NWFP Environmental Protection Agency

Environmental Guidelines

Sanitation Schemes

No:	Version: **B**	Date: **21 May 2004**	Page **1** of **20**

Contents

1. Introduction

The selection of an appropriate technical system for wastewater entails a careful process based on technical, environmental, health, social, institutional, financial and economic considerations.

1.1 Scope of the Guidelines

These guidelines are applicable to sanitation projects costing less than Rupees ten million. It includes the following type of projects:

- Latrines
- Septic tank and leach field systems
- Sewers and sewage systems

1.2 How to use these Guidelines

The project proponent (the local government, municipal government, city government, the cantonment board, NGO, or private organization) is obliged to use these guidelines. The project proponent has to fill in an environmental assessment form. The following steps are to be taken in this regard:

Step 1: Provide information on project [use **Section I**]

Step 2: Determine Applicability (*Are you sure that IEE or EIA is not required?*) [use **Section II**]

Step 3: Describe the physical, biological and social environment [use **Section III**]

Step 4: Assess potential impacts and applicable mitigation measures [use **Section IV**]

Step 5: Provide undertaking to the EPA on mitigation measures and compliance [use **Section V**]

Completed form is to be submitted to the NWFP Environmental Protection Agency for evaluation. NWFP EPA may request for additional information or decide to undertake visit to the proposed project site in order to assess the environmental impact of the proposed project.

1.3 Glossary

Act means the Pakistan Environmental Protection Act, 1997

Biological Oxygen Demand (BOD) BOD is a measurement of oxygen required by bacteria to oxidize (stabilize) the organic matter in the wastewater

Blackwater is wastewater from toilets and latrines containing feces or body fluids and water from sinks used for food preparation or disposal of chemical or biological ingredients.

Contamination introduction of impurities in the environment

Drain A channel or pipe along which liquid drains away; *esp.* (a**)** a pipe for leading away rainwater etc.; (b**)** an open channel made to drain an area of land; an artificial river

Disease Vectors insects or small mammals carrying disease-causing germs

Environment means (a) air, water and land; (b) all layers of the atmosphere; (c) all organic and inorganic matter and living organisms; (d) the ecosystem and ecological relationships; (e) buildings, structures, roads, facilities and works; (f) all social and economic conditions affecting community life; and (g) the inter-relationships between any of the factors in sub-clause (a) to (f).

Environmental Assessment a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgments on whether the development should go ahead.

Ecosystem a biological community plus the surrounding physical environment

Endangered Species a species in danger of becoming extinct

Greywater is the water that has been used once in a house or building for washing clothes, shower, bathing, hand washing , or dishwashing and can therefore be used again in toilets or to water gardens and landscaping.

Impact on Environment means any effect on land, water, air or any other component of the environment, as well as on wildlife harvesting, and includes any effect on the social and cultural environment or on heritage resources.

Infiltration seepage of water intro ground

Invasive Non-native Species a species that is introduced into an area or region from outside

Mitigation Measure means a measure for the control, reduction or elimination of an adverse impact of a development on the environment, including a restorative measure.

Pathogens the microorganisms that are capable of producing disease

Potable water is water that is safe for drinking and cooking

Regulations means the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2000

Sanitation treatment and disposal of sewage

Soakway a pit into which wastewater flows in order to drain slowly out into the surrounding soil

Septic Tank a tank (associated either with a sewage works or with a residence not connected to a sewer) in which the solid content of sewage is allowed to settle and accumulate and is purified by the action of anaerobic bacteria

Sewer a conduit that carries away sewage or wastewater

Stabilization Ponds shallow ponds or lagoons constructed to treat domestic wastewater

Sludge any muddy or slimy matter or deposit; a thick suspension of fine particles or gel in a liquid, esp. one formed as waste in any of various industrial and mechanical processes

Soil Erosion physical removal of soil, either by wind or by running water

Sedimentation Deposition of material in the form of sediment, as a geological process, or in a liquid in a tank, centrifuge, etc

