APPENDICES

CHAPTER 1

PLANNING

1.1 OBJECTIVE

The objective of a public waste water collection and disposal system is to ensure that sewage or excreta and sullage discharged from communities is properly collected, transported, treated to the required degree and finally disposed off without causing any health or environmental problems.

1.2 NEED FOR PLANNING

Waste water disposal systems can be either the on-site type or the kind where water-borne wastes are disposed off-site into a water body or on land. To keep overall costs down, most urban systems today are planned as an optimum mix of the two types depending on various factors

Planning is required at different levels: national, state, regional and community. Though the responsibility of various organizations in charge of planning public waste water disposal systems is different in each case, they still have to function within the priorities fixed by the national and state governments and keep in view overall requirements of the area.

The waste water disposal projects formulated by the various State Sponsoring Authorities at present do not always contain all the essential elements for appraisal. When projects are assessed for their cost benefit ratio and for institutional or funding purposes, they are not amenable for comparative study and appraisal. Also, at times different standards are adopted by the Central and State agencies regarding various design parameters. It is necessary therefore to specify appropriate standards and design criteria and avoid different approaches.

1.3 BASIC DESIGN CONSIDERATIONS

In designing waste water collection, treatment and disposal systems, planning generally begins from the final disposal point going backwards to give an integrated and optimum design to suit the topography and the available hydraulic head, supplemented by pumping if essential. Once the disposal points are tentatively selected, further design is guided by the following basic design considerations:

- Engineering
- Environmental
- Process
- Cost

These considerations are discussed below in detail.

1.3.1 Engineering Considerations

Topographical, engineering and other considerations which figure prominently in project design are noted below:

1. Design period, stage wise population to be served and expected sewage flow and fluctuations

2. Topography of the general area to be served, its slope and terrain. Tentative sites available for treatment plant, pumping stations and disposal works

3. Available hydraulic head in the system upto high flood level in case of disposal to a nearby river or high tide level in case of coastal discharge or the level of the irrigation area to be commanded in case of land disposal

4. Ground water depth and its seasonal fluctuation affecting construction, sewer infiltration, structural design (uplift considerations)

5. Soil bearing capacity and type of strata expected to be met in construction.

6. On site disposal facilities, including the possibilities of seggregating the sullage water and sewage and reuse or recycle sullage water within the households

1.3.2 Environmental Considerations

The environmental and socio-economic impacts of a sewage treatment plant may prove adverse during the operation stage. Therefore, the following aspects should be considered during design:

a) ***Surface Water Hydrology and Quality***

Hydrological considerations affect the location of outfalls to rivers with regard to protection of nearby water supply intake points either upstream or downstream, especially at low flow conditions in the river. Hydrological considerations also help determine expected dilutions downstream,frequency of floods and drought conditions, flow velocities, travel times to downstream points of interest, navigation etc.

Surface water quality considerations include compliance with treated effluent standards at the discharge point with respect to parameters like BOD, suspended and floating solids,oil and grease, nutrients, coliforms etc. Special consideration may be given to the presence of public bathing ghats downstream. The aquatic ecosystem (including fish) may also need protection in case of rivers through minimum dissolved oxygen downstream, uptake of refractory and persistent substances in the food chain, and protection of other legitimate uses to which the river waters may be put.

b) ***Ground Water Quality***

Another environmental consideration is the potential for ground water pollution presented by the treatment units proposed to be built. For example, in certain soils, special precautions may be needed to intercept seepage of sewage from lagoons and ponds. Land irrigation would also present a potential for ground water pollution especially from nitrates.

In case of low cost sanitation methods involving on-site disposal of excreta and sullage waters, ground water pollution may need special attention if the ground water table is high and the soil relatively porous.

c) ***Coastal Water Quality***

Shoreline discharges of sewage effluents, though treated, could lead to bacterial and viral pollution and affect bathing water quality of beaches. Discharges have to be made sufficiently offshore to benefit from dilution and natural die-away of organisms before they are washed back to the shoreline by currents. The presence of nutrients could also promote algal growth in coastal waters, especially in bays where natural circulation patterns might keep the nutrients trapped in the water body.

d) *Odour and Mosquito Nuisance*

Odour and mosquito nuisance in the vicinity of sewage treatment plants, particularly in the down-wind direction of prevailing winds, can have adverse impacts on land values, public health and well being and general utility of amenities may be threatened. These factors have to be considered in selecting sites for location of sewage treatment plants and treated sewage irrigation fields.

e) *Public Health*

Public health considerations pervade through all aspects of design and operation of sewage treatment and disposal projects. Some aspects have already been referred to earlier. Public health concepts are built into various bye laws, regulations and codes of practice which must be observed, such as:

i) effluent discharge standards including permissible microbial and helminthic quality requirements

ii) standards for control of toxic and accumulative substances in the food chain

iii) potential for nitrate and microbial pollution of ground waters

iv) deterioration of drinking water resources including wells

v) deterioration of bathing water quality

vi) control measures for health and safety of sewage plant operators and sewage farm workers who are exposed to or handle raw and/or treated sewage.

f) *Landscaping*

Sewage treatment plant structures need not be ugly and unsightly. At no real extra cost, some architectural concepts can be used and the buildings designed to suit the main climates (humid or dry) generally met within India.

