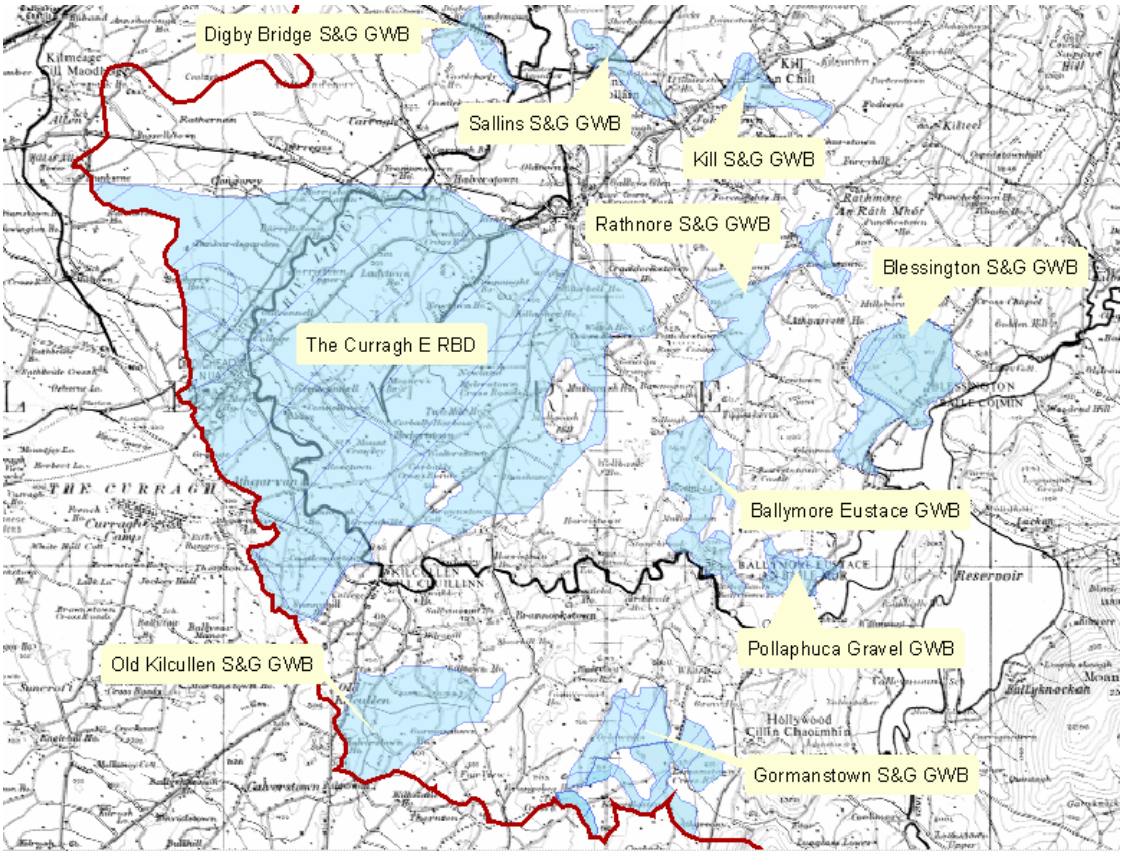
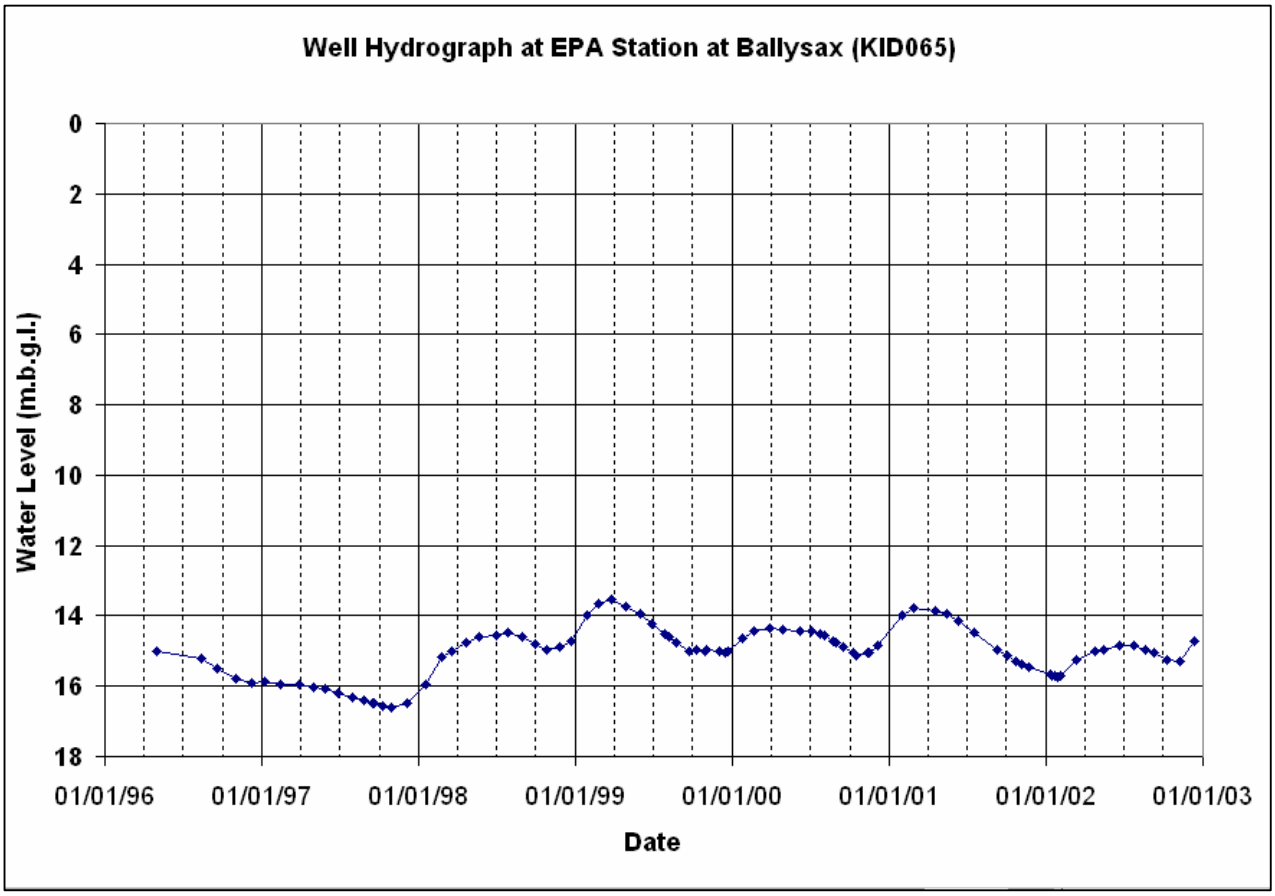
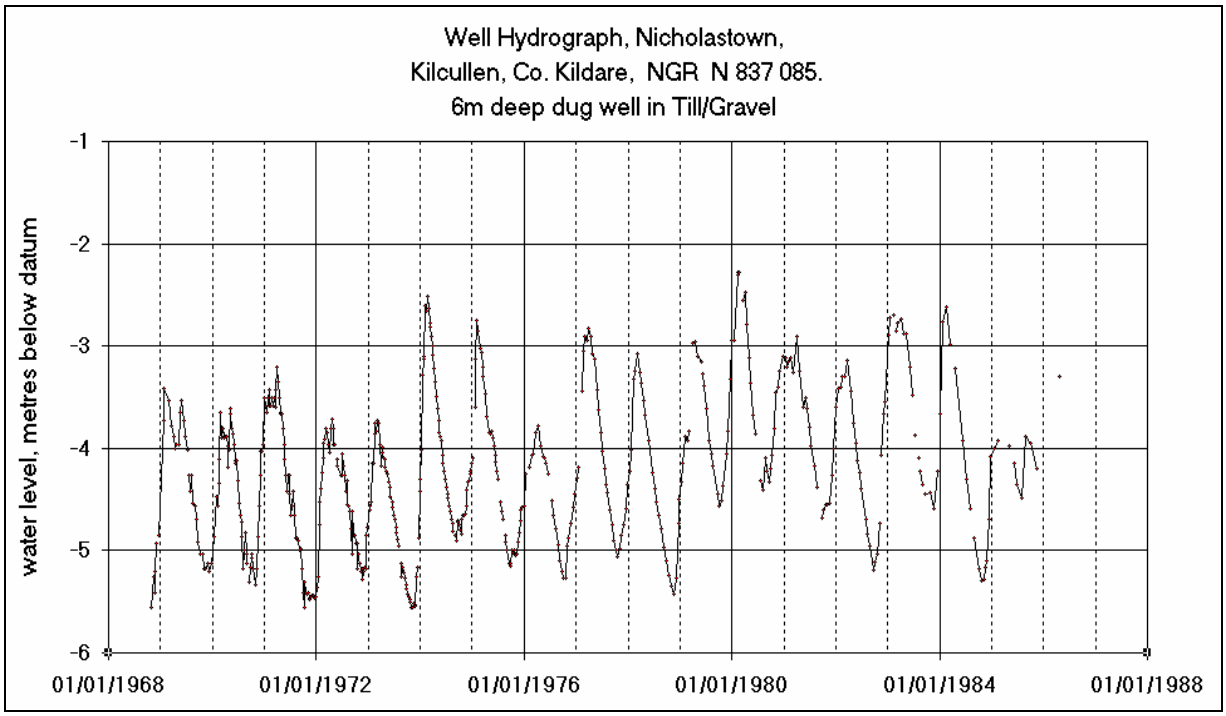
The Curragh (East) GWB: Summary of Initial Characterisation.

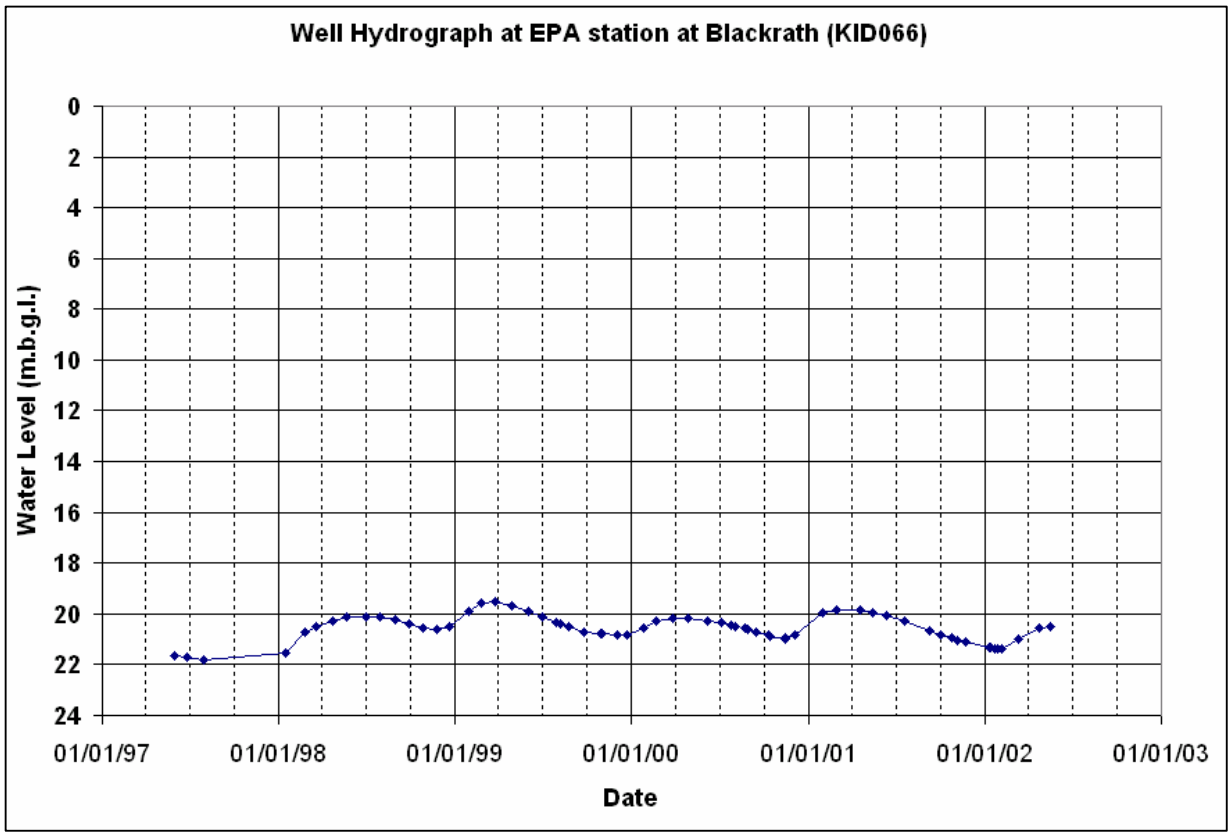
Hydrometric Area Local Authority		Associated surface water bodies	Associated terrestrial ecosystems	Area (km^2)
Kildare Co. Co. Hydrometric Area 09		River Liffey	The Curragh (392), Mouds Bog (SAC 395), Liffey Bank above Athgarvan (1396)	91.4
Topography		This GWB is located in the lowlands of County Kildare. The land surface is mostly flat with gentle undulations. There is an increase in elevation from 80 m OD in the north to around 120 m in the south. To the southeast the aquifer is bounded by the Lower Paleozoic rocks (slates, etc) of the Leinster Massif, and to the northwest by the low ridge of the Chair Hills - notably Dunmurry Hill, Grange Hill, the Chair of Kildare and the Hill of Allen - again mainly composed of pre-Carboniferous rocks. The land surface is highest along the NW to SE trending boundary between the SE and E RBDs; the elevation reduces to the southwest.		
Geology and Aquifers	Aquifer type(s)	**Rg**: Regionally Important Sand and Gravel Aquifer.		
