WPCC DRAFT FACILITIES PLAN - 2015

For the Long Hill area, the cost estimates indicate that Alternative B, the STEP or low-pressure system, is more economical to construct than a conventional gravity system, even when accounting for the on-lot costs including septic tank replacement and pump installation. This is largely because of the believed shallow bedrock that would be much more costly to remove in a gravity sewer system where a large percentage of the sewers are greater than 10 feet deep due to the topography.

6.2.6.2 Downtown Center

Two alternative collection system configurations were mapped for the small Downtown Center area To date, two potential treatment and recharge sites have been identified, and desktop calculations to determine their capacity must be performed when Amendment 7b is executed. Both of the collection system alignments utilize all gravity sewers. The alternative collection system configurations are shown on **Figure 6-2-AB** and are summarized as follows:

- Alternative A:
    - Collect and convey to the east, to the parking lot located north of East Main Street and east of Post Office Square
- Alternative B:
    - Collect and convey to the west, to the parking lot located south of West Main Street and west of Dan Vece Jr. Way.

Either of these alternatives would require some property acquisition to convey to the groundwater recharge site.

Table 6.2 – Downtown Center Collection System Costs

Collection System Alternative Layout	Engineer's Opinion of Probable Construction Cost*
Downtown Center A	$3,000,000
Downtown Center B	$5,000,000

*Construction Cost includes 30% planning-level construction contingency. Engineering fees, project contingencies, and other project costs are discussed in Section 8.

For the Downtown Center, the cost estimates indicate that Alternative A, conveying to the parking lot north of East Main Street and east of Post Office Square is more economical than conveying to the west. This is due to the general rise in topography from east to west, meaning a larger percentage of deep sewers (greater than 20 feet deep) is required for Option B. Deeper gravity sewers can have substantially higher construction costs per foot, particularly in areas where groundwater may be encountered during construction.

6.2.6.3 Coastal

A total of sixteen alternative configurations were mapped for the Coastal area. These include four different collection system themes, and four potential treatment facility locations. These are shown on Figures 6-3-1.AB, 6-3-1.CD, 6-3-2.AB, 6-3-2.CD, 6-3-3.AB, 6-3-3.CD, 6-3-4.AB, and 6-3-4.CD, and summarized as follows:

- Alternative 1 (A, B, C, D):
    - Harbor View Association: local in-neighborhood collection and recharge, STEP or low-pressure sewer system
    - Beach Park Point area: local in-neighborhood collection and recharge, gravity sewer system

  - Shore Road, Groveway, and Meadow Road areas to one of four potential treatment facility locations (A, B, C, D) and recharge at the Old Post Road site. Conveyance to treatment facility locations A or B can be by gravity, though some areas are deep, but C or D require a pumping station.
- Alternative 2 (A, B, C, D):
  - Harbor View Association: local in-neighborhood collection and recharge, STEP or low-pressure sewer system
  - Beach Park Point area, Shore Road, Groveway, and Meadow Road areas to one of four potential treatment facility locations (A, B, C, D) and recharge at the Old Post Road site. Conveyance to treatment facility locations A or B can be by gravity, though some areas are deep, but C or D require a pumping station. Some properties in Beach Park Point require pumping/low-pressure sewers.
- Alternative 3 (A, B, C, D):
  - Harbor View Association, Beach Park Point area, Shore Road, Groveway, and Meadow Road areas all conveyed to one of four potential treatment facility locations (A, B, C, D) and recharge at the Old Post Road site. Conveyance to treatment facility locations A or B can be by gravity, though some areas are deep, but C or D require a pumping station. All properties in Harbor View and some properties in Beach Park Point require pumping/low-pressure sewers.
- Alternative 4 (A, B, C, D):
  - Harbor View Association, Beach Park Point area, Shore Road, Groveway, and Meadow Road areas all conveyed to one of four potential treatment facility locations (A, B, C, D) and recharge at the Old Post Road site. This Alternative is based on an entirely low-pressure or STEP collection system.

