SECTION V

DESIGN CALCULATIONS

OPERATING POINTS & SYSTEM HEADLOSS:

There are three operating points to consider:

I. Single zone forward field flush (typically every 15-25 cycles or every 15 days)
II. Single or dual zone dose flow (typically 3-5 doses/day/zone)
III. Disc Filter Backflush (at preset volumes, times, or pressure differential)

When calculating headloss American suggests taking the worst case scenarios to ensure proper flushing. For example 50' of equivalent length is added to most pipe lengths to more than compensate for minor losses. Velocity head is typically so small it is negligible.

I. Items to consider when calculating Forward Field Flushing requirements are as follows:

1. TDH from pump to Hydraulic Unit (or suction lift to pumps on H.U.).
2. Loss through the Hydraulic Unit.
3. Loss in supply force main to drip zones.
4. Loss through 24v zone valve assembly.
5. Loss through zone supply manifolds.
6. Loss through longest drip lateral in zone (from mfg. chart).
7. Static lift.
7. Loss through return manifolds.
8. Loss through common zone return line.

II. Items to consider when calculating Single or Dual Zone Dosing requirements are as follows:

1. TDH from pump to Hydraulic Unit (or suction lift to pumps on H.U.).
2. Loss through the Hydraulic Unit.
3. Loss in supply force main to drip zones.
4. Loss through 24v zone valve assembly.
5. Loss through zone supply manifolds.
6. Loss through longest drip lateral in zone (from mfg. chart).
7. Static lift.

Residual pressure at emitters must be calculated to verify it is within proper operating range (7-70 psi).

III. Items to consider when calculating Disc Filter Backflushing requirements are as follows:

1. TDH from pump to Hydraulic Unit (or suction lift to pumps on H.U.).
2. Backflush pressure at filter unit (typically 50 psi).
3. Loss in return line.

* Note: Loss in return is typically negligible since it is suggested to have a gravity return line from H.U. Back to head of system. If not gravity then TDH in return line must be considered.

An example headloss and system calculation sheet is included as an attachment. Please contact American Manufacturing for assistance in headloss calculations and proper pump sizing and specification.

Design Calculations

The designer must run design calculations in order to lay out the system in the field and after the system is laid out to determine if the hardware components of the system will function properly. These calculations are for the most part the same as typically performed during the design of wastewater treatment or pumping facilities.

Size of Absorption Area

The total amount of absorption area required generally depends on two factors, the daily wastewater load of the facility being serviced by the system and the absorption capacity and treatment ability of the soil.

Demand analysis: Calculate the design flow.

Example: Flow = 360 gpd per home x 60 Homes = 21,600 Gallons per Day Design Flow

Soil Loading Rate: Determine the soil loading rate.

A field evaluation of the soils at the site must be completed by a qualified person, such as a soil scientist as described in section II. The site evaluator should determine the soil loading rate and the depth of installation. The calculations are performed with the soil loading rate.

Example: Area = 21,000 gpd / 0.1 gpd per sq. ft. area = 216,000 square feet of required area.

Linear feet of tubing: Compute total tubing necessary for the absorption field.

Tubing necessary = Area / 2 = (Daily Flow / AREA Loading Rate) / 2 = Linear Feet
Tubing necessary = (21,000 GPD / 0.1 gal./day/ft^2) / 2 = 108,000 Linear Feet

Determine Layout: Determine layout of the dripper line absorption field.

It must be determined through the designer's system evaluation if larger or smaller zones are the best suited for the site. Zone control is typically incremented in groups of four (4). For example:

108,000 linear feet / 4 = 27,000 linear feet per zone (250 (+) gpm filtration unit)
108,000 linear feet / 16 = 6,750 linear feet per zone (90 (-) gpm filtration unit)

Keep each individual dripper line lateral length the same length in each zone. Attempt to provide 300 linear feet per lateral from its connection to the supply manifold to its connection to the return flush manifold. Always configure the system supply line to *feed using top feed manifolds* and supply and return *from the highest* elevations. When running a continuous dripper line, it may turn and make a loop or series of loops back to the return flush line before making a connection. Feed each lateral from the lower elevation from the top feed manifold. Call American for assistance in zone layout.

Determine Zone Operating Conditions: Calculate Dosing and Flushing flows

108,000 linear feet / 16 = 6,750 linear feet per zone
6750 linear feet per zone / 300 linear feet per lateral = 22.5 laterals,
(Use 24 laterals, 8 laterals per sub zone.)
24 laterals X 300 linear feet per lateral = 7200 linear feet per zone.
7200 feet / 2 = 3600 emitter
3600 X .61 gallons per hour per emitter / 60 minutes per hour = 36.6 Gallons per minute Dosing
24 laterals X 1.6 gpm per lateral flushing rate = 38.4 gpm for Flushing
Dosing + Flushing = 36.6 + 38.4 = 75 gpm total flow required.
Reference "Zone Dynamics Table" and select an ASD90, 90 gpm filtration unit.

Determine Pump Operating Conditions: Calculate Systems Head Curves

The pump must be able to properly operate under three conditions. First calculate the head loss during field flushing. Second determine pump requirements for backwashing the disc filters. Third, determine if pump will dose one or two zones at a time and in all cases it will not over pressurize the piping network and operate each process according to design. American Manufacturing can assist in this determination.

Size of Pump/Dosing Tanks

The pumping tank should provide flow equalization and emergency storage. The designer should determine the backup requirements for mechanical equipment and therefore how much storage is appropriate for a specific site. Typical demand pumping stations require an operating volume determined by pump run times and storage determined by the operators response time in case of mechanical failure. A drip dispersal system is a pump system with filtration. Typical storage requirements range from one half (1/2) to a full day storage for flow equalization. Emergency storage due to a catastrophic mechanical event varies and could be evaluated in the same manner as pump systems servicing similar facilities in the region.

Example: For a 21,600 GPD waste flow.
Volume of Pumping Tank = 21,600 Gallons x 1/2 = 10,800 Gallons operating volume.
Volume for emergency storage = ½ day X 21,600 = 10,800 Gallons Storage volume
Total Tank Volume = Operating Volume + Emergency Storage Volume = 21,600 Gallons

Equalization operating volume may be further enhanced in consideration of conveyance system storage and pretreatment process equalization.