CHAPTER 5

SEWER COLLECTION SYSTEMS

5.1 BACKGROUND

Most sewage collection systems are conventional gravity (CG) type and are generally the best choice unless other local factors dictate the use of other alternatives. Alternatives collection system types generally include:

- Conventional Gravity (CG)
- Small Diameter Gravity (SDG)
- Pressure Sewers with Grinder Pumps (GP)
- Pressure Sewers with Septic Tank Effluent (STEP)
- Vacuum Sewers (VS)

In order to identify appropriate wastewater collection alternatives for the Clinton community and its proposed service area, the particular characteristics of the Clinton community must be acknowledged. Some of these characteristics are:

- limited number of initial customers,
- seasonal residential occupancy,
- current utilization of on-site wastewater systems,
- limited economic viability of a segment of the current residents,
- diversity of land types (upland vs. beachfront),
- different soil types and varied topography, and
- land use limitations set by various regulatory agencies.

Also, the relative urgency to implement centralized wastewater facilities is likely to differ within the community.

In order to help evaluate centralized and decentralized wastewater collection and conveyance alternatives for Clinton, some general logistical factors pertaining to these alternatives are summarized as follows.

1. Conventional gravity sewer systems for a centralized collection system are not recommended for the flat waterfront areas because of excessive trench depth and difficult excavation conditions. Vacuum or pressure sewer systems are more appropriate for this area.

2. If wastewater treatment is to be accomplished by a single, centralized plant, it will generally be necessary to construct more pipeline and larger diameter pipe to create the initial collection and conveyance network compared to de-centralized treatment approach.

3. A conventional centralized gravity sewer collection system must be configured to conform with the topography, consequently there is little flexibility in the manner of expanding the collection network. Gravity pipeline generally would be larger, buried deeper and have greater total length compared to a pressure sewer system (GP or STEP) serving the same area.

4. A pressure sewer system (GP or STEP) has significant flexibility in the way the collection network can be configured and expanded. Planning and construction of a pressure sewer system can be done in a manner very similar to a water distribution system and topography is not a major constraint. Compared to gravity sewers, pressure sewer pipes are smaller, buried relatively shallow and do not need to be located at the low elevation side of a lot.

5. Because there are a large number of existing septic tanks in the service area, and the ability exists to retain sewage solids at the customers lot, the following benefits can be realized:

   - Reduced sewer maintenance costs – less potential for blockages.

   - Significantly reduces preliminary treatment (screening, grit removal etc.) and sludge handling loads at treatment plant(s).

6. If the MBR treatment plant options are selected, it is advantageous to utilize a STEP system for sewage collection because the septic tanks to provide beneficial removal of grit and debris that might otherwise damage the membrane materials.

7. In summary, considering the diverse characteristics of the proposed service area, together with the contrasting options for wastewater treatment (MBR and SBR), it is likely that several different methods of sewage collection should be implemented: conventional gravity (CG), pressure sewers with either grinder pumps GP or STEP and vacuum sewers (VS). Waterfront lots on Brighton Beach and Columbia Beach will be served most effectively by alternative wastewater collection systems such as vacuum sewers, STEP or grinder systems.

8. It is unlikely that a centralized wastewater treatment plant would be located on the waterfront; consequently, at least two pump stations would be needed to lift the sewage from the waterfront areas up to a treatment plant in the upland area.

9. The three separate natural drainage basins may impose some topographical obstacles to linking the basins together by gravity collection pipe network thus necessitating one or two sewage pumping stations in the upland area.

5.2 CENTRALIZED COLLECTION AND CONVEYANCE ALTERNATIVES

There are two basic alternatives for centralized collection and conveyance of sewage from the proposed service area to the treatment plant:

- Combination System: maximizes gravity sewer pipelines, conveys all wastewater solids to the treatment plant and minimizes alternative conveyance methods.

- Pressure systems (STEP or GP): maximizes the use of pressure sewers and may include septic tanks at each customer's lot to retain wastewater solids (STEP).

