# SWIFTWATER TERMINOLOGY

**River right**
- looking downstream the right hand side of the river

**River left**
- looking downstream the left hand side of the river.

**Laminar flow**
- most of the water flowing in a downstream fashion with different layers moving at different speeds. Friction from the sides, bottom, and air slow the outer layers. Just below the surface in the middle of the river is the fastest moving water.

**Helical flow**
- water against the banks causes the water next to it to flow in a corkscrew motion downstream between the bank and the main current.

**Top load**
- anything that floats on the top of the river.

**Suspended load**
- anything floating inside the river neither floating on top or touching the bottom (like particles of sand).

**Bottom load**
- anything being pushed or rolled along the river bed.

**Eddy**
- caused by water flowing around an obstacle (like a boulder or river bank) then back in towards the obstacle to fill the low pressure area (water usually flows in a different direction than the main laminar flow).

**Eddy fence or wall**
- turbulent water between the main current and the eddy (it can be several feet wide and may contain whirlpools). There may also be a substantial height difference between the eddy and current.

**Cushion/pillow**
- a reactionary feature that forms as water piles up on the upstream side of an obstacle and pushes floating objects away from the obstacle.
- A pillow does not form on an undercut rock or bank

**Boil line**
- boiling bubbly water downstream of a hydraulic.

**Standing Wave (Haystack)**
- a rhythmic series of waves that can be caused by:
  - fast moving current entering a slower section
  - sudden constriction or change in the river's gradient or cross-section
  - water flowing over a submerged obstacle
  - converging currents

**Hydraulic** (reversal, hole, pour-over, keeper, stopper)
- forms when water flows over an obstacle that is near the surface causing a re-circulating current as the water dives down behind the obstacle then flows back upstream (the re-circulating water usually becomes aerated with a white foamy appearance).
  - *Smiling,* as viewed from upstream, the hydraulic curves downstream and the re-circulating water feeds downstream; it is usually a hazard you can escape from by moving to the sides and being flushed downstream.
  - *Frowning,* as viewed from upstream, the hydraulic curves upstream and the

re-circulating water feeds back into the middle of the hydraulic (this type of hydraulic is much more difficult to escape from).

**Strainer**

- anything that allows water but not a solid object to pass through (usually a build up of debris or logs).

**Boulder/Debris sieve**

- a pile of rocks or other debris that act like a strainer.

**Confluence**

- a flowing together of currents such as the convergence of two streams.

**Upstream V**

- a V of water pointing upstream caused by downstream water flowing around an object; it is a reactionary feature signalling the presence of an obstruction.

**Downstream V (tongue)**

- water flowing between two obstacles forms a V which usually denotes the path of least resistance (the largest V is the main channel and does not need to be in the middle of the river).

Alex

# WATER DYNAMICS

The rate water flows down a river varies across its width and depth. It is important to understand how these current variations affect a raft's behavior. Guides must learn how to cope with these differentials and use them advantageously. For example, if you are drifting downstream, the raft can spin on an eddy line at the most inopportune moment, perhaps above a dangerous rapid. On the other hand, with an understanding of flow rates, you can quickly get under control or exit from the main stream under complete control.

## *1 Straight Line*

Assume you are paddling down a straight stretch of river with a straight shoreline and relatively smooth riverbed. The slowest water is along the river's banks and bottom because of friction. The water flows progressively faster toward the middle of the river (Diagram 1) with the faster current right in the centre.