Suspended Solids (SS) organic and inorganic particles, which do not dissolve in the wastewater but remain suspended

2. Project Profile

2.1 Project Description

Sanitation projects involve construction of:

- Individual latrines
- Community latrines
- Small-scale septic and leach field systems
- Settled and simplified sewers
- Water stabilization ponds
- Constructed wetlands
- Water-borne sewage with disposal to surface waters

2.2 Environmental Aspects

Site Selection

- Damage to sensitive ecosystems or endangered species

Construction of Buildings and structures

- Damage to sensitive ecosystems or endangered species
- Cause erosion and sedimentation

Soakways and Drains

- Cause erosion
- Alter the natural flow of rainwater runoff
- Create pools of stagnant water

Pit Latrine

- Increase transmission of vector-borne diseases
- Contaminate groundwater supply with pathogens
- Contaminate water supplies, damage water quality and/or transmit disease at other locations if waste is not properly handled and treated during or after servicing.
- Cause injury to people or animals
- Odor

Composting Toilets

- Increase transmission of vector-borne diseases
- Contaminate groundwater supply with pathogens
- Cause disease transmission to field workers and consumers of agricultural products

Dry Toilets

- Increase transmission of vector-borne diseases
- Cause disease transmission to field workers and consumers of agricultural products
- Odor

Septic Tanks

- Contaminate groundwater supply with pathogens
- Contaminate surface water supplies with nutrients, biological oxygen demand (BOD), suspended solids (SS) and pathogens (Septic tank effluent generally contains relatively high concentrations of pathogens, BOD, and SS).
- Contaminate water supplies, damage water quality and/or transmit disease at other locations if waste is not properly handled and treated during or after servicing.

Upflow Anaerobic Filters

- Damage ecosystems and degrade surface water quality. Sludge has high concentrations of nutrients, BOD, and solids.
- Cause disease transmission to field workers and consumers of agricultural products (Sludge may still contain pathogens).

Settled and Simplified Sewers

- Damage ecosystems and degrade surface water quality
- Transmit diseases to field workers and consumers of agricultural products

Biogas Reactors

- Damage ecosystems and degrade surface water quality
- Transmit diseases to field workers and consumers of agricultural products

Wastewater Stabilization Ponds (Anaerobic, Facultative, Aerobic)

- Damage ecosystems and degrade surface water quality

- Transmit diseases to field workers and consumers of agricultural products
- Odor

Reed Bed Filter

- Contaminate groundwater or surface water

Subsurface Wetland

- Contaminate groundwater or surface water

Free Water Surface Wetland/Floating aquatic Macrophytes

- Provide breeding ground for disease vectors
- Introduce invasive non-native species

Slow-rate Overland Flow

- Contaminate groundwater or surface water

Slow-rate Subsurface Flow

- Contaminate groundwater or surface water

Rapid Infiltration

- Contaminate groundwater or surface water

Sludge Management

- Damage ecosystems and degrade surface water quality
- Cause disease in handlers and processors

Wastewater Use in Agriculture and Aquaculture

- Cause disease in field workers and consumers of agricultural products

2.3 Mitigation Options

Site Selection

- Survey for, and avoid wetlands and other ecologically sensitive sites in the project area

Construction of Buildings and structures

- Train and monitor workers
- Gather data on soil type, slope and topography to determine the potential for significant erosion
- Use silt screens, straw bales or similar erosion control measures
- Avoid damaging vegetation
- Revegetate areas damaged during construction
- Use proper bedding materials for pipes

Soakways and Drains

- Use riprap (cobbled stone), gravel or concrete as needed to prevent erosion of drainage structures
- Monitor and keep drains and soakways clear

Pit Laterine

- Devote adequate attention to identifying and addressing social barriers to using latrine
- Use the ventilated improved pit latrine design that traps insect vectors
- Evaluate depth to water table, including seasonal fluctuations and groundwater hydrology. The size and composition of the unsaturated zone determine the residence time of effluent from the latrine, which is the key

factor in removal and elimination of pathogens. Pit latrines should not be installed where the water table is shallow or where the composition of the overlying deposits makes groundwater or an aquifer vulnerable to contamination.

