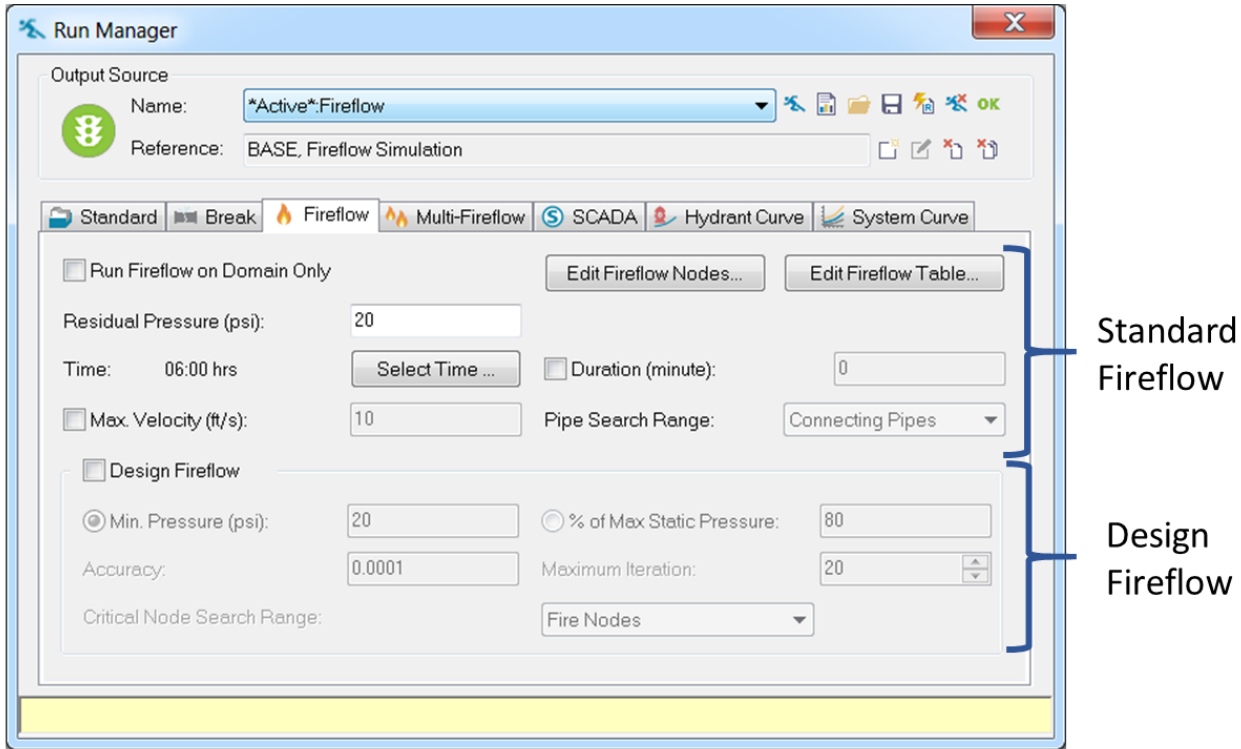


# Fireflow Run Results

There are two components to the InfoWater Pro Fireflow Run Results, Standard Fireflow Run, and the Design Fireflow Run. Based on which analysis is evaluated different reports will be generated. It is important to understand how each of the reports display output results and how these results may vary based on the constraints specified.



## Fireflow Standard Report

The first report is a standard fireflow simulation. This report includes static demand, static pressure, static head, fireflow demand, residual pressure, hydrant available flow, and hydrant pressure at available flow. Two additional columns are included when you choose Max. Velocity from Run Manager dialog box.

The fireflow report contains the same information, regardless if the Minimum Design Pressure design flow calculation is checked or not.

