3.0 Water Treatment Plant Construction/Modification/Rehabilitation

The purpose of this section is to provide guidance for preparing an engineering report/environmental information document (ER/EID) for projects which propose to construct, rehabilitate and/or modify a water treatment plant (WTP). Examples are:

- Build a new WTP
- Rehabilitate an existing WTP
- Replace large portions of an existing WTP to address issues related to treatment inefficiencies.
- Change treatment technology

This section applies to projects similar to the above-listed examples. For projects which propose the rehabilitation, repair or replacement of individual or relatively small pieces of equipment, see Section 5.0.[1] The outline of the ER/EID must follow the order presented in this section, and the following subsections describe and discuss what the ER/EID must include.

Some projects may qualify for Minor ERs/EIDs. (See Section 1.4.1 for the details of when these are allowed.) For Minor ERs/EIDs, complete the tables provided in Appendix A for the requirements in each section.

For Major ERs/EIDs, the guidance may allow alternative data, methodologies, and the way material is presented; *however, the format must always be followed*. Each subsection will advise if these are allowable.

- Alternative data sets other than those specified in this section *may be* proposed in certain subsections. *In all cases, alternative data sets must be identified, discussed, justified and compared with the corresponding data set specified in the guidance.* You must provide an acceptable rationale for the preferred alternative data set to the one specified in the guidance.
- Alternative methodologies must be specified and discussed, and the findings compared with the findings based on the corresponding methodologies in the guidance. All alternative methodologies must include supporting data, calculations, assumptions and documentation so that results can be replicated.
- If material is presented in alternative manner, the required discussion must be in the body of the ER/EID. Supporting information (e.g., maps, calculations, supporting data, etc.) may be included in an appendix rather than the body of the ER/EID. A tabular display of the data is encouraged where feasible.

The Division strongly recommends that as the ER/EID is prepared, the Consultant and Owner meet with the Division to discuss population and/or water demand well before proceeding to the next steps, which should help the process move more smoothly and help determine the alternatives to be analyzed.

[1] Please note that this section of guidance will be at a later date. If you think your project falls into this category, please contact Division staff for further information on how to proceed.

As stated in Section 2.1.1, the report must follow the prescribed format in the guidance. ERs/EIDs for projects under this section must follow the format below:

Upfront Information
1.0. Executive Summary
2.0. Existing Facilities and Project Planning
  2.1. WTP Condition
  2.2. Current Population
  2.3. Current Water Demand
  2.4. Population Projections
  2.5 Flow Projections
3.0. Purpose and Need
4.0. Alternatives Analysis
  4.1. Alternatives Description
  4.2. Present Worth Analysis
  4.3. Alternatives Analysis Summary
  4.4 Project Description
5.0. Environmental Information Document[2]
6.0. Financial Analysis
7.0. Public Participation[3]

3.1 Upfront Information

Prepare the upfront information (e.g., Title Page, Table of Contents) as specified in Section 2.2.1.

3.2 Executive Summary

Prepare the Executive Summary in accordance with Section 2.2.2. Include current and proposed WTP capacity. A copy of the primary and secondary water quality standards must be included in the Appendix.

3.3 Existing Facilities and Project Planning

Before drafting the Need and Purpose statement as defined in Section 2.2.3, the reasons for the project must be determined. To do so, first characterize the current situation. The following sections discuss what should be included in this section.

3.3.1 Water Treatment Plant Condition

This section will determine the potential issues related to the actual condition of the system. The information presented in this section will provide part of the basis for the need and purpose of the project. Review the following sections and complete the requirements as discussed.

[2] As noted in Section 3.7, there is a separate environmental process for the CDBG-I program. Therefore, this section is not needed in the ER for projects funded wholly or partially by CDBG-I.
[3] Ibid.

3.3.1.1 Overview of System

Requirements

Provide two figures. The first should be more of a vicinity figure that shows the Applicant. In this figure, provide

- Basemapping as described in Section 2.1.5.
- The municipal limits of the Applicant and/or county lines.
- Major roadways and waterbodies.
- Location of source water, clearly marked.
- Location of storage tanks
- Major water mains and booster pump stations.
- All WTP(s) which treat(s) water for the entire system.
- The WTP where the project is located.