Apart from the usual development of a small garden near the plant's office or laboratory, some considerations need to be given to sites for disposal of screenings and grit in an inoffensive manner, general sanitation in the plant area and provision of a green-belt around the treatment plant.

1.3.3 Process Considerations

Process considerations involve factors which affect the choice of treatment method, its design criteria and related requirements such as the following:

a) *Waste water Flow and Characteristics*

This constitutes the primary data required for process design. The various parameters to be determined are described in other sections of this manual.

b) *Degree of Treatment Required*

In case of domestic or municipal sewage, this is considered, for example, in terms of removal of BOD/COD, nutrients (nitrogen and phosphorous), coliforms, helminths etc. Land disposal generally has to meet less stringent discharge standards than disposal to surface waters. Land disposal also has the advantage of giving nutrient removal and is, thus, preferred wherever it is feasible. It is often not enough to aim only at BOD removal and let other items be left to unspecified, incidental removal, whatever may occur. The selection of a treatment process thus, depends on the extent of removal efficiency required for all important parameters and the need to obviate nuisance conditions.

c) *Performance Characteristics*

The dependability of performance of a process inspite of fluctuations in effluent quality and quantity are very useful attributes in ensuring a stable effluent quality. Similarly, ability to withstand power and operational failures, also form important considerations in choice of process. The more high-rated process, the more sensitive it is in operation. Other processes like digesters, lagoons and ponds may be sensitive to temperature. The choice has to match with the discharge standards to be met in a specific case.

The performance characteristics for some methods of sewage treatment are indicated in Appendix 1.1

d) *Other Process Requirements*

Various other factors affecting the choice of a process include requirements in terms of:

- land
- power (and its dependability)
- operating (and control) equipment requirement and its indigenous availability
- skilled staff
- nature of maintenance problems
- extent of sludge production and its disposal requirements
- loss of head through plant in relation to available head (to avoid pumping as far as possible)
- ease of stage wise extension of plant with time.

Between land and power requirements, a trade-off is often possible, based on actual costs of the two items. This could well be exploited to get an optimum solution for meeting treatment requirements and giving a dependable performance.

Under Indian conditions, the extent of mechanisation adopted should generally be the minimum possible. The operating equipment and its ancillary control equipment should be easy to operate and maintain (with indigenously available spare parts) as far as possible. From this view point, it is to be noted that, methane gas collection, scrubbing to remove hydrogen sulphide wherever necessary and its conversion to electricity, impose a high level of operation and maintenance skills. The option of gas collection and supply to a nearby industry or area should be favoured during the site selection stage wherever possible.

1.3.4 Cost Considerations

Finally from among the few selected options, the overall costs (capital and operating) have to be determined in order to arrive at the most optimum solution.

Capital costs include all initial costs incurred upto plant start up, such as:

- civil construction, equipment supply and erection costs
- land purchase costs including legal fees, if any
- engineering design and supervision charges
- interest charge on loan during construction period.

Operating costs after start up of plant include direct operating costs and fixed costs, such as:

- amortisation and interest charges on capital borrowings
- direct operation and maintenance costs on
  - staff
  - chemicals
  - fuel and electricity
  - transport
  - maintenance and repairs
  - insurance
  - overheads.

1.4 DESIGN PERIOD

Sewerage projects may be designed normally to meet the requirements over a thirty year period after their completion. The period between design and completion should also be taken into account which should be between three to six years depending on the type and size of the project.

The thirty year period may however be modified in regard to certain components of the project depending on their useful life or the facility for carrying out extensions when required and rate of interest, so that expenditure far ahead of its utilisation is avoided. Necessary land for future expansion/duplication of components should be acquired in the beginning itself. Where expensive tunnels and large aqueducts are involved entailing large capital outlay for duplication, they may be designed for ultimate project requirements.

The project components may be designed to meet the periods mentioned in Table 1.1.

1.5 POPULATION FORECAST

1.5.1 General Considerations

The design population will have to be estimated with due regard to all the factors governing the future growth and development of the project area in the industrial, commercial, educational,social and

administration spheres. Special factors causing sudden immigration or influx of population should also be foreseen to the extent possible.

A judgement based on these factors would help in selecting the most suitable method of deriving the probable trend of the population growth in the area or areas of the project from out of the following mathematical methods, graphically interpreted where necessary.

a) ***Demographic Method of Population Projection***

Population change can occur only in three ways- (i) by births (population gain) (ii) by deaths (population loss) or (iii) migration (population loss or gain depending on whether movement out or movement in occurs in excess). Annexation of an area may be considered as a special form of migration. Population forecasts are frequently obtained by preparing and summing up of separate but related projections of natural increases and of net migration and is expressed as below.

