

**Andelina Farms
Wastewater Treatment Plant
Preliminary Basis of Design**

May 2018

Andelina Farms is a proposed Planned Unit Development in Saline Township located along US-12 just west of the City of Saline. The overall development includes approximately 158 single family and 126 multifamily homes to be built in two phases. The Andelina Farms Wastewater Treatment Plant (WWTP) is intended to handle the wastewater from the proposed development and discharge to an unnamed tributary of the Saline River.

The following is a preliminary basis of design for the proposed treatment plant. All component sizing is preliminary and will be confirmed during the design phase with the actual NPDES permit limits.

Residential Equivalent Units

158 single family	= 158
126 multifamily at 0.8 REU	= 101
 Total	 = 259 REUs

Design Flows

Assuming 100 gallons per capita per day, and 3 people per REU, design flows for the development are proposed to be:

Average Flow	78,000 gpd
Max Flow	156,000 gpd

The peak flow ratio will be based on the formula in Figure 1 of Chapter 10 of Ten States Standards:

$$\frac{Q_{Peak}}{Q_{Ave}} = \frac{18 + \sqrt{Population}}{4 + \sqrt{Population}}$$

Assuming 3 people per REU for a population of 777, the Peak flow ratio is 3.88 or 210 gallons per minute for the ultimate development.

Design Wastewater Characteristics

The following wastewater characteristics were used in preparing the proposed WWTP improvements:

Characteristic	Design Concentration (mg/l or as indicated)	Design Loading at Average Flow of 78,000 gpd (lb/ day)
Biochemical Oxygen Demand	250	162.63
Total Suspended Solids	250	162.63
Ammonia Nitrogen	45	29.27
Phosphorus	7	4.55
Fat, Oil and Grease	< 30	n/a
Water Temperature	50 to 77 Deg F	n/a
Alkalinity	300	n/a

Assumed NPDES Permit Requirements

The following effluent requirements have been assumed for the proposed Basis of Design. The Basis of Design will be modified as necessary based on the actual effluent requirements contained in the NPDES permit.

Carbonaceous Biochemical Oxygen Demand (CBOD5)

May 1 to Nov 30

2.50 lbs/ day Monthly Average, 6.3 lbs/ day 7-Day average

4.0 mg/l Monthly Average, 10 mg/l Daily Average

Dec 1 to Apr 30

15.6 lbs/ day Monthly Average, 25.0 lbs/ day 7-Day Average

25 mg/l Monthly Average, 40 mg/l 7-Day Average

Total Suspended Solids

May 1 to Nov 30

12.1 lbs/ day Monthly Average, 18.8 lbs/ day 7-Day average

20 mg/l Monthly Average, 30 mg/l 7-Day Average

Dec 1 to Apr 30

18.8 lbs/ day Monthly Average, 28.2 lbs/ day 7-Day Average

30 mg/l Monthly Average, 45 mg/l 7-Day Average

Ammonia Nitrogen (as N)

May 1 to Nov 30

0.31 lbs/ day Monthly Average, 1.3 lbs/ day 7-Day average

0.5 mg/l Monthly Average, 2 mg/l Daily Average

Total Phosphorus (as P)
0.63 lbs/ day Monthly Average
1.0 mg/l Monthly Average

Minimum CBOD5 and Total Suspended Solids % Removal
Dec 1 to Apr 30
85% monthly calculation

Wastewater Treatment

The proposed wastewater treatment system is proposed to be an extended air flow through plant consisting of an influent screen, equalization tank, two aeration tanks, one clarifier, sludge holding tanks and associated equipment and appurtenances.

Influent Pump Station

An influent pump station consisting of two pumps will be provided to lift the sewage through the screen to the equalization tank. The pumps will be sized for the peak flow of 210 gallons per minutes. A magnetic flow meter will be used to monitor influent flow.

Influent Screen

The sewage will be screen through a drum screen with 1/4" openings. A manual screen will be provided as bypass.

Equalization Tank

After screening, the wastewater will enter the equalization (EQ) tank. Air lift pumps will be used to move the wastewater to the rest of the process. The EQ tank will be configured as follows:

Basin		
Number		1
Width		25'
Length		14'
Operating Depth		10'
Volume		26,000 gallons or 33% of the Design Flow
Air Lift Pumps		
No.		3
Size		3"

Secondary Treatment

The secondary treatment process consists of two extended air basins configured as follows:

Number	2
Width	12'
Length	36'
Operating Depth	14'
Total Volume	6,048 cubic feet, 45,239 gallons
Hydraulic Retention Time	28 hours
Organic Loading	13.44 lb BOD /day/ 1000 cf
MLSS	4000 mg/l
F/M Ratio	0.05 to 0.1
MCRT	13 to 21 days

The aeration system will use fine bubble diffusers and blowers to provide oxygen for process and mixing energy. The blower size is based on the following oxygen requirements:

lb O ₂ /day for BOD: (162.63 lb/day)(1.25 lb O ₂ /lb BOD) =	203.3 lb O ₂ /day
lb O ₂ /day for TKN: (29.27 lb/day)(4.6 lb/O ₂ /lb TKN) =	134.7 lb O ₂ /day
Total Oxygen Required (78,000 gpd)	338 lb O ₂ / day.

The backup blowers will also provide mixing air to the sludge tanks. Air for the various air lifts pumps will be taken off the blower header. The blower size has been increased by 50% to account for this use and peak loadings.

Blowers	
No.	3
Capacity	240 icfm
Hp	15 hp, 480 V
Drive	Variable Speed
Fine Bubble Diffusers	
No.	80 per tank, 160 total
Flow per Diffuser	up to 3 cfm

Secondary Clarifier

A clarifier with a sludge collector mechanism sized for the ultimate flow is proposed. The clarifier will be configured as follows:

Diameter	20'
Weir Diameter	18'
Side water depth	12'

Max Surface Overflow Rate	960gpd / sf
Peak Weir Loading Rate	2759gpd / f
Return Rate	150%
Peak Solids Loading Rate	29.0 lbs / day / sf

A 6" air lift pump will pump the RAS to the EQ or Aeration tanks, as well as provide means for wasting the sludge.

Disinfection

An ultraviolet disinfection system is proposed sized for the ultimate flow.

Effluent Pump Station

An effluent pump station consisting of two pumps will pump the wastewater to the outfall. A magnetic flow meter will monitor the effluent flow rate.

Phosphorus Reduction

Alum will be added to coagulate and aid in the settling of phosphorus as necessary to meet the NPDES limits.

Biosolids Management

Waste sludge generated during the treatment process will be thickened and stored in the aerated sludge holding tanks under aerobic conditions.

Sludge Holding Tanks

No.	2
Width	14'
Length	24'
Depth	14'
Volume	35,150 gallons each, 70,300 total

At 0.8 pounds of sludge produced per pound of BOD treated, the WWTP will produce 130 pounds of sludge per day. At 2.0% solids, this will equate to 780 gallons per day. The holding tanks have a 90day storage capacity

Air will be provided to the holding tanks by the aeration blowers. Coarse bubble diffusers will be installed to provide 180 cfm of air for processing sludge and mixing the tanks.

Flow Metering

Influent and effluent flow meters will be provided.

Sampling

Refrigerated 24-hour Composite samplers will be provided to sample locations as defined in the NPDES permit.

SCADA/ Alarms

In general, motor status of the various equipment will be monitored by a Programmable Logic Controller. A dialer will be provided to notify operators in case of alarms associated with the operation of the equipment or security of the facility.

Backup Power

A generator will be provided for backup power.