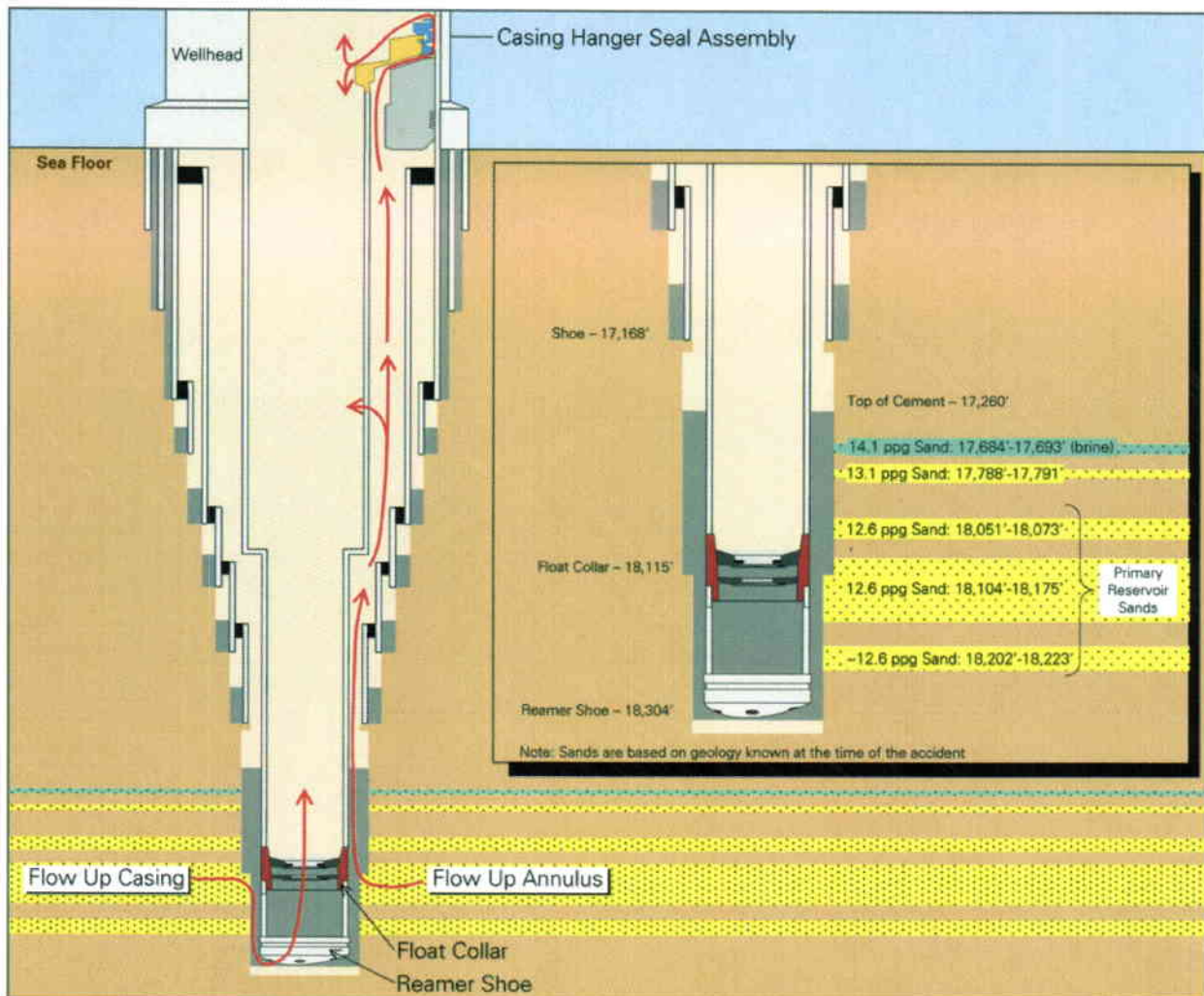


## 2 Annulus Cement Barrier

The annulus cement barrier failed to prevent hydrocarbons from entering the annulus after cement placement. The investigation team assessed possible failure modes and paths that led to hydrocarbon migration from the formation into the wellbore. (Refer to Figure 1.)



**Figure 1.** Hydrocarbon Zones and Potential Flow Paths.

A combination of factors could have contributed to the loss of well integrity, if hydrocarbons entered the wellbore before, during or after cement placement.

To evaluate whether hydrocarbons could have entered the wellbore before cement placement, the investigation team conducted a detailed analysis of actual downhole mud density, fluid volume pumped, and swab and surge pressures while running casing. A volumetric analysis indicated that even if hydrocarbons were present in the wellbore, they would have been circulated out of the well prior to the loss of well control. Data analysis gave no indication that hydrocarbons entered the wellbore prior to cement placement.