The net effect of births and deaths on population is termed natural increase (natural decrease, if deaths exceed births).

Migration also affects the number of births and deaths in an area and so, projections of net migration are prepared before projections for natural increase.

TABLE 1.1
DESIGN PERIODS FOR COMPONENTS OF SEWERAGE SYSTEM AND SEWAGE TREATMENT

Sl. No.	Component	Recommended Design Period in years	Clarification
1.	Collection System i.e. Sewer Network	30	The system should be designed for the prospective population of 30 years, as its replacement is not possible during its use.
2.	Pumping Stations (Civil Works)	30	Duplicating machinery within the pumping station would be easier/cost of civil works will be economical for full design period.
3.	Pumping Machinery	15	Life of pumping machinery is generally 15 years.
4.	Sewage Treatment Plant	30	The construction may be in a phased manner as initially the flows may not reach the designed levels, and it will be uneconomical to build the full capacity plant initially. (Refer Chapter 10.2).
5.	Effluent disposal and utilisation	30	Provision of design capacities in the initial stages itself is economical.

This method thus takes into account the prevailing and anticipated birth rates and death rates of the region or city for the period under consideration. An estimate is also made of the immigration from and immigration to the community, its growth area wise and the net increase of population is calculated accordingly considering all these factors by arithmetical balancing.

b) ***Arithmetical Increase Method***

This method is generally applicable to large and old cities. In this method the average increase of population per decade is calculated from the past records and added to the present population to find out population in the next decade. This method gives a low value and is suitable for well settled and established communities.

c) ***Incremental Increase Method***

In this method the increment in arithmetical increase is determined from the past decades and the average of that increment is added to the average increase. This method increases the figures obtained by the arithmetical increase method.

d) ***Geometrical Increase Method***

In this method percentage increase is assumed to be the rate of growth and the average of the percentage increase is used to find out future increment in population. This method gives much higher value and is mostly applicable for growing towns and cities having vast scope for expansion.

e) ***Decreasing Rate of Growth***

In this method it is assumed that rate of percentage increase decreases and the average decrease in the rate of growth is calculated. Then the percentage increase is modified by deducting the decrease in rate of growth. This method is applicable only in such cases where the rate of growth of population shows a downward trend.

f) ***Graphical Method***

In this approach there are two methods. In one, only the city in question is considered and in the second, other similar cities are also taken into account.

i) Graphical method based on single city

In this method the population curve of the city (i.e. the population vs past decades) is smoothly extended for getting future value. This extension has to be done carefully and it requires vast experience and good judgement. The line of best fit may be obtained by the method of least squares

ii) Graphical method based on cities with similar growth pattern

In this method the city in question is compared with other cities which have already undergone the same phases of development which the city in question is likely to undergo and based on this comparison, a graph between population and decades is plotted and extrapolated.

g) ***Logistic Method***

The **S** shaped logistic curve for any city gives complete trend of growth of the city right from beginning to saturation limit of population of the city. This method is applicable for very large cities with sufficient demographic data.

h) ***Method of Density***

In this approach the trend in rate of density increase of population for each sector of a city, is found out and population forecast is done for each sector based on the above approach. Addition of sector wise population gives the population of the city.

1.5.2 Final Forecast

While the forecast of the prospective population of a projected area at any given time during the period of design can be derived by any one of the foregoing methods appropriate to each case, the density and distribution of such population within the several areas, zones or districts will again have to be made with a discerning judgement on the relative probabilities of expansion within each zone or district, according to its nature of development and based on existing and contemplated town planning regulations.

Wherever population growth forecast or master plans prepared by town planning or other appropriate authorities are available, the decision regarding the design population should take their figures into account.

Worked out examples for estimation of the future population by some of the methods are given in Appendix 1.2.

1.6 ESTIMATION OF WASTEWATER FLOW

1.6.1 Sources of Waste Water

Sanitary sewage is mostly the spent water of the community draining into the sewer system with some ground water and a fraction of storm water from the area draining into it. Domestic sewage is the wastewater from kitchen, bathroom, lavatory, toilet and laundries. The water supply to the communities already contains mineral organic matters to which human excreta, papers,dirt, other fluid wastes and other substances are added.

Industrial wastewaters vary in composition with industrial operations. Some are relatively clean rinse waters, others are heavily laden with organic or mineral matter, or with corrosive, poisonous, flammable, or explosive substances. Some are so objectionable that they should not be admitted to the public sewerage system. Others contain so little and such unobjectionable waste matters that it is safe to discharge them into storm drains or directly to natural bodies of water. Industrial waste flow should follow the guide lines of the Pollution Board or any other competent authority.