For this analysis, the four potential treatment facility locations are

- (A) – 266 East Main Street – portion of parking lot at ShopRite plaza
- (B) – 338 East Main Street – undeveloped portion of self-storage facility
- (C) – 46 Meadow Road – undeveloped portion of Nichols Auto Parts
- (D) – 11 Heritage Park road – undeveloped wooded land, rear of industrial complex

Table 6.3 – Coastal Collection System Costs

Alternative	Engineer's Opinion of Probable Construction Cost*
Coastal 1A	$25,000,000
~~Coastal 1B~~	~~$43,000,000~~
Coastal 1C	$21,000,000
Coastal 1D	$24,000,000
Coastal 2A	$24,000,000
~~Coastal 2B~~	~~$43,000,000~~
Coastal 2C	$19,00,000
Coastal 2D	$18,000,000
Coastal 3A	$24,000,000
~~Coastal 3B~~	~~$43,000,000~~
Coastal 3C	$20,000,000 XXXX
Coastal 3D	$19,000,000 XXXX
Coastal 4A	$28,000,000
~~Coastal 4B~~	~~$31,000,000~~
Coastal 4C	$27,000,000
Coastal 4D	$26,000,000

*Construction Cost includes 30% planning-level construction contingency. Engineering fees, project contingencies, and other project costs are discussed in Section 8.

From the collection system-only costs, it appears that treatment facility location "B" is the least economical by a large margin. This is because of the need to install the sewer via trenchless means under wetlands from Shore Road to East Main Street. This location also includes a longer run of force main in East Main Street than other locations, and the most "deep" (greater than 20') gravity sewer for Alternatives 1-3. As such, Location "B", the self-storage facility, is not recommended to be pursued.

Locations "C" and "D", treatment facilities in immediate proximity to the Old Post Road recharge site, also appear more economical than Location "A". Based on this, the preferred treatment facility sites are at the end of Meadow Road ("C") and in the rear of the Heritage Park Road industrial complex ("D"). Final facility locations will be determined in part by property availability and economics. It is noted that location "D" is the only one above the 100-year flood plain.

For the Coastal area, the cost estimates indicate that Alternative 4, the STEP or low-pressure systems, are not economical when compared to the conventional gravity/pumping station layouts in Alternatives 1, 2, and 3. Further, it appears that Alternatives 1, 2, and 3 do not offer significant cost differentials between them. For treatment facility locations "C" and "D", collection system Alternatives 2 and 3 have marginally lower estimated construction costs than Alternative 1. Given the preliminary planning level of this estimate, however, any of the Alternatives 1, 2, or 3 are considered similar and should all remain viable.

6.3 Wastewater Treatment Process Alternatives

Water Pollution Control Facilities (WPCFs) must remove particulate matter, as well as chemical and biological contaminants. Large particulate matter is removed in the preliminary treatment process by screening, grinding, or rapid settling methods. Fine particles and floating scum are removed during primary treatment. Chemical and biological contaminants are removed during secondary treatment through processes such as suspended-growth biological treatment, attached growth and dual biological treatment, or natural systems. Treated water is then disinfected to prevent the spread of disease causing organisms, protecting both the environment and public health.

WPCFs vary in size from a household-sized septic system to a city-wide centralized WPCF. In between these extremes, there are mid-sized WPCF options which treat wastewater from groups of homes or buildings of various sizes. This section provides alternatives for treating Clinton's wastewater at community facilities sized for the following:

- Long Hill area – approximately 75,000 gpd
- Coastal area – approximately 100,000 gpd, possibly separated into 2 facilities
- Downtown Center area – approximately 10,000 gpd

For the proposed discharge to groundwater, the anticipated permit effluent limits are as follows:

- BOD – 20 mg/L
- TSS – 20 mg/L
- TN – 10 mg/L
- TP – 15 mg/L, with possibility for site absorption
- pH – 6-9
- Fecal coliform- 200 count/100mL sample

This is based on guidance from DEEP's Water Permitting and Enforcement Division to be consistent with other currently active permits.

