Hydraulic profile of seawage treatment plant

Business

Reating hydraulic profiles for sewage treatment plants. Background During my last 20 years of experience working in the design of wastewater treatment plants, there were no two identical treatment plants. Each plant has its unique process, site layout and facilities. Consequently, hydraulic profiles are different and each plant was evaluated separately.

The only similarity is the concept and the procedure that was followed in order to prepare the hydraulic profile. The following will provide the engineer with some basics needed to start doing his own hydraulic calculations by using simple excel sheet.

The provided example is easy to follow and the designer may select whatever suites his case and work out his case accordingly. A. Data Collection Stage: The following information is important to start any hydraulic calculations for sewage treatment plants: 1. Plant Site Layout; This drawing will help identifying the location of the treatment facilities, gravity flow path, dimensions, lengths of pipes and channels .

. etc. 2. Process Flow Diagram; This drawing is required to identify the average, minimum, maximum current and future flow rates in each pipe and process unit falling within the gravity scheme. . Piping and Instrument Diagram; this drawing will identify the location, number and sizes of minor losses for valves, tees, fittings, entrance and exit losses.

4. Existing Site Survey; this drawing will help planning the site layout and identify the location of plant facilities. 5. Site Grading and Drainage Layout; this drawing will be required to identify the top of structures / walls and the grade elevation at each process facility. 6. Plan and Profile drawings; these

drawings are required to identify the invert elevations and slopes of all gravity pipes.

7.

Mechanical drawings; some mechanical drawings are required when we need to obtain details not available in civil drawings such as Isometric drawings, piping plan and sections .. etc. 8.

Site visits; the engineer shall be familiar with the site conditions especially when the project scope is an expansion for an existing plant. Hydraulic engineer shall field verify the existing facilities against the as-built drawings and confirm the flow scheme and sometimes need to measure weir lengths and check weir crest elevations using survey tools. In some cases, as-built drawings do not reflect the actual site conditions.

B. Identify the Gravity Flow Path Mark up the plant site layout and identify the gravity flow path. You may need to mark more than one path depends on the proposed processes and the site layout.

In some cases, you need to run the hydraulic calculation for treated water path separate from the sludge treatment path. To properly manage this task, follow the following steps: 1. Use Yellow mark up to mark the critical gravity flow path for each type of process. The critical path could be the longest path or the path with higher flow capacities. 2.

Mark up all process units falling in this path including all intermediate pumping systems. Pumping facilities are considered as a brake point for the hydraulic profile. But it is always preferred to show it in the scheme for

continuity purposes and better understanding of the system. 3. Mark up all weirs.

Weirs are also considered as brake point for the hydraulic profile. The expression brake point means the location on the hydraulic profile where the designer can manage the structure’s elevations and accordingly the water level at this location.

An example is the secondary clarifier perimeter v-notch weir. 4. Start numbering all head loss elements such as pipes, weirs, gravity flow measurement channels and all components on the gravity flow path the will create hydraulic head losses. The numbering shall start from the end point back to the start point.

For example, from the final treated effluent to the head works. There is no specific numbering system and it is left to the designer to decide the convenient way. The example presented in this blog will provide annotations such as P for pipe, RW for rectangular weir and VW for V-Notch weir…. etc. 5.

Study the process flow diagram and carefully transfer the flow data information to the head loss elements marked on the site layout.

Engineer shall consider current and future peak flow rates. Sometimes, average flow rates are included for knowledge purposes. Low flow rates are not critical in hydraulic calculations since it may drop to Zero. C. Flow Rate Summary Table After marking the site layout as explained in step B above, the engineer can summarize the components in a simple table as indicated in the example below. This table will be used as the master information that will be linked to all other sheets.

It will simplify reviewing the data and modifying it as needed. D. Create the Hydraulic Profile Scheme From the marked up site layout, the engineer can transfer the plan into an elevation scheme as shown in example-1. The rows in excel sheet can be adjusted so that the row height of 50 pixels will represent one meter of elevation. This technique will simplify representing the levels in a very accurate way.

To utilize this feature, Draw a line and then use the up and down arrow key to adjust the location to the level required by counting the pixels. All structures can be drawn to in similar way.

The final presentation of the Hydraulic profile will be accurate. Water level symbol can be placed on each structure in an approximate location. E. Losses Calculation Use any hydraulic handbook to calculate the minor losses for pipes considering the flow situation whether it is full flow or partial flow.

Head over the weirs are also provided in such books. Sample calculations are provided in the example below. Head loss through comminutors, mechanical screens and grit removal units are normally provided by the equipment manufacturer. It is always recommended to provide each minor losses calculation in a separate excel sheet.