

Introduction

The existing wastewater reclamation and reuse system facilities of the Wasco Sanitary District, Campton Township, Kane County, include treatment, storage and spray irrigation on the Fox Mill development site. The current facilities planning area (FPA) is shown on Figure 1.

The current capacity of the District's system is 236,000 gpd based on 60.5 acres of spray irrigation area with an application rate of 1.5 inches/week for 35 weeks, as reflected in IEPA Permit No. 1999-AB-4294, August 20, 1999, a copy of which is included in Appendix A.

The originally permitted project included spray irrigation of various open space parcels within the Fox Mill development. Since it is proposed that these irrigation areas be deleted, it is necessary to provide for a substitute irrigation area to meet the total project requirements.

A substitute spray irrigation area is proposed for the Bergland Property also shown on Figure 1. The Bergland Property irrigation site will provide sufficient total area so that the wastewater treatment facilities irrigation capacity can be increased to the original design capacity of 316,000 gpd as indicated in IEPA Permit No. 1993-GA-2787, June 18, 1993, a copy of which is also included in Appendix A.

The proposed additional irrigation area within the Bergland Property is 22.8 acres. This will result in a total irrigation area of $60.5 + 22.8 = 83.2$ acres. A total irrigation area of 80.9 acres is required for the 316,000 gpd capacity rating.

The facilities needed to provide for irrigation on the Bergland Property include the following:

- second irrigation pump station at site of existing irrigation pump station
- irrigation pipeline from the second irrigation pump station to the Bergland Property
- Irrigation pump facilities on the Bergland Property
- Irrigation distribution system on the Bergland Property
- Groundwater monitoring wells on the Bergland Property

Bergland Property Irrigation Area

The proposed Bergland Property irrigation area is shown on Figure 2. The determination of the irrigation area has been based, in part, on groundwater information included in the "Wasco Sanitary District, Wastewater Reclamation and Reuse System, Engineering Report," October, 1992, by Sheaffer & Roland, Inc. (S&R). Additional information was obtained from the "Soil Boring Logs," prepared by Bruce R. Putnam, soil scientist, in March, 1992. A copy of the "Soil Boring Logs" and the accompanying "Soil Survey Map for Bergland Property" are included in Appendix B.

The criteria given in the "Illinois Design Standards for Slow Rate Land Application of Treated Wastewater" were used in determining the soils to be irrigated. In particular, the soils selected generally have 4-foot depths or greater to groundwater.

The observed groundwater levels of the Putman data generally support the estimated seasonal high groundwater contours of the S&R "Wasco Sanitary District, Wastewater Reclamation and Reuse System, Engineering Report." Seasonally high groundwater conditions generally occur in Illinois during the months of March and April. Since the Putman data was obtained in March, it is likely that the observed groundwater levels are the seasonal high groundwater levels. *blawc*

A review of the Putman map and field logs shows some discrepancies between the determined groundwater depth for individual borings and the suggested groundwater depths based on visual soil observation. The observed groundwater levels have been used in the _____ *No* irrigation area determination.

The Bergland property irrigation area will be used for the hay crops. Spray irrigation buffers for the project site will be consistent with section 372.230b of the "Illinois Design Standards for Slow Rate Land Application of Treated Wastewater." The irrigation area will be 200 feet from the existing residential well to the northwest of the project area.

The Putnam Report identifies the following principal soil types within the Bergland Property:

<u>No.</u>	<u>Soil Name</u>	<u>Minimum⁽¹⁾ Permeability (In/Hr)</u>
93	Rodman	2.0
145	Saybrook	0.6
148	Proctor	0.6
149	Brenton ✓	0.6
152	Drummer	0.6
198	Elburn	0.6
323	Casco	0.6
802	Orthents	1.0 ⁽²⁾
865	Pits, Gravel	2.0 ⁽²⁾

An analysis of the average weekly irrigation application rate for the minimum permeability -- 0.6 inches/hour -- is included in Tables 1 and 2. Although the theoretical average application rate is 5.20 inches./week, a design application rate of 1.50 inches is utilized. At this rate and 120 days of winter storage, as originally permitted, an estimated average flow of 89,050 gpd could be accommodated on the Figure 2 irrigation area.

With the 22.8 acres of irrigation on the Bergland Property added to the 60.5 acres of irrigation at the treatment facilities site, a total of 83.3 acres are available to meet the 316,000 gpd system capacity requirement.

⁽¹⁾-Soil Survey of Kane County, Illinois

⁽²⁾-Putnam Report

Table 1: Hydraulic Loading Based on Soil Permeability

Month	Precip. (Pr) (1) (inches)	ET (2) (inches)	ET-Pr (inches)	Soil (3) Perc. (inches)	Soil Hydraulic Loading	
					(inches)	(cm)
January	2.20	0.2	-2.00	0	0	0
February	1.90	0.6	-1.30	0	0	0
March	3.00	1.8	-0.40*	14.40*	14.00	35.56
April	4.20	2.9	-1.30	43.20	41.90	106.43
May	4.10	4.9	0.80	44.64	45.44	115.42
June	4.80	5.6	0.80	43.20	44.00	111.76
July	4.90	5.8	0.90	44.64	45.54	115.67
August	4.50	5.2	0.70	44.64	45.34	115.16
September	4.20	3.4	-0.80	43.20	42.40	107.70
October	4.00	1.7	-2.30	44.64	42.34	107.54
November	2.50	0.4	-1.40*	28.80*	27.40	69.60
December	2.80	0.1	-2.70	0	0	0
TOTAL	43.00	32.6			348.36	884.84
*(November has been adjusted for 20 days; March has been adjusted for 10 days)						

(1) 20-year return period precipitation

(2) Evapotranspiration data for Argonne, Illinois.

