to do by providing separate areas (containers) in a designated impermeable waste storage area
- Brief staff on the segregation requirements
- Organic waste **SHALL** be segregated from non-organic waste
- Hazardous waste **SHALL** be segregated from non-hazardous waste
- If there is no space on site to segregate wastes for reuse or recycling, consider off site recycling by using a waste management subcontractor that has the necessary facilities.

8. Waste Disposal

Disposal of waste from site must only be carried out by a registered waste carrier who should be able to provide a copy of their waste carriers' licence – check local government/authorities requirements. Waste materials removed from the construction area **SHALL** be disposed at the approved landfill site.

It is recommended to carry out review of the local waste practices - what waste facilities are available in the country/region. If no facilities are available nearby the site, this may be an opportunity for joint action with the local community to explore options to create local disposal site – controlled dump site.

Unauthorised and uncontrolled dumping of the waste generated on construction site is strictly forbidden.

9. Burial of waste

If there are no waste collection facilities in the area, disposal of construction waste should be by burying. Burial **SHALL** be in pits. Following conditions **SHALL** be followed for pits location and construction:

- located downstream of any water sources (30m away),
- away from human settlements (at least 50m distance),
- only inactive or non-hazardous waste, which do not have potential for leaking can be buried,
- bottom of the pit should be min 1.5m above water table,
- sides of the pit need to be stable and should be at 45 degrees unless a geotechnical expert advises otherwise,
- a small fence **SHALL** be constructed around the pit to avoid accidents and scavenging,
- pit **SHALL** be protected from the rain water ingress and from the wind (prevent spreading waste in the area),
- location of the pit **SHALL** be agreed with the UNOPS representative and local authorities, if necessary.
- pit **SHALL** be covered by at least 600mm of earth material prior to abandonment.

No hazardous waste (medical waste, batteries) should be disposed in these pits.

Wherever possible the organic waste should be composted.

10. Burning of waste

Burning of waste on site is the last option for disposal of waste, allowed only if all other options are exhausted. If this form of the waste disposal is necessary, it will require permission of the UNOPS HSE Manager.

Uncontrolled and unauthorised burning of the waste generated by the project is strictly forbidden.

Burning of the hazardous waste is strictly forbidden.

If burning of the waste is authorised by the UNOPS HSE Manager, it **SHALL** follow following rules:

- be undertaken in the pits, located downwind of the construction site and dwellings – as a minimum 50m away,
- treated wood should be removed from the waste stream before burning,
- fire prevention measures shall be implemented to reduce fire hazard.

***Notes on changes in this version:** the main change was the introduction of section 1 that emphasises the control of hazardous waste and the additions too section 6 that describe handling of hazardous waste. The other change is the introduction of numbering of sections for ease of reference. The title of the guidance is now Waste Management rather than solid waste management.*

GEM 03 - PROTECTION OF WATER

The word '**SHALL**' in upper caps and bolded indicates a **mandatory requirement**.

General

Waters, including rivers, streams, ditches, ponds, lakes/lochs/loughs, groundwater and coastal waters should be protected from harm and pollution.

Pollution can result from any of the following entering a body of surface or groundwater: any poisonous, noxious or polluting matter or any waste matter (including silt, cement, concrete, oil, petroleum spirit, chemicals, solvents, sewage).

Common pollutants of water are:

- Garbage
- Silt
- Cement or concrete wash water (highly alkaline)
- Detergents
- Hydrocarbons, eg oil, diesel

It is vital to manage sites properly to protect the water environment and water supplies. A site does not need to be next to a river or other water body to cause a problem. Any pollutants getting into subsoil surface water drain or groundwater can end up in a river even if it is miles away.

Controls **SHALL** prevent the entry, or accidental spillage, of solid matter, contaminants, debris, and other pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Controls should be applied in a hierarchical manner i.e. applying control measures at source, if not possible at pathway, if not possible at receptor.

Consents and permits

Discharges to drains (foul sewer) or surface water drains or water bodies may require a formal approval (licence or consent/permit) from the relevant body/regulator.

It is therefore crucial to identify any discharge and abstract consents requirements from the local authorities and obtain them if necessary, before any work commences.