There are a number of treatment process alternatives available that will meet these anticipated flow rates and discharge criteria. A discussion of the most widely used and generally most cost-effective process alternatives is presented below. The purpose of this discussion is simply to give the reader a brief introduction to the required treatment processes and to present adequate information for development of a planning-level cost estimate. This discussion is not intended to be an all-inclusive evaluation of treatment alternatives. A detailed evaluation and final selection of treatment processes should be the first step of a preliminary design effort.

For the flows required in Clinton, numerous manufacturers offer "packaged" treatment systems, which include most of the treatment equipment in one scope of supply. Some manufacturers use variations of the general processes outlined below. Some package systems are available pre-assembled shipped in containers, and others require on-site construction of tanks. Many manufacturers recommend buildings for control equipment, or they may be optional to camouflage the treatment facility. Building architecture can be designed to match the surrounding community.

6.3.1 Treatment Facility Process Technologies

6.3.1.1 Preliminary and Primary Treatment

Preliminary treatment includes the initial treatment processes to remove coarse matter from the waste stream to prevent damage to downstream equipment. This generally includes screening and grit removal.

Rotating Biological Contactors (RBCs)

The RBC process uses a fixed culture of microorganisms that mechanically rotate on a disk partially submerged in the wastewater. As the disk rotates the microorganisms are exposed to air to promote growth of these microorganisms, which in turn consume the organics found in the wastewater. A settling tank is then provided for removal of the pollutants. To achieve nitrogen removal, a minimum of two RBCs are used in series with at least one submerged to promote anoxic conditions and foster denitrification.

Sequencing Batch Reactors (SBRs)

SBRs treat wastewater in the same way as conventional activated sludge, but accomplish the process batch by batch in a single tank. Wastewater is fed into a tank and undergoes mixing, anoxic, and aeration stages to metabolize the waste. Once these stages are complete, all air is shut off and settling is completed in the same tank. Sludge is drawn off of the bottom and removed as waste. The clarified liquid is then decanted. An SBR process requires a minimum of two tanks to allow filling of one tank while the second is processing the waste.

SBRs generally require flow equalization following the process. The rate of decant in SBRs is generally much faster than the incoming wastewater flow. Flow equalization is relatively inexpensive and is included to eliminate the need to size downstream treatment processes for this high decant rate. One manufacturer using SBR technology is Sanitaire.

Membrane Bioreactors (MBRs)

Membrane treatment is a variation of activated sludge treatment that uses membranes for solids separation in lieu of traditional settling tanks. MBR distinguishes itself from other activated sludge processes by using membranes in place of final clarifiers. This eliminates many of the common problems associated with achieving a properly settling biomass, along with problems associated with continuing biological activity in the final clarifiers, such as ammonia release and denitrification.

One commonality of all MBR systems is that the activated sludge process operates at a higher concentration of bacteria to wastewater than traditional systems. There are several types of membrane MBR processes including hollow fiber suction membranes, flat panel suction membranes, and pressure membranes, and different configurations are offered by several manufacturers. MBRs typically operate at 2-3 times the bacteria concentration of a conventional plant, significantly reducing process tank volume. When designing MBRs for nutrient removal, process configurations are similar to the conventional activated sludge process, except that the secondary clarifier is replaced by the membrane tank. MBRs typically have small footprint and excellent effluent quality, but can have high capital and operational costs. Two manufacturers using MBR technology are Dyntec and GE Water.

Packed Bed Filters (with STEP system)

Specifically applicable for the STEP collection systems, where primary settling occurs prior to the treatment facility, Orenco Systems manufactures a recirculating media filter package under the name AdvanTex. Orenco's process consists of recirculating a portion of the filtrate from the secondary treatment system to an anoxic zone within the initial primary solids settling/collection chamber or in a separate pre-anoxic tank. After primary or pre-anoxic treatment, effluent is transported to the recirculation-blend tank or chamber, where it is blended with the filtrate. The blended wastewater is distributed over the AdvanTex textile media and percolates down through the media, where it is filtered, cleaned, and nitrified by the naturally occurring microorganisms populating the media. After treatment, a portion of the filtrate is returned to the recirculation-blend chamber while a portion is transported to the next treatment stage or to dispersal, and a portion also may be returned directly to the pre-anoxic treatment stage. The AdvanTex system does not produce sludge.