For the purposes of this plan, it is necessary to design a complete collection network, including pipe sizes and construction and operation costs. Consequently, it is necessary to assume an appropriate type of sewer collection network for each option. The following is a detailed description of the two collection networks that were evaluated for this plan:

Combination Gravity and Vacuum or Grinder System

A combination system consists of predominantly gravity lines with two smaller vacuum or grinder systems to serve the waterfront areas. The gravity portion of the system consists of approximately 7 miles of pipe, of which 80% is 8" diameter, with 10", 12", and 15" diameter pipe comprising the remaining 20%. The gravity portion of the system would serve all areas within the proposed service area except the waterfront homes along Brighton Beach and Columbia Beach. All sewage solids are conveyed to the treatment plant and there are no onsite septic tanks needed. This collection system configuration is assumed to be appropriate for centralized treatment Options 4, and 5. Refer to Figure 5.1 – Centralized Collection System, showing a detailed collection network for this type of system.

Waterfront property along both Brighton and Columbia Beaches would be served by either a vacuum or a grinder pump system. Approximately 2.5 miles of pipe ranging from 2" to 8" diameter will be installed. In the case of vacuum sewers, each house will have a small sump tank buried on site, which will control the release of sewage into the system. When a certain volume of sewage is reached within the tank, a valve automatically opens for a short time and the sewage is "vacuumed" into the conveyance pipeline and carried to the central vacuum station under negative pressure. In the case of a grinder pump system, each house would have a small sump tank and a grinder pump will convey the sewage by positive pressure.

Phasing:

Under this centralized wastewater collection alternative, it is generally assumed that waterfront lots and RC-zoned property fronting SR525 comprise the areas most likely to need or benefit from a community sewer system. Most upland residential areas and other RC lots not fronting SR525 are assumed to connect to the sewer at later times in the future. Therefore, the initial phase of a sewer system construction under this alternative would include the following facilities:

- Vacuum systems to serve both waterfront residential areas (Brighton and Columbia Beaches)
- A pump station to lift sewage from the waterfront (near the ferry terminal) to the upland gravity collection sewers.
- Gravity sewer along SR 525 frontage.
- Conveyance pipeline along Humphrey Road extending from SR 525 to the WWTP west of Tiffany Drive.

Subsequent phases of collection sewer mains that would occur within 20 years might include some of the side streets in the central area and the Tiffany and Marshall Road, neighborhoods at the south end of Columbia Beach. Remaining collection system extensions that would likely be built beyond 20 years include the upland residential areas such as; Central Avenue, Simmons Avenue, Harding Avenue, Berg Road, Conrad Street, the Clinton Park Plat, etc.

Pressure (STEP) System

Septic Tank Effluent Pump (STEP) Systems are comprised of three main elements: a septic tank, a pump, and small diameter pressure sewer lines. All generated sewage enters the customer's septic tank in the same manner as a traditional on-site septic system. Most solids settle out to the bottom of the septic tank, floatables, grease and scum accumulate in the top and the clarified liquid portion of the sewage is pumped out into the pressure sewer lines and conveyed to the wastewater treatment plant. With pressure sewer lines, topography is not a major issue; consequently, they can be installed at relatively shallow depths, similar to water lines. Operating pressures for STEP systems can be over 100 psi. Typically for STEP systems, the septic tank along with the pump components are owned and maintained by the sewer district. STEP systems can produce significant odor problems at discharge locations such as the wastewater treatment plant or pump stations unless special care is taken to suppress odors in the facility design.

A STEP system can continue to use existing septic tanks if they are in good condition, otherwise new septic tanks will be installed. All septic tanks need to be pumped out

periodically. This would require some form of monitoring and inspection. The STEP system would convey only a small amount of solids to the treatment plant consequently the conveyance pipes can be smaller diameter than those of a traditional gravity system (the Combination System). The total length of conveyance pipe within the system is approximately 9 miles. About 7 miles (77%) are between 1.25" and 2.5" diameter, while the remaining 2 miles (23%) are between 3" and 8" diameter. For this plan, a pressure sewer (STEP) system is used in conjunction with MBR wastewater treatment (Options 2 and Option 3) and sewage solids are not conveyed to the treatment plant which is preferable for the MBR process. Refer to Figure 5.2 – De-Centralized Collection System, showing a detailed collection network for this type of system.

Phasing:

The rationale for construction phasing for this STEP collection system is generally the same as for the Combination Gravity and Vacuum System.

5.3 HYDRAULIC MODELING

The preliminary design and modeling of the Clinton sewer system was done in HYDRA, which is a sewer modeling program created by Pizer, Inc., of Seattle, WA. A detailed discussion of the required information (Population, Flows) for the modeling process and the results can be found in Appendix A.