## 4.0 Water Lines Extension/Replacement/Rehabilitation/Re-routing

The purpose of this section is to provide guidance on how to prepare an engineering report (ER)/environmental information document (EID) for a project that involves the water lines. Some examples of water line projects may be:

- Installing waterlines to serve an area containing failing private well systems.
- Replacing/rehabilitating aging water lines with same size or larger size pipe.
- Extending water lines to close the loop or to provide additional connections.
- Installing pipelines to and from source, treatment plant or storage tanks.

This section applies to projects similar to the above-listed examples. The outline of the ER/EID must follow the order presented in this section. ER/EID must include the following subsections.

Some projects may qualify as a Minor ER/EID. (See Section 1.4.1 for the details of when these are allowed.) For Minor ERs/EIDs, complete the tables provided in Appendix B 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*. 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 practicable.

The Division strongly recommends that as the ER/EID is prepared, the Consultant and Owner meet with the division to discuss population and/or flow projections well before proceeding to the next steps.

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. Distribution System Condition
    2.2. Current Water Demand
    2.3 Flow Projection
    2.4 Future Situation Downstream of Project
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 Proposed Project Description
5.0. Environmental Information Document[1]
6.0. Financial Analysis
7.0. Public Participation[2]

## 4.1 Upfront Information

Prepare the upfront information (e.g., Table of Contents, Appendices) in accordance with Section 2.2.1.

## 4.2 Executive Summary

Prepare the Executive Summary in accordance with Section 2.2.2.

## 4.3 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 the current situation.

### *4.3.1 Distribution System 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.

[1] As noted in Section 4.7, 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.
[2] Ibid.

#### 4.3.1.2 *Overview of System*

***Requirements***

Part of determining the condition of the water system is to gain an understanding of the size of the distribution system and the area where the project will occur. 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.
- Major Water mains and booster pump stations.
- The WTP(s) which treats the water for the entire system.
- The project location.

In addition to including this figure, if the water line replacement/extension will occur in an area that is smaller than the entire service area, then provide an additional figure that shows the following:

- Basemapping as described in Section 2.1.5.
- The municipal limits of the applicant and/or county lines.
- Major roadways and waterbodies.
- Water distribution lines with size of the pipe clearly marked
- Booster pump stations (with capacities clearly stated) within the project area.
- The direction of water flow.
- Location of fire hydrants.
- The project location.

***Major/Minor ERs/EIDs***

- Please include these figures as part of Section 2.1 of the ER/EID.
- Complete Table 2.1.1 in Appendix B.
- Additionally, text may be provided to provide more explanation regarding the distribution system.

#### 4.3.1.3 *General Pipe Condition History*

Pipe breaks, leaks and pressure loss are often indicators of the poor condition of a distribution system. Follow the requirements below regarding assessing and reporting pipe conditions.

***Requirements***

List and describe any issues that have happened over the past five years within the project area. Attach any information regarding this and show where these problems occurred. If water loss due to leaks is suspected, provide treated water data Vs metered water data. Describe the efforts

to pin point the locations of the water leak, such as installing water meters at predetermined sites, or measuring pressure at fire hydrants.

Discuss whether the applicant is under a Special Order by Consent (SOC) or is currently negotiating one with the North Carolina Department of Environment and Natural Resources (DENR) Division of Water Resources (DWR). Additionally, discuss any other special orders under which the applicant may be, such as an order for the U.S. Environmental Protection Agency (EPA). Provide full copies of these orders in an appendix of the ER/EID.

Show all pipe breaks on a map. This map should also contain the same basemapping as the project location figure (see Section 2.1.5) , the local government unit boundaries, the transmission lines and booster pump stations within the project area, the direction of water flow, and the location of all pipe breaks/pressure loss that are keyed to Table 2.1.1 in Appendix B.

***Major/Minor ERs/EIDs***

- Complete Table 2.1.2 in Appendix B and place it in the body of the ER/EID.
- If the project involves only pipe extension complete Table 2.1.3 and place it in the body of the ER/EID.
- Include the required map in the ER/EID with the appropriate map reference in Tables 2.1.2 and 2.1.3.
- Provide all pipe breaks reports shown in the table in an appendix of the ER/EID. List the appendix reference in the table.
- Provide full copies of any special orders in an appendix of the ER/EID. List the appendix reference in the table.

