**Sector Guidelines and Generic TORs for**

**Environmental and Social Impact Assessment**

**Pollution Management with Respect to**

 **Water and Waste Water**

**Sector Guidelines[[1]](#footnote-1)**

This category includes new projects and project components and rehabilitation activities involving: conduits for collection and conveyance of wastewater, pumping stations, conventional and innovative treatment works, wastewater reclamation and reuse projects, ocean outfalls, wastewater treatment sludge management facilities, a variety of small-scale sanitation systems for rural and urban areas, and urban stormwater drainage projects. Where water quality problems are severe, as is the case in many densely populated urban areas, individual wastewater projects may be executed as increments of long-term pollution control programs whose ultimate objectives realistically may take 10 to 20 years or more to achieve. Water pollution control programs often include significant institution-building and national water pollution control policy formulation components.

**1. Potential Environmental Impacts**

The pollutants in municipal wastewater are suspended and dissolved solids consisting of inorganic and organic matter, nutrients, oil and grease, toxic substances, and pathogenic microorganisms. Urban stormwater can contain the same pollutants, sometimes in surprisingly high concentrations. Human wastes that are not properly treated and are disposed of at the point of origin or are collected and carried away pose risks of parasitic infections (through direct contact with fecal material) and hepatitis and various gastrointestinal diseases including cholera and typhoid (through contamination of water supplies and food).

When wastewater is collected but not treated properly before disposal or reuse, the same public health hazards exist at the point of discharge. If such discharge is to receiving water, additional harmful effects will occur (e.g., habitat for aquatic and marine life is impaired by accumulated solids; oxygen is depleted by decomposition of organic material; and aquatic and marine organisms may be further harmed by toxic substances, which may spread to higher organisms through bioaccumulation in food chains). If the discharge enters confined waters such as a lake or bay, its nutrient content can cause eutrophication, with nuisance plant growth which can disrupt fisheries and recreation. Solid waste generated in wastewater treatment (grit, screenings and primary and secondary sludge) can pollute soil and groundwater if not properly handled.

Wastewater projects are executed in order to prevent or alleviate the effects of the pollutants described above on the human and natural environments. When properly carried out, their overall environmental impact is positive. Direct impacts include abatement of nuisances and public health hazards in the serviced area, improvement in receiving water quality, and increases in the beneficial uses of receiving waters. In addition, installation of a wastewater collection and treatment system provides an opportunity for more effective control of industrial wastewater through pretreatment and connection to public sewers and offers the potential for beneficial reuse of treated effluent and sludge. Indirect impacts include the provision of serviced sites for development, increased fishery productivity and revenues, increased tourist and recreational activity and revenues, increased agricultural and silvicultural productivity and/or reduced chemical fertilizer requirements if treated effluent and sludge are reused, and reduced demands on other water sources as a result of effluent reuse.

A number of these potential positive impacts lend themselves to measurement and thus can be incorporated quantitatively into analyses of the costs and benefits of various alternatives when planning wastewater projects. Human health benefits can be measured, for example, by estimating avoided costs in the form of health care expenditures and lost workdays which would result from poor sanitation. Reduced drinking and industrial water treatment costs and increased fishery, tourism and recreation revenues can serve as partial measures of the benefits of improved receiving water quality. In a region where demand for housing is high, the benefits of providing serviced lots may be reflected in part by the cost differential between installing the infrastructure in advance or retrofitting unplanned communities.

Systems in which treated wastewater or sludge are reused may be more expensive to construct and operate than those in which the sludge is disposed of as a waste product. In evaluating alternatives involving reuse, however, it is important to include such benefits as increased water availability to support development in the region, the opportunity to diminish irrigation demands on potential public water supply sources, reduced need for chemical fertilizers, incremental improvements in crop and timber production, and low-cost means to re-vegetate marginal soils or reclaim them for agriculture or silviculture. These too can often be measured, most of them by calculating avoided costs.

Unless they are correctly planned, sited, designed, constructed, operated and maintained, waste-water projects are likely to have a negative impact overall, failing to yield the full benefits for which the investment was made and adversely affecting other aspects of the environment besides. The individual items listed are self-explanatory, for the most part, and will not be discussed in detail in the text. However, there are several characteristics common to many of the potential impacts and mitigating measures which should be emphasized as special issues throughout project preparation, assessment and implementation. These are: first, the importance of sound and comprehensive wastewater system planning; second, the fundamental dependence of wastewater projects on proper operation and maintenance (and thus on strong institutional support for both); third, selection of appropriate technology; fourth, the necessity for an effective industrial wastewater pretreatment program in any municipal system serving industrial customers; and finally, the need to consider a number of potential sociocultural impacts which are sometimes ignored in project preparation (see Table 1 for a summary of all potential impacts and recommended mitigating measures).