	ID	Static Demand (gpm)	Static Pressure (psi)	Static Head (ft)	Fire-Flow Demand (gpm)	Residual Pressure (psi)	Hydrant Available Flow (gpm)	Hydrant Pressure at Available Flow (psi)	Critical Pipe ID at Available Flow	Critical Pipe Velocity at Available Flow (ft/s)
1	11	16.80	99.87	345.48	1,000.00	95.69	1,336.95	93.58	8	2.97
2	13	16.80	94.69	345.52	1,000.00	90.14	912.65	90.82	102	2.99
3	15	30.24	98.66	345.70	1,000.00	95.34	250.71	98.16	96	3.03
4	19	100.80	96.65	345.07	1,000.00	90.50	657.21	93.96	18	3.02
5	21	16.80	99.64	344.97	1,000.00	93.48	758.78	95.57	22	3.01
6	23	16.80	98.38	345.05	1,000.00	92.54	545.59	95.94	26	3.02
7	25	16.80	96.18	344.98	1,000.00	29.12	117.50	94.74	24	3.00
8	27	16.80	97.56	345.15	1,000.00	92.43	514.93	95.55	28	3.02
9	29	16.80	100.78	344.60	1,000.00	92.10	416.16	98.28	30	3.02
10	31	16.80	98.17	344.57	1,000.00	65.07	117.50	97.23	32	3.00
11	33	16.80	98.00	344.18	1,000.00	87.58	577.01	93.41	34	3.02
12	35	16.80	96.28	344.19	1,000.00	85.77	965.29	86.56	36	2.98
13	37	16.80	99.25	344.05	1,000.00	-29.13	117.50	96.57	38	3.00
14	39	16.80	94.99	344.22	1,000.00	84.62	748.17	88.41	44	3.01
15	41	16.80	97.96	344.09	1,000.00	-28.70	117.50	95.32	42	3.00
16	43	16.80	98.05	344.29	1,000.00	87.98	647.05	92.87	48	3.03
17	45	16.80	95.86	344.23	1,000.00	32.29	117.50	94.35	46	3.00
18	47	30.24	99.41	344.43	1,000.00	89.95	554.95	95.62	50	3.01
19	5	0.00	99.86	345.45	1,000.00	95.56	1,298.44	93.60	6	3.01
20	7	16.80	99.86	345.45	1,000.00	95.20	896.87	95.99	12	3.00
21	71	16.80	98.52	345.37	1,000.00	85.82	454.73	95.08	82	3.01
22	73	16.80	99.79	345.29	1,000.00	24.71	117.50	98.20	80	3.00
23	75	16.80	97.66	345.38	1,000.00	87.63	423.88	95.12	86	3.03
24	77	16.80	99.79	345.31	1,000.00	32.99	117.50	98.36	84	3.00
25	79	16.80	96.81	345.42	1,000.00	89.90	388.03	95.17	90	3.01
26	81	16.80	91.15	345.36	1,000.00	28.53	117.50	89.82	88	3.00
27	83	16.80	95.54	345.50	1,000.00	91.34	708.10	93.05	94	3.03
28	85	16.80	97.70	345.47	1,000.00	93.65	1,576.77	89.97	8	3.01
29	9	16.80	93.36	345.46	1,000.00	89.14	1,173.30	88.15	16	2.99

**Row** - A row is a series of horizontal cells in this spreadsheet. A row is identified by a number.

**ID** - The InfoWater Pro data element ID is displayed in this section of the Output Report Manager.

**Static Demand** - The nodal demand at the fireflow simulation timestep. This value corresponds to the baseline demand at the specified timestep.

**Static Pressure** - The nodal calculated pressure for the static demand at the fireflow simulation timestep.

**Static Head** - Node hydraulic grade at the current simulation time step, ft (m).

**Fire Flow Demand** - The user-specified fireflow demand at the current node when the hydrant is flowing.

**Residual Pressure** - The residual pressure at the current junction which includes both the fireflow demand plus the static demand. This pressure value assumes that only the current hydrant (node) is subjected to the assigned fire demand and that no other fire demands are considered in generating this value.

**Hydrant Available Flow** - The maximum flow that is available while maintaining the user-specified minimum residual pressure at the current node, assuming that only this hydrant (node) is flowing.

**Hydrant Pressure at Available Flow** - Residual pressure calculated for the available flow at the current hydrant (node). This value should equal the residual pressure specified by the user.