- Ensure that a reliable system for safely emptying latrines and transporting the collected material off-site for treatment is used. This should include use of a small pit-emptying machine such as the vacutug that relies on an engine-driven vacuum pump.
- Ensure that collected material is adequately treated and not directly applied to fields or otherwise disposed of improperly.
- Properly decommission pit latrines. Do not leave pits open. Fill in unused capacity with rocks or soil.

Composting Toilets

- Maintain humidity of composting material above 60% and supplement excreta with generous quantities of carboniferous material (dry leaves, straw, etc.). The pile should then remain aerobic, odor-free and insect-free.
- Construct sealed vaults to hold composting material if using fixed-batch systems. If using movable-batch systems check removable containers for leaks before installing.
- Test samples from active chamber and mature chamber after fallow period for *Ascaris* eggs and fecal coliforms
- Allow sufficient residence time in mature chamber. This may vary from 6 months in warm climates to 18 months in cooler climates.
- Ensure that the systems will be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized.

Dry Toilets

- Maintain humidity of composting material below 20% and supplement excreta 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. pH is the most important factor for sterilization
- Construct sealed vaults to hold dehydrating and curing material
- Ensure that the systems will be properly operated and maintained so that the soil amendment taken out after the treatment period is truly sanitized.
- Test samples from active chamber and mature chamber after fallow period for *Ascaris* eggs and fecal coliforms to assess level of sterilization
- Allow sufficient residence time in mature chamber. This may vary from 6 months in warm climates to 18 months in cooler climates.

Septic Tanks

- Evaluate depth to the water table, including seasonal fluctuations and groundwater hydrology. If water table is too high, line the tank with clay, plastic sheeting or some other impermeable material to prevent leakage.
- Avoid direct discharge of effluent to waterways if possible. Direct discharge to waterways with sufficient volume and flow to assimilate the waste may be acceptable. It is better 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.
- Ensure that a reliable system for safely removing sludge and transporting the collected material off-site for treatment is available. This should include use of a mechanized (probably vacuum-based) removal system.
- Ensure that collected sludge is adequately treated and not directly applied to fields or otherwise improperly disposed of (See Sludge management below).

Upflow Anaerobic Filters

- Treat sludge before secondary use (see Sludge management below). Do not allow disposal in or near water bodies
- Provide workers servicing, transporting, and otherwise exposed to sludge with appropriate protective clothing including, at a minimum, rubber gloves. Train workers to wash hands and faces frequently with soap and warm water and make both available (See Wastewater and sludge use in agriculture and aquaculture below).

Settled and Simplified Sewers

- Ensure that collected sewage will be treated, e.g., in a wastewater stabilization pond, and not simply discharged to a river or stream or used directly in agriculture or aquaculture. This is especially important for simplified sewerage, since there is no interceptor tank.

Biogas Reactors

- Do not allow disposal of digested slurry in or near water bodies
- Follow WHO or other national or international guidelines for use of sludge in wastewater in agriculture and aquaculture (see Sludge and wastewater reuse below).

Wastewater Stabilization Ponds (Anaerobic, Facultative, Aerobic)

- Avoid discharging single (facultative) pond systems directly into receiving waters. If this is unavoidable, construct hydrography-controlled release lagoons that discharge effluent only when stream conditions are adequate. Install secondary treatment such as a constructed wetland, if possible.
- Use two-, three- or five-pond systems if possible (anaerobic, facultative, (maturation))
- Allow only restricted uses for agriculture and aquaculture of

effluent from all but five-pond systems

Reed Bed Filter

- Evaluate depth to the water table, including seasonal fluctuations and groundwater hydrology. If water table is too high, line tank with clay, plastic sheeting or some other impermeable material to prevent leakage.

Subsurface Wetland

- Evaluate depth to the water table, including seasonal fluctuations and groundwater hydrology. If water table is too high, line tank with clay, plastic sheeting or some other impermeable material to prevent leakage.

