NATURAL SYSTEMS UTILITIES
WATER REIMAGINED

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PLANNING BOARD

WASTEWATER SYSTEM DESIGN MEMO

Cawley Crossing
Warren Township, Somerset County

April 8, 2021

PREPARED FOR:

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1.0 PURPOSE AND SCOPE

Cawley Crossing is a proposed special needs housing development featuring three residential buildings and associated infrastructure, located in Warren Township, Somerset County, New Jersey. The proposed plan consists of a total of thirty (36) bedrooms distributed among six residential buildings, plus one building for common use. Because the municipal sewer system is at capacity and does not extend to the project, an onsite wastewater treatment and groundwater recharge system is proposed to treat all wastewater from these units.

2.0 SITE LOCATION

The project site consists of one parcel identified as Block 83 Lot 4 totaling approximately 10 acres located in Warren Township in the CR-130/65 (Cluster Residential) zoning district. The north side of the site is bounded by Mountain Avenue and the south side of the site is bounded by US Route 78. The site abuts agricultural land to the west and residential / forested land to the east.

3.0 PROJECTED WASTEWATER FLOWS AND CHARACTERISTICS

The projected design flow for the Cawley Crossing development is 4,510 GPD as detailed in Table 1. The design flow is based upon the criteria in the Technical Requirements for Treatment Works Approval Applications N.J.A.C. 7:14A-23.3.

TABLE 1: **DESIGN WASTEWATER FLOW**

Wastewater Generating Component	Units	Flow/unit (gpd)	Subtotal (gpd)
1-bedroom, Assisted Living	24	100	2,400
1-bedroom, Independent Living	12	150	1,800
2-bedroom, Independent Living	0	225	0
*Employee	7.75	40	310
Total (gpd)			**4,510**

*Maximum expected staff hours per day is 62 (7.75 eight hour shifts)

Raw wastewater characteristics are expected to be domestic in nature, as presented in Table 2:

TABLE 2: DESIGN INFLUENT CHARACTERISTICS

Parameter	Value
Biochemical Oxygen Demand (BOD_5)	300 mg/l
Total Suspended Solids (TSS)	250 mg/l
Total Kjeldahl Nitrogen (TKN)	50 mg/l
Total Phosphorus (TP)	8 mg/l
pH (Standard Units)	6-9

4.0 TREATED EFFLUENT

Treated effluent will be discharged to an on-site ground water recharge area near the center of the project site. Hydrogeologic investigations studies and groundwater modeling activities are ongoing. Based on similar projects, the expected preliminary effluent limits are listed in Table 3.

TABLE 3: DESIGN EFFLUENT CHARACTERISTICS

Parameter	Value
Biochemical Oxygen Demand (BOD_5)	< 10 mg/L
Total Suspended Solids (TSS)	< 10 mg/L
Total Nitrogen	< 10 mg/L
pH	6-9 SU
Fecal Coliform	< 200 CFU / 100 ml

5.0 WASTEWATER TREATMENT SYSTEM

The proposed wastewater treatment facility will be located near the southeast corner of the property. Treated effluent will be recharged to groundwater through subsurface infiltration beds near the center of the property.

5.1 Treatment Process Overview

Domestic wastewater will be collected from the residential buildings and conveyed by a combination of gravity sewers and force mains that transfer raw wastewater to the treatment facility. The core of the treatment processes will be located within a dedicated building. The major treatment elements include:

- Trash Trap
- Flow Equalization
- Fine Screen
- Biological Treatment
- Membrane Filtration
- Ultraviolet Disinfection
- Effluent Dosing
- Sludge Holding Tank

A simplified schematic overview of the process is attached.

5.2 Trash Trap

Influent is pumped from the pump station to a trash trap, which will prevent the passing of large solids and floatables such as gravel or sand, grease, and small plastics, meanwhile reducing the influent BOD for biological treatment. Once every three to six months the trash trap is pumped out to remove solids. The tank will be equipped with coarse air diffusers to agitate the tank if necessary.

5.3 Flow Equalization

Following the trash trap, an equalization (EQ) tank will moderate influent flows and reduce variability of influent wastewater characteristics. Coarse bubble diffusers will be installed to prevent settling of solids, mitigate odors, and ensure complete mixing. Submersible pumps in the equalization tank will pump wastewater to the fine screen. The tank will be equipped with two submersible pumps (one in duty and one standby), which will operate using level sensors to automatically control flow to the fine screens.

