Sector Guidelines

for Pre-Feasibility Studies on

WASTEWATER MANAGEMENT

A. Introduction

1. Context

Cities Development Initiative of Asia (CDIA) Sector Guidelines describes the approach to pre-feasibility studies in the sectors most commonly encountered in CDIA support to cities. These guidelines are a sector-specific appendix to the overarching *CDIA Pre-Feasibility Study Guidelines* (CDIA 2011) that sets out the format, process, and output requirements in general.

The Sector Guidelines are not meant to replace terms of reference or to provide detailed technical input for consultants, who are assumed to be qualified and experienced professionals in their field and thus technically capable. These apply to the conduct of a pre-feasibility study (PFS) for a project or group of projects (hereinafter referred to as "the project") identified and prioritized in the plan and by the relevant authority for implementation.

These guidelines apply in the context of existing policies, visions, plans, and studies pertaining to wastewater management and other related issues. These address the approach expected of consultants engaged at the PFS stage as regards wastewater management.

2. Objective

CDIA support to the formulation of any wastewater treatment project aims to enhance the impact, sustainability, and inclusiveness of the project. This means that the project should

1. Comprise a viable component of *integrated wastewater management*, including a holistic approach to provision of services and infrastructure, institutional capacity, environmental and social concerns, economic and financial systems (see section B);

2. Be *inclusive* in the sense that stakeholders should be involved (i) to ensure a tailor-made and sustainable wastewater treatment system after having considered a range of possible options for solutions that are accessible and affordable to all regardless of income level, education, gender, etc. in the targeted areas, and (ii) to minimize the risk of unfounded

(investment) decisions and adverse impacts. Any risk of negative impact should be clearly communicated and measures taken to adequately compensate stakeholders (see section C);

3. Be *economically viable* and *financially sustainable* in that the economic rate of return on a project must be acceptable *and* that revenues, subsidies, taxes or levies, concession/ lease revenue, community service obligation payments, carbon credits or any combination of these must be capable of funding capital and operational costs in various components of the project, including long-term maintenance and capacity building (see section D);

4. Be *environmentally sustainable* in that the proposed wastewater treatment system must aim to improve existing environmental and health conditions *and* that adequate measures will be taken to mitigate any potential adverse environmental impacts of the project (see section E); and

5. Have *sound, transparent governance* arrangements enabling efficient planning, financing, design and construction, commissioning, and operation of the project (see section F).

B. Developing an Integrated Wastewater Management System

The vision for any city in Asia must include an environment-friendly, low-carbon, integrated, and inclusive development. To achieve this vision, it is imperative that all wastewater—whether from households, commercial areas, government offices, hospitals, industrial sites, or other sources—is treated properly before entering the natural bodies of water that people depend on. An integrated wastewater management system should typically make use of existing infrastructure (if any) and build on sound visions, policies, strategies and plans, not limited to wastewater management but all sectors that influence the performance of such a system. The proposed investment project must also be based on a sound policy and planning framework and within the relevant regulatory framework. In case the framework is not adequate or threatens the successful implementation of the project, the PFS should at an early stage identify the key issues and determine how these can be solved.

An overall assessment of the current wastewater management, strengths, weaknesses, and areas for intervention, should be made based on baseline data, and professional judgment where data are not available. The PFS should address the following key considerations in an integrated system:

- **Service provision to all**

The provision of sewerage network and the need for it may not be fully comprehended or appreciated by the public, if compared to the obvious nuisance from e.g. lack of solid waste collection services. The pollution from wastewater to surrounding water bodies is also less visible and more difficult to link to a specific source. However, the collection and treatment of wastewater is vital to a city's sustainability. The PFS should carefully investigate, as far as possible, depending on availability of data, the current situation as to provision of services, particularly to marginalized areas. Special attention should be paid to the possible combined storm water/drainage[1] and sewerage piping network, and the challenges to the system in case of heavy rainfall. The reasons for non-service must be examined and solutions recommended, bearing in mind disaster management and flooding issues. Technical considerations should include additional load to the wastewater treatment plant and potential impacts on septic tanks (e.g., overflow during flooding), failure at the treatment plant, and bypass of untreated water.

[1] CDIA 2011 *Sector Guidelines for Pre-feasibility Studies on Flood and Drainage Management*

The PFS should also, as far as reasonable, elaborate on the actual load and contributing flows to the common wastewater treatment plant (if any) from industrial sites, hospitals, and others that typically should provide their own water treatment facility prior to discharging to the public network.

- **Appropriate technology**

The location and design of a large-scale wastewater treatment plant must naturally be carefully considered for future capacity needs, urban growth patterns, and land use in the vicinity. The concept of appropriate technology should be adopted—i.e., the choice of technology can range from large-scale, more conventional plants to small-scale solutions that meet the needs and suit the conditions of the area in question. The choice of technology or system can also depend on visions for renewable energy, green housing, climate change, among others.

