Design Tips for Flood Control Pumping Stations

By Mick Erikson

The pentagon green below are used by Grundfos staff when analyzing the requirements of new pumping stations. Although useful, they are not foolproof recommendations and cannot replace individual, job-specific advice. This article will review the general considerations required when designing a flood control pumping station, followed by more specific design examples.

Choosing a Pump

Generally speaking, propeller pumps are recommended for low-head applications, and mixed-flow pumps are ideal for medium-head applications. As a rule of thumb, the immersion of the impeller is buried in silt and the pump should be placed symmetrically in the pump sump. While ensuring that there is sufficient distance from the outer diameter of the pump to all walls of the sump. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained. Monitoring the condition of pumps helps lower the total life cycle cost of the flood control application. Proper monitoring and maintenance can lead to sedimentation of sand and rags, which in turn can cause additional cavitation and vibration problems.

Starting at the basic need for success and will help keep overall costs to a minimum:
- Review the head and flow calculations, paying close attention to how they are calculated. Check the expected maximum, average and peak flows. One also should determine whether the head requirement varies; this will have a profound influence on the duty point of the pump.
- Check the site physically to confirm flow and head possible—particularly if it is a replacement job. Things may well have changed significantly since the station first was designed.
- Determine the number of pumps needed from the specified flow and head requirements.
- Determine the pump type to be used.

The main design requirement for a pump design is to provide the discharge at the required head and flow. The flow being delivered to the pump units should be uniform, steady and free of interruptions and cannot replace individual, job-specific advice. This article will review the general considerations required when designing a flood control pumping station, followed by more specific design examples.

Consequences When Designing Pump Stations

Carefully going through all these steps will create an effective foundation for success and will help keep overall costs to a minimum:
- Review the head and flow calculations, paying close attention to how they are calculated. Check the expected maximum, average and peak flows. One also should determine whether the head requirement varies; this will have a profound influence on the duty point of the pump.
- Check the site physically to confirm flow and head possible—particularly if it is a replacement job. Things may well have changed significantly since the station first was designed.
- Determine the number of pumps needed from the specified flow and head requirements.
- Determine the pump type to be used.

The following fact sheet should be considered:
- The velocity and distribution of the fluid in the inlet channel should be of a uniform flow. The angle of the bottom should have an inclination of 10 to 15 degrees.
- The velocity of the water in the inlet channel should be less than 1.2 meters per second. The overall velocity of the water in the pump station should be between 3.5 and 5.5 m/s.
- The effects of flow disturbances should be distributed for as possible from the pump intake.
- Slag areas should be avoided. If the design creates such slag regions, they should be filled with concrete before operation commence.
- Care should be taken to avoid suction vortex in connection with pump immersion. As a rule of thumb, the immersion of the pump should be between one to two times the pump diameter, depending on flow rate. Specific recommendations must be obtained from the manufacturer in each case.
- The distance between the pump and the pump bottom also must be observed. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained.

Choosing a Pump

Generally, propeller pumps are recommended for low-head applications, and mixed-flow pumps are ideal for medium-head applications. As a rule of thumb, the immersion of the impeller of the pump should be placed symmetrically in the pump sump while ensuring that there is sufficient distance from the outer diameter of the pump to all walls of the sump. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained.

Choosing a Pump

Generally speaking, propeller pumps are recommended for low-head applications, and mixed-flow pumps are ideal for medium-head applications. As a rule of thumb, the immersion of the impeller is buried in silt and the pump should be placed symmetrically in the pump sump while ensuring that there is sufficient distance from the outer diameter of the pump to all walls of the sump. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained.

Choosing a Pump

Generally speaking, propeller pumps are recommended for low-head applications, and mixed-flow pumps are ideal for medium-head applications. As a rule of thumb, the immersion of the impeller is buried in silt and the pump should be placed symmetrically in the pump sump while ensuring that there is sufficient distance from the outer diameter of the pump to all walls of the sump. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained.

Choosing a Pump

Generally speaking, propeller pumps are recommended for low-head applications, and mixed-flow pumps are ideal for medium-head applications. As a rule of thumb, the immersion of the impeller is buried in silt and the pump should be placed symmetrically in the pump sump while ensuring that there is sufficient distance from the outer diameter of the pump to all walls of the sump. The distance should never be less than half the pump diameter in order to avoid suction chamber conditions; at the same time, it is recommended to have separation walls between the pumps so that they are not influencing each other. The pumps used are of high quality, system is designed well and the staff is well trained.