> ***Major/Minor ERs/EIDs***
>
> Include these figures as part of Section 2.1 of the ER/EID. Additionally, text may be provided to provide more explanation regarding the system.

3.3.2 WTP Condition

As part of determining the need for the project, it is important to gain an understanding of the WTP condition. An overall assessment of the condition of the WTP provides an overview of the basics of the WTP and the groundwork for a more detailed assessment of the specific components of the WTP. Complete the following sections related to the WTP.

3.3.2.1 General WTP Condition

Requirements

Describe the general condition of the WTP. This description should be a general description of (1) the basic process; (2) whether the WTP is in good working order; and (3) the trend in water demand.

Provide the average daily demand in million gallons per day (MGD) for the past two years. Flow sheets must be provided in an appendix of the ER/EID.

Include any Notices of Violation (NOV) that the WTP might have incurred over the past five years. If there are any special orders such as a SOC, discuss the pertinent information as to why the special order was put into place, the final completion deadline, and any intermediate deadlines.

Additionally, include diagrams or schematics of treatment trains, noting the overall direction of flow as well as recycle loops. Also, provide a plan (or plans) which show(s) and label(s) the physical location of each unit operation and process or (system of operations and processes) in sufficient detail to show (and label) major yard piping and pumping.

Minor/Major ERs/EIDs

- For the current condition of the WTP, complete Table 2.1.1 and 2.1.2 in Appendix A and include in the body of the ER/EID.
- If NOVs or special orders are listed, provide full copies of these NOVs or special orders in an appendix of the ER/EID. Reference the appendix in the table.
- Provide both a conceptual schematic and a plan diagram in the ER/EID. Supply the appropriate reference for these figures in the table.
- Include flow records for the past two years in an appendix of the ER/EID. Reference the appendix in the table.

3.3.2.2 Current Water Demand

Requirements

Historical water demand data is a key component in assessing the current demand and need to expand or construct a WTP. Provide this data for at-least the last two years. Specifically, provide the average annual daily demand (Q_{AA}) and the maximum daily demand ($Q_{\text{-max daily}}$), maximum hourly demand and fire demand ($Q_{\text{hourly-max}}$) for each year. Explain design flow for the WTP and design flow for the equipment (with issues) in particular. Also discuss if the current design flow is sufficient to satisfy current demands or expansion of the equipment is needed.

Annual Average Daily Demand – The daily demand averaged over a year (i.e., any consecutive 12 month period).

Maximum Daily Demand – Average of two highest consecutive days of record of the water treated. Or use appropriate peaking factor with a detailed justification for the peaking factor.

Minor ERs/EIDs

- Complete Table 2.1.3 in Appendix A for average demand for the two-year period ($Q_{2\text{-yr}}$) as well as average annual daily demand (Q_{AA}), the maximum daily demand, ($Q_{\text{- max daily}}$), and the maximum hourly demand ($Q_{\text{hourly - max}}$) for each year. Place the table in the body of the ER/EID.
- In an appendix of the ER/EID, provide backup information such as daily flow records from the last two years.

Major ERs/EIDs

Additional parameters/rationale may also be used.

3.3.2.3 Condition of WTP Equipments (Existing WTPs)

To further understand the condition of the WTP, each piece of equipment should be assessed. For WTPs that will be modified, it will also provide the basis for the need to upgrade/modify/replace equipment.

Requirements

Provide information regarding the size, age, condition, and other pertinent information that would provide a solid assessment of each portion of the water treatment processes. If possible, provide photos of each piece of equipment. The equipment should include but is not limited to the following:

- Raw water intake structures
- Mixing equipment
- Flocculation
- Clarification
- Filtration
- Disinfection
- Filter back wash and other sludge stream treatment and disposal

Condition should be assessed as follows:

- **Good.** The equipment shows little signs of wear and functions in an efficient manner with only routine maintenance. It shows minimal signs of corrosion and deterioration.
- **Fair.** The equipment shows some signs of wear and fails periodically. Some repair outside of routine maintenance is required to keep the equipment functioning. Minor upgrades provide reliability.
- **Poor.** The equipment shows signs of wear and fails on a regular basis. Repairs outside of routine maintenance occur frequently. The equipment shows excessive signs of corrosion that limits functionality. Upgrades are needed to provide reliability.