Free Water Surface Wetland/Floating aquatic Macrophytes

- Use plant and animal species that are native to the region. Avoid introducing water hyacinth, water milfoil, or salvinia, which have proven extremely invasive outside of their natural range.
- If using water hyacinth, maintain dissolved oxygen at 1.0 mg/L, frequently harvest and thin plants and/or add mosquitofish (*Gambusia affinis*) to the wetland or use other plant species such as duckweed, water lettuce (*Pistia stratiotes*), water milfoil, or salvinia (*Salvinia spp*.).

Slow-rate Overland Flow

- Use where growing season is year round. Requires vegetation
- Use only where soil textures are sandy loam to clay loam
- Use where groundwater is >3 ft. below surface

Slow-rate Subsurface Flow

- Use only where soil textures are sandy loam to clay loam
- Use where groundwater is >3 ft. below surface

Rapid Infiltration

- Use only where soil textures are sandy loam to clay loam
- Use where groundwater is >3 ft. below surface

Sludge Management

- If possible, choose treatment technologies that do not generate sludge, such as wastewater stabilization ponds
- Compost sludge, then use as soil amendment for agriculture
- Provide workers with appropriate protective clothing, including rubber gloves, boots, long-sleeved shirts and pants. Train workers to wash hands and faces frequently with soap and warm water and make both available.

Wastewater Use in Agriculture and Aquaculture

- WHO guidelines recommend (1) treat to reduce pathogen concentrations, (2) restrict use to crops that will be cooked, (3) use application methods that reduce contact with edible crops, and (4) minimize the exposure of workers, crop handlers, field workers and consumers to waste.
- Wastewater used in aquaculture should have $<10_3$ fecal coliforms per 100 ml to minimize risk to

public health. (*See Guidelines for the safe use of wastewater and excreta in agriculture and aquaculture: Measures for Public Health Protection*, 1989, WHO, Geneva.

Environmental Assessment Checklist

Section I: Project Description

File No _____ (To be filled by EPA)

Date _____

General Information

1. Project Name or Title_____
2. Project Proponent (Department or Organization) _____
3. Address _____
4. Telephone _____
5. Fax _____
6. E-mail _____
7. Representative of the Proponent_____
8. Designation _____
9. Name of the person who conducted this assessment _____
10. Designation _____
11. Qualification_____

Project Information

12. Project Location_____
13. Cost of the Project_____
14. Period of construction (start and end dates) _____

Proposed Activity

15. Number and type of major construction equipment that will be used _____
    _____
    _____
16. The total construction material that will be utilized? _____
    _____
    _____
17. Will any new land be acquired?_____
    If yes, please specify
    The total area:_____

Present ownership of land _____

What is the present use of the land? _____

How the land will be acquired (Through Land Acquisition Act or direct purchase)? _____

When the compensation will be paid? _____

18. In case of state land, are there any squatter settlements on the land? _____

If yes, please specify

Number of settlements _____

Will any compensation be paid? _____

When the compensation will be paid? _____

19. Is construction work during the night planned? _____

20. How many trees are likely to be removed? _____

21. Sanitation scheme type _____

22. Number of households that will be served _____

23. Brief Project Description _____

_____

_____

Please attach a map of the proposed scheme

24. Type, size, capacity and length of sewers _____

25. Proposed wastewater disposal _____

Section II: Screening

1. Is the proposed scheme or part of the scheme in an ecologically sensitive area?

   ☐ Yes ☐ No

2. Is the proposed scheme going to cost Rupees five million or more?

   ☐ Yes ☐ No

If the answer to any of the above questions is yes, then the project would require an initial environmental examination or an environment impact assessment. Refer to the Pakistan Environmental Protection Agency Review of Initial Environmental Examination and Environment Impact Assessment Regulations, 2000 for appropriate category.

