For several years much concern has been felt on Long Island because of the overdevelopment of ground-water resources of the western part of the Island. The excessive draft in Kings County has lowered ground-water levels to below sea level over an area of more than 40 square miles--in places to more than 29 feet below sea level. This extensive decline has resulted in considerable encroachment of salt water. The regional draw-down has, of course, spread laterally, although opinion differs greatly as to the distance that the effect has extended eastward on the Island.

The rise and fall of ground-water levels reflect changes of storage in underground reservoirs. As with surface reservoirs, the quantity of water stored in underground reservoirs varies with the amount of intake or recharge and with the amount of discharge or withdrawal. If recharge is in excess of discharge, ground-water storage will increase and ground-water levels will rise. Conversely, if discharge is greater than recharge, ground-water storage will decrease and ground-water levels will decline. Overdevelopment of the ground-water resources of an area will therefore invariably result in a progressive decline of ground-water levels. On the other hand, ground-water levels in areas where overdevelopment has not been critical will display no persistent downward trends. In critical areas, or in areas that may become critical, it is therefore desirable to follow systematically the trends of ground-water-level fluctuations.

In attempting to determine whether ground-water levels have declined progressively as a result of overpumping, one must consider all contributing factors of both recharge and discharge. Chief among the factors of recharge is precipitation, which largely determines the amount of recharge to the underground reservoir. Other factors being equal, ground-water levels will rise during or following periods of heavy precipitation and will decline during or following periods of deficient precipitation. Thus, if over a period of years there is a net decline of ground-water levels of the magnitude that might be expected because of differences of precipitation, such a decline does not indicate overdevelopment.

The trend of fluctuations of ground-water level can be observed in different ways. If periodic water-level observations are available for many wells, maps showing contours on the water table can be prepared from time to time and comparisons can be made among the maps. Such maps are very desirable for certain types of study because they show conditions over large areas on a particular date, but they have many disadvantages for determining the trend of ground-water-level fluctuations. Careful drawing of the maps involves much work, is time consuming, and entails more or less personal interpretation. In many areas water-level measurements are not available at enough locations to provide adequate data for drawing the contours. Furthermore, an erroneous contour pattern may be obtained over a considerable area if data for one or more unsuitable wells are unknowingly used. Water levels in pumped wells, perched water-table wells, or artesian wells are obviously unsuitable for use in drawing contours on the water table because they do not indicate the true position of the main water table.

The trend of ground-water-level fluctuations may be indicated by a comparison of profiles showing water levels on different dates in a line of observation wells. The chief weakness of this comparison is that the fluctuations so shown are representative of only those in a relatively narrow band along the line of wells. This weakness can be overcome, of course, by establishing additional lines of wells; but in order to make comparisons that are representative of the area as a whole, some method for obtaining a mean of all the profiles must be used. Such a method is similar to the average water-level method described below.

Both contour and profile methods of studying ground-water-level trends are reasonably satisfactory for comparing water levels on perhaps two or three dates. Both methods become complicated, cumbersome, and confusing, however, when a comparison is made of water levels on more dates, especially on many successive dates. For example, if comparisons on a yearly basis are desired and the available records cover a period of 8 years, it would be rather difficult to obtain a clear comparison by superimposing eight profiles. If comparisons on a monthly basis are desired, the still greater number of profiles makes the comparisons even more complicated and confusing. Moreover, it may not be practicable to prepare contour maps and profiles once each month for determining changes in ground-water storage.

Trends of ground-water-level fluctuations with the passage of time are shown clearly by a simple graph in which water level is plotted against time. Such a graph shows at a glance the trends that have taken place during the period of record. If periodic measurements of water level in one observation well over a period of years are plotted against time, the graph will show the trends of the fluctuations in the area surrounding that well. An observation well in another part of the area may, of course, show somewhat different fluctuations because of differences of such factors as geology, topography, recharge, and discharge. If water-level data are