The karst groundwater resources located within the Burren and Gort lowland regions have important agricultural, ecological, commercial and domestic significance in Ireland. The hydraulic connection between these groundwater sources and the coastal zone makes these systems particularly vulnerable to saltwater intrusion, which may result in the salinization of the freshwater resource. The overall objective of this study was to build on previous investigations and assess the groundwater chemistry in these coastal karstic regions. These data were used to understand the spatial variation in major ion chemistry and nutrient levels of the groundwater sources in the region, and the extent of saltwater intrusion within the groundwater environment.

Figure 1. Location of borehole wells identified and used in this study.

The study area extends along the southern coast of Galway Bay near the town of Kinvarra, Co. Clare and approximately 10 km inland from the coastline.

Figure 2. Piper diagram for samples collected in August 2009.

Background (B) samples
Bicarbonate type waters; Mg and Ca content varies in B waters; Higher Mg generally found in samples from Gort lowlands, likely a result of contact with dolomitic layers.

Saltwater-influenced (S) samples
Higher [Na] & [Cl] compared to B samples; Near coastal wells affected (2, 3, 4, 45 & 48); Well water at one location deviates from mixing line suggesting additional geochemical processes are affecting the waters.

% Seawater in samples (based on C12)
Well 2, 3, 48: ~ 0.5% (May & August 2009); Well 4: ~ 2% (May & August 2009); Well 45: ~ 25% (May 2009); ~ 70% (August 2009).

Other trends
Wells 3 & 48 are B in samples in May 2009. Higher [X] in well 48 (not evident in Piper diagram) may be due to anthropogenic contamination. Seawater contribution is small in most wells, therefore difficult to detect using those methods.

Figure 3. Groundwater salinity and chloride concentrations.

5 samples in Group 1 are influenced by seawater (based on C12), but the well water has low total masses. As a result, salinity is not an accurate indicator of seawater influence in this well (well 2).

5 samples in Group 2 are wells that are intermittently influenced by seawater (wells 3 & 48). The extent of seawater influence in these wells will depend on local conditions such as precipitation, groundwater recharge, and water extraction rates.

Figure 4. Nitrate concentrations, DOC concentrations and temperature values collected on groundwater samples.

5 samples are in the shaded zones.
Nitrate concentrations are below the European communities drinking water parametric value of 50 mg NO3/L and the European communities groundwater threshold value of 37.5 mg NO3/L in all but one sample (not shown). Higher nitrate concentrations may be expected in the groundwater due to poor degradation conditions, but dilution is likely a major control in the karst system.

DOC values are generally higher in May 2009 samples, likely due to agricultural activities.

Although water temperatures may be regulated by heat generated by downhole pumps, general trends show lower temperatures in winter (Feb 2009) compared to other months. Some wells show a greater range in temperature (e.g., 2, 3, 4, & 5), likely due to more unstable flow conditions.

Other trends
Well 2: ~ 25% (May & August 2009); ~ 70% (August 2009).
Well 3 & 48: ~ 25% (May & August 2009); ~ 70% (August 2009).

Figure 5. Results from datalogger installed in well 50.

Water levels respond to Galway Bay tides. The time lag, calculated during periods of low precipitation, is <2 h. Rainfall events take approximately 2 to 3 days to impact water levels in the well.

Figure 6. Maps denoting zones of seawater and tidal influence in the study area.

Wells used for geochemical analysis were not monitored for water levels, but those within the seawater zone are likely tidal. Similarly, geochemical evidence is required to determine if the unused wells are within the seawater-affected zone. However, based on measured conductivity values only one unused well is clearly within the seawater-affected zone (Fig. 5).