For wastewater treatment, high-capacity treatment plants are the urban norm, but septic—on-site or decentralized—systems should be considered for low-density urban areas. The installation and use of small-scale systems for domestic wastewater may be more suited for addressing rapid and/or partly uncontrolled urbanization, low-density development, and/or where there are difficulties in cost-recovery. Regardless of the size of the treatment plant, the PFS should strive at maximum resource recovery/reuse, whether it concerns water reuse, energy consumption (or production), or nutrients in water or sludge.

- **Coordination with other development**

The wastewater management project(s) proposed in the PFS should be an integrated and logical part of a whole system, i.e., be in harmony with other infrastructure development. The connected infrastructure in wastewater management—typically consisting of the sewerage network, wastewater treatment plant, and sludge disposal site—is a long-term investment in a construction that may be difficult to change or adjust at a later stage. Thus, careful consideration must be made in the PFS to, allow for flexibility. This would entail, for instance, allowing for expansion to increase capacity or preparing for connection to the electricity grid so that energy from biogas production can be supplied. The siting of a treatment plant may also depend on the urban road network, for example, and the existence or plans for a sanitary landfill for the transport and disposal of dewatered sludge. There may be added value through coordination and linkage to rural areas, e.g. utilization of dewatered sludge as fertilizer, or reuse of water for irrigation. As far as possible, given the limited time frame, the PFS must investigate these options, coordinate with the relevant departments and other stakeholders, and explore possibilities for public–private partnership (PPP). The consultants should also investigate if there is any other assistance in the sector. The proposed project must complement other externally or nationally financed interventions.

- **Land use**

The proposed wastewater management project must be consistent with land use plans, and the size and operation of such a plant often makes it difficult to find a suitable area. Special attention should be given to the risk of locating a wastewater treatment plant in an area that may be suitable today but will, in a few years, be too close to expanding urban areas or new housing development. The possibility of renewable energy production and distribution may also have a bearing on location. Any conflict in land use as well as the reduced value of land should be addressed.

Summary

- Review planning and regulatory framework to identify terms or gaps that may hamper the project and recommend approaches for policy to bridge these gaps.
- Identify the necessary building blocks in an integrated system—people's needs, appropriate technology, land use, human resources, urban road network, and other infrastructure and housing.
- Identify prioritized projects and necessary investments.
- Demonstrate, and quantify where possible, how the proposed project will improve the environment, and the living conditions of people, especially the poor and women.

C. Developing an Inclusive Wastewater Management Project

The basis for an inclusive project would be to identify and invite all stakeholders to actively participate already during the planning process and for them, particularly the poor, to benefit from the project components. Gender aspects are crucial—women and children are more vulnerable to the adverse impacts of pollution, such as the contamination of a water source due to lack of proper sanitation.[2] Public awareness should be promoted for water users to understand the implications and risks connected with discarding hazardous liquid waste into the sewerage system, for example. The role of the private sector as water users and polluters should not be underestimated, and the load on the public sewerage network and facilities must be examined. The overall aim is to develop a sustainable wastewater management system, accommodating all contributing flows and water consumers, that is accessible and affordable to all with minimal risk of unfounded (investment) decisions and adverse impacts.

The PFS should analyze the following:

1. Limitations in land use, urban growth, livelihood, and public health due to adverse impacts from the present lack of wastewater handling, and how the project improve this.
2. New employment opportunities tied to project components, including indirect benefits tied to compost (sludge) sale and renewable energy.
3. Likely disruption to communities in terms of relocation, division, noise, disruption of the visual context of important historic or scenic sites. The scale and cost of relocation should be estimated along with options for near-site resettlement (to minimize disruption to employment).

Costs associated with the social impact mitigation measures should be included in the financial assessment (section D) and the associated management systems should be incorporated into governance arrangements (section F).

Summary

- Identify stakeholders for consultation at an early stage.
- Identify livelihood issues and design a project that will benefit as many as possible and especially the poor, directly or indirectly.
- Propose a project that will minimize disruption to the community.

[2] See ADB checklists on involuntary resettlement, indigenous peoples planning, poverty reduction, participation and gender and development.

D. Ensuring Financial and Economic Viability

1. Financial Assessment

The primary aim of the financial assessment is to make a realistic assessment, as far as possible, of the project costs in investment and operations and maintenance (O/M), project revenues, and possible financing schemes, either from own sources or external funds. Given the early stage in project design, it may be difficult to estimate these costs. For instance, the site selection and land acquisition may not yet be finalized or the final choice of technology must be further elaborated in a feasibility study or detailed engineering design study. However, the PFS should include this primary, early assessment to indicate to both the local government and potential investors whether the project is worth pursuing.