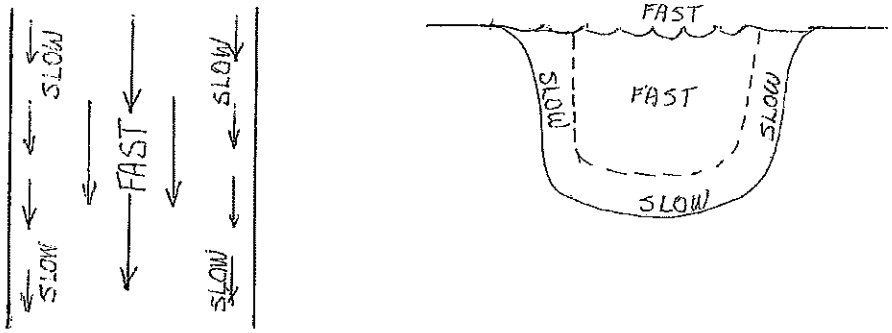



**Figure 1: Straight Line**

## *2 Curve or Bend*

Now, let's look at a bend in the river. Because of centrifugal forces, the deep water channel moves to the outside as it sweeps around the corner (Diagram 2). On the inside of the bend, water moves very slowly, like the hub of a wheel. Another current develops as the water on the surface is carried toward the outside of the bend and downward (Diagram 3). This undertow can be dangerous in a large river. The outside of the bend is always deep, while inside the corner is always shallow. As a general rule, when running a curve or bend in the river, move toward the inside of the curve to compensate for the water pushing to the outside.

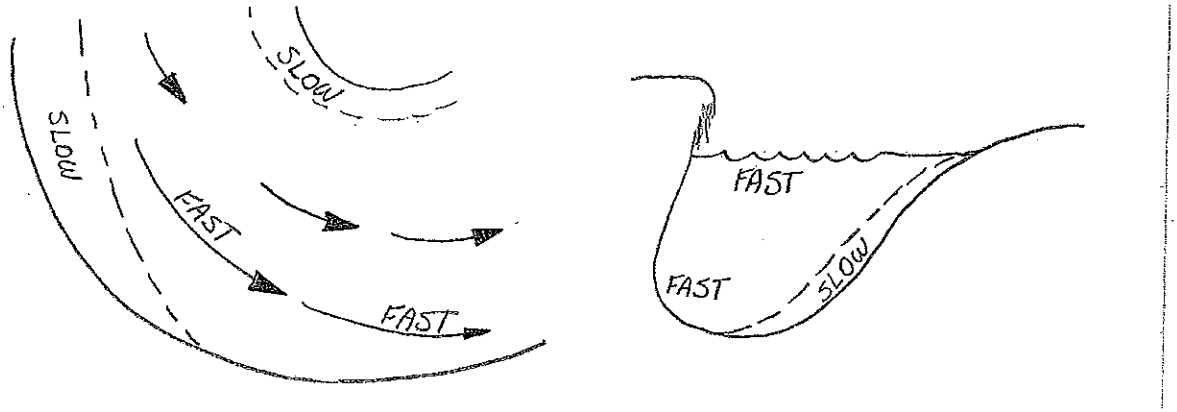



**Figure 2: Curve or Bend in the River**

It is very helpful to know what effect rocks can have on surface water when passed over by current. Knowing where the rocks are, recognizing the deep water channels and putting your raft where you want it to go is important.

### *3 Rocks and Still Water*

In deep, quiet or slow moving water, the surface tells you nothing about the river's bottom. A rock, only a couple of inches under the surface often gives no sign of its presence unless the water is clear. River water is often either dark or has surface reflections that make it difficult to see through. As a result, it's quite common to run aground in the slow water above or below a rapid.

### *4 Rocks in Slow Current*

As the river's speed increases, rocks near the surface cause disturbances just downstream, possibly in the form of a wave curling upstream. The wave isn't much of a problem but the rock in front of it can be.

### *5 Rocks in Deep Fast Current*

An increase in the water's depth and speed of the current causes a corresponding increase in the wave's size. If the rock is deep enough and the wave isn't too large, you can run over the rock and through the wave with no problem.

**Figure 3: Rocks in Deep, Fast Current**

### *6 Rocks in Deep, Very Fast Current*

With a further increase in water depth and velocity, the wave builds to become a breaking wave or explosion wave. An explosion wave run at the wrong angle could flip a raft.

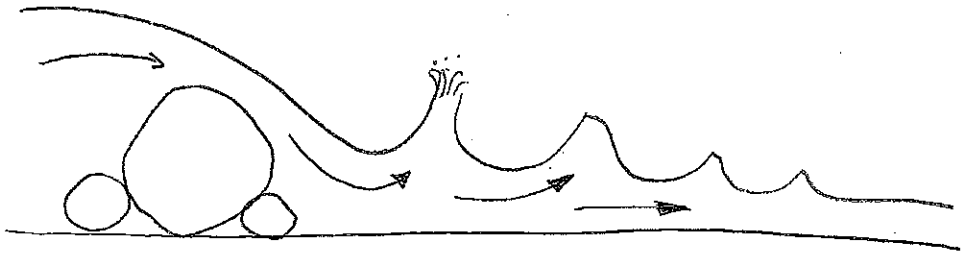


**Figure 4: Rocks in Deep, Very Fast Current**

### ..7 *Rocks or Ledges Causing Hydraulics*

One of the more dangerous obstacles is a hydraulic. It is often caused by a large volume of water pouring over a large rock or ledge. The fast-moving water scoops out a deep hole that is filled with foaming, aerated water and rolls back upstream. This water has little buoyancy and can easily hold a raft and fill it up with water in its turbulence.