Prior to works commencement all drainage on site (and around site) should be identified.

To avoiding spillages on site:

- store liquids, solids and powders away from drains and waters,
- use of secondary containment, i.e. bunds around oil storage tanks, double skin tanks,
- use of drip trays around mobile plant,
- preferably only equipment in good condition (not leaking) should be used on site,
- designate area for refuelling – ideally on impermeable surface, away from water bodies and surface water drains; supervise deliveries,
- create designated wash out for concrete lorries – ideally it should be located at least 10m away from drains and waters,
- provide spill kits on site, ideally in vicinity of the areas where they may be used,

- place interceptors in drains to catch oils.

Managing effluent from vehicles, boot and tools washing

Vehicle wheels may need to be washed on site to avoid mud on public roads. Facilities should be provided for site workers to wash their boots to remove mud. Cleaning should be carried out in a bunded area and if possible water should be recycled (provided that is not contaminated).

If tools and equipment need to be washed, this should be undertaken well away from any waters or surface water drains on an area of hardstanding to avoid infiltration of potential pollutants into soils.

Surface water run off

Surface water run off should be managed so that it does not run into excavations, over disturbed ground or onto haul roads. Following actions should be considered for preventing and managing runoff and silty water:

- Endeavour to minimise land clearing and land shaping
- Allow a permanent stabilisation of disturbed areas as soon as land shaping is complete
- If possible and appropriate, use undisturbed areas as sediment buffer zones either during construction or on a long-term basis
- If possible endeavour to locate imported material and soil stockpiles in areas that minimise on-site traffic movement
- If possible plan works that cause ground disturbance outside of rain periods
- When undertaking earthworks ensure there is a buffer strip left to protect surface water
- If necessary, erect silt fences along the downslope or sideslope of disturbed areas
- Placing bunding or silt traps or cover around drains to prevent silt runoff

Areas of standing water **SHALL** be not allowed on site, as they may potentially create health and safety hazard for site staff and neighbourhood.

Discharge from site

- Silty or discoloured water **SHALL** not be discharged from the site
- Surface water runoff **SHALL** not be directly entering waters
- Water containing detergents **SHALL** not be allowed to enter either surface water drains or other surface or groundwater bodies

Monitoring

- Undertake regular (daily) visual inspections of waters at or near the site for signs of harm - look for any visible signs of discolouration in waters,
- If a settlement tank is used, ensure that water is not moving too fast and/or overflowing (other than at the discharge point)
- Check outfalls and pipework daily to ensure they are clean and clear of litter

Dealing with the water pollution:

- Pump to grassland or other soakaway – well away from excavations to avoid recirculation through the ground. The silty water should contain no chemical pollutants. This option is only suitable for water that is unpolluted aside from its silt content.
- Pump to sewer – consent from the sewage provider will be required
- Pump to settlement tank/constructed ponds/lagoons
 - A settlement lagoon (pond or tank) works by retaining water in an undisturbed state long enough for suspended solids to settle out. The clean water then either flows out at the discharge point or is pumped out.
 - The size of the tank/lagoon should be adequate for the settlement time required and the rate at which water flows or is pumped into it. A long, narrow, shallow settlement lagoon can help to maximise retention time of all water in the lagoon.
 - The tank should be periodically cleaned out to prevent a build-up of silt.
 - Regular inspect/monitoring of the outflow quality should be undertaken
 - Depending on the legal requirements, a consent/licence to pump clean water from the surface of settlement lagoons into waters or a designated discharge point should be sought from the local authorities
- Pass through a filtration system

Discharges with fairly coarse particles (but no other pollutants) and relatively small flows may be treated easily and cheaply by passing them through steel tanks or even skips filled with a suitable filter, such as fine single size aggregates (5 to 10 mm), geotextiles or straw bales.
- Pump into a tanker and dispose of off site (most expensive).

Use water on site:

It is good practice on site to consider water use needs and to seek to reduce these wherever possible, to reduce the need to use potable water from taps.