Use a sub-section (Major ER/EID) or table (Minor ER/EID) per each piece of equipment to discuss the information above and any additional information that provides an accurate description of the equipment. On a diagram, show where this piece of equipment is located within the WWTP site. Also, where possible, include photographs and reference these photographs in the description. Provide any supporting information in an appendix to the ER/EID and supply the appropriate reference in the body of the ER/EID. Additional information should be provided in an appendix of the ER/EID.

For Filter back wash and other sludge stream treatment, discuss the existing treatment/disposal methods and also include a NPDES permit for existing WTPs and ability/efforts to obtain one for new water treatment plants.

Minor ERs/EIDs

- Using Table 2.1.4 in Appendix A as the standard, complete a table for each piece of equipment (e.g., 2.1.4a, 2.1.4b). Print these tables and include them in the body of the ER/EID.
- Provide any photos taken of equipment in an appendix to the ER/EID. List the appropriate reference in the table.
- Provide any supporting information in an appendix to the ER/EID. List the appropriate reference in the table.

3.3.2.4 Proposed WTP (New WTPs only)

Requirements

For construction of a new WTP, describe how water demands of the area to be served by the proposed WTP is currently met. For example, the Applicant might be buying treated water from another facility or using private wells.

Discuss the availability and type of source water and required intake structures and pump stations.

Conventional physical, chemical and microbiological raw water quality characteristics must also be specified in this section.

Provide a short discussion on finished water quality requirements including promulgated limits and any challenges in meeting the standards using conventional treatment.

Minor ERs/EIDs

- Complete Table 2.1.5 in Appendix A.
- Provide a map that shows the location of the new WTP. List the reference for this map in the table.

3.3.3 Current Population

Current population provides the basis for future population and may supply part or all of the need for the project. Follow the steps in this section to determine current population for the Applicant and the WTP service area.

Requirements

Provide the total population for the Applicant/Service Area for the year 2000 and 2010 using U.S. Census data. If the Service Area covers multiple communities provide the individual community population to justify total population.

Major/Minor ERs/EIDs

- Complete Tables 2.2.1 in Appendix A.
- Provide supporting information from the U.S. Census website in an appendix of the ER/EID. Reference the appropriate appendix in the table.

3.3.4 Current Water Demand

Part of describing the current condition of the WTP to be expanded, constructed, or modified is characterizing the water demand from the service area. If metered data from the previous years is available, calculate treated average daily flow and maximum daily flow as described in the Section 3.3.2.2. For new WTP construction, with no historical water use data, estimate water demand using number of service connections and daily flow requirements as given in NCAC 15A18C.0409. For bulk customers of the water system, include flow commitments as outlined in the inter-municipal or other agreements.

Residential, Commercial, Industrial and bulk sale demands should be listed separately.

3.3.4.1 Fire Demand

Estimate fire demand and provide a detailed discussion on how this is estimated. If historical demand or size of the largest building in the area is used for this calculation provide details and reference on how many gallons per minute flow for how many hours were used to calculate this flow. If the ISO Fire Suppression Rating Schedule is used as a reference, please state that and provide necessary calculations and assumptions in the appendix.

3.3.4.2 Estimate Current Total Design demand

Provide Residential, Commercial, industrial and bulk sales individually and add up to indicate the current water demand.

Compare this data with the with average gallons of water treated per day.

Average Daily Demand (gallons per day) = Residential Demand + Commercial Demand+ Industrial Demand + Fire Demand + Bulk Sales

Minor ERs/EIDs

- Use Table 2.3.1 in Appendix A. Print this table and place it in the body of the ER/EID.
- Provide supporting information in an appendix of the ER/EID and supply the appropriate reference in the table.
- Provide any contracts/agreements related to flow commitments in an appendix of the ER/EID.

Major ERs/EIDs

Alternative methodologies may be used. If an alternative methodology is used, explain the methodology in the body of ER/EID, and present the results. All backup data, methodologies used, assumptions made, and calculations must be provided in an appendix of the ER/EID.

