IPGC Pipe Length & Size Determination
Example / Situation

I have determined that I need to capture and convey a flow rate of 1.75 cfs (or 785.45 gpm). My situation is such that I can only install the main conveyance pipe at a maximum slope of 1.25%. Also, I don't want the water depth above the capture pipe (or IPGC pipe) to be greater than one-foot.

I need to determine the following:

1. What pipe size is needed to convey a flowrate of 1.75 cfs (or 785.45 gpm) at a 1.25% slope assuming free outfall.

2. What length and size of IPGC capture pipe would be required to capture the 1.75 cfs without the ponded water depth exceeding one foot?

Procedure:

A. Begin by looking at column 1 of the conveyance table (See Tab 2 below) and find a pipe slope of 1.25%. From here, move across the table horizontally until you see a flowrate that is > than 1.75 cfs (or > 785.45 gpm). Once you find it, then move up the column vertically to see which pipe diameter this is under. Inspection of the conveyance table shows that only a 12" pipe could freely convey 1.75 cfs (or 785.45 gpm) at a slope of 1.25%. Therefore, a 12-inch pipe size or larger should be used to provide the needed conveyance. Although a 12" pipe size is required for conveyance, a 12" IPGC capture pipe is not necessarily required. However, for both simplicity and conservatism, It is recommended that a 12" IPGC pipe size also be used for capturing the flow. This concept is discussed more in Procedure B.

Since we know that a 12-inch diameter pipe is required for conveyance, we can now use the performance curves to determine the length and size of IPGC pipe needed to capture the flow rate while maintaining a water depth of less than 1 foot.

First, it is important to explain how the performance curve graphs work. Make sure you have them in front of you while reading this. The performance curves are shown on graphs with the flow rate plotted on the horizontal (or x-axis) and the required head (or water depth) plotted on the vertical (or y-axis). Each graph contains several curves, but each curve shows the performance for a specific length of IPGC pipe. Each graph covers a range of available IPGC pipe lengths, with the first graph covering up to 5 feet, the second from 5 to 10 feet, and so on. Two sets of graphs are provided so that one can make a determination using flow rate units of cubic feet per second or gallons per minute.

B. As previously discussed, since a 12" pipe size is required for conveyance, it is recommended that a 12" IPGC pipe size also be used for capturing the flow. If physical limitations cannot support a 12-inch pipe size at the point of capture, other viable options using smaller IPGC sizes may be available to capture all of the flow. However, if a smaller IPGC pipe size is chosen for capturing the runoff, more individual IPGC sections and more IPGC pipe length would be required in order to capture and convey the flow to the 12" conveyance pipe while limiting the water depth to only one foot. The options for 3", 4", 6", and 8" IPGC pipe are provided for discussion following the recommended option.

Since we know that a 12-inch pipe size is required for conveyance, let's first look at the 12-inch IPGC performance curves. The first graph shows the performance of 12" IPGC pipe lengths from 1.5 feet on up to 5.0 feet. Since we know that the flow rate is 1.75 cfs (or 785.45 gpm), we first have to find this on the horizontal (or x-axis). Inspection of the first 12-inch IPGC graph shows flowrates from 0.0 to 9.0 cfs (or 0 to 4,000 gpm) on the horizontal (or x-axis). Since our flowrate of 1.75 cfs (or 785.45 gpm) is within this range, we then check to see what the required head would be for a specific length of 12" IPGC pipe. Inspection of the graph shows that a 2-foot section would require a head between 2.0 and 2.5 feet, which does not meet the maximum head of one-foot requirement. Moving to the right now, inspection of the graph shows that a 2.5-foot section requires less than 3-

inches (or < 0.25 feet) of head. The 2.5-foot section easily satisfies the maximum depth of one-foot requirement. Any length greater than 2.5 feet would lower the required head even more. Therefore, only 2.50' of 12" IPGC pipe would be required to capture the 1.75 cfs (or 785.45 gpm). Additionally, the 12" IPGC capture pipe would only need to be installed with a slope of 0.21%.

Following the same procedure above, we can check what lengths would be required if we wanted to use a 3, 4, 6, or 8 inch IPGC pipe size to capture the same 1.75 cfs (or 785.45 gpm). As is pointed out in the following paragraphs, some of the smaller sizes are not viable options.

* For the 3-inch size, inspection of the 2nd 3-inch IPGC performance graph indicates that 6.5 feet of 3-inch IPGC pipe would be adequate to limit the water depth to one foot. Essentially, this means that 6.5 feet of 3-inch IPGC pipe provides enough open slit area to capture the 1.75 cfs (or 785.45 gpm) while limiting the water depth to one foot. However, the 6.5-foot section of 3-inch capture pipe cannot freely convey 1.75 cfs unless it is installed at a slope of 334.20%. Since the 3" capture pipe cannot be installed at a reasonable slope (less than 15% or so), there are many more viable options.

* For the 4-inch size, inspection of the 1st 4-inch IPGC performance graph indicates that 4.5 feet of 4-inch IPGC pipe would be adequate to limit the water depth to one foot. Essentially, this means that 4.5 feet of 4-inch IPGC pipe provides enough open slit area to capture the 1.75 cfs (or 785.45 gpm) while limiting the water depth to one foot. However, the 4.5-foot section of 4-inch capture pipe cannot freely convey 1.75 cfs unless it is installed at a slope of 72.05%. Since the 4" capture pipe cannot be installed at a reasonable slope (less than 15% or so), there are still more viable options.

* For the 6-inch size, inspection of the 1st 6-inch IPGC performance graph indicates that 3.5 feet of 6-inch IPGC pipe would be adequate to limit the water depth to one foot. Essentially, this means that 3.5 feet of 6-inch IPGC pipe provides enough open slit area to capture the 1.75 cfs (or 785.45 gpm) while limiting the water depth to one foot. The 3.5-foot section of 6-inch IPGC capture pipe could freely convey 1.75 cfs if it is installed at a slope of 8.29%. The 8.29% slope is certainly viable and practical if the physical conditions of the installation site allow the 8.29% installation slope. This is a good option.

* For the 8-inch size, inspection of the 1st 8-inch IPGC performance graph indicates that 3.0 feet of 8-inch IPGC pipe would be adequate to limit the water depth to one foot. Essentially, this means that 3.0 feet of 6-inch IPGC pipe provides enough open slit area to capture the 1.75 cfs (or 785.45 gpm) while limiting the water depth to one foot. The 3.0-foot section of 8-inch IPGC capture pipe could freely convey 1.75 cfs if it is installed at a slope of 1.79%. The 1.79% slope is certainly viable and practical if the physical conditions of the installation site allow the capture pipe to be installed at 8.29%. This would be the second best option.

As you can see, the options become more reasonable as the pipe sizes approach the needed conveyance pipe size, but for simplicity we recommend just using the same size pipe for conveyance and capture.