GROUND WATER

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Abstract: Ground water in cold regions differs from that in warm regions, not by virtue of any changes in its adherence to physical laws of ground-water flow, but by its interaction with frozen ground and freezing conditions in the surface environment. Permafrost, which underlies about 85 percent of Alaska, 50 percent of the Soviet Union and Canada, and 22 percent of China, is a confining layer that transmits slight amounts of water. Movement of water occurs along thin films of liquid water adsorbed on soil grains, even at temperatures well below freezing. Ground water is classified as subpermafrost or suprapermafrost, depending on whether it is below or above the permafrost, respectively. In the zone of continuous permafrost, suprapermafrost water is available seasonally but is susceptible to contamination. Subpermafrost water is expensive to develop and commonly brackish to saline, particularly in coastal environments. Large springs in limestone terranes are a major water resource in the Arctic. Taliks underlying rivers do not contain flowing ground water, and are not a major water supply except in rivers such as the Mackenzie which flow throughout the winter. Coastal communities in the Arctic have additional water-supply problems

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caused by shallow salt water. In the zone of discontinuous permafrost, communities near rivers generally have no problem developing a water supply, although water commonly must be treated to remove iron, manganese, methane, and hydrogen sulfide. Base flow in streams is a poor indicator of aquifer properties because much of the winter discharge of ground water freezes and does not contribute to base flow. Formation of icings in the channels of streams may cause high water-table conditions to occur during the winter, when it would not be expected. Water-supply wells generally function well with moderate frost protection. Observation wells, however, require additional work to continuously adjust for a frozen-ground phenomenon termed "frost jacking." Water quality in cold regions is commonly affected by reducing conditions, high concentrations of organics and reduced microbial activity. Permafrost can be thawed either by removing insulating vegetation or by regional or global climate warming. This can have significant consequences on water supplies, waste disposal activities, engineered structures, and biological habitats.