There are two types of sewerage systems viz.

i) Separate system, where one is designed to cater to the municipal wastewaters and a second to take care of storm water flows and

ii) Combined system where both municipal wastewater as well as storm water are carried in one network .

For estimation of wastewater flow in the case of a network designed for carrying only municipal wastewaters, allowance is generally made for infiltration of ground water through joints.

1.6.2 Per Capita Wastewater Flow

Rate of wastewater flow depends upon rate of water supply to the community and the rate of ground water infiltration. The details of estimating the quantities of wastewater flow are discussed in 3.1.

1.7 SEWAGE CHARACTERISTICS

Characterisation of wastewater is essential for an effective and economical wastewater management programme. It helps in the choice of treatment methods, deciding the extent of treatment, assessing the beneficial uses of wastewater and utilising the waste purification capacity of natural bodies of water in a planned and controlled manner. While analysis of waste in each particular case

is advisable, data from other similar cities may be utilised during initial stages of planning.

Quality parameters for which sewage is to be tested are discussed in 10.5

1.7.1 Effect of Industrial Waste

Waste from industries can form an important component of sewage flow both in volume and composition. It is therefore necessary to collect detailed data about nature of industries, quantity and character of the waste and their variations which may affect the sewerage system or the sewage treatment process. Quality and character of waste water are to be based on flow measurements and laboratory analysis of the composite samples.

1.8 SURVEY AND INVESTIGATION

Survey and investigation are pre-requisites both for framing of the preliminary report and the preparation of a detailed sewerage project. The engineering and policy decisions taken are dependent on the correctness of the data collected and its proper evaluation.

1.8.1 Basic Information

For an effective investigation, a broad knowledge of the problems likely to be faced during the various phases of implementation of the project is essential. Information on physical, developmental, fiscal and other aspects has to be collected.

1.8.1.1 Physical Aspects

These would necessitate the collection of information relating to:

a) Topography or elevation difference needed for design of sewers and location of out fall and disposal works

b) Subsoil conditions, such as types of strata likely to be encountered, depth of ground water table and its fluctuations. In the absence of any records, preliminary data should be collected by putting atleast 3 trial bores or trial pits per hectare

c) Underground structures like storm drains and appurtenances, city survey stones; utility services like house connections for water supply and sewerage, electric and telephone cables, gas lines and

d) Location of streets and adjoining areas likely to be merged or annexed.

Possible sources of information are, existing maps and plans showing streets from revenue or town surveys or Survey of India maps. Other sources, are topographical maps of Survey of India if available with existing spot-levels, aerial photographs, photographs of complex surfaces for supplementing the existing instrumental surveys by concerned authorities like Municipalities and Roads Departments.

1.8.1.2 Developmental Aspects

The following should be taken into account:

a) types of land use, such as commercial, industrial, residential and recreational; extent of areas to be served

b) density of population, trends of population growth and demographic studies

c) type and number of industries for determining quantity and nature of wastes and location of their discharge points

d) existing drainage and sewerage facilities and data relating to them

e) flow in existing sewers and sewers of similar areas to assess the flow characteristics

f) historical and socio-economic data

g) basis of design and information on the maintenance of existing sewers and

h) effluent disposal sites and their availability.

Possible sources of information are census records, town and metropolitan master plans, regional planning records, land use plan,flow gauging records, stream flow records, meteorological data and Pollution Control Boards.

1.8.1.3 FISCAL ASPECTS

The various factors that will have an important bearing are:

a) existing policies or commitments of obligation which may affect the financing of the project

b) outstanding loan amounts and instalments of repayments

c) availability of Central and State loans, grant-in-aid, loans from other financing bodies such as Life Insurance Corporation, Industrial Development Corporation, HUDCO, International Bank for Reconstruction and Development and other Banks and Institutions

d) present water rates, sewer-tax and revenue realised from them, size of property plots and land holding, the economic condition of community with respect to their tax-paying capacity and

e) factors affecting the cost of constructions, operation and maintenance. Some of the information can be obtained from the records relating to Municipal and State Tax Levies, Acts and Rules governing loans, procedures for financing projects and registers and records of the authorities maintaining water supply and sewerage systems.

1.8.1.4 OTHER ASPECTS

The considerations that are likely to influence are:

a) changes in political boundaries by physical acquisition or merger of adjacent communities or by possible extension of limits

b) feasibility of multi-regional or multi-municipal systems

c) prevailing water pollution prevention statutes,other rules and regulations relating to discharge of industrial and domestic wastes

d) present status of the governmental, semi-governmental or municipal authority sponsoring the project, its capacity, adequacy, effectiveness and the desirability of its modification or necessity of a new organisation to satisfactorily implement and maintain the project and

e) the inconveniences likely to be caused to the community during execution and the feasibility of minimising them by suitable alignment or location of the components of the system.

Possible sources of information are National Acts, State and Municipal Laws and Byelaws, minutes of the past meetings of the municipal or other governing bodies and discussions with officials, municipal councillors and other local leaders.