Section III: Environmental Profile

1. Describe the terrain of the project area:
   - ☐ Flat or Level (Slope < 3%)
   - ☐ Level to moderately steep (Slope 3%-30%)
   - ☐ Moderately steep to mountainous (Slope > 30%)

(In case the proposed scheme will pass through terrain in which the slope varies, indicate the maximum slope)

2. Is there any site of cultural importance (graveyard, shrine, mosque, archeological site) within 100 m of the proposed scheme?

   ☐ Yes ☐ No

   If yes, please describe?_____

3. How many sensitive receptors (schools, colleges, hospitals, and clinics) are within 100 m of the proposed scheme?_____

   Please describe?_____

4. Are there signs of soil erosion or landslide anywhere in the project area?

   ☐ Yes ☐ No

   If yes, please describe (where, nature)? _____

   _____

5. Is there any surface water body (river, canal, stream, lake, wetland) within 250 m of the proposed scheme?

   ☐ Yes ☐ No

If yes, describe each water body:

Name (including type, ie, river, canal or stream)	**Dimensions**	**Status and Uses** (Is it polluted? Is domestic or other wastewater discharged to it? What are its uses, eg, agriculture, domestic, industrial, washing, fishery

6. Is there any groundwater well within 250 m of the proposed scheme?

☐ Yes ☐ No

If yes, describe each well:

Type (Dug well, tube well, hand pump)	**Location** (Village and distance from the scheme)	**Depth and Yield**	**Uses** (Drinking, agriculture, domestic, industrial, washing, livestock)

7. What are the present sources of potable water?_____
_____
8. How is the wastewater presently disposed? _____
_____
9. Are water-borne diseases common in the area?

☐ Yes ☐ No

10. How are the general hygienic conditions of the project area?

☐ Generally clean
☐ Fair
☐ Poor

11. Is there any bad odor in the project area?

☐ Yes ☐ No

What is the source of the odor?_____

12. What is the total population of the area?_____

13. What are the main sources of income of the community?_____
    _____
14. What is the average income per household? _____
15. What is the average household size? _____
16. What proportion of the houses in the area are *pukka, semi-pukka, and* kutcha? _____

Section IV: Impact Assessment

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
Erosion and sedimentation	☐	Silt screens, straw bales or similar erosion control measures will be used	☐	
		Damage to vegetation will be avoided	☐	
		Areas damaged during construction will be revegetated	☐	
Alteration in natural flow of rainwater runoff	☐	Riprap (cobbled stone), gravel or concrete will be used as needed to prevent erosion of drainage structures	☐	
Creation of stagnant water pools	☐	Contouring will be undertaken to ensure proper flow	☐	
Creation of stagnant water pools	☐	Ensure that spilled water and rainwater drain to a soakway or equivalent structure and do not accumulate and create stagnant standing water (Soakways)	☐	
Increase transmission of vector born diseases	☐	Ventilated improved pit latrine design will be used that traps insect vectors (Pit latrine)	☐	
		Humidity of composting material will be maintained above 60% and excreta will be supplemented with generous quantities of carboniferous material (dry leaves, straw, etc.). The pile should then remain aerobic, odor-free and insect-free (Composting toilet)	☐	

Continued…

…Continues

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
		Humidity of composting material will be maintained below 20% and excreta will be supplemented with alkaline material (ashes or lime). The pile should then remain both odor free and insect free. (Dry toilets)	☐	
		Generous applications of ashes will help ensure that pathogens are destroyed. pH is the most important factor for sterilization (Dry toilets)	☐	
Ground water contamination	☐	Pit latrines will not be installed where the water table is shallow or where the composition of the overlying deposits makes groundwater or an aquifer vulnerable to contamination	☐	
		Generous applications of ashes will help ensure that pathogens are destroyed. pH is the most important factor for sterilization (Dry toilets)	☐	
		If water table is too high, tank will be lined with clay, plastic sheeting or some other impermeable material to prevent leakage (Septic tank, red bed filter, subsurface wetland)	☐	
		Slow-rate overland flow and slow-rate subsurface flow will be used where groundwater is >3 ft. below surface	☐	
Surface water contamination	☐	Generous applications of ashes will help ensure that pathogens are destroyed. pH is the most important factor for sterilization (Dry toilets)	☐	
		If water table is too high, tank will be lined with clay, plastic sheeting or some other impermeable material to prevent leakage (Septic tank, red bed filter, subsurface wetland)	☐	