Source: *Variability in Evapotranspiration in Illinois*, D.M.A. Jones, Illinois State Water Survey Circular 89

(3) Soil percolation capability based on 10.0 percent of the minimum permeability of 0.60 inch/hour.

Source: *Soil Survey of Kane County, Illinois*

Table 2: Hydraulic Loading Based on Soil Permeability and Nitrogen

Month	Pr-ET (cm)	(1) Crop Nitrogen Uptake (kg/ha)	(2) Allowable Nitrogen Loading (cm)	(3) Allowable Hydraulic Loading (cm)	Design Loading	
					(cm)	(inches)
January	5.08	0	0	0	0	0
February	3.30	0	0	0	0	0
March	1.02	0	0.46	35.56	0.46	0.18
April	3.30	0	1.50	106.43	1.50	0.59
May	-2.03	20	44.53	115.42	44.53	17.53
June	-2.03	60	135.44	111.76	111.76	44.00
July	-2.29	80	180.78	115.67	115.69	45.54
August	-1.78	60	135.56	115.16	115.16	45.34
September	2.03	20	46.38	107.70	46.38	18.26
October	5.84	10	25.38	107.54	25.38	9.99
November	3.55*	0	1.61	69.60	1.61	0.63
December	6.86	0	0	0	0	0
TOTAL		250	571.64	884.84	462.45	182.06
*(November has been adjusted for 20 days; March has been adjusted for 10 days)						In/Wk 5.20

(1) Based on nitrogen uptake rate of 250 kg/ha/yr for an alfalfa, bromegrass and timothy mix.
Source: USEPA *Process Design Manual for Land Treatment of Municipal Wastewater*

(2) Based on data from The Chancellory (Hamilton Lakes), Itasca, Illinois. Percolate nitrogen of 2 mg/l and applied nitrogen of 8 mg/l were used in the above calculations.

(3) From Table 2

Irrigation Facilities

As previously noted, the following additional facilities are needed in order to irrigate the Bergland Property:

- Second irrigation pump station at site of existing irrigation pump station;
- Irrigation pipeline from the second irrigation pump station to the Bergland Property;
- Irrigation pump facilities on the Bergland Property;
- Irrigation distribution system on the Bergland Property;
- Groundwater monitoring wells on the Bergland Property.

The proposed facilities include pumping to a holding pond or enlarged wet well on the Bergland Property. The reclaimed water will then be pumped from the holding pond to the irrigation distribution system.

The amount of reclaimed water to be irrigated each week based on an average of 1.5 inches/week = $(22.8)(43,560)(1.5/12)(7.48) = 928,612$ gallons. The required pumping rate at the second irrigation pump station based on pumping the 928,612 gallons over 40 hours per week = $928,612/(60)(40) = 387$ gpm.

An 8-inch irrigation pipeline will be located as shown on Figure 3. A portion of the pipeline exists and has been utilized as a wastewater forcemain in the Fox Mill development. The pipeline will conform to AWWA C900, class 150, DR18. The estimated total length is 10,500 feet. The estimated static lift is 10 feet. The estimated station discharge (based on $C=120$) and typical vertical turbine pump curves for the second irrigation pump station are given in Appendix C.

An enlarged wet well on the Bergland Property will provide reclaimed water storage for 2 hours for operating flexibility. The volume required is $(2 \text{ hours})(60)(387 \text{ gpm}) = 46,440$ gallons.

The capacity of the Bergland Property irrigation pump station will be based on the same criteria as the second irrigation pump station or 387 gpm with an estimated maximum irrigation system operating pressure of 85-90 psi. The estimated station discharge and typical vertical turbine pump curves are also given in Appendix C.

The irrigation system would utilize full circle and partial circle Rain Bird Rain Guns. Typical information on the Rain Gun is included in Appendix D.

The proposed upgradient and down gradient groundwater monitoring well locations based on estimated groundwater flow directions are shown on Figure 2.

Facilities Summary

The proposed Bergland irrigation facilities are summarized below:

1. Second Irrigation Pump Station
Single stage, 1770 R.P.M., Vertical Turbine Pump 410 GPM @ 52 feet,
Wetwell – 2,000 gallons
2. Irrigation Pipeline
10,500 L.F. – 8", AWWA C900, class 150, DR18
3. Bergland Irrigation Pump Station
Five stage, 1770 R.P.M., Vertical Turbine Pump 375 GPM @ 240 feet,
Wetwell – 50,000 gallons
4. Bergland Irrigation Distribution System
PVC piping with Rain Guns
5. Groundwater Monitoring Wells – 6 wells