**2. Project Alternatives**

A variety of siting and technological alternatives exists for wastewater collection, treatment and disposal, and sludge management. Several will be applicable in every situation.

(a) Collection Systems: on-lot treatment; individual holding tanks with truck collection; small-diameter gravity, pressure or vacuum sewers; shallow sewers; flat sewers; simplified sewerage systems; conventional gravity sewers and force mains; regional collection systems; community or sub-regional systems;

(b) Treatment Works: community on-lot systems; oxidation ditches; stabilization ponds; aerated lagoons; artificial wetlands (or constructed wetlands); land treatment; conventional biological treatment; physical-chemical treatment; preliminary or primary treatment with ocean disposal;

(c) Disposal: reuse in agriculture, silviculture, aquaculture, landscaping; reuse for groundwater recharge; rapid infiltration; underground injection; reuse in industrial applications; ocean outfall; surface water discharge; nightsoil treatment plants;

(d) Sludge Management: composting; co-composting with municipal refuse; reuse in agriculture or silviculture; reclamation of marginal land for reforestation, cultivation; energy recovery (methanization); incineration; landfill; ocean disposal.

**3. Monitoring**

Because these are environmental projects, good construction inspection practices to ensure that the system is built to specifications are also good environmental management practices. Particular attention should be given to adherence to the mitigation plan provisions to protect stream channels, beaches, and wetlands. An operational monitoring program should be developed to observe trends in influent volume and strength; detect hazardous substances entering treatment works; enforce industrial pretreatment regulations; control the treatment process; assess and manage treatment plant performance; monitor environmental quality at disposal locations; and ensure sludge products and reclaimed wastewater meet reuse standards.

The frequency and level of sophistication of sampling depends in part on the size of the system and the nature of its treatment processes. Monitoring is expensive; it requires laboratory facilities, equipment, and technicians. As a general principle, measure only parameters necessary for managing the system, safeguarding its staff and equipment, and protecting the environment.

In designing the monitoring program, the emphasis should be on supporting sound operations of the wastewater system. This entails establishment of system performance standards. Data should be collected to monitor attainment of those standards, interpreted and then delivered efficiently and timely to those who must make operational decisions -the system's operators and managers. Monitoring data is also useful to designers for improvement of future projects. All too frequently, monitoring programs are seen only, or primarily, as enforcement tools. Although enforcement action may be necessary to achieve compliance with standards in some cases, a timely report placed in the hands of a conscientious treatment plant superintendent may be more effective in protecting the environment.

**Table 1. Summary of all potential impacts and recommended mitigating measures**

| **Potential Negative Impacts** | **Mitigating Measures** |
| --- | --- |
| **Direct** |
| 1. Disturbance of stream channels, aquatic plant and animal habitat, and spawning and nursery areas during construction.
 | 1. Do not route sewer lines in stream channels. Require erosion/sedimentation controls during construction.
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| 1. Alterations in watershed hydrologic balance when wastewater is exported by collection in large upstream areas and discharge downstream.
 | 1. Consider sub−regional and small community systems water−short areas.

Take full advantage of opportunities for wastewater reclamation/reuse, especially in water−short areas. |
| 1. Degradation of neighborhoods or receiving water quality from sewer overflows, treatment works bypasses, or treatment process failure.
 | 1. Phase construction of collector systems and treatment avoid raw wastewater discharges.

Select appropriate technology.Design for reliability, case of maintenance.Implement management and training recommendations, monitoring program, and industrial waste pretreatment. |
| 1. Degradation of receiving water quality despite normal system operation.
 | 1. Site and design treatment works and disposal or reuse on the basis of adequate data on the characteristics of wastewater and the assimilative capacity of the receiving body.

Use mathematical models for siting surface water discharges determining required level of treatment, and for siting designing ocean outfalls.Take full advantage of appropriate land application alternatives, especially in water−short areas.Implement monitoring program and industrial waste pre−treatment program (see text for guidelines). |
| 1. Public health hazards in vicinity of discharges or reuse sites during normal operation of system.
 | 1. Select appropriate technology.

Ensure preapplication treatment and operating guidelines application and other water reuse systems are adequate safeguard health of humans and livestock.Restrict access to wastewater or sludge disposal sites health hazards are unavoidable. |
| 1. Contamination at land application sites: soil and crops by toxic substances and pathogens; groundwater by toxic substances and nitrogen.
 | 1. Site and design treatment works and disposal or reuse on the basis of adequate data on the characteristics of wastewater and land application site.