3.4 Project Planning

The life of many pieces of WTP equipment is expected to be 20 years which is also the terms of typical loans made by the Division. This is important because the planning for future will help establish the need for the project and will help size the WTP accurately. This section discusses what the Division needs to review in terms of population projections and flow projections. Keep in mind that, *If the primary need of the project is "future growth", the project is not eligible for funding under current DWSRF regulations.*

To ensure a project is not driven by speculative future growth, estimate the current growth rate and use that rate to project the population and water demands for the next 20-year period.

If a higher growth rate must be used, justify the higher growth by including signed contracts and/or inter municipal agreements.

3.4.1 Population and Flow Projections

This section can be skipped, if the project strictly rehabilitates or replaces one or two pieces of equipments with no capacity increase.

If the service area includes multiple communities with different population growth rates, population projections for these individual communities should be shown separately with supporting information in the appendix.

Requirements

To project population growth for the next 20-year period, data from U.S. Census Bureau, State Data Center Estimates municipal population estimates, comprehensive plans, or projections based on connections may be used. If multiple data sources are used, show the results of each source in the table/chart and provide supporting information in the appendices of the ER/EID. Most importantly, justify the source of data and clearly state assumptions and show calculations in the Appendix.

Major/Minor ERs/EIDs

- Summarize population estimates and residential flow estimates in Table 2.4.1 in Appendix A.
- Provide supporting information verifying the population projections.
- Clearly state the assumptions and show calculations in the appendix.

3.4.2 Flow Projections

Determining future flow is critical to ensuring that the proposed project is properly sized to accommodate future flows. Since population projections determine flows, ensure that the population projection was completed as discussed in Section 2.4.1. The following sections describe how to determine future average daily demands.

Requirements

Use future (20-year) population and current average usage (gallons per day) to estimate future residential flow. Commercial and Residential flows must also be projected using appropriate factors. You must provide supporting documentation for all growth rates assumptions. If an alternative population and flow projection was utilized, provide a justification as to why this was used over the flow projection developed based on the methodologies described in this guidance.

If the service area/project area has undeveloped parcels of land, include the flow from the undeveloped property in the current water demand only if the developer has a signed agreement with the Applicant.

Estimate future design demand by adding current demand, future demand due to residential, commercial and industrial growth, and future demand due to existing and proposed (signed agreements required at the time of Application submittal) bulk customers flow commitments.

Major/Minor ERs/EIDs

- Summarize flow projection data in Table 2.5.1 (Appendix A) and include it in the body of the ER/EID.
- Provide any supporting information related to flow projections in an appendix and list the appropriate reference in the table.
- If the applicant wishes to use a different design year other than Year 20, you must discuss that with the division and obtain prior approval.

3.5 Purpose and Need

Complete the Purpose and Need statement (Table 3.1 in Appendix A) in accordance with Section 2.2.3.

3.6 Alternatives Analysis

3.6.1 Alternatives Description

The first part of the alternatives analysis consists of describing the alternatives considered for projects which propose to construct, expand and/or modify a WTP. Describing the alternative provides the opportunity to consider the impacts and benefits related to each alternative under consideration and provides the groundwork related to the present worth analysis (see Section 2.2.4). For projects which propose to construct, expand and/or modify a WTP, the following alternatives (as applicable) may be considered:

- No-Action Alternative
- Optimum Operation of Existing Facilities
- Rehabilitation of Existing Facilities
- Regionalization/consolidation
- Construction/expansion/modification using conventional treatment
- Construction/expansion/modification using alternative treatment
- Preferred Alternative

Requirements

The details of what is needed for the description of the alternatives will be discussed in Sections 3.6.1.1 through 3.6.1.8 below.

Minor ERs

Each of the alternatives discussed in the sections below must be included by using Tables 4.1.1 through 4.1.7 in Appendix A, as needed, for each alternative. Each alternative description must include the following:

- A description of each alternative as described in the sections below. Where appropriate, include figures, schematics, and maps.
- Include preliminary design information for the proposed project, including preliminary design criteria for all proposed unit processes and operations, a flow schematic for major treatment processes and/or operations, detention times, loading rates, mixing requirements, tank and pump sizes, etc. sufficient to evaluate the proposed project.
- For feasible alternatives, the capital cost and present worth as derived from the present worth analysis.
- For all alternatives, a *brief qualitative* discussion of environmental impacts and a comparison to the Preferred Alternative. For projects qualified as Categorical Exclusion, state so.
- For all alternatives, a discussion regarding why the alternative was accepted or rejected, including capital cost, present worth, and environmental impacts.