### *4.3.2 Replacement/Re-routing /Extension Prioritization*

If the projects involving water line rehabilitation and replacement were identified from an extensive Water System Evaluation Study, please describe the methodology and provide the data in a tabular form. If no work toward prioritizing distribution system components for rehabilitation/replacement or extension has been completed, describe how the Applicant identified the need for replacing/re-routing or extending the proposed water lines.

***Major/Minor ERs/EIDs***

- Complete Table 2.1.4 in Appendix B and place it in the body of the ER/EID.
- If this project is part of CIP, mention that that provide copies of relevant pages in the appendix and list the reference in appropriate cell of the Table.

### *4.3.3 Current Water Flow and Pressure*

Knowing the current water flow through the section of the distribution system to be rehabilitated or replaced helps to establish if the project will be a true rehabilitation/replacement project or an expansion project. Additionally, it helps to bolster the need for the project.

***Major/Minor ERs/EIDs***

- Complete Table 2.2.1 in Appendix B and place it in the body of the ER/EID.
- Table 2.2.1 should list all the pipes in the project area proposed to be replaced or rehabilitated.
- If the project involves pipe extension indicate that provide estimated flow and pressure for that section of the pipe.
- Available pressure can be measured / estimated. Indicate how the data is obtained in the additional information cell and provide necessary supporting information in an Appendix.

***Requirements***

Discuss the current size, capacity and available pressure during peak (fire) demand of the water lines to be rehabilitated or replaced. Provide the calculations/models used to make this determination in an appendix to the ER/EID. Note that methodologies may be related to pump drawdown tests and runtimes, metered flow, or estimated flow using pressure calculations at the fire hydrants.

### *4.3.4 Flow Projections*

State the capacity of the water lines to be rehabilitated or replaced. Then provide the future peak demand at Year 20 of the proposed project. Compare this future peak flow to both the current peak flow and the current capacity. If flow increases/decreases will occur, provide the percentage increase/decrease. Describe the rationale for the future demands. If flows will increase, discuss the methodology used to determine projected flow. Include any calculations in an appendix of the ER/EID.

Steps involved in determining the future flow is outlined here:

4.3.4.2 *Provide increase/decrease in number of connections*

Data from municipal population estimates, comprehensive zoning and land use plans, or projections based on connections may be used to determine increase in number of connections. If the project is not anticipated add any new connections, state so in this section.

It is strongly recommended that as the ER/EID is prepared, the Consultant and Owner meet with the Division to discuss population projections before proceeding to the next steps, which will help determine the alternatives to be analyzed.

***Major/Minor ERs/EIDs***

- Complete Tables 2.3.1 and 2.3.2 in Appendix B and place it in the body of the ER/EID.
- If the project involves pipe extension indicate that provide estimated flow and pressure for that section of the pipe.
- Available pressure can be measured / estimated. Indicate how the data is obtained in the additional information cell and provide necessary supporting information in an Appendix.

4.3.4.3 *Estimate Future Flow (Year 20) through the pipe*

Estimate Future flow based on number of connections and historical water demand. Estimate peak flow including fire flow requirements. If historical water data is not available, estimate water demand using daily flow requirements as given in NCAC 15A.18C.0409.

4.3.4.4 *Determine whether capacity is sufficient*

For existing pipe calculate available capacity considering residual pressure requirements. Compare Future flow (design year 20) with current capacity of the pipe line. If Capacity increase is warranted, provide size and material of proposed pipe. If the pipe size has to be increased to a 6-inch to meet minimum size requirements for fire hydrant installation, discuss this in this section.

### *4.3.5 Future Situation Downstream of Project*

For water main extension projects, discuss if minimum pressure requirements can be met downstream of the project. For water line expansion projects, give the capacity of pipe downstream and discuss if any upgrades to the downstream infrastructure is needed to meet current or future capacity requirements.

## 4.4 Purpose and Need

Complete the Purpose and Need section in accordance with Section 2.2.3.

## 4.5 Alternatives Analysis

### *4.5.1 Alternatives Description*

The first part of the alternatives analysis summarized in Section 2.2.5 consists of describing the alternatives considered for the project. Describing the alternative provides the opportunity to consider the impacts and benefits related to each alternative considered, and provides the groundwork related to the present worth analysis (see Section 2.2.4). For Water line extension projects, the following must be considered:

- No-Action Alternative
- Extending Water line via alternate routes
- Combination of Replacement and Re-routing

- Preferred Alternative

For Water line Rehabilitation/Replacement Projects, following alternatives must be evaluated.