Implement monitoring program and effective industrial pretreatment program. Ensure preapplication treatment and operating guidelines application and other wastewater reuse systems are adequate. |
| 1. Odors and noise from treatment process or sludge disposal operations.
 | 1. Site treatment works only near compatible land uses.

Select appropriate technology.Include odor control and low−noise equipment in design.Implement management and training recommendations |
| 1. Emissions of volatile organic compounds from treatment process.
 | 1. Establish effective industrial waste pretreatment program.
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| 1. Soil, crop or groundwater contamination and disease vector breeding or feeding at sludge storage, reuse or disposal sites.
 | 1. Incorporate sludge management in system feasibility technology selection, design, staffing, training, budgeting startup plan.

Implement effective industrial waste pretreatment program.Ensure preapplication treatment and operating guidelines application and other reuse or disposal systems are adequate safeguard health of humans and livestock.Inspect for compliance with operating guidelines. |
| 1. Worker accidents during construction and operation, especially in deep trenching operations.
 | 1. Enforce adherence to safety procedures.
 |
| 1. Worker accidents caused by gas accumulation in sewers and other confined spaces or by hazardous materials discharged into sewers.
 | 1. Emphasize safety education and training for system Implement effective industrial waste pretreatment program text for guidelines).

Provide appropriate safety equipment and monitoring Enforce adherence to safety procedures.  |
| 1. Serious public and worker health hazard from chlorine accidents.
 | 1. Incorporate safety provisions in design, operating procedures, and training.

Prepare contingency plan for accident response. |
| 1. Nuisances and public health hazard from sewer overflows and backups.
 | 1. Routinely inspect sewers for illegal connections and obstructions.

Clean sewers as necessary.Provide monitoring system with alarms for pump station. Provide alternate power supply at critical pump stations.Educate public to prevent disposal of solid waste in sewers. |
| 1. Failure to achieve public health improvement in serviced area.
 | 1. Conduct sanitation and hygiene education program.
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| 1. Dislocation of residents by plant sitting.
 | 1. "Involuntary Resettlement" standard is not applicable to FECO. FECO will not finance projects involving involuntary resettlement.
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| 1. Perceived or actual nuisances and adverse aesthetic impacts in neighborhood of treatment works.
 | 1. Incorporate neighborhood improvements and useful facilities in project.
 |
| 1. Accidental destruction of archaeological sites during excavation.
 | 1. Include notification and protection procedures for properties in construction contract documents (see FECO’s Environmental and Social Safeguards Standards –Physical Cultural Resources).
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| **Indirect** |
| 1. Unplanned development induced or facilitated by infrastructure.
 | 1. Coordinate installation of sewerage with land use Strengthen land use control regulations and institutions.

Integrate planning for infrastructure in urban development projects. |
| 1. Regional solid waste management problems exacerbated by sludge.
 | 1. Incorporate sludge, excreta and septage in regional waste management planning and in wastewater system studies and technology selection.

Implement industrial waste pretreatment program. |
| 1. Loss of fisheries productivity.
 | 1. Evaluate importance of receiving water in local and fisheries.

Implement mitigating measures for direct impacts 3. |
| 1. Reduction of tourist or recreational activity.
 | 1. Give special attention to real or perceived nuisances aesthetic impacts in selecting site and technology.
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**Generic Terms of Reference**

These terms of reference will be used when commissioning an environmental and social impact assessment (ESIA) of pollution management projects with respect to water and waste water, and they should be adapted and tailored to each specific situation. The actual scope and depth of the assessment will be determined by the nature, complexity and importance of the issues studied, as identified in the screening process.

**Introduction and Background**

1. Introduction. This section should state the purpose of the terms of reference, identify the development project to be assessed, and explain the executing arrangements for the ESIA.

2. Background information. Pertinent background for potential parties who may conduct the ESIA, would include a brief description of the major components of the proposed project, a statement of the need for it and the objectives it is intended to meet, the implementing agency, a brief history of the project (including alternatives considered), its current status and timetable, and the identities of any associated projects. If there are other projects in progress or planned within the region which may compete for the same resources, they should also be identified here.

3. Objectives. This section will summarize the general scope of the ESIA and discuss its timing in relation to the processes of project preparation, design, and execution.

4. ESIA requirements. This paragraph should identify any regulations and guidelines which will govern the conduct of the assessment or specify the content of its report. They may include any or all of the following:

* FECO Environmental and Social Safeguards Standards;
* National or provincial laws and/or regulations on environmental reviews and impact assessments;
* ESIA regulations of any co-financing organizations involved in the project.

