

APPENDICES

Appendix B

Summary of Geology and Hydrogeology of the South Eastern River Basin District

South Eastern River Basin District Subsoils

The subsoils overlying the bedrock were deposited during the Quaternary period from the beginning of the Ice Age approximately 1.6 million years ago to the present time. The origins of the subsoils are associated with the movement of ice sheets that extended from the north and across the Irish Sea Basin.

The deposits from the ice sheets in-filled or partially in-filled hollows and valleys in the pre-glacial topography. These deposits were laid down in three phases of glaciation (Meehan 1997). The finer grained materials such as clays silts and sands are generally associated with advancing ice-sheets while the coarser grained materials sands and gravels are generally associated with retreating ice sheets. More recently fine grained alluvial deposits can be found along the main river floodplains as a result of deposition after periods of high river flows.

South Eastern River Basin District Bedrock

In the western portion of the South Eastern River Basin District the higher ground generally comprises Devonian, Silurian and Ordovician sandstones, siltstones, mudstones and conglomerates with progressively younger Carboniferous shales and limestones occupying the valley floors. The Slieve Bloom, Silvermines and Galtee Mountains define the northwestern and western margins of the basin while the Knockmealdown, Monavullagh and Commeragh Mountains define the south western margins of the basin. The southern and eastern margins of the basin are defined by the coastal areas of Waterford and Wexford.

The high ground in the central portion of the catchment is dominated by the Castlecomer Plateau comprising Carboniferous sandstones, siltstones and shales interbedded with coal measures, and the Slieve Ardagh Hills to the north of Roscrea comprising shales, sandstones and limestones with coal seams.

In the east the rocks are generally older with the oldest rocks occurring in the southeast corner of the district around Carnsore Point in Wexford. Much of the eastern area is dominated by the granites of the Leinster Batholith from the Wicklow Mountains to the Blackstairs Mountains between Carlow and Wexford. The south eastern area comprises Ordovician volcanic and sedimentary rocks that have been metamorphosed by the intrusion of the granites.

Detailed information on the geology and hydrogeology of each of the Hydrometric Areas in the South Eastern River Basin District is presented in the Report on the Geology and Hydrogeology of the South Eastern River Basin District and is summarised below.

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Hydrometric Area 11 - Wexford (East)

Geology

Subsoil

The subsoil in the catchment comprises glacial tills and sand and gravels in the higher ground, with alluvial deposition around the flood plains of the Owenavarragh, Tinnock and Ballydesmond Rivers.

A very distinctive area of small hills and water-filled hollows between Kilmuckridge and Curraclloe is known as the Screen Hills Moraine. It is considered to be a classic example of a Kame and Kettle Moraine, formed as the margins of the ice sheets started to melt. Sea cliffs cutting across the Screen Hills reveal that they are composed of sands, gravels and tills in which marine shells and shell fragments are found. The subsoil sequence locally is up to 100 m thick.

Bedrock

The bedrock geology of Area 11 is summarised below.

Summary of the Bedrock Geology of Hydrometric Area 11

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Cahore Group	Greywackes-They form the bedrock from the coast around Cahore Point running SW to Taghmon	P1	No Data Available
Newtown Fm	Grey-green greywacke and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon	L1	No Data Available
Ballyhoge Fm	Dark grey Slates with siltstone laminae-part of the lower and upper successions in the Ribband Group	L1	No Data Available
River Chapel Fm	Purple buff and green slates-underlies much of the central portion of the Hydrometric Area	L1	No Data Available
Ballylane Fm	Green and grey Slate with thin siltstone-found in succession in the northern portion of the area	P1	No Data Available
Oaklands Fm	Green, red-purple buff slate and siltstone-found in succession in the northern portion of the area	L1	No Data Available
Campile Fm	Rhyolites and rhyolitic tuffs-these rocks stretch from Courtown in the east to Camolin in the west	Regionally Important	No Data Available
Ballymartin Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Regionally Important	No Data Available
Ballysteen Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Regionally Important	No Data Available
Wexford Fm	Carboniferous Limestones and calcareous shales- the youngest rocks in Area 11 at the southern end of Area 11	Rf	No Data Available

Hydrogeology

Subsoil

The subsoil consists of sands and gravels, clays and tills of variable extent and thickness. These deposits play a key role in the groundwater flow regime within the catchment. The hydrogeological significance of the materials depends on their permeability. For example, low permeability clays and glacial tills offer protection to underlying bedrock aquifers, restrict recharge to them and where present in sufficient thickness confine the bedrock aquifers.