	Main aquifer lithologies	SAND & GRAVEL - Grain size data are available for eight of twenty-six samples taken from a well drilled by the GSI in 1980 at the Curragh Camp. The particle size distribution curves show fines of less than 8%. These samples also show the variability of the aquifer material, consisting largely of sand & gravel horizons and occasional till horizons.		
	Key structures.	The geological structure of the area was important in the deposition of this aquifer but does not have a controlling effect on current groundwater flow.		
	Key properties	Porosities are estimated to be about 30-40% (Hayes, 2001). Permeabilities are estimated from test pumping to be in the order of 15-50 m/d. The bulk permeability of the aquifer is estimated to be 100 m/d for aquifer modelling purposes (Hayes, 2001). A number of gravel pits are located in the southern part of the GWB.		
	Thickness	The Mid-Kildare Gravel Aquifer lies in a shallow trough oriented NE-SW, in the surface of the limestone bedrock. It is the bedrock surface topography which primarily controlled the depth of this aquifer. The areas of greatest thickness are to the northeast along the drainage divide where it can be up to 70 m thick in places. This thickness reduces away from this area of higher elevation.		
Overlying Strata	Lithologies	At the surface there are large areas of till capping the sand & gravel aquifer		
	Thickness	White Young Green (2002) indicate that the thickness of the tills is generally less than 3 m		
	% Area aquifer near surface	There is a relatively high proportion of sand and gravel near the surface because the till overlying the aquifer is quite thin.		
	Vulnerability	High		
Recharge	Main recharge mechanisms	This GWB is recharged from rainwater percolating through the topsoil and unsaturated sand and gravel deposits. Surface runoff from such gravel aquifers is considered to be low, not more than 20% of effective rainfall. Less permeable layers in the deposit, even if thin, can create perched water tables and prevent recharge of the true water table. Where the water table lies below the local river network it is likely that some stream water may pass into the aquifer. This will be most likely in the higher elevations where a river flows onto the aquifer from where it has previously been flowing over impermeable subsoil or bedrock.		
	Est. recharge rates	Detailed recharge estimates modelled for the Mid-Kildare Aquifer, as part of the hydrogeological investigation for the Kildare Bypass, are around 415 mm/year for the area of the Curragh Camp (White Young Green, 2002).		
Discharge	Springs and large known abstractions	St. Patrick's Well (Spring), Lewistown, Ballysax.		
	Main discharge mechanisms	The main discharge mechanisms present are baseflow discharge to rivers, seepages at the extremities of the body and discharge via springs. Where the water table is sufficiently close to the surface such that the riverbed elevation is lower than it is, the aquifer will contribute groundwater to the river. High Dry Weather Flow values observed at river gauges within the aquifer supports this. The occurrence of springs in a gravel aquifer is unusual, as these are more commonly associated with Karstic aquifers. It is considered that the discharges from such areas were initial small seepages, which were then altered by man to increase the flow. Natural processes can also lead to the convergence of flow at these springs.		