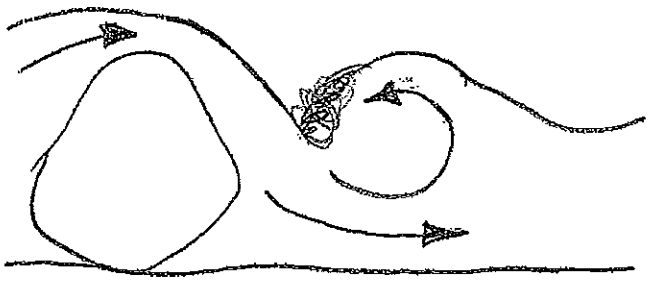


**Figure 5: Rocks or Ledges Causing Hydraulics**

### .3 *Shallow Entry Hydraulics*

Current enters the hydraulic with a gradual drop, i.e. Phil's Hole

### ˙9 *Steep Entry Hydraulics*

Current enters the hydraulic with a sudden drop, i.e. Ledge at the Lorne

NOTE: Hydraulics to be AVOIDED have:

1. steep entries
2. closed in ends
3. long recycles

### *10 Water Flowing Around a Rock or Obstruction*

In rapids, rocks cause most of the problems and obviously they are to be avoided. However, they aren't all bad. Hiding just downstream of the bigger rocks and rocks that protrude above the surface, you will find "Eddies" of flat water. Water can't flow through a rock so it is forced to go around it or over it. If the rock is close enough to the surface, very little water will go over it. In either case, a pool of relatively still water will be created behind it. These flat water areas provide a haven in the rapids. Eddies area great place to rest and plan your next move.
Sometimes water formations develop not because of current and rocks but rather because of current and great amounts of water volume.

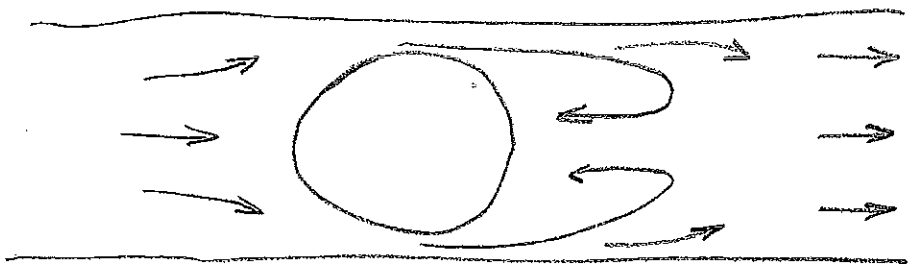


**Figure 6: Water Flowing Around a Rock or Obstruction**

### *11 Diagonal Curling Wave*

A diagonal curling wave is created when a river or stream constricts, dropping over a drop or ledge. As the river funnels into one large V, a water formation (either a wave or hydraulic) is created at the point of the V. The sides of the V which extend from the shore to the water formation, consist of a wave curling diagonally.

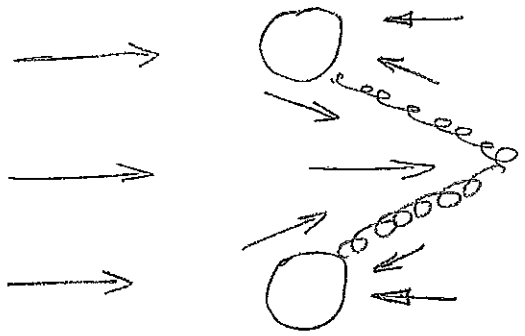


**Figure 7: Diagonal Curling Wave**

### *12 Standing Waves*

Standing waves are usually found at the apex of downstream V's. they are friendly, deep water waves caused by fast water racing down and hitting deep, slower moving water. They are often aligned in a downstream series like a roller coaster.