It is vital for the viability of the project to investigate revenue streams for each investment with a direct cost recovery component, whether it is based on user fees or revenues from energy production (e.g., heat exchange or biogas production), water reuse, compost sale, among others. The assessment of affordability and willingness to pay on the part of each market segment in each investment should be rigorous and well documented. The possibilities of differentiated fee systems, based upon the polluter-pays principle and financial ability, should be investigated. Equity should be strived at. This is particularly valid for wastewater management, in which the facilities and network are often taken for granted as a public service with no counter-obligations. The risk of noncompliance in payment of user fees and the possible remediation measures should also be discussed.

Existing project cost estimates should be investigated so that new solutions, at reduced costs or better performance, etc., can be suggested. Costs should be benchmarked against average construction costs in country. Costs should explicitly include social (e.g., relocation) and environmental mitigation measures.

Subsidies, cross-subsidies from leasing of property, community service obligation payments, and others should be assessed for their sustainability and legal enforceability. Clean Development Mechanism (CDM) for energy efficiency investments and reduction of greenhouse gas (GHG) emissions through use of renewable energy (through biogas production), and other credit and/subsidies from international agencies should be assessed based on prior experience with similar projects and, if necessary, on engagement of specialist expertise[3] to provide advice where such funding is crucial to the viability of the project.

The financial assessment should include cash flow, income statement, and balance sheet projections of any corporate or special purpose vehicle (SPV) entities involved in the financing as well as a standard financial cost benefit analysis (CBA). The hurdle rate adopted for this latter should be the relevant weighted average cost of capital (WACC) for the sector and country, but where private investors are involved, market rates for return in equity and debt should be the benchmark for viability.

In particular, the assessment must include an analysis of the cash flow of participating (mostly local) government with project capital expenses and subsidies included to determine the sustainability of the project in related to likely revenue streams. Such an analysis should be the basis for discussions about alternate organizational structures for implementation (see section F). For example, public–

[3] ADB Clean Energy Facility can provide resources for assessments of Clean Development Mechanism.

private partnership (PPP) models can be used on unbundled, commercially viable, components of projects. Thus, such analysis should be done in a preliminary form early in the consultant engagement period.

Summary

- Assess project investment and O/M costs, as far as possible.
- Assess willingness to pay and resulting revenue generation, both direct and indirect revenue base.
- Adopt realistic return hurdle rates.
- Assess impact of project on (local governments) budget and use as basis for developing implementation options.
- Provide financial analysis for all relevant organization participants and adopt realistic return hurdle rates.

2. Economic Assessment

The economic assessment in a wastewater management project should have direct benefits estimated on the willingness to pay for services, augmented by externalities such as cost savings resulting from water reuse, public health improvement, and other things such as employment (income increase or decrease) and investment opportunities, due to more efficient land use and increased tourism. Benefits from reduced carbon emissions should also be explained in the PFS, adopting proxy values where necessary as set out in ADB's Guidelines for the Economic Analysis of Projects.[4] Care should be taken to avoid double counting, such as health and employment productivity increases. Shadow pricing of costs is standard and follows an established process in each country. Hurdle rates for economic assessment are routinely set by ADB and other agencies in each country. ADB standards should be adopted in the PFS where available.

Summary

- Estimate all benefits of the proposed project.
- Undertake economic assessment using established processes and hurdle rates in the country concerned using ADB standards where possible.

E. Ensuring Environmental Sustainability

Wastewater management projects would typically strive at improving the environmental and health conditions. The PFS should assess the impacts associated with the present system and how these will change after the proposed project implementation. The objective of the proposed PFS interventions is to maximize the positive impacts and minimize the negative ones, if any.

Most infrastructure projects would eventually require the preparation of an environmental impact assessment (EIA) as a basis for an environmental or similar permit. At the PFS stage, a rapid environmental assessment (REA) or a rapid environmental impact assessment (REIA) may be required.[5] It is also vital that the requirements and the time frame for a full-blown EIA are identified

[4] ADB 1997. *Guidelines for the Economic Analysis of Projects.*
[5] ADB *Rapid Environmental Assessment checklists for categorization of projects.*

already during the PFS stage to avoid delays in downstream work and unexpected investments costs for environmental protection measures.

In terms of reducing possible adverse environmental impacts, the process is similar to that adopted for social assessment. The proposed investments and facilities should be screened to determine (i) potential environmental impacts in terms of noise and pollution to communities; and (ii) potential impacts on water resources, forest resources, biodiversity, etc. as set out in ADB's environmental checklist.[6] Mitigation measures should be formulated and costed. The implications of these measures should be included in the financial assessment (see section D) and governance arrangements (section F) of the project. This includes the assessment of any positive or negative impacts related to climate change, e.g., renewable energy production from water/sludge and emissions of greenhouse gases.