	Hydrochemical Signature	The majority of sediments in this aquifer are **Calcareous**; some sediments derived from granite are reported at depth but their effect on surface water bodies will be negligible. The analyses indicate a hard to very hard water for both Curragh Camp supply boreholes (251-350->350 mg/l). Average Electrical Conductivity in this area is 665 µS/cm, which is quite high.		
Groundwater Flow Paths		Variability in the aquifer material influences the hydrogeological behavior of the aquifer. The aquifer is unconfined in most places. Static water gradients are estimated from the water table contours produced by Wright (1988) and from contours produced by White Young Green (2002) to be in the order of 0.002. The velocity of groundwater flow is considered to be 1 m/day.		

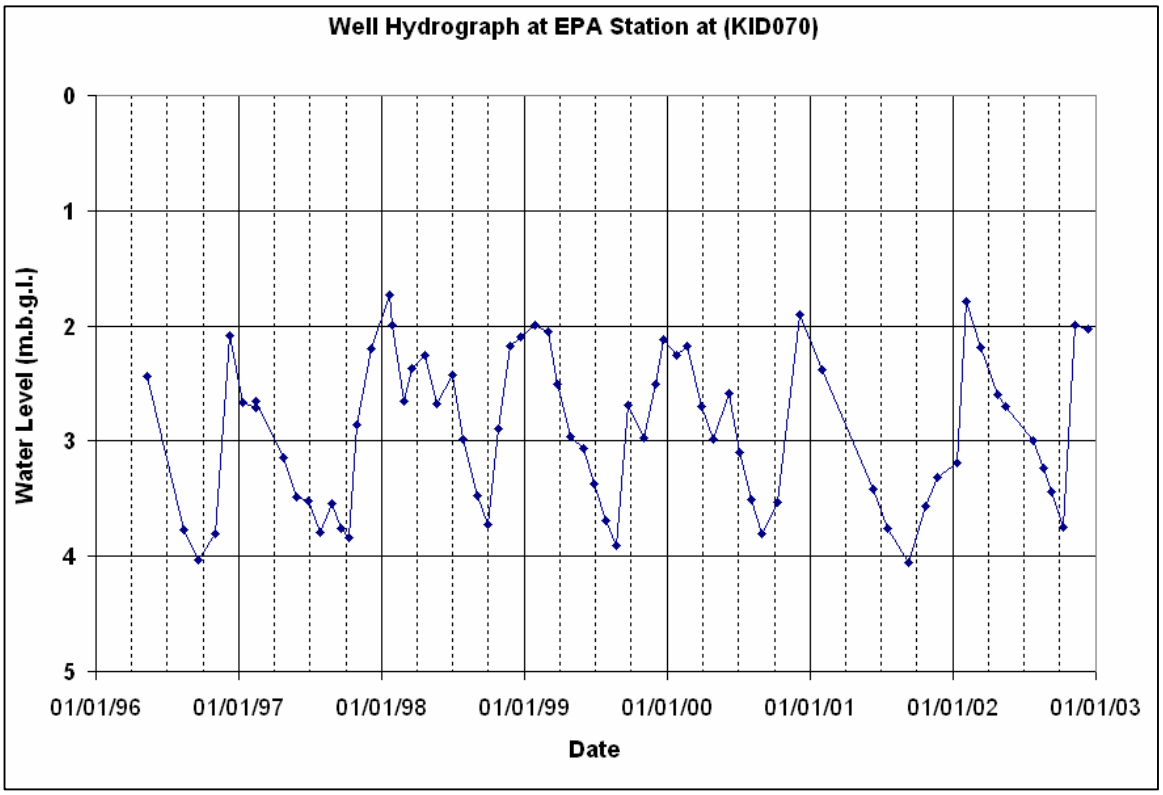
Groundwater & surface water interactions	The Mid-Kildare Aquifer is a feeder for the Grand Canal and an important source of baseflow for the streams and rivers. This is supported by the estimated flow from the aquifer to the Milltown Feeder at Pollardstown Fen of approximately 25,000 m^3/day (Daly, D. 1981). It is also supported by high specific dry weather flow for the Tully stream, which is calculated as 3.9 l/sec/km^2 (figures above 2 l/sec/km^2 are considered to indicate significant baseflow). The aquifer provides baseflow for the major river catchments in Kildare, namely the Liffey, the Barrow and the Boyne. The Pollardstown Fen also derives its water from the aquifer.