- Place the tables for each alternative in the body of the ER/EID with all supporting information in an appendix.

Major ERs/EIDs

For Major ERs/EIDs, include the information as discussed above in the requirements for Minor ERs/EIDs. However, the information may be presented in narrative form, or in some combination of narrative with tables. Supporting documentation must be included in an appendix to the ER/EID.

3.6.1.1 No-Action Alternative

This Alternative must be evaluated for all types of projects. For this alternative, discuss what would happen if the project were not built. In answering this question, describe the public health impacts that would occur from not building the project. In the rationale, describe why this alternative was not chosen, including whether it was feasible to continue as discussed in the no-action scenario.

3.6.1.2 Optimum Operation of Existing Facilities

In the description of this alternative, discuss how the facilities at the WTP could be optimized to improve performance without making any upgrades beyond those that would be a part of normal maintenance procedures. In the rationale, describe why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.3 Rehabilitation of Existing Facilities

In the description of this alternative, discuss how the facilities at the WTP could be rehabilitated to improve performance without making any capacity increases or replacements. In the rationale, describe why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.4 Regionalization/Consolidation

Regionalization has been a goal that has been supported by the DENR, and it must be examined for WTP construction, expansion, or modification. Note that regionalization may include constructing, expanding, or modifying a WTP to serve more than one Applicant but may also consist of bringing water service of more than one agency under one management umbrella such as a water district.

Describe what type of regionalization will occur (e.g., management, physical interconnection, etc.). If more than one combination of regionalization was considered, then each combination should be its own alternative. If the Regionalization/Consolidation Alternative is the preferred alternative, provide inter-local or other agreements between agencies. On a figure, show what entities will be impacted by the regionalization. If infrastructure is involved, show this infrastructure on the figure.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.5 Construction/Expansion/Modification Using Conventional Treatment

In the description of this alternative, discuss how the project purpose can be met by replacing the current equipments with similar or other conventional treatment technologies such as flocculation/sedimentation, filtration and disinfection. For the treatment technology, discuss the processes involved, anticipated treatment levels and provide treatment schematics.

Discuss the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.6 Construction/Expansion/Modification Using Alternative Treatment

If and only if Conventional Treatment is found to be inadequate, evaluate alternative advanced treatment techniques. Discuss treatment technique and provide preliminary design details in this section. If a pilot study is required, states the need for it and also provides the anticipated time line and resources required to complete this study. If a pilot study is already completed, provide the results and discuss how this study will aid in the design process.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.7 Preferred Alternative

The project selected as the Preferred Alternative may be different from the above alternatives. If it is not, simply state that one of the above alternatives is the preferred. If it is, then describe the preferred alternative in the same manner as discussed above. Provide the rationale as to why this alternative is the preferred alternative.

3.6.2 Present Worth Analysis

Complete the present worth analysis in accordance with Section 2.2.4.

3.6.3 Alternatives Analysis Summary

Complete the alternatives analysis in accordance with Section 2.2.5.

3.6.4 Proposed Project Description

Prepare the project description in accordance with Section 2.2.6. Include in the project description, a bulleted list of all project components.

3.7 Environmental Information Document

Complete the environmental Information Document for the Preferred Alternative in accordance with Section 12.[4,5]

3.8 Financial Analysis

Complete the financial analysis in accordance with Section 2.2.7. Projects funded entirely by the grant funds do not need to complete this section.

3.9 Public Participation

Complete the public participation section in accordance with Section 2.2.9.[6]

[4] The Division has the right to request additional environmental impact analysis if it is deemed necessary during ER/EID review.
[5] As noted in Section 3.7, there is a separate environmental process for the CDBG-I program. Therefore, this section is not needed in the ER for projects funded wholly or partially by CDBG-I.
[6] Ibid.