1.8.2 Project Surveys

1.8.2.1 Preliminary Project Surveys

This is concerned with the broad aspects of the project. Data on aspects such as capacity required, basic arrangement and size, physical features affecting general layout and design, availability of effluent disposal facilities, probable cost and possible methods of financing, shall be collected to prepare an engineering report describing the scope and cost of the project with reasonable accuracy. In framing such estimates, due consideration must be given to the escalation of prices of basic materials and their availability. While extreme precision and detail are not required in this phase, all the basic data obtained must be reliable.

1.8.2.2 Detailed Project Surveys

Surveys for this phase form the basis for the engineering design as well as for the preparation of plans and specifications for incorporation in the detailed project report. In contrast to preliminary survey this survey must be precise and contain contours of all the areas to be served giving all the details that will facilitate the designer to prepare design and construction of plans suiting the field conditions. It should include, inter-alia, network of bench marks and traverse surveys to identify the nature as well as extent of the existing underground structures requiring displacement, negotiation or clearance. Such detailed surveys are necessary to establish rights of way,minimise utility relocation costs, obtain better bids and prevent changing and rerouting of lines.

1.8.2.3 Construction Surveys

All control points such as base lines and bench marks for sewer alignment and grade should be established by the engineer along the route of the proposed construction. All these points should be referred adequately to permanent objects.

a) ***Preliminary Layouts***

Before starting the work, rights-of-way, work areas, clearing limits and pavement cuts should be laid out clearly to ensure that the work proceeds smoothly. Approach roads, detours, by-passes and protective fencing should also be laid out and constructed prior to undertaking sewer construction work. All layout work must be completed and checked before construction begins.

b) ***Setting Line and Grade***

The transfer of line and grade from control points, established by the engineers, to the construction work should be the responsibility of the executing agency till work is completed.

The methods generally used for setting the line and grade of the sewers are discussed in 7.3.1.

The procedure for establishing line and grade where tunnels are to be employed in sewer system are discussed in 7.1.2.

1.9 PROJECT REPORT

1.9.1 General

All projects have to follow distinct stages between the period they are conceived and completed. The various stages are:

Pre-Investment Planning

Identification of a project
Preparation of project report

Appraisal and Sanction

Construction of facilities and carrying out support activities

Operation and Maintenance

Monitoring and feed back

1.9.1.1 PROJECT REPORTS

Project reports deal with all aspects of pre-investment planning and establish the need as well as the feasibility of projects technically, financially, socially, culturally, environmentally, legally and institutionally. For big projects economical feasibility may also have to be examined. Project reports should be prepared in three stages viz.(i) identification report (ii) pre-feasibility report and (iii) feasibility report. Projects for small towns or those forming parts of a programme may not require preparation of feasibility reports. Detailed engineering and preparation of technical specification and tender documents are not necessary for taking investment decisions, since these activities can be carried out during the implementation phase of projects. For small projects, however, it may be convenient to include detailed engineering in the project report, if standard design and drawing can be adopted.

Since project preparation is quite expensive and time consuming, all projects should normally proceed through three stages and at the end of each stage a decision should be taken whether to proceed to the next planning stage and commit the necessary manpower and financial resources for the next stage. Report at the end of each stage should include a time table and cost estimate for undertaking the next stage activity and a realistic schedule for all future stages of project development, taking into consideration time required for review and approval of the report, providing funding for the next stage, mobilising personnel or fixing agency (for the next stage of project preparation) data gathering, physical surveys, site investigations etc.

The basic design of a project is influenced by the authorities/organisations who are involved in approving, implementing, operating and maintaining the project. Therefore the institutional arrangements through which a project will be brought into operation, must be considered at the project preparation stage. Similarly responsibility for project preparation may change at various stages. Arrangements in this respect snould be finalised for each stage of project preparation. Some times more than one organisation may have a role to play in the various stages of preparation of a project. It is therefore necessary to identify a single entity to be responsible for overall management and coordination of each stage of project preparation. it is desirable that the implementing authority is identified and those responsible for operation of a project are consulted at the project preparation stage.

1.9.2 Identification Report

Identification report is basically a desk study, to be carried out relying primarily on the existing information. It can be prepared reasonably quickly by those who are familiar with the project area and needs of project components. This report is essentially meant for establishing the need for a project.