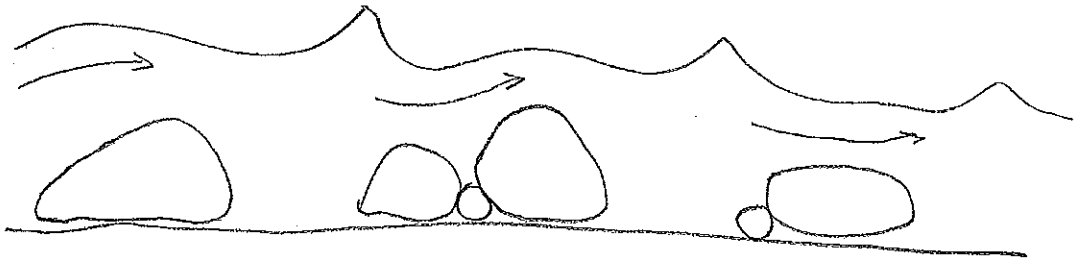
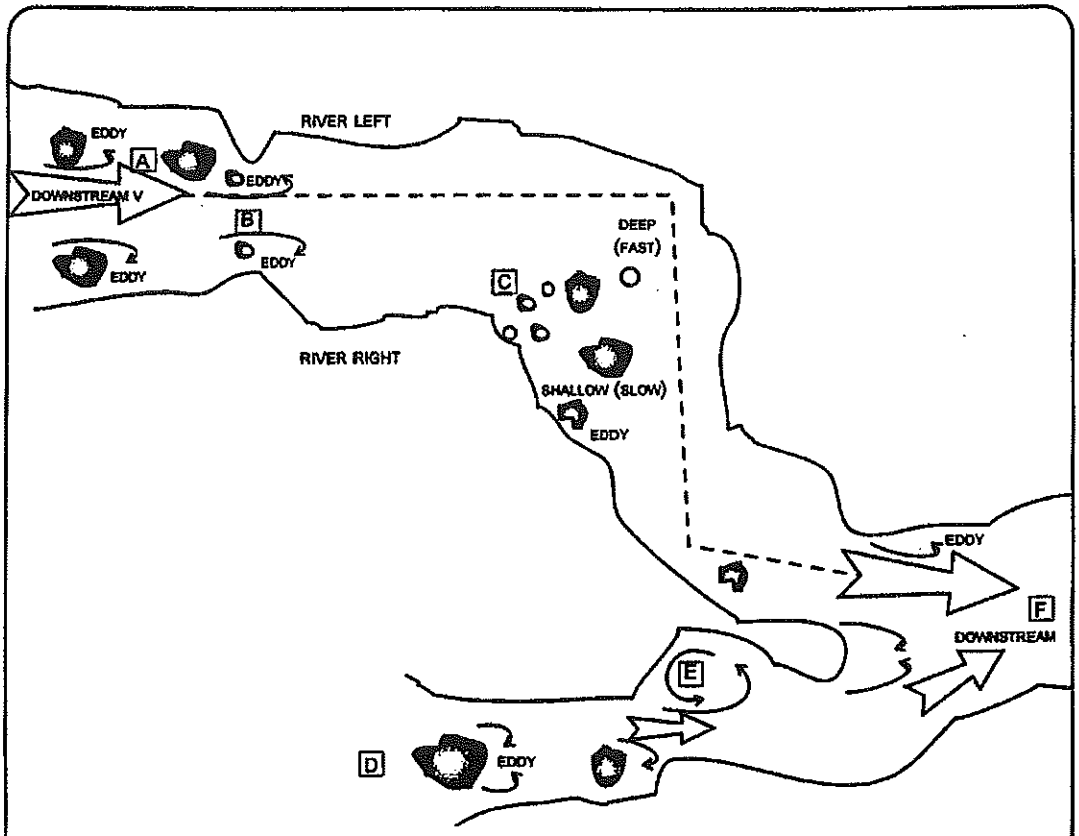


**Figure 8: Standing Waves**




**Legend:**

A ..... Downstream "V": There may be more than one at any particular site.