Summary

- Identify the relevant environmental regulatory framework and its implications on project implementation.
- Estimate the environmental and health improvements expected from the proposed project.
- Estimate the possible environmental and health-related risks and impacts, and the costs for mitigating these risks.
- Investigate possibilities to reduce greenhouse gas emissions or minimize the risk of increased emissions (mitigation), and determine if the project is part of adaptation measures.

F. Ensuring Good Governance

The institutional arrangements for implementing the project must be clearly described and agreed with the city government. [7]The ability to successfully implement wastewater management projects, achieving social and environmental benefits, avoiding and mitigating adverse impacts, and achieving financial sustainability, depends on a sound governance structure.

The PFS must include the following:

(a) Discussion of organizational options for design, construction/ commissioning and operation, including the possibility of PPP options. Where such options are pursued, the organization structure for transparent oversight, monitoring, and regulating private operations needs to be considered. A monitoring system with clear and measurable key performance indicators must be discussed. In terms of services integration, the arrangements for coordination across sectors and facility providers need to be described. Stakeholders must be involved at an early stage, and their continued influence and input should be secured and institutionalized for the whole duration of the project.

(b) Consideration of how, and with what incentives, will the existing institutions and stakeholders change to the proposed arrangements.

[6] ADB. 2003. *ADB Environmental Assessment Guidelines*.
[7] CDIA 2011 *Guidelines for Urban Governance and Institutional Development*

(c) Consideration of the legal basis of each involved organization, its sources of revenue and responsibilities for expenditures (the two must match), and the hierarchy of authority across organizations (the legal basis of coordination).

For wastewater management projects, factors such as good governance in terms of particularly discipline in the system performance and the public's and all other water users' awareness and collaboration are vital. Connection fees may be more difficult to justify compared to water tariffs for drinking water supply, for instance, where the lack of such service has immediate, detrimental effects. Possible resistance to development of infrastructure (not-in-my backyard) cannot be ruled out mainly due to the nuisance of smell from a wastewater treatment plant or sludge disposal site.

Summary

- Design of institutional arrangements must be thoroughly documented, encompassing the legal and financial bases of sustainable operation.
- A clear description of how we get from where we are now to the proposed arrangements is required.

G. Institutional Strengthening

The PFS team must, at an early stage in the project (i) identify and assess the valid regulatory framework for wastewater treatment, emission parameters, handling of wastewater sludge, landfilling and other aspects relevant to the TOR (ii) identify the legally appointed actors in the wastewater area as well as the actual operators and stakeholders. Note that the institutional strengthening and the overall sustainability of the project could benefit from closer inter-departmental interaction, e.g., better coordination between various government offices as well as dialogue and synergies with external players.

The city government shall then, supported by the PFS team, design a reference group or other structure and a communication strategy to ensure participation by the key stakeholders throughout the whole duration of the project. Such a process will improve institutional capacity by fostering dialogue, setting joint priorities, and coordinating approaches to investment. Closer dialogue will enable faster and more accurate fact-finding and a possibility (for the local government) to elaborate on a better internal structure, including the extended lifetime of the reference group after the finalization of the project.

H. Capacity Development

The PFS must identify all stakeholders and their respective responsibilities as well as present and potential capacity in the wastewater management area and suggest a capacity development program that will match proposed projects and measures. The overarching goal is to create a sustainable system and ensure that investments in the sector are properly handled. This includes technical and environmental expertise with operational staff, but also ability to manage and monitor the operation, especially in a PPP setup.

The function of the system is also dependent on the water users' knowledge and level of responsibility, thus public awareness and training of industrial users (if applicable) are crucial activities. Coordination between the local government and/or the private operation and international or national nongovernment organizations (NGOs) can give synergies and a better impact.

The PFS team should explicitly plan activities for capacity development and training, designed and conducted to address the local situation and needs, during the pre-feasibility study as well as part of a future capacity development program.

I. Conclusion

Although a PFS financed by CDIA will not support urban planning studies, it may help a city to concretize its city development vision, examine alternatives to solve its wastewater management problems, and recommend investments for further feasibility study and/or implementation.

The criteria for a successful CDIA PFS, derived from the above, can be summarized as follows:

- *Technical effectiveness*—the extent to which proposed investments solve the wastewater management goals of a city and satisfy the needs of the people;
- *Impact*—the extent to which the investments impact, positively or negatively, the livability of the area, efficiency of land use, the local economy, air, soil and water, nearby natural resources, energy, the urban transport network and access to services, among others;
- *Cost effectiveness*—the extent to which the costs of the investments are commensurate with their benefits;
- *Financial sustainability*—the extent that funds required to build and operate the preferred options are likely to be available and affordable; and
- *Equity*—the costs and benefits of the alternatives are distributed fairly across different population groups.