indicating likely alternatives which would meet the requirements. It also provides an idea of the magnitude of cost estimates of a project to facilitate bringing the project in the planning and budgetary cycle and makes out a case for obtaining sanction to incur expenditure for carrying out the next stages of project preparation. The report should be brief and include the following information:

a) identification of the project area and its physical environment

b) commercial,industrial, educational, cultural and religious importance and activities in and around the project area (also point out special activities or establishments like defence or others of national importance)

c) existing population,physical distribution and socio-economic analysis

d) present wastewater disposal arrangements in the project area, pointing out deficiencies, if any, in system of collection and treatment

e) population projection for the planning period, according to existing and future land use plans or master plans, if any

f) establish the need for taking up a project in the light of existing and future deficiencies in waste water disposal services, pointing out adverse impacts of non-implementation of the project, on a time scale

g) bring out, how the project would fit in with the national/regional/sectoral strategies and with the general overall development in the project area

h) identify a strategic plan for long term development of waste water disposal services in the project area, in the context of existing regional development plans and such other reports, indicating phases of development

i) state the objectives of the short term project under consideration, in terms of population to be served and the impact of the project after completion, clearly indicating the design period

j) identify project components, with alternatives if any; both physical facilities and supporting activities

k) preliminary estimates of costs (component-wise) of construction of physical facilities and supporting activities, cost of operation and maintenance

l) identify source for financing capital works and operation and maintenance. work out annual burden (debt servicing + operational expenditure)

m) indicate institutions responsible for project approval, financing, implementation, operation and maintenance (e.g. Central Government, State Government, Zilla Parishad, Local Body, Water Supply Boards)

n) indicate organisation responsible for preparing the project report (pre-feasibility report, feasibility report), cost estimates for preparing project report and sources of funds to finance preparation of project reports

o) indicate time table for carrying out all future stages of the project and the earliest date by which the project might be operational

p) indicate personnel strength required and training needs for implementation of the project, indicate if any particular/peculiar difficulties of policy or other nature that are likely to be encountered for implementing the project and how these could be resolved

q) recommend actions to be taken to proceed further

The following plans may be enclosed with the report:

i) an index plan to a scale of 1 cm =2 Km showing the project area, existing works, proposed works and location of community/ township or institution to be served

ii) a schematic diagram showing the salient levels of project component.

1.9.3 Prefeasibility Report

After clearance is received, on the basis of identification report from the concerned authority and/or owner of the project and commitments are made to finance further studies, the work of preparation of pre-feasibility report should be undertaken by an appropriate agency, which may be a central planning and design cell of the Dept. dealing with Wastewater Board, Local Body, or professional consultants working in the water supply-sanitation environmental areas. In the latter case terms of reference for the study and its scope should be carefully set out. Pre-feasibility study may be a separate and discrete stage of project preparation or it may be the first stage of a comprehensive feasibility study. In either case it is necessary that it precedes taking up of a feasibility study because the prefeasibility study is essentially carried out for screening and ranking of all project alternatives, and to select an appropriate alternative for carrying out detailed feasibility study. The pre-feasibility study helps in selecting a short term project which will fit in the long term strategy for improving services in the context of overall perspective plan for development of the project area.

A pre-feasibility report can be taken to be a Preliminary Project Report, the structure and component of which are as follows:

i) executive summary

ii) introduction

iii) the project area and the need for a project

iv) long term plan for wastewater disposal

v) proposed wastewater disposal project

vi) conclusions and recommendations

vii) tables, figures/maps and annexes.

1.9.3.1 Executive Summary

It is a good practice to provide an Executive Summary at the beginning of the report, giving its essential features, basic strategy, approach adopted in developing the project and the salient features of financial and administrative aspects.

1.9.3.2 Introduction

This section explains the origin and concept of the project, how it was prepared and the scope and status of the report. These sub-sections may be detailed as under:

a) ***Project Genesis***

i) describe how the idea of the project originated, agency responsible for promoting the project

ii) list and explain previous studies and reports on the project, including the project identification report and agencies which prepared them

iii) describe how the project fits in the regional development plan, long term sector plan, land use plan, public heath care and wastewater management programme etc.

b) ***How was the Study Organised***

i) explain how the study was carried out, agencies responsible for carrying out the various elements of work and their role in preparing the study

ii) time table followed for the study.

c) ***Scope and Status of the Report***

i) how the pre-feasibility report fits in the overall process of project preparation

ii) describe data limitation

iii) list interim reports prepared during the study

iv) explain if the pre-feasibility report is intended to be used for obtaining approval for the proposed project.

1.9.3.3 PROJECT AREA AND THE NEED FOR THE PROJECT

This section establishes the need for the project. It should cover the following:

a) ***Project Area***

i) give geographical description of the project area with reference to maps

ii) describe special features such as topography, climate, culture, religion, migration, etc., which may effect project design, implementation and operation

iii) map showing administrative and political jurisdiction

iv) describe any ethnic, cultural or religious aspects of the communities which may have a bearing on the project proposal.

b) ***Population Pattern***

i) Estimate population in the project area, indicating the sources of data or the basis for the estimate

ii) review previous population data, historic growth rates and causes

iii) estimate future population growth with different methods and indicate the most probable growth rates and compare with past population growth trends

iv) compare growth trends within the project area, with those for the region, state and the entire country

v) discuss factors likely to affect population growth rates

vi) estimate probable densities of population in different parts of the project area at future intervals of time e.g. five, ten and twenty years ahead

vii) discuss patterns of seasonal migration if any within the area

viii) indicate implication of the estimated growth pattern on housing and other local infrastructure.

