

Pump Discharge Criteria:

SUBJECT 1

The concept of Lead and Lag pump vs. main and secondary (backup) pump, are two different concepts:

Lead & Lag pump operation method:

The lead pump turns on at a certain design water surface (WS) elevation (usually 18" – 24" or more, above the pump well floor). The lead pump discharges portion of the maximum allowable discharge (NOTE: Allowable discharge here is not necessarily based on the 150' strip. Please refer to SUBJECT 2). The lag pump starts when the WS rises to another design elevation. The lag pumps assist the lead pump and shuts off when the WS drops to a certain design level, leaving the lead pump to finish the job. For smaller storms, the lag pump may not even turn on. For this reason, a good design is to alternate the lead and lag pumps with each storm to ensure even operation for both pumps. This is good design practice and enhances the longevity and reliability of the pump, but this is not a requirement. The two pumps' combined discharge shall not exceed the allowable discharge.

Main & Backup pump operation method:

This is not the ideal situation. The lead pump is sized for maximum (100%) allowable discharge. The backup pump is also sized for maximum discharge. The backup pump is supposed to be used only when the lead pump has completely failed, however if the backup pump can be turned on manually by the operator/owner during the lead pump operation, the pump discharge would become double the allowable potentially causing adverse impact. The hydraulics section strongly discourages this type of operation. Only one HOA (hand-off-automatic) pump control will be allowed on the motor control center. Operating both pumps at once, especially during construction is not acceptable.

SUBJECT 2

In case of pumped discharge to TxDOT roadside ditch or storm sewer system, the maximum allowable discharge and outfall restrictor size shall be calculated per following steps:

- 1) Obtain the "allowable discharge" from the as-built drainage area map & hydraulic data sheet. In lieu of the as-built plan, "allowable discharge" may be calculated based on the rational method with the area equal to the standard 150-ft strip, $C=0.65$ and 2-yr intensity with a time of concentration no less than 10 minutes.
- 2) Calculate the "allowable discharge", based on the pro-rata method as outlined below:
 - I. Find the contributing drainage area upstream of the point of proposed discharge. This is all the contributing drainage areas including TxDOT R.O.W., and any portion of the site that drains to TxDOT drainage system in existing condition.
 - II. Calculate the % of the project area to the entire contributing drainage area.

- III. Calculate the ditch bank full capacity (open channel hydraulics) and the capacity of the immediate downstream driveway culvert (pipe under pressure). Multiply the lesser of the two calculated discharges by the % of site area to the total contributing drainage area, calculated in step 2.
- 3) For the pumped discharge portion of the detention volume, the lesser of the calculated allowable discharge obtained in steps 1 and 2 will be multiplied by 20% to obtain the maximum allowable pumped discharge.
For the gravity portion of the detention volume, the full allowable discharge as calculated in steps 1 or 2 may be used. Restrictor will be design based on full allowable discharge. All pumps shall cease to operate when gravity discharge begins. Combined gravity and pumped discharge will not be permitted under most conditions.

Example Calculations for step 2:

Total tract = 5 acres

Site total contributing drainage area = 5 acres

Total watershed area contributing to the point of outfall = 100 acres

% of the site to the total contributing drainage area = 5% = 0.05

Ditch full bank capacity at the outfall using manning equation = 35 cfs

Using the standard equations for culverts under pressure the capacity of an existing 24" RCP driveway culvert located downstream of the proposed outfall is **25 cfs**. Allowable H.W. elevation for the culvert calculations shall be the lower of the right and left top bank elevations upstream of the driveway.

Maximum Allowable Discharge = 0.05 x (the lesser of two flows calculated above)

Maximum Allowable Discharge = 0.05 x **25** = 1.25 cfs

SUBJECT 3

Pumped discharge SWPPP and how to minimize / prevent silt deposit in TxDOT R.O.W.

Due to the energy imparted to stormwater by the pump and the shearing action of centrifugal pumps, such stormwater is more likely to carry suspended solids in the discharge. Significant effort shall be applied to prevent the suspension of silt in the pumped stormwater. If necessary, the pumped stormwater (During construction) shall be processed in a separate unit or a temporary stilling basin to remove the suspended silt prior to discharge. The discharge of suspended silt, especially during construction is not acceptable.

SUBJECT 4

Allowable % of detention volume to be pumped

The engineer will design the proposed discharge of the detention volume to allow minimum 25% by gravity and maximum 75% by pumped discharge.

SUBJECT 5

Pump Shut-Down Junction Box and Return Line

The pump force main must first enter a junction box that is equipped with a float that will automatically shutdown the pump operation once water surface level (WSE) in the junction box reaches certain elevation. The pump shut-down elevation is site specific and will vary on a case by case which requires coordination with Hydraulic Section. The outfall pipe lead from the junction box will require a restrictor pipe based on “gravity allowable” discharge. The restrictor pipe will be in the private property for the owner to maintain. The return line shall be designed to return the flow back to the internal drainage system and the detention pond, once the restrictor capacity is exceeded.

SUBJECT 6

Pump information required on the plan for review

- a) Pump system and performance curve
- b) Pump motor control center wiring diagrams (ladders)
- c) Pump vendor/ manufacturing information
- d) The pump’s Rising and Falling cycle table
- e) Discharge rate

NOTE: Two pumps may operate at the same time, if both pumps discharge does not exceed allowable discharge; otherwise provide only one control operating either pump with an arrangement such as a single pole – dual throw switch. To test an individual pump then a momentary-on jog button can be installed for each pump.

SUBJECT 7

Groundwater discharge not allowed

The permit is for the discharge of stormwater only. The applicant shall demonstrate that groundwater infiltration shall not occur during or after construction. This can be accomplished with a water table map that clearly demonstrates that the flow line elevation of the pumped detention pond is above the seasonally adjusted water table. The water table shall be established by a new survey that maps the water table surface for the entire site, with emphasis at the proposed detention pond location. The map shall be signed and sealed by a P.G. or a P.E. registered to practice in Texas. Alternately, the proposed detention pond can be isolated and sealed during construction. In no cases shall groundwater be pumped to the TxDOT right of way at any time. The discharge of groundwater to the TxDOT right of way is not acceptable.

ADDITIONAL REQUIREMENTS FOR PROJECTS WITH PUMPED DISCHARGE

Multiple pumps that stage the flow are perfectly acceptable in any configuration if the total flow of all the pumps does not exceed the agreed upon allowable flow.

For a single pump with a reserve pump or back up pump, the total flow of the pumps will exceed the allowable flow. For this reason, the two pumps must not be operated at the same time. To prevent this from occurring, we request one of two pump control configurations:

1. Utilize only one hand-off-automatic switch with an n pole-dual throw switch to select between the two pumps. An alternator may be used to automatically exercise both pumps, but in no way shall the configuration allow two pumps to operate by hand or auto simultaneously.
2. Utilize two auto-off switches (one for each pump), but eliminate the hand function. Instead, install a jog button that will close when pressed and open upon release. Use an alternator to automatically switch between the two pumps with each successive cycle. In this way, the pumps can be “jogged” or tested but the action is momentary.