**Note:** These two additional columns appear when you choose Max. Velocity in your Report Manager settings.

**Critical Pipe ID at Available Flow (optional)**- The pipe with the highest velocity within our Pipe Search Range assigned by the user under the fireflow tab of the Run Manager. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

**Critical Pipe Velocity at Available Flow (optional)** - The velocity of the critical Pipe after satisfying the maximum velocity constrain. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

## Fireflow Design Report

The fireflow design report displays the final design flow.

InfoWater Pro will generate a fireflow design report that determines the minimum pressures in the critical node searching range and returns a Design Flow to be used as a maximum available fireflow in order to maintain minimum pressures in the distribution system.



The velocity constraint is only considered in the available flow and design flow calculation if the maximum velocity option is selected.

Report Manager

Fireflow Design [\*Active\*Fireflow]

ID	Total Demand (gpm)	Hydrant Available Flow (gpm)	Critical Node ID for Design Run	Critical Node Pressure at Available Flow (psi)	Critical Node Pressure at Fire Demand	Critical Pressure for Design Run (psi)	Hydrant Design Flow (gpm)	Hydrant Pressure at Design Flow (psi)	Critical Pipe ID for Design Run	Critical Pipe Velocity at Design Flow (ft/s)
1	11	1,016.80	11	93.58	95.69	20.00	1,336.95	93.58	8	2.98
2	13	1,016.80	13	90.82	90.14	20.00	912.65	90.82	102	2.99
3	15	1,030.24	15	98.16	95.34	20.00	250.71	98.16	96	3.03
4	19	1,100.80	19	93.96	90.50	20.00	657.21	93.96	18	3.02
5	21	1,016.80	21	95.57	93.48	20.00	758.78	95.57	22	3.01
6	23	1,016.80	25	93.75	90.34	20.00	545.59	95.94	26	3.02
7	25	1,016.80	25	94.74	29.12	20.00	117.49	94.74	24	3.00
8	27	1,016.80	39	93.02	89.94	20.00	514.93	95.55	28	3.02
9	29	1,016.80	31	95.67	89.49	20.00	416.15	98.28	30	3.02
10	31	1,016.80	31	97.23	65.07	20.00	117.50	97.23	32	3.00
11	33	1,016.80	33	93.41	87.58	20.00	577.01	93.41	34	3.02
12	35	1,016.80	35	86.56	85.77	20.00	965.29	86.56	36	2.98
13	37	1,016.80	37	96.57	-29.13	20.00	117.49	96.57	38	3.00
14	39	1,016.80	39	88.41	84.62	20.00	748.17	88.41	44	3.01
15	41	1,016.80	41	95.32	-28.70	20.00	117.49	95.32	42	3.00
16	43	1,016.80	45	90.68	85.78	20.00	647.03	92.87	48	3.03
17	45	1,016.80	45	94.35	32.29	20.00	117.49	94.35	46	3.00
18	47	1,030.24	47	95.62	89.95	20.00	554.95	95.62	50	3.01
19	5	1,000.00	39	88.88	90.81	20.00	1,299.41	93.60	6	3.01
20	7	1,016.80	7	95.99	95.20	20.00	896.97	95.99	12	3.00
21	71	1,016.80	71	95.08	85.82	20.00	454.73	95.08	82	3.01
22	73	1,016.80	73	98.20	24.71	20.00	117.50	98.20	80	3.00
23	75	1,016.80	75	95.12	87.63	20.00	423.88	95.12	86	3.03
24	77	1,016.80	77	98.36	32.99	20.00	117.49	98.36	84	3.00
25	79	1,016.80	81	89.51	84.24	20.00	388.02	95.17	90	3.01
26	81	1,016.80	81	89.82	28.53	20.00	117.49	89.82	88	3.00
27	83	1,016.80	81	88.66	86.95	20.00	708.04	93.05	94	3.03
28	85	1,016.80	85	89.97	93.65	20.00	1,576.77	89.97	8	3.01
29	9	1,016.80	9	88.15	89.14	20.00	1,173.30	88.15	16	2.99

**Row** - A row is a series of horizontal cells in this spreadsheet. A row is identified by a number.

**ID** - Hydrant (Junction node) identifier.

**Total Demand** - The total nodal demand at the fireflow simulation timestep. This value corresponds to the sum of the baseline demand (Static Demand) and the fireflow demand (Fireflow Demand) for the selected timestep.