c) ***Economic and Social Conditions***

i) describe present living conditions of the people of different socio-economic and ethnic groups

ii) identify locations according to income levels or other indications of socio-economic studies

iii) show on the project area map location-wise density of population, poverty groups and ethnic concentrations and the present and future land uses (as per development plan)

iv) information on housing conditions and relative proportions of owners and tenants

v) provide data on education, literacy and un-employment by age and sex

vi) provide data and make projection on housing standards and average household occupancy in various parts of the project area

vii) describe public health status within the project area with particular attention to diseases related to water and sanitary conditions

viii) provide data on maternal and infant mortality rates and life expectancy

ix) discuss the status of health care programmes in the area, as well as other projects which have bearing on improvements in environmental sanitation.

d) ***Sector Institutions***

i) Identify the institutions (Government, Semi-Government, Non-Government) which are involved in any of the stages of water supply and sanitation project development in the area, (Planning, preparing projects, financing, implementation, operation and maintenance and evaluation)

ii) comment on roles, responsibilities and limitation (territorial or others) of all the identified institutions, in relation to water supply and sanitation (This may also be indicated on a diagram).

e) ***Existing Wastewater, Disposal Systems and Population Served***

Describe each of the existing wastewater disposal systems in the project area, indicating the details as under:

Area served, quantity and quality of wastewater collected, components of the system such as collection network,pumping stations, treatment works and effluent disposal methods etc.

Private waste water disposal methods such as septic tanks, on site latrines etc.

f) ***Drainage and Solid Wastes***

Briefly describe existing systems of storm water drainage and solid waste collection and disposal. This discussion should be focused in terms of their impact on wastewater management and environment.

g) ***Need for a Project***

i) Comment as to why the existing system cannot satisfy the existing and projected demands for services with reference to population to be served

ii) Describe the consequences of not taking up a project, (which may include rehabilitation or developing a new system)

iii) Indicate priorities to improvement of existing system, expansion of systems, construction of new system, assessment of the need for consumer education in hygiene and comments on urgency of project preparation and implementation.

1.9.3.4 LONG TERM PLAN FOR WASTEWATER DISPOSAL

a) Wastewater disposal services have to be planned as a phased development programme and any short term project should be such as would fit in the long term strategy. Such a long term plan or the strategic plan should be consistent with the future overall development plans for the areas. A long term plan may be prepared for a period of 30 years and alternative development sequences may be identified to provide target service coverage at affordable costs. From these alternative development sequences, a priority project to be implemented in short term can be selected. It is this project which then becomes the subject of a comprehensive feasibility study.

b) Alternative development sequences should be identified in the light of the coverages to be achieved during the planning period in phases. This calls for definition of the following:

i) population to be covered with improved waste water management facility

ii) target dates by which the above mentioned coverage would be extended within the planning period, in suitable phases

iii) consistency and co-ordination to be maintained between projections for both water supply and sanitation services.

c) It must be noted that availability of funds is one of the prime factors which will ultimately decide the scope and scale of a feasible project

d) Selection of a Strategic Plan

Each of the alternative development sequences, which can overcome the existing deficiencies and meet the present and future needs, consists of a series of improvements and expansions to be implemented over the planned period. Since all needs cannot be satisfied in immediate future, it is necessary to carefully determine priorities of target groups for improvement in services and stages of development and thus restrict the number of alternatives.

e) Planning for system requirement includes consideration of the following:

i) possibilities of rehabilitating and/or de-bottlenecking the existing systems

ii) alternative treatment systems and pumping schemes

f) It may also be necessary to ascertain if supporting activities like health education, staff training and institutional improvements etc., are necessary to be included as essential components of

the project. All the physical and supporting input need to be carefully costed (capital and operating) after preparing preliminary designs of all facilities identified for each of the development sequences. These may then be evaluated for least cost solution by 'net present worth' method, which involves expressing all costs (capital and operating) for each year in economic terms, discounting future costs to present value, selecting the sequence with the lowest present value

g) As stated above, costs are to be expressed in economic terms and not in terms of their financial costs. This is because the various alternatives should reflect resource cost to the economy as a whole at different future dates. Costing of the selected project may however be done in terms of financial costs, duly considering inflation during project implementation.