**Required Qualifications and Expertise**

The expert or team of experts should have solid experience assessing the condition and possible impacts upon pollution management with respect to water and waste water, with particular expertise in environmental engineering, environmental planning, ecology (terrestrial, aquatic or marine), water quality, wastewater utility management, economics, and governance (where appropriate). Expertise in public participation is also required.

**Scope of Work**

**Task 1. Legal, political and institutional context**

Describe the pertinent regulations and standards governing environmental quality, pollutant discharges to surface waters and land, industrial discharges to public sewers, water reclamation and reuse, agricultural and landscape use of sludge, health and safety, protection of sensitive areas, protection of endangered species, siting, land use control, etc., at international, national, regional and local levels (The TOR should specify those that are known and require the consultant to investigate for others.)

**Task 2. Description of baseline information**

Baseline data is important in order to describe and map the receptors in the project site and to understand their sensitivity. The data is also key for defining mitigation measures, developing a monitoring plan and setting targets. Data provided should include a description of the project site. The data needs to be focused and relevant for further decision making – e.g. for supporting decisions about project design such as project location, technology, mitigation measures.

To establish sufficient knowledge of the project site the assessment should compile the following information:

(a) Description of the project: location; general layout; unit process description and diagrams; size in terms of population and population equivalents, present and projected; number and types of connected industries; anticipated influent characteristics, preconstruction activities, construction activities, schedule, staffing and support facilities and services; operation and maintenance activities; required off-site investments; and life span.

(b) Physical environment: geology (general description for overall study area; details for land application sites); topography; soils (general description for overall study area; details for land application sites); monthly average temperatures, rainfall and runoff characteristics; and description of receiving waters (identity of streams, lakes, or marine waters; annual average discharge or current data by month, chemical quality; existing discharges or withdrawals).

(c) Biological environment: terrestrial communities in areas affected by construction, facility siting, land application or disposal; aquatic, estuarine or marine communities in affected waters; rare or endangered species; sensitive habitats, including parks or preserves, significant natural sites; and species of commercial importance in land application sites and receiving waters.

(d) Sociocultural environment: present and projected population; present land use; planned development activities; community structure; present and projected employment by industrial category; distribution of income, goods and services; recreation; public health; cultural properties; tribal peoples; and customs, aspirations and attitudes.

The analysis should also address planned developments and future land use in the site and the region other than the project under considerations. Potential data gaps should be identified; in case these constitute critical baseline data needed for the project, recommendations for the collection of these data should be made.

**Task 3. Determination of the potential impacts of the proposed project**

Special attention should be given to:

* the extent to which receiving water quality standards and/or beneficial use objectives will be achieved with the proposed type and level of treatment;
* the length of stream or expanse of lake or marine waters which will be positively or negatively affected by the discharge, and the magnitude of the changes in water quality parameters;
* projected quantitative changes in beneficial uses, such as fisheries (species composition, productivity), recreation and tourism (visitor-days, overnights, expenditures), waters available for portable supply, irrigation, industrial use;
* sanitation and public health benefits anticipated.

**Task 4. Analysis of alternatives**

Describe alternatives that were examined in the course of developing the proposed project and identify other alternatives which would achieve the same objectives. The concept of alternatives extends to siting, design, technology selection, construction techniques and phasing, and operating and maintenance procedures. Compare alternatives in terms of potential environmental impacts; capital and operating costs; suitability under local conditions; and institutional, training, and monitoring requirements. When describing the impacts, indicate which are irreversible or unavoidable and which can be mitigated. To the extent possible, quantify the costs and benefits of each alternative, incorporating the estimated costs of any associated mitigating measures. Include the alternative of not constructing the project, in order to demonstrate environmental conditions without it.

**Task 5. Environmental and social management plan**

Recommend feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels. Estimate the impacts and costs of those measures, and of the institutional and training requirements to implement them. Consider compensation to affected parties for impacts which cannot be mitigated. Prepare a management plan including proposed work programs, budget estimates, schedules, staffing and training requirements, and other necessary support services to implement the mitigating measures.

**Report**

The ESIA report/statement should be concise and limited to significant environmental and social issues; this should include emerging issues. The main text should focus on findings, conclusions and recommended actions, supported by summaries of the data collected and citations for any references used in interpreting those data. Unpublished documents used in the assessment may not be readily available and should also be assembled in an appendix. The ESIA report/statement should be organized according to the outlines in FECO Environmental and Social Safeguards Standards-ESIA.

1. Contents taken reference of World Bank Environmental Assessment Sourcebook [↑](#footnote-ref-1)