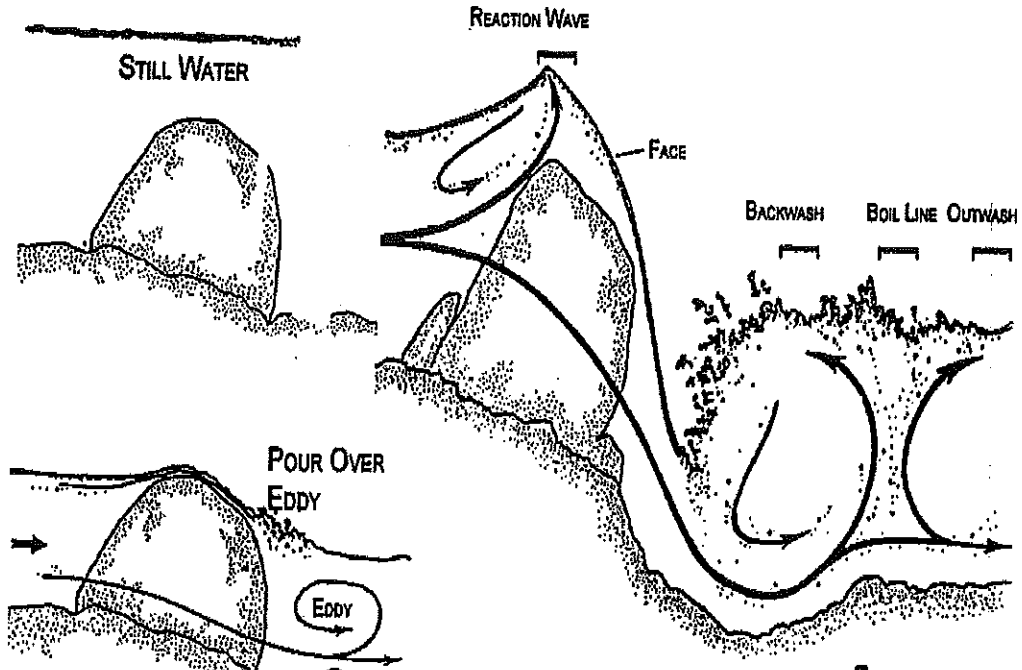
B..... Constriction: A narrowing of a river causing an increase in velocity.

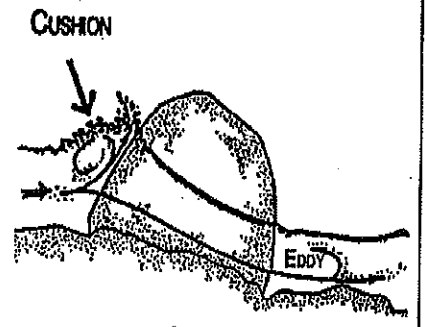
C ..... Rock Fence (or Boulder Sieve): A strainer of rocks often seen in shallow water areas, i.e., the inside of a curve.

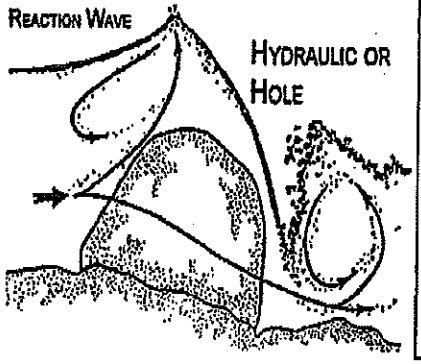
D ..... Feeder Stream: These waterways add both water and debris to the river. Rapids are often found at their mouth.

E..... Eddy: Horizontal reversal of water flow where the pressure of the current along an obstacle causes the water behind the obstacle to reverse flow upstream.

F ..... Confluence: The meeting of two waterways.




Hydraulics come in many shapes and sizes. Here are four examples of the shapes and hydrology created by these different shapes.

**Figure 1**
This is known as a smiling hole. The hydraulic effect may be very strong in the center of this hole but weakens on the sides, to a point where it is actually going downstream.

**Figure 2**
This is the classic shape of the hydraulic found at the base of a low head dam. These are also found occurring naturally in rivers and floods.

**Figure 3**
This is known as a frowning hole. The reversal is strong around the circumference of the hydraulic. This is the second most difficult hole to escape after the low head dam.