Higher permeability sands and gravels allow a high level of recharge and provide additional storage to the underlying bedrock aquifers. Where the sands and gravels are of significant extent and thickness they may be considered as aquifers in their own right. In east Wexford the sands and gravels are sufficiently thick (15 - 50 m) and extensive to be considered as a Regionally Important Aquifer with yields ranging between 500 – 1500 m³/d.

Bedrock

The bedrock geology across the country is such that there is little or no bedrock with intergranular (primary) permeability. Virtually all of the bedrock contains water as a result of the presence of fractures, fissures, faults and dissolution of the bedrock as a result of interaction with water movement. The nature and composition of the bedrock therefore determines its hydrogeological significance.

In Area 11 the Lower Carboniferous limestones of the Wexford and Ballysteen formations can yield significant groundwater supplies and are considered to be Regionally Important bedrock aquifers with yields ranging from 400 - 2,500 m³/d. The Ordovician Volcanics and Campile Formation which are up to 1500m thick are also considered to be Regionally Important bedrock Aquifers with yields ranging from 400 - 2000 m³/d.

Other rocks in the region are considered to be locally important to poor aquifers. These aquifers generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Hydrometric Area 12 - The Slaney River Catchment

Geology

Subsoil

The subsoil in the catchments comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the Slaney the Bann, the Urrin, the Boro and the Tinnacross Rivers and streams. Limestone erratics occur in the glacial deposits around Tullow and

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Shillelagh. The rich soils of the Tullow lowlands originate from the high concentration of limestone based erratic material in the glacial deposits and from the parent bedrock material beneath.

Bedrock

The bedrock geology is summarised below

Summary of the Bedrock Geology of Hydrometric Area 12

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Butter Mountain Fm	Dark slate, schist, quartzite and coticule-at the northern portion of Area 12	L1	High-Extreme
Tullow Pluton	Granite-part of the Leinster Batholith-at the northern portion of Area 12.	P1	High-Extreme
Newtown Fm	Grey-green greywacke and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon	L1	No Data Available
Cullenstown Fm	Grey-green metagreywackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Cullentra Fm	Grey-green metagreywackes and slates -form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Shelmaliere Fm	White, purple quartzites with slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Ballyhoge Fm	Dark grey slates with siltstone laminae-underlies much of the central portion of Area 12	L1	No Data Available
River Chapel Fm	Purple buff and green slate-underlies much of the central portion of Area 12	L1	No Data Available
Ballylane Fm	Green and grey slate with thin siltstone	L1	Extreme
Oaklands Fm	Green, red-purple buff slate and siltstone-found in succession in the northern portion of the area	L1	No Data Available
Maulin Fm	Dark grey-blue slate, phyllite and schist	L1	High-Extreme
Campile Fm	Rhyolites and rhyolitic tuffs-these rocks stretch from Courtown in the east to west Waterford	Regionally Important	No Data Available
Ballysteen Fm	Limestone and calcareous shales-in the southern end of Area 12	Regionally Important	No Data Available
Wexford Fm	Limestone and calcareous shales-dolomitised along the coast in Wexford Harbour	Regionally Important	No Data Available
Ballymartin Fm	Limestone and calcareous shales in the southern end of Area 12	L1	No Data Available

Hydrogeology

Subsoil

The subsoil deposits consist of sands and gravels, clays and tills of variable extent and thickness. These deposits play a key role in the groundwater flow regime within the catchment. The hydrogeological significance of the materials depends on their permeability. For example, low permeability clays and glacial tills offer protection to underlying bedrock aquifers, restrict recharge to them and where present in sufficient thickness confine the bedrock aquifers.

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Higher permeability sands and gravels allow a high level of recharge and provide additional storage to the