Continued…

…Continues

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
		Direct discharge of effluent to waterways will be avoided if possible. Direct discharge to waterways with sufficient volume and flow to assimilate the waste may be acceptable. It is better 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 (Septic tank)	☐	
		Leaks from cracked containment structures, broken pipes, faulty valves and similar structures will be monitored and repaired.(Standpipes)	☐	
		Sludge will not be disposed off near water bodies	☐	
		Two-, three- or five-pond systems will be used if possible (anaerobic, facultative, (maturation). Discharging single (facultative) pond systems directly into receiving waters will be avoided. If this is unavoidable, Hydrography-controlled release lagoons will be constructed that discharge effluent only when stream conditions are adequate. Secondary treatment such as a constructed wetland will be installed, if possible.(Wastewater stabilization ponds)	☐	
		Slow-rate overland flow and slow-rate subsurface flow will be used where groundwater is >3 ft. below surface	☐	

…Continues

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
		Collected sewage will be treated, e.g., in a wastewater stabilization pond, and not simply discharged to a river or stream or used directly in agriculture or aquaculture. This is especially important for simplified sewerage, since there is no interceptor tank. (Settled and simplified sewer)	☐	
Damage to ecosystem	☐	Collected sewage will be treated, e.g., in a wastewater stabilization pond, and not simply discharged to a river or stream or used directly in agriculture or aquaculture. This is especially important for simplified sewerage, since there is no interceptor tank. (Settled and simplified sewer)	☐	
Disease transmission to workers and consumers of agricultural products	☐	WHO or other national or international guidelines will be followed for use of sludge in wastewater in agriculture and aquaculture (Biogas reactors) (WHO guidelines recommend (1) treat to reduce pathogen concentrations, (2) restrict use to crops that will be cooked, (3) use application methods that reduce contact with edible crops, and (4) minimize the exposure of workers, crop handlers, field workers and consumers to waste)	☐	
Provision of feeding grounds for disease vectors	☐	Creation of stagnant water pools will be avoided	☐	
		Disease vectors will be monitored	☐	

Continued…

…Continues

Potential Negative Environmental Impacts	*Tick, if relevant*	*Mitigation Measures*	*Tick, if proposed*	*Monitoring*
Introduction of invasive non-native species	☐	That plant and animal species will be used, which are native to the region.(Free water surface wetland/Floating aquatic macrophytes)	☐	
Disease in handlers and processors	☐	WHO or other national or international guidelines will be followed for use of sludge in wastewater in agriculture and aquaculture. (WHO guidelines recommend (1) treat to reduce pathogen concentrations, (2) restrict use to crops that will be cooked, (3) use application methods that reduce contact with edible crops, and (4) minimize the exposure of workers, crop handlers, field workers and consumers to waste)	☐	
		Workers will be provided with appropriate protective clothing, including rubber gloves, boots, long-sleeved shirts and pants, and workers will be trained to wash hands and faces frequently with soap and warm water and both will be made available (Wastewater treatment facilities)	☐	

Section V: Undertaking

I, _____ (*full name and address*) as proponent for _____ (*name, description and location of project*) do hereby solemnly affirm and declare:

1. The information on the proposed project and the environment provided in Forms I, II and III are correct to the best of my knowledge
2. I fully understand and accept the conditions contained in the Guidelines for _____
   (*name, number and version of the guidelines*)
3. I undertake to design, construct and operate the project strictly in accordance with the project described in Form I, submitted with this undertaking.
4. I undertake to implement all mitigation measures and undertake monitoring stated in Form IV, submitted with this undertaking.

Date _____ Signature _____

Name _____

Designation _____

(with official stamp/seal)

Witnesses:

	Signature	Name	Address
1	_____	_____	_____
2	_____	_____	_____