**Hydrant Available Flow** - The maximum flow that is available while maintaining the user-specified minimum residual pressure at the current node, assuming that only this hydrant (node) is flowing.

**Critical Node ID for Design Run** - The node within the Critical Node Searching Range with the lowest pressure when the current nodal junction is loaded with the total demand.

**Critical Node Pressure at Available Flow** - The calculated pressure at the Critical Node.

**Critical Node Pressure at Fire Demand** - The calculated pressure at Fire Demand.

**Critical Pressure for Design Run** - The calculated pressure for Design Run.

**Hydrant Design Flow** - The maximum flow available at the current hydrant (node) such that the pressure anywhere within the critical node searching range (Fire Nodes, Entire Network, or Domain) does not drop below the minimum design pressure specified. Based on the critical nodes identified (junction node with minimum pressure in the critical node searching range), InfoWater Pro determines the design flow as the minimum of the adjusted flows for each junction node needed to maintain the minimum design pressure in the entire critical node searching range. Ultimately, the Design Flow as it is the least flow value of all considered residual pressures and velocity constraints. This is the value that an engineer would provide to a local fire department by saying this is the maximum (theoretical) flow possible at the subject junction in order to maintain 20 psi at all times in the distribution system.

**Hydrant Pressure at Design Flow** - The current flow available at the current node such that the hydrant pressure does not drop below the minimum design pressure specified.

**Note:** These two additional columns appear when you choose Max. Velocity in your Run Manager dialog box.

**Critical Pipe ID for Design Run (optional)** - If Max. Velocity Constraint is checked, this column will be created to show the pipe ID with the highest velocity within our Pipe Search Range assigned by the user. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

**Critical Pipe Velocity at Design Flow (optional)** - If Max. Velocity Constraint is checked, InfoWater Pro calculates the maximum flow available at the hydrant while maintaining the user-specified residual pressure and the maximum velocity constraint. This value presents the velocity of the critical Pipe after satisfying the maximum velocity constrain. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

## Explanation on Fireflow Reports

Fireflows are an integral part of the Hydraulic modeling process and provide a means to calibrate your model. Use the InfoWater Pro Fireflow module to analyze existing hydrants or provide recommendations for future build-outs.

In InfoWater Pro, there are four constraints that are applied while conducting fireflows.