Conceptual model	The boundaries of the aquifer are quite well defined to the southeast by topography and southwest by the boundary between the South Eastern RBD and the Eastern RBD but elsewhere the extent of the aquifer is not at definitive. For the purposes of this evaluation the aquifer has been defined by the existence of at least 5 metres of saturated sand/gravel as seen from the borehole evidence. The aquifer has intergranular permeability. The permeability and thickness of the deposits and the water table gradient control the flow of groundwater. The aquifer is considered to be highly permeable since the covering of till over the gravel is not substantial in the majority of the area. Groundwater recharge is disperse and autogenic, these recharging waters flow into the Liffey Catchment by discharging directly to the Liffey itself which crosses the GWB or as seepage and springs at the edge of the GWB which then join tributaries of the Liffey.
Attachments	Hydrographs for boreholes KID065, KID066, KID070 & 2619NEW397
Instrumentation	Stream gauge: None Borehole Hydrograph: KID070, KID065, KID066 *In addition, as part of the current work being done on the Kildare by-pass there is regular monitoring of wells around the aquifer to provide information on the aquifers response to the construction of the by-pass.* EPA Representative Monitoring boreholes: None
Information Sources	McConnell B, Philcox M, Sleeman A G, Stanley G, Flegg A M, Daly E P, Warren W P (1994) *A Geological description to accompany the Bedrock Geology 1:100,000 Scale Map Series, Sheet 16, Kildare-Wicklow*. Geological Survey of Ireland, 70 pp. Daly D (1981) Pollardstown Fen. Hydrogeological Assessment of the Effects of Drainage on the Water Supply to the Grand Canal. Internal Report, Geological Survey of Ireland, 40pp. Hayes T, Sutton S, Cullen K, Faherty J (2001) The Curragh Aquifer: Current Conceptual Understanding & Numerical Modelling. Proceedings 21st Annual Seminar, IAH Irish Group 16-17 October 2001, Tullamore. K T Cullen - White Young Green Ltd (2000) Groundwater Abstraction at Kilkea Lodge Farm. Kelly C, Fitzsimons V (2002) County Kildare Groundwater Protection Scheme. Report for Kildare County Council. Geological Survey of Ireland. Wright G R (1988) *The Mid-Kildare Gravel Aquifer*. Proceedings 8th Annual Seminar, IAH Irish Group, Portlaoise, 10pp.
Disclaimer	Note that all calculation and interpretations presented in this report represent estimations based on the information sources described above and established hydrogeological formulae


Digby Bridge S&G GWB
Sallins S&G GWB
Kill S&G GWB
Rathnore S&G GWB
Blessington S&G GWB
The Curragh E RBD
Ballymore Eustace GWB
Pollaphuca Gravel GWB
Old Kilcullen S&G GWB
Gormanstown S&G GWB


Well Hydrograph at EPA Station at Ballysax (KID065)
Water Level (m.b.g.l.)
0
2
4
6
8
10
12
14
16
18
01/01/96
01/01/97
01/01/98
01/01/99
01/01/00
01/01/01
01/01/02
01/01/03
Date


Well Hydrograph, Nicholastown,
Kilcullen, Co. Kildare, NGR N 837 085.
6m deep dug well in Till/Gravel
water level, metres below datum
-1
-2
-3
-4
-5
-6
01/01/1968
01/01/1972
01/01/1976
01/01/1980
01/01/1984
01/01/1988


Well Hydrograph at EPA station at Blackrath (KID066)
Water Level (m.b.g.l.)
0
2
4
6
8
10
12
14
16
18
20
22
24
01/01/97
01/01/98
01/01/99
01/01/00
01/01/01
01/01/02
01/01/03
Date


Well Hydrograph at EPA Station at (KID070)
Water Level (m.b.g.l.)
0
1
2
3
4
5
01/01/96
01/01/97
01/01/98
01/01/99
01/01/00
01/01/01
01/01/02
01/01/03
Date