Some construction activities, for example concrete batching or dust suppression, require water to be abstracted from surface water or groundwater. Water abstraction cases need to be carefully managed, as they can potentially lead to:

- shortages in water supply
- increased pollution due to reduced dilution of pollutants
- damage to habitats

For each abstraction case an impact assessment must be prepared and agreement (abstract consent) from the relevant authority obtained.

Working over or near to water:

- Ensure that a comprehensive risk assessments is completed for activities that involve working near or over the water,
- Preferably no site works should occur within 10 m of the edge of waters,
- Avoid storing fuel near water,

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- Spray, dust or other airborne materials should be prevented from entering waters (i.e. erecting dust screens on bridges, use of decking/barges below the works - acting as a bund in case of spillage)
- Check if the banks or bed of waters outside the area of the works are not being affected by site operations (discharges or vehicle movements etc)
- Regularly check waters downstream of the works to see if these are silted or discoloured or if there is an oily sheen visible on the water
- Plan for emergency – ensure that spill kits (or booms across the river to contain pollutants) are available, ensure that site staff is aware of the location of spill kits and knows how to use them.

Dealing with water in excavations

- Prevent water from entering excavations,
- Manage groundwater flowing into excavations - install cut off ditches, walls or well point dewatering
- Make sure that water pump out from the excavation is passing through the settlement tank

GEM 04 - WASTEWATER

The word '**SHALL**' in upper caps and bolded indicates **a mandatory requirement**.

Level of provision of the sanitation facilities on site will depend on number of people working on the site, duration of the project and local conditions.

If possible, drainage from site facilities (toilets, washing facilities, kitchen) should be connected to the sewer network in the area. Such connection will require obtaining consent from the relevant authority.

Alternatively, temporary toilets can be provided on site and their content should be regularly tankered away and disposed in responsible manner – sewer network, sewer treatment plant. Any discharge must be agreed with the relevant authority.

Septic tanks can be installed, provided that:

- If water table is too high, tank should be lined with clay, plastic sheeting or some other impermeable material to prevent leakage
- Direct discharge of effluent to waterways should be avoided if possible. Direct discharge of the effluent to waterways with sufficient volume and flow to assimilate the waste may be acceptable. It is recommended to add a secondary treatment, such as passing effluent through an anaerobic filter, followed by discharge to an absorption field, or better yet, a constructed wetland.
- Sewage from showers and washing facilities can be directed straight to the soak drains.
- A system for sludge removal and transportation of the collected material off-site for treatment should be provided.
- The collected sludge must be adequately treated and not directly applied to fields or otherwise improperly disposed of.

Main considerations for design and installation of the septic tank:

- The tank **SHALL** be structurally sound and water tight,
- Tank should be large enough to serve number of the users and provide suitable conditions for the settlement, storage and partial decomposition of solids.
- The capacity of the tank (C) can be calculated in the basis of the number of users (P):
$$C = 180 \times P + 2000 \text{ [litres]}$$
- The tank should have as a minimum two compartments, with the first chamber providing at least 2/3 of the total capacity.
- A proper access for maintenance should be allowed.
- Tanks should be equipped with the ventilation pipes.
- If possible single soak point should be avoided; a drainage field should be constructed.
- Drainage trenches should be constructed as a min 2 m away from each other, with the 300mm granular material below the distribution (perforated) pipe.
- A drainage field **SHALL** be downstream of any water sources, with at least 50m distance.

Discharging untreated sewage to the water body is strictly prohibited.

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If drainage or treatment facilities are not available locally, it is recommended review the local conditions and provide sanitation facilities similar to the local ones.

In absence of any systems it is recommended to undertake consultation with the local community and explore opportunities to improve sanitation conditions in the area. This may involve conversion of the temporary facilities constructed for the project into permanent structure used by the community, if feasible.

Preventing a contamination of groundwater sources should be the priority, and that depends on several factors:

- Type of toilet – the rate of flow of pathogen-containing liquid from latrine pits to the soil beneath is proportional to the quantity of liquid in the pit (static head). Dry toilets present the smallest risk of groundwater contamination.
- Water table – a latrine pit must be above the water table during all seasons. 1.5m above the surface is the minimum depth necessary to ensure the pit contents remain dry, however recommended distance is 2.0m.
- Soil type – Clay, silt, and fine sand soil types all have grain sizes small enough to act as natural filters for microbial contaminants (<0.2mm).
- Distance to nearest water source – the risk of contamination of a surface or groundwater source by a toilet depends on the distance to the source, the direction and velocity of the flow of water in the soil (hydraulic gradient), and the soil/rock permeability. 30m is considered the minimum separation for most soil types, however recommended distance is 50m. Toilets shall be always located downstream of any water source.