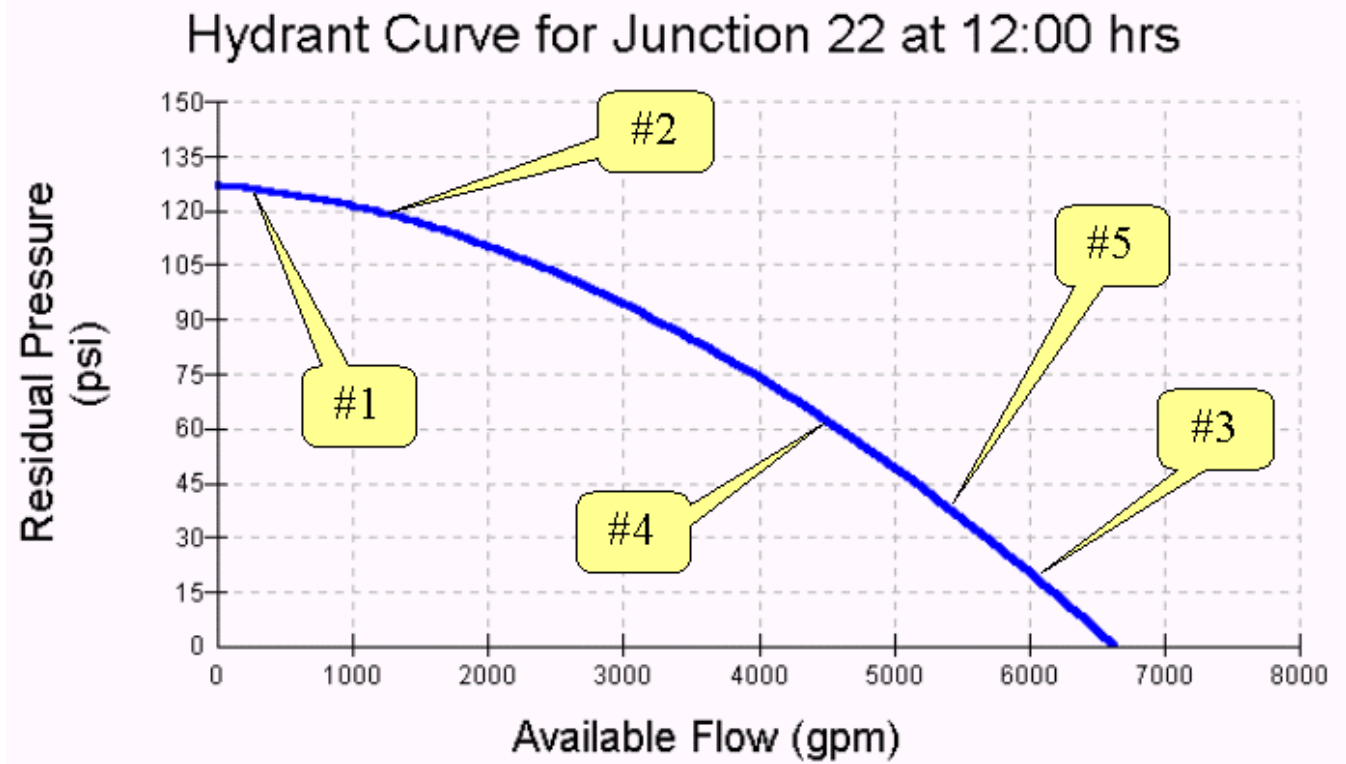
**Constraint 1** - The Fireflow demand imposed on each hydrant.

**Constraint 2** - The Residual Pressure that imposed on the Hydrant through the InfoWater Pro Run Manager dialog box. This is the minimum pressure allowed at the hydrant.

**Constraint 3** - The Minimum Design Pressure that is imposed on the junctions that may be affected when the Hydrant supplies water during a fireflow simulation. Include these junctions by assigning them to your Critical Node Searching Range.

**Constraint 4 (optional)** - The Maximum Velocity Constraint can be additionally assigned on the top of Residual Pressure Constraint. This will affect the fireflow analysis and the fireflow design.

InfoWater Pro will run your Fireflow analysis and provide you with two reports. The Fireflow Report or the Hydrant report will display the hydrant results. This report includes static demand, static pressure, fireflow demand, residual pressure, available flow at the hydrant and pressure at the available flow. The Fireflow design report displays the final design flow. The contents of this report are different, depending on whether the Minimum Design Pressure at the bottom of the Fireflow tab of the Run Manager dialog box is checked or not checked.



#### Fireflow Report Variables

The Fireflow Report summarizes fireflow simulation results such as the static demand, static pressure, fireflow demand, residual pressure, and hydrant available flow, and hydrant pressure at available flow.

**Row** - A row is a series of horizontal cells in this spreadsheet. A row is identified by a number.

**ID** - Hydrant (Junction node) identifier.

**Static Demand** - This field displays the Static or the Basic Demand imposed on the Junction (200 gpm). Refer to #1 in the Hydrant Graph (see above).

**Static Pressure** - This represents the static pressure corresponding to the static demand of 200gpm (126.72 psi). Refer to #1 in the Hydrant Graph (see above). This pressure indicated the pressure at the hydrant when it only supplies the Static Demand. The Fireflow Demand for the hydrant is not assigned while calculating the Static Pressure.

**Fire Flow Demand** - This is the Fireflow demand imposed by the user.

**Residual Pressure** - This represents the resulting pressure because of a sum total of the Static Demand and the Fireflow demand (1,200 gpm, 120 psi). Refer to #2 in the Hydrant Graph (see above).