6.3.1.3 Disinfection

Following biological treatment, plant effluent is typically disinfected using either ultraviolet (UV) light or through addition of chlorine. If sodium hypochlorite is used, a holding tank is required to ensure adequate detention time is achieved prior to discharge. The addition of a chlorine solution such as sodium hypochlorite may also require addition of a dechlorinating solution such as sodium bisulfite to ensure the effluent is not toxic to aquatic life in the receiving stream.

At the estimated flow rates for Clinton, UV disinfection is anticipated to be more cost effective because the reaction is instantaneous, requires no holding tanks to achieve the required detention time, requires no chemical feed systems, and requires no dechlorination. Some package plant manufacturers may include a chlorine tank in their design and that must be evaluated during the design stage.

6.3.1.4 Ancillary Processes and Equipment

In addition to the above treatment processes and the related equipment requirements, numerous ancillary equipment and processes will be needed. The following features must be evaluated during the design of each facility.

- Odor control facilities.
- Administrative and laboratory space
- Backup power such as an onsite generator
- Sludge holding or thickening facilities
- Miscellaneous pumping systems
- Electrical, control and instrumentation system
- Chemical systems, depending on the treatment alternative, for pH adjustment or carbon source
- Related site work including screening from populated areas

Most notably, significant flow equalization will be required at each of the treatment facilities. Particularly at the Old Post Road site, the groundwater recharge capacity is anticipated to be closely matched with the anticipated average daily flows. In order to allow use of this recharge site, flow from peak hours and high days and weeks must be equalized and distributed to the effluent recharge field at a rate within the permitted capacity. If equalization is designed before treatment, it also minimizes the size and expense of the treatment facilities themselves. Sizing of equalization basins, both before and after treatment, must be investigated as part of the preliminary design phase.

6.3.2 Treatment Facility Costs and Recommendations

Numerous manufacturers, noted above, were reviewed for their ability to meet the flow and effluent requirements anticipated in Clinton. For each potential treatment facility (Long Hill, Downtown Center, and Coastal), a range of costs was obtained and is presented below. In each case, manufacturer package costs were obtained and additional components that are not part of manufacturers' costs were added. Most significantly, at present, allowances for significant equalization tankage are included at each potential treatment facility.

Also included in each treatment facility cost is an estimate for construction of a subsurface groundwater absorption field at one of the identified recharge sites.

Table 6.4
Treatment Facility and Subsurface Groundwater Recharge Field Construction Costs

Location	Engineer's Opinion of Probable Construction Cost*	Notes
Long Hill (75,000 gpd)	$9 million to $14 million	MLE and MBBR packages are the lowest; MBRs and STEP packed bed filters are the highest. Option for architectural building enclosure significantly impacts costs.
Downtown Center (10,000 gpd)	$3 million to $4 million	MLE package is the lowest; MBRs are the highest. Option for architectural building enclosure significantly impacts costs.
Coastal Single Facility (100,000 gpd)	$10 million to $18 million	MLE package is the lowest; MBRs and STEP packed bed filters are the highest.
Coastal Split Facilities (2 @ 50,000 gpd)	$11 million to $18 million	MLE package is the lowest; SBRs and STEP packed bed filters are the highest. Option for architectural building enclosure significantly impacts costs.

*Construction Cost includes 30% planning-level construction contingency. Engineering fees, project contingencies, and other project costs are discussed in Section 8.

Packaged treatment facilities are well-suited to the range of flows presented herein, and can meet the required effluent limits. It is recommended that each of the packaged treatment systems be revisited during a preliminary design phase. In particular, the siting of the treatment facility will help to dictate some of the substantial "optional" costs, most notably the need for a complete, architecturally finished building enclosure around the facility, buried or exposed tankage, and the level of odor control required.

CDM Smith