5.4 Fine Screens

From the EQ tank, wastewater will be pumped to the fine screens with apertures typically less than 2mm. The screen drains by gravity into biological treatment tank while solids drop into a receptacle for disposal. The screen enclosure will be vented through a carbon filter to ensure no odors escape this area. The screens will be periodically cleaned and debris from the trash receptacles will be emptied by the operator.

5.5 Biological Treatment

Anoxic Tank

Screened wastewater will flow by gravity into the anoxic tank, where denitrification occurs. Raw wastewater serves as a carbon source for denitrifying bacteria that reduce nitrate and nitrite in nitrified mixed liquor. The anoxic tank will be equipped with coarse bubble diffusers, which keep solids in suspension and prevents accumulation on the bottom of the tank. Periodic injection of coarse bubbles limits oxygen transfer, preserving anoxic conditions, and offers operational advantages when compared to mechanical mixers. The design includes the capability to add a supplemental carbon source (Micro-C) to the anoxic tank, if needed.

Aerobic Tank

Wastewater will flow over a weir from the anoxic tank into the aeration tank, wherein the process wastewater will undergo carbonaceous oxidation and nitrification. Air will be supplied to the mixed liquor through fine bubble diffusers that are pressured by high capacity blowers.

The aeration diffusers at the bottom of the tank also provide tank mixing. Control of pH will be accomplished automatically in the aeration tank via injection rates of sodium hydroxide. The process will require minimal alkalinity adjustment due to the alkalinity produced by denitrification in the anoxic tank.

5.6 Membrane Filtration

From the aeration tank, wastewater will flow by gravity to the membrane filtration tank. Liquid/solid separation is accomplished by membranes with nominal pore sizes typically less than 0.5 microns. Retained activated sludge is recirculated from the membrane filtration tank to the anoxic tank. This recycle allows mixed liquor, rich in nitrates and nitrites, to be returned for denitrification.

5.7 Ultraviolet Disinfection

Permeate from membrane filtration tank will pass through an ultraviolet light disinfection system using germicidal lamps. Lamps will be fully enclosed and specifically designed to destroy microorganisms present in the treated wastewater. A UV intensity sensor will be installed with an alarm to alert operators when the UV intensity falls below acceptable levels. The control panel will display the UV intensity reading. A manual cleaning system will be used to ensure the effectiveness of the disinfection process.

5.8 Effluent Dosing

Effluent from the UV disinfection system will flow to an effluent dosing tank and be metered. A duplex effluent pump system will pump the flow directly into groundwater recharge area.

5.9 Sludge Disposal

Sludge will be discharged to the sludge holding tank with a total solids concentration of approximately 1.0%. Decant pumps will be provided to enable the operator to periodically

return supernatant back to the process. Through the decanting process, sludge may be thickened to approximately 1.5. Air will be injected into sludge hold tank periodically through coarse bubble diffusers to prevent anaerobic conditions, which can generate odors. Periodically, the sludge will be removed by a licensed waste hauler as needed for final disposal at a NJDEP approved disposal location.

5.10 Chemicals

The following chemicals will be used to facilitate plant operation and maintenance if needed.

TABLE 4: CHEMICALS

Chemical	Use
Sodium Hydroxide	pH control
Micro-C	Denitrification
Sodium Hypochlorite	Membrane cleaning

5.11 Process Control

A Programmable Logical Controller (PLC) will be equipped with all required input/output modules for system operations. All control functionalities (for pumps, blowers, and process monitoring) will be available on the PLC touch screen and can be securely accessed remotely as well. The PLC will be capable of sending alerts, via email or text message, to indicate any alarm conditions or provide relevant notifications.

5.12 Treatment Building

The treatment building will house the majority of the process units except for the trash trap, equalization tank, effluent dosing tank, and sludge holding tank. The building will be provided with hot and cold water, a utility sink, counter space for process control tests, lights, electrical receptacles, heat and ventilation. The connection to the potable water system will be protected

with a reduced pressure zone principle (RPZ) type backflow preventer, as required. Wastewater from the sinks and floor drains will return to the equalization tank.

5.13 Odor Control

All tanks will be covered to provide odor containment. In addition, an activated carbon based odor control vessel will be installed to further control from all tanks as well as from the fine scree enclosure. Filtered air will be discharged to atmosphere, outside of the building.

5.14 Onsite Backup Power

The site layout will contain a backup generator that will allow for the plant to operate uninterrupted at full capacity in the event that utility power is lost.