**Hydrant Available Flow** - The maximum flow that is available while maintaining the user-specified minimum residual pressure at the current node, assuming that only this hydrant (node) is flowing (6,013 gpm). Refer to #3 in the Hydrant Graph (see above).

**Hydrant Pressure at Available Flow** - Residual pressure calculated for the available flow at the current hydrant (node). This value should equal the residual pressure specified by the user (20 psi). Refer to #3 in the Hydrant Graph (see above).

**Note:** These two additional columns appear when you choose Max. Velocity in your Run Manager dialog box.

**Critical Pipe ID for Design Run** - If Max. Velocity Constraint is checked, this column will be created to show the pipe ID with the highest velocity within our Pipe Search Range assigned by the user. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by you.

**Critical Pipe Velocity at Design Flow** - If Max. Velocity Constraint is checked, InfoWater Pro calculates the maximum flow available at the hydrant while maintaining the user-specified residual pressure and the maximum velocity constraint. This value presents the velocity of the critical Pipe after satisfying the maximum velocity constrain. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

#### **Fire Flow Design Report**

The Fireflow Design Report summarizes fireflow simulation results such as the Total Demand, Available Flow at Hydrant, Critical Node ID, Critical Node Pressure, Critical Node Head and Design Flow. InfoWater Pro creates the Fireflow Design Report only if the Minimum Design Pressure option under the Design Flow Calculation section of the FireFlow tab in the Run Manager dialog box is checked.



The velocity constraint is only considered in the available flow and design flow calculation if the maximum velocity option is selected. If selected, the Design Report will include the Critical pipe ID and the Critical Pipe Velocity.

**Row** - A row is a series of horizontal cells in this spreadsheet. A row is identified by a number.

**ID** - Hydrant (Junction node) identifier.

**Total Demand** - The total nodal demand at the fireflow simulation timestep. This value corresponds to the sum of the baseline demand (Static Demand) and the fireflow demand (Fire-Flow Demand) for the selected timestep (12,00 gpm). Refer to #2 in the Hydrant Graph (see above).

**Hydrant Available Flow** - The maximum flow that is available while maintaining the user-specified minimum residual pressure at the current node, assuming that only this hydrant (node) is flowing.

**Critical Node ID for Design Run** - The node within the Critical Node Searching Range with the lowest pressure when the current nodal junction is loaded with the total demand.

**Critical Node Pressure at Available Flow** - The calculated pressure at the Critical Node.

**Critical Node Pressure at Fire Demand** - The calculated pressure at Fire Demand.

**Critical Pressure for Design Run** - The calculated pressure for Design Run.

**Hydrant Design Flow** - The maximum flow available at the current hydrant (node) such that the pressure anywhere within the critical node searching range (Fire Nodes, Entire Network, or Domain) does not drop below the minimum design pressure specified. Based on the critical nodes identified (junction node with minimum pressure in the critical node searching range), InfoWater determines the design flow as the minimum of the adjusted flows for each junction node needed to maintain the minimum design pressure in the entire critical node searching range. In final, point #4 is ultimately the Design Flow as it is the least flow value of all considered residual pressures and velocity constraints. This is the value that an engineer would provide to a local fire department by saying this is the maximum (theoretical) flow possible at the subject junction in order to maintain 20 psi at all times in the distribution system.

**Hydrant Pressure at Design Flow** - The current flow available at the current node such that the hydrant pressure does not drop below the minimum design pressure specified.

**Note:** These two additional columns appear when you choose Max. Velocity in your Run Manager dialog box.

**Critical Pipe ID for Design Run** - If Max. Velocity Constraint is checked, this column will be created to show the pipe ID with the highest velocity within our Pipe Search Range assigned by the user. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.

**Critical Pipe Velocity at Design Flow** - If Max. Velocity Constraint is checked, InfoWater Pro calculates the maximum flow available at the hydrant while maintaining the user-specified residual pressure and the maximum velocity constraint. This value presents the velocity of the critical Pipe after satisfying the maximum velocity constrain. It will be blank if the velocities of the selected pipe are less than the maximum velocity assigned by user.