- No-Action Alternative
- Rehabilitation of water lines
- Replacement of water lines with same material/size pipe and/or in the existing trench
- Replacement of water lines with different material/ size pipe and/or alternate route
- Combination of Replacement/Rehabilitation
- Preferred alternative

***Requirements***

The details of what is needed for the description of the alternatives will be discussed in Sections 4.5.1.2 through 4.5.1.7 below.

***Minor ERs/EIDs***

Each of the alternatives discussed in the sections below must be included by using Tables 4.1.1 through 4.1.7, as needed, in Appendix B 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 and maps.
- For feasible alternatives, include preliminary design information for the proposed project, including preliminary design criteria for the pipe lines (Pressure, diameter, design flow, etc.), and any other equipment in the distribution system proposed for replacement or re-routing. For each feasible alternative, prepare a capital cost, operation and maintenance, and present worth analysis.
- 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. Supporting documentation must be included in an appendix to the ER/EID.

#### 4.5.1.2 *No-Action Alternative*

For this alternative, discuss what would happen if the project were not built. In answering this question, describe the social, economic, and environmental 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.

#### 4.5.1.3 *Rehabilitation*

Discuss whether or not rehabilitation is a feasible alternative. Describe the various methods that could be used to rehabilitate the water lines. In a figure, show where the rehabilitation for each alternative considered would occur. Provide the rationale as to whether the alternative by itself would be accepted or rejected.

#### 4.5.1.4 *Replacement*

In this alternative, describe whether replacement is a feasible alternative. Discuss the various methods that could be used to replace portions of the distribution system. In a figure, show where the replacement for each alternative considered would occur. Provide the rationale as to whether the alternative by itself would be accepted or rejected.

#### 4.5.1.5 *Combination of Rehabilitation and Replacement*

For this alternative, describe the various alternatives which would combine rehabilitation and replacement to meet previously identified needs. For instance, discuss those portions of the collection system which would be amenable to rehabilitation and thus be a more economical alternative to replacement. In other areas, the deterioration of the pipes may make rehabilitation unrealistic. Provide the rationale as to whether the alternative by itself would be accepted or rejected.

#### 4.5.1.6 *Pipe Materials, and Alignment Alternatives*

Consider at least two types of pipe materials that could be utilized in the repalcement of the collection system. It is at the discretion of the Applicant and their consultant to include more pipe materials. Examine how using different pipe materials could impact the project in terms of cost, public safety, and life expectancy. Discuss the material(s) under consideration as well as the pros and cons of each material. Alternatives for material may be bid as alternatives. If one type of material was completely eliminated from consideration, provide the rationale for rejection. Otherwise, provide the rationale as to why a certain material was used.

Consider at least two route alignments that could be utilized to implement the project. It is at the discretion of the applicant and their consultant to include additional alignments. Consider various route alignments to reduce both cost and environmental impact. In this section, discuss each routing alignment. Show each alignment on a figure that includes major roadways and waterbodies. Additionally, discuss whether piping of different materials would be used at different location. Each major combination of alignment and materials must be considered as a separate alternative. If one alignment was completely eliminated from consideration, provide the

rationale for rejection. Otherwise, provide the rationale as to why a certain route or alignment was used.

For example, Materials A and B might be considered for a project as well as Routes C and D. Then this alternative analysis would result in four alternatives as follows: (1) Material A and Route C, (2) Material B and Route C, (3) Material A and Route D, and (4) Material B and Route D.

#### 4.5.1.7 *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.

### *4.5.2 Present Worth Analysis*

Complete the present worth analysis in accordance with Section 2.2.4.

### *4.5.3 Alternatives Analysis Summary*

Complete the alternatives analysis in accordance with Section 2.2.5.

### *4.5.4 Proposed Project Description*

Prepare the proposed project description in accordance with Section 2.2.6.

## 4.6 Environmental Information Document

Complete the environmental information document in accordance with Section 12.[3,4]

## 4.7 Financial Analysis

Complete the financial analysis in accordance with Section 2.2.7.

## 4.8 Public Participation

Complete the public participation section in accordance with Section 2.2.9.[5]

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[3] The Division has the right to request additional environmental impact analysis if it is deemed necessary during ER/EID review.
[4] 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.
[5] Ibid.