1.9.3.5 PROPOSED WASTEWATER PROJECT

a) ***Details of the Project***

The project to be selected may consist those components of the least cost alternative of development sequence, which can be implemented during the next 3 to 4 years. Components of the selected project may be as follows:

i) rehabilitation and de-bottlenecking of the existing facilities

ii) construction of new facilities for improvement and expansion of existing systems

iii) support activities like training, consumer education, public motivation etc.

iv) equipment and other measures necessary for operation and maintenance of the existing and expanded systems

v) consultancy services needed (if any) for conducting feasibility study, detailed engineering, construction supervision, socio-economic studies, support activities.

b) ***Project Components***

All project components should be thoroughly described, duly supported by documents such as:

i) location maps

ii) technical information for each physical component and economic analysis where necessary

iii) preliminary engineering designs and drawings in respect of each physical component, such as collection network, pumping stations, treatment plants, disposal system

c) ***Implementation Schedule***

A realistic implementation schedule should be presented, taking into consideration time required for all further steps to be taken, such as conducting feasibility study, appraisal of the project, sanction to the project, fund mobilisation, implementation, trial and commissioning. In preparing this schedule due consideration should be given to all authorities/groups whose inputs and decisions can affect the project and its timing.

d) ***Cost Estimates***

Cost estimates of each component of the project should be prepared and annual requirement of funds for each year should be worked out, taking into consideration the likely annual progress of each component. Due allowance should be made for physical contingencies and annual inflation. This exercise will result in arriving at total funds required annually for implementation of the project.

e) ***Pre-feasibility Report***

The pre-feasibility report should bring out any major environmental and social impact the project is likely to cause and if these aspects will affect its feasibility. (Refer to 1.3.2)

f) ***Institutional Responsibilities***

The pre-feasibility report should identify the various organisations/departments/agencies who would be responsible for further planning and project preparation, approval, sanction, funding, implementation, operation and maintenance of the project and indicate also the manpower needed to implement and later operate and maintain the project.

It should also discuss special problems likely to be encountered during operation and maintenance, in respect of availability of skilled and technical staff, funds, transport, chemicals, communication, power, spare parts etc. Quantitative estimates of all these resources should be made and included in the project report.

g) ***Financial Aspects***

The capital cost of a project is a sum of all expenditure required to be incurred to complete design and detailed engineering of the project, construction of all its components including support activities and conducting special studies. After estimating component-wise costs, they may also be worked out on annual basis throughout the implementation period, taking into consideration construction schedule and allowances for physical contingencies and inflation. Basic item costs to be adopted should be of the current year. Annual cost should be suitably increased to cover escalation during the construction period. Total of such escalated annual costs determines the final cost estimate of the project. Financing plan for the project should then be prepared, identifying all the sources from which funds can be obtained and likely annual contribution from each source, until the project is completed. The possible sources of funds include:

i) cash reserves available with the project authority

ii) grant-in-aid from government

iii) loans from government

iv) loans from financing institutions like Life Insurance Corporation, Banks, HUDCO etc.

v) open market borrowings

vi) loans/grants from bilateral/international agencies

vii) capital contribution from voluntary organisation or from consumers.

h) ***Interest on Loan***

If the lending authority agrees, interest payable during implementation period can be capitalised and loan amount increased accordingly.

i) ***Recurring Expenditure***

The next step is to prepare recurrent annual costs of the project for the next few years (say 10 years) covering operation and maintenance expenditure of the entire system (existing and proposed). This would include expenditure on staff, chemicals, energy, spare parts and other materials for system operation, transportation, up-keep of the systems and administration.

The annual financial burden imposed by a project comprises the annual recurring cost and payment towards loan and interest(debt-servicing) less the revenue derived from taxes, tariffs etc.

j) *Financing Plan*

Every State Government and the Government of India have schemes for financing water supply and waste water disposal schemes in the urban and rural areas and definite allocations are made for the national plan periods. It will be necessary at this stage to ascertain if and how much finance can be made available for the project under consideration and to estimate annual availability of funds for the project till its completion. This exercise has to be done in consultation with the concerned department of the Government and the lending institutions, who would see whether the project fits in the sector policies and strategies and can be brought in an annual planning and budgetary cycle taking into consideration the commitments already made in the sector and the overall financial resource position. The project may be finally sanctioned for implementation if the financing plan is firmed up.

1.9.3.6 CONCLUSIONS AND RECOMMENDATIONS

a) *Conclusions*

This section should present the essential findings and results of the pre-feasibility report. It should include a summary of:

i) existing coverage

ii) review of the need for the project

iii) long-term development plans considered

iv) the recommended project, its scope in terms of coverage and components

v) Priorities concerning target-groups and areas to be served by the project

vi) Capital costs and tentative financing plan

vii) Annual recurring costs and debt servicing and projection of operating revenue

viii) Urgency for implementation of the project

ix) Limitation of the data/information used and assumption and acknowledgements made and need for indepth investigation, survey and revalidation of assumptions and judgements, while carrying out feasibility study.

The administrative difficulties likely to be met with and risks involved during implementation of the project should also be commented upon. These may pertain to boundary question for the project area, availability of land for constructing project facilities, coordination with the various agencies, acceptance of service by the beneficiaries, shortage of construction materials, implementation of support activities involving peoples' participation, supply of power, timely availability of funds for implementation of the project and problems of operation and maintenance of the facilities.

b) *Recommendations*