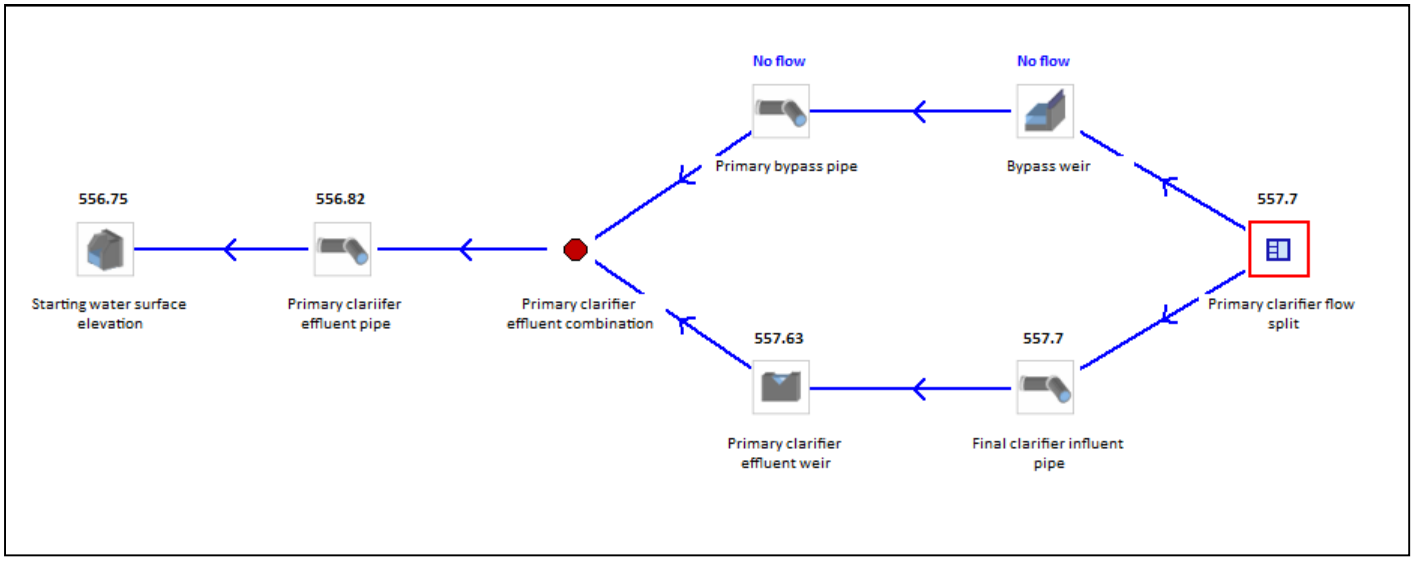
Visual Hydraulics Example V – Flow Path That Receives No Flow (Bypass Flow)

One of the more useful applications of the flow split analysis capabilities of Visual Hydraulics is the determination of flow to bypass paths, which is quite common in treatment plant applications. Often flow splits are set up to allow a certain flow value to be conveyed through a portion of the treatment process, and if that flow value is exceeded, the additional flow will be conveyed around that process (bypassed). Visual Hydraulics can be used to analyze this type of scenario and determine when bypasses occur.

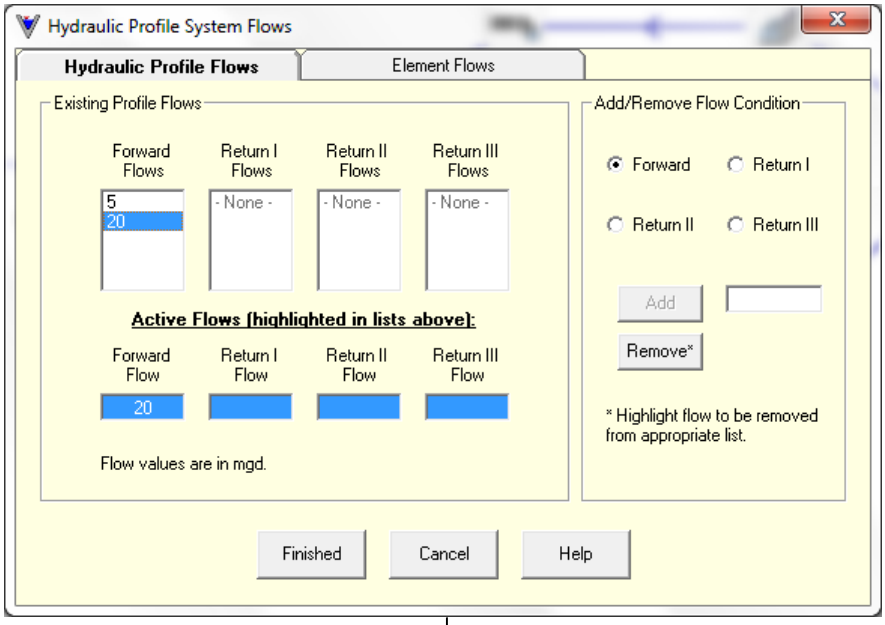
Problem: A flow split has been set up at the head of a treatment plant's primary process. Under normal flow conditions, all of the flow is conveyed through the primary treatment train. Under higher flows, however, a bypass weir allows some of the flow to be bypassed around the primary treatment units so that they are not hydraulically overloaded. The client wishes to determine under a certain high flow scenario how much flow will be conveyed through the primary process and how much flow will be bypassed. The flow conditions for the plant are as follows:

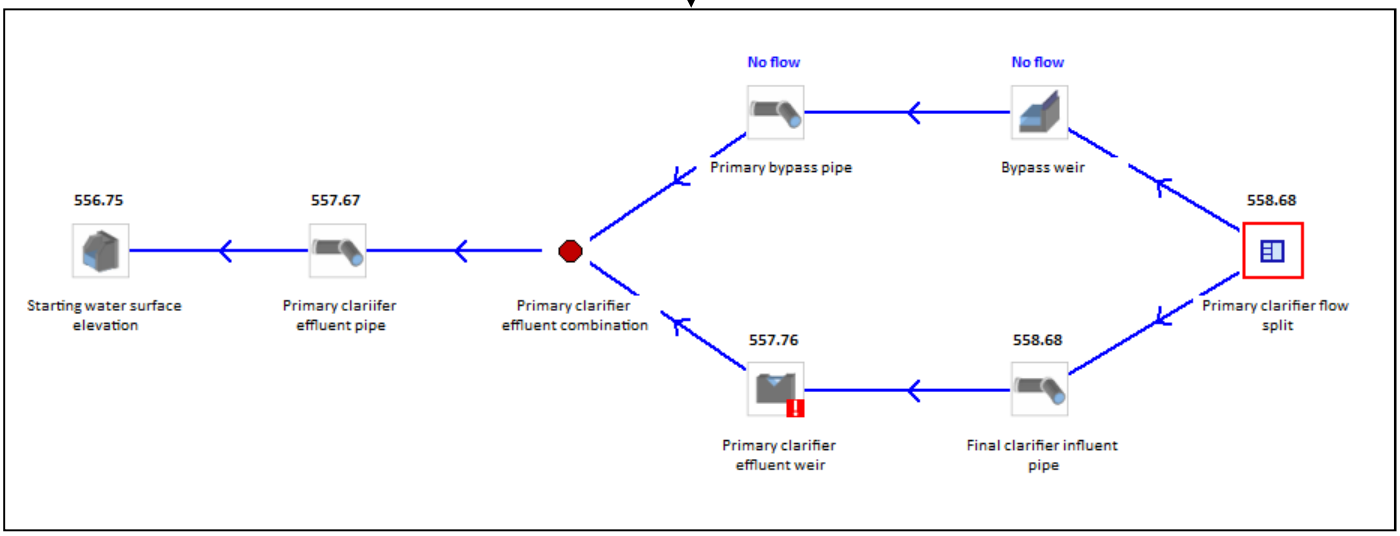
Normal flow – 5 MGD
Peak flow – 20 MGD
Bypass weir elevation – 558.50

The hydraulic profile for the treatment plant has been created in Visual Hydraulics. A screenshot of the primary process portion of the treatment plant at a normal flow of 5 MGD is shown as follows:

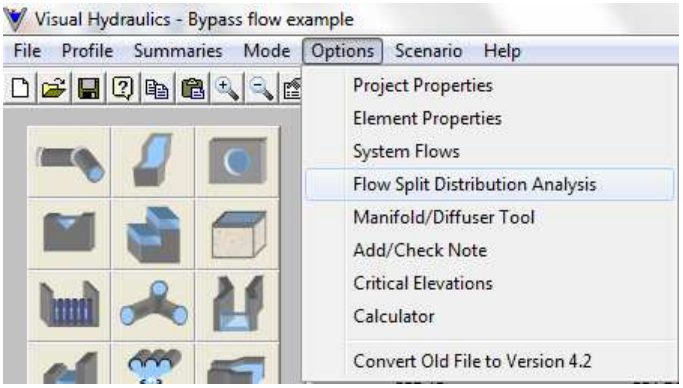


As can be seen from the hydraulic profile, under normal flow conditions, all of the flow is conveyed through the primary treatment process, with no flow being bypassed. The plant sees flows up to 20 MGD during peak flows, so the hydraulic profile needs to be analyzed at that higher flow to determine how the bypass flow path will be affected. If the flow is changed from 5 MGD to 20 MGD and the profile is then updated:

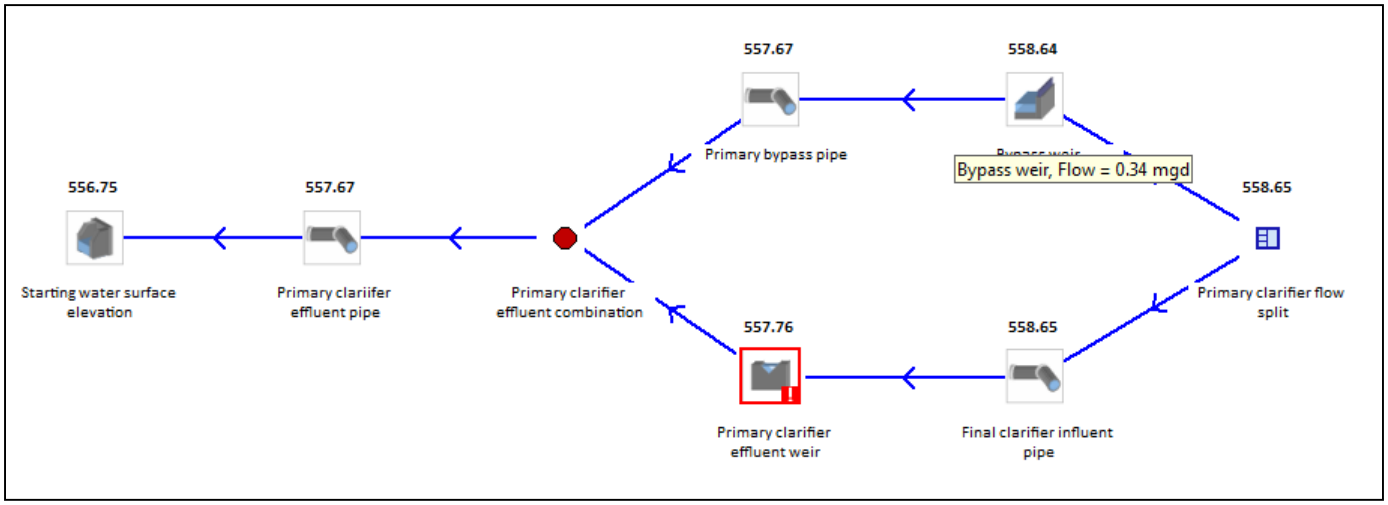




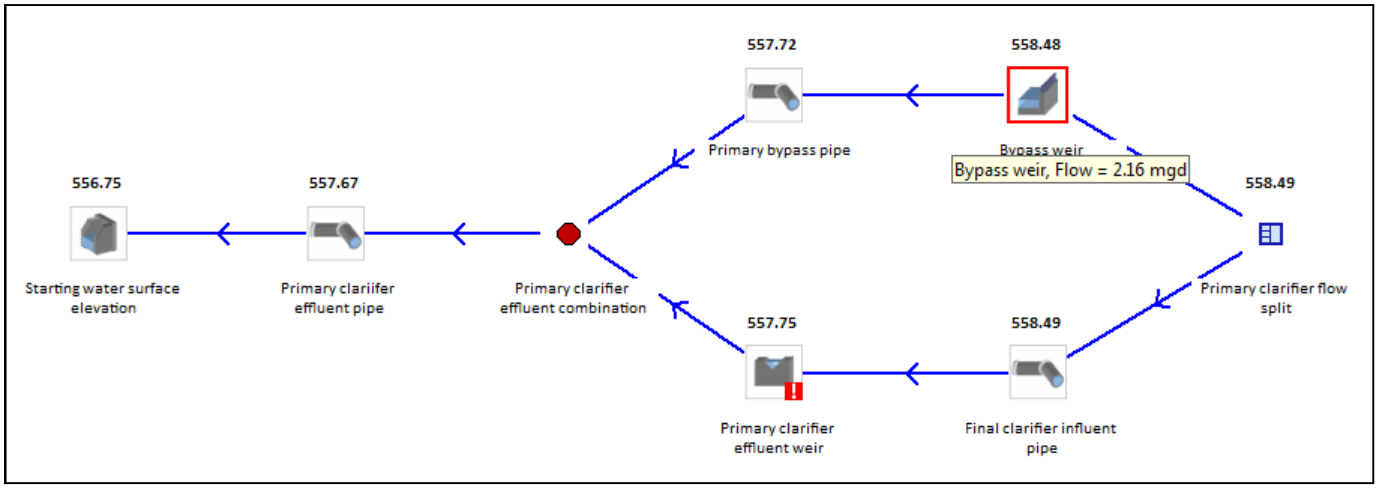
It can be seen from the revised hydraulic profile that the water elevation at the final clarifier influent pipe is 558.68, which exceeds the bypass weir elevation of 558.50. Therefore there will be flow conveyed to the bypass path. To determine exactly how much flow is conveyed through the bypass path and how much flow is conveyed through the primary clarifier path, the flow distribution tool is used:



A flow distribution analysis on the hydraulic profile is then run, and the software determines how much flow is conveyed through the bypass path and how much flow is conveyed through the primary clarifier path:



In this case, only 0.34 MGD is conveyed through the bypass path, so the overflow is not a significant one. If the overflow weir is lowered to say 558.0, the difference is quite significant, resulting in a bypass flow of 2.16 MGD.



As can be seen, lowering the overflow weir by 6 inches (0.5 feet) increases the flow to the bypass path from 0.34 MGD to 2.16 MGD.