Additionally, direction of the wind should be taken into the consideration and potential odor and fly nuisance.

Sanitation facilities should not be constructed in the areas prone to flooding or if this is not possible, they should be flood protected by raising their level.

Following options for sanitary facilities can be considered (based on the recommendation of the WaterAid, USAid for sanitation solutions in the rural areas of the developing countries):

Pit Latrine (PL) or Ventilated Improved Pit (VIP) latrine

- Pit latrines should not be installed where the water table is shallow.
- The pit **SHALL** be least 3m deep and, if necessary to attain this depth, the floor level of the building above it should be raised above ground level.
- Recommended dimension of the pit for the family of five is 1.2m, for design period 3-5 years.
- For PL lid should be provided over the hole to minimise odour and fly nuisance, for VIP latrines the room should be well ventilated so as to allow the flow of air into the pit.
- The VIP latrines **SHALL** have a vent pipe which should be at least 100mm in diameter and should extend from the pit to about 1m above the roof, it should be fitted with fly screen
- In unstable ground the pit walls should be supported with timber, bricks or blocks.
- Single or double pits can be provided.
- For single pit - when it is full, it should be covered with leaves and soil and a small tree is planted on top to grow in the compost. No handling of the waste is required.
- In double pits, while one is filling with excreta, the second pit remains out of service. When the first pit is filled with excreta up to about 50 cm below the slab, it is taken out of use and

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the remaining space is filled with grass and vegetation materials that can be composted. The second pit should be then used until is full. The first pit will stay sealed for a period of 6–12 months (depending on the climate), during which time the waste will decompose and any pathogenic microorganisms will die. After this period, the material (humus soil) in the first pit can be taken out manually.

Composting toilets

- Humidity of composting material should be maintained above 60% and excreta supplemented with generous quantities of carboniferous material (dry leaves, straw, etc.). The pile should then remain aerobic, odor-free and insect-free
- Vaults should be constructed as sealed vaults to hold composting material if using fixed-batch systems.
- Test samples should be taken from active chamber and mature chamber after fallow period for Ascaris eggs and fecal coliforms
- Sufficient residence time should be allowed in mature chamber. This may vary from 6 months in warm climates to 18 months in cooler climates
- The systems must be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized

Dry toilets

- In a dry toilet ash or lime mixed with dry soil are added to create a dehydrating environment for breakdown and die off of pathogens.
- Humidity of composting material should be maintained below 20% and excreta supplement with alkaline material (ashes or lime). The pile should then remain both odor free and insect free. Generous applications of ashes will help ensure that pathogens are destroyed.
- Sealed vaults should be constructed to hold dehydrating and curing material.
- The toilet paper should not be added to the dry toilets.
- The systems must be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized
- Test samples should be taken from active chamber and mature chamber after fallow period for Ascaris eggs and fecal coliforms
- Sufficient residence time should be allowed in mature chamber. This may vary from 6 months in warm climates to 18 months in cooler climates

Pour Flush Latrines

- Uses principle of the cistern flush toilet, but water is pour manually, on average 2-3 liters of water is required per flush
- Sewage is disposed to a septic tank or seepage pit
- To prevent smells rising from the pit a U-bend water seal can be incorporated.
- For further information on design of the pour flush latrines refer to <http://water.worldbank.org/publications/design-pour-flush-latrines>

For all installation hand-washing facilities **SHALL** be provided.

GEM 05 - BORROW PIT MANAGEMENT

This document provides guidance on management of borrow pits. The Contractor should remain responsible for managing borrow pit operations.

Borrow pit site reclamation (also called reinstatement) must be completed prior to handover of the road section to which the borrow site was used.

