The Dallas-Monmouth area, located in the west-central Willamette Valley, Oregon, consists of Tertiary marine and volcanic bedrock units which are locally overlain by alluvium. The occurrence of groundwater with high
salinities has forced many rural residents to use public water supplies. Lithologic descriptions from driller’s logs, geochemical (INAA), and x-ray diffraction analyses were used to determine alluvial facies distribution, geochemical and clay mineral distinctions among the units, and possible sediment sources. Driller’s log, chemical and isotopic analysis, and specific conductance information from wells and springs were used to study the hydrogeologic characteristics of the aquifers and determine the distribution, characteristics, controlling factors, and origin of the problem groundwaters.

Three lithologic units are recognized within the alluvium on the basis of grain-size: 1) a lower fine-grained unit; 2) a coarse-grained unit; and 3) an upper fine-grained unit. As indicated by geochemical data, probable sediment sources include: 1) Cascade Range for the recent river alluvium; 2) Columbia Basin plutonic or metamorphic rocks for the upper fine-grained older alluvium; and 3) Siletz River Volcanics from the west for the coarse-grained sediment of the older alluvium.

The Spencer Formation (Ts) is geochemically distinct from the Yamhill Formation (Ty) and the undifferentiated Eocene-Oligocene sedimentary rock (Toe) with higher Th, Rb, K, and La and lower Fe, Sc, and Co concentrations. The clay mineralogy of the Ty is predominantly smectite (86%) while the Ts contains a more varied clay suite (kaolinite, 39%);
smectite, 53%; and illite 8%). The Ty and Toe are geochemically similar, but are separated stratigraphically by the Ts. The Siletz River Volcanics is distinct from the marine sedimentary units with higher Fe, Na, Co, Cr and Sc concentrations. The Ty and Toe are geochemically similar to volcanic-arc derived sediments while the Ts is similar to more chemically-evolved continental crust material.

Wells that encounter groundwater with high salinities (TDS>300 mg/l): 1) obtain water from the marine sedimentary bedrock units or the older alluvium; 2) are completed within zones of relatively low permeability (specific capacities ≤5 gpm/ft); and 3) are located in relatively low-lying topographic settings. The poor quality waters occurring under these conditions may be due to the occurrence of mineralized, regional flow system waters. Aquifers of low permeability are less likely to be flushed with recent meteoric water, whereas upland areas and areas with little low permeability overburden are likely zones of active recharge and flushing with fresh, meteoric water.

The most saline waters sampled have average isotopic values (δD = -6.7 °/oo and δ18O = -1.7 °/oo) very near to SMOW, while the other waters sampled have isotopic signatures indicative of a local meteoric origin. The Br/Cl ratios of most (10 of 14) of the waters sampled are within 20% of seawater. A marine connate origin is proposed for these waters with varying amounts of dilution with meteoric waters.
and water-rock interaction. The problem waters can be classified into three chemically distinct groups: 1) CaCl₂ waters, with Ca as the dominant cation; 2) NaCl waters with Na as the dominant cation; and 3) Na-Ca-Cl waters with nearly equal Na and Ca concentrations. The NaCl and CaCl₂ waters may have similar marine connate origins, but have undergone different evolutionary histories. The Na-Ca-Cl waters may represent a mixing of the NaCl and CaCl₂ waters.