1. Site assessment and selection

A preliminary site assessment prior to undertaking excavation works should be undertaken. Such assessment shall include as a minimum the following:

1.1. Land tenure and approval for use

- A written approval for use of the proposed site shall be obtained from the local authorities. It is recommended to commence discussion with relevant authorities as soon as possible to understand requirements and potential limitations of the process. Negotiation may require preparation of the narrative that describes borrow pit operations, outlines potential risk to the community, proposes mitigation measures to control and minimise such risks and presents restoration plans.

1.2. Geotechnical site investigation

- Borehole drilling and/or excavation of test pits shall be carried out to confirm the extent and quality of the materials within the proposed site. Test pits and boreholes shall be decommissioned unless used as a borrow site.
- Hydrogeological information shall be obtained to determine the presence and depth of any groundwater table.

1.3. Site property lines and location

- Borrow pits should be preferably located in the areas with minimal volume of vegetation or existing/decommissioned pits can be used.
- The borrow pit site shall have clearly defined property lines which will be surveyed and clearly marked to limit excavation within the approved area of the site.
- The size of the area to be excavated shall be a maximum of 10,000 m² (or 1 ha). Larger area may be excavated upon written approval from the UNOPS representative.
- The borrow pit operational site must have an undisturbed buffer area of natural vegetation of a minimum of 25 meters in width around the perimeter of the site – excluding entry roadway with a maximum width of 5 meters.
- The property line of the site shall be a minimum of 100 meters from the nearest households and 100 meters away from the nearest watercourse.
- Location of the borrow pit place shall be well documents. Documentation should include: a map showing the location and a plan-view of the site, a photographic record of the site in its undisturbed state (photographs should be taken from the geographic center of the proposed site in 8 directions: north, northeast, east, southeast, south, southwest, west, and northwest).

2. Borrow pit operations

During borrow pit operations as a minimum good management practices shall be followed:

2.1. Operational area

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- Site area shall include: area of extraction, a buffer zone, perimeter berm, stockpiles (i.e. top soil and overburden) and area for general operations.

2.2. Stockpiles

- Topsoil depth ranges between 150 mm and 500 mm. The exact depth shall be determined from the geotechnical site assessment. Topsoil shall be stripped and stockpiled away from other materials. Topsoil shall be only used for reclamation purposes when pit operation is complete.
- Overburden soil (i.e. the layer of soil below the topsoil and above the material of interest) shall be used as a perimeter berm to direct drainage on the site or stockpiled separately from topsoil and later used to landscape and backfill exhausted areas of the borrow pit.

2.3. Excavation slopes

- Pit excavations shall be a maximum of 6 meters in depth with a maximum allowable horizontal to vertical slope (H:V) of 2:1 or 50% grade.
- One side of the excavation shall have a maximum horizontal to vertical slope (H:V) of 2.5:1 or 40% grade for efficient operation of heavy equipment and to allow for ease of access.
- Pit excavations greater than 6 meters must be fenced all round.

2.4. Duration of operations

- An estimated lifespan of site should be given based on the geotechnical assessment, anticipated rate of extraction and planned site reclamation.

3. Environmental and safety management

The Contractor must undertake the following environmental protection and public safety measures:

3.1. Site Access/Safety

- The extraction site should have a barrier such as yellow warning tape and/or perimeter berms to control or discourage public access. Alternatively, the Contractor can post a local full-time guard until the site is reinstated.
- Any deep excavation site that has standing water greater than 0.75 meters deep must be protected from public access by installing a fence and/or posting a full-time guard before the water level goes down.
- Entrances to the site should be gated so as to block ease of access and shall be designed to provide vehicles with adequate sight distance to avoid a safety hazard.
- Durable warning signs shall be posted around the perimeter of the borrow site not more than 50 meters apart which will provide symbols of danger and no trespassing (e.g. skull and crossbones).
- Liaison with the local community should be undertaken, which includes information on dangers within borrow pit operational sites and that trespassing is not permitted.

3.2. Visual

- Ensure that existing vegetation within the minimum 25-meter buffer area is not disturbed, as it should provide some visual screening of pit operations from the road and nearby residents.

3.3. Noise

- Ensure that existing vegetation within the minimum 25-meter buffer area is not disturbed, as it should screen noise of pit operations from nearby residents.

3.4. Water

- If water is needed for borrow pit operations, a water extraction points such as a borehole, shall be established within the site, ideally located near the perimeter of the property for use by the local community once the site is reinstated.
- Borrow pits shall not be located within a wetland area.
- Excavation below the water table is not permitted.
- Standing water in the borrow pit is not permitted and shall be removed either through drainage structures and/or pumping. Alternatively, any pits with deep (greater than 0.75 meter) pools of water must be secured by a fence and/or full-time guards to prevent public access.
- Under no circumstances shall community members be allowed to use water at an active borrow pit site for any purpose (e.g. watering their animals, washing clothes, etc.).

3.5. Water discharge

- Overburden soil can be used as a perimeter berm to direct drainage away from the site.
- Efforts shall be made to reduce the amount of runoff into the borrow pit.

3.6. Erosion

- Erosion control measures must be undertaken in all aspects of pit operations including stockpiles and access roads. These measures include reduced slopes, seeding, and stockpile covers to protect stockpiles and the adjacent land.
- Topsoil stockpiles shall be protected from wind and water erosion by reducing slopes (i.e. less than 50% grade), using a covering, and/or spraying with water.

3.7. Dust

- In all operation of the borrow pits, measures shall be undertaken to minimise dust emission and spreading (water sprinklers, covering stockpiles, introducing speed limit, etc).
- If a rock crusher is used, the dust control measures shall be undertaken by using a water truck or fixed sprinklers on crushing equipment.

4. Site reclamation

Site reclamation (reinstatement) should be completed prior to handover of completed road section.

4.1. Stockpile reuse

- Overburden stockpiles and perimeter berms shall be placed on the excavated site and graded to the desired slopes and drainage paths.
- Reserved topsoil shall be spread on top of the overburden with more topsoil focused on sloping land (minimum depth on slopes: 150 mm).

4.2. Final slope and drainage

- Suitable surface slopes together with drainage ditches and conduits – as needed – shall be constructed to prevent water from collecting at the site.
- Final slopes within the site shall be a maximum horizontal to vertical slope (H:V) of 3:1 or 33% grade.

4.3. Final cover

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- The borrow pit operational site including access roads shall be thoroughly scarified as needed to help establish adequate vegetative cover.
- A minimum of 75% of vegetative cover should be established and maintained following the first rains after reclamation.
- Particular focus shall be given to vegetation cover on the side slopes of the excavated area to minimize erosion. Any required seeding used shall be of local plant varieties.

4.4. Interim reclamation

- When excavation activities are going to cease for longer than 60 days, interim reclamation measures should be undertaken to protect the environment and public safety.
- Interim reclamation measures include a minimum of seeding of topsoil stockpiles and grading the site to reduce erosion potential.

GEM 06 - PRESERVATION OF HISTORICAL, ARCHEOLOGICAL AND CULTURAL REMAINS

Protection of the historical, scientific, geological and archaeological findings is an important part of the process of preservation of the world's cultural heritage.

Known sites of the historical, scientific, geological and archaeological importance **SHALL** not be considered for location of the project, unless the aim of the project is preservation of the site.

Potential for the presence of the areas of historical, scientific, geological and archaeological importance **SHALL** be identified at the project initiation stage, through the Environmental Assessment process. Consultation with the relevant authorities and local communities will be necessary.

If areas as described above are located in the vicinity of the project site, they **SHALL** be suitably protected, depending on the intrusiveness of the site activities, by fencing, screening, sheet piling etc.

In locations, where there is a potential for discovering items of the historical, scientific, geological and archaeological importance, it is recommended to undertake the trial pits, prior to commencement of any substantial excavation.

If evidence of possible scientific, historical, geological, archaeological or cultural interest or value during the execution of the works is discovered, work in this area must be stopped immediately. The UNOPS representative shall be notified on the nature and location of findings.

A reasonable precaution and care must be exercised so that artefacts or fossils uncovered during excavation operations are not damaged. The area shall be isolated/fenced off.

The relevant authority must be informed on the findings as soon as it is possible, furthermore assistance and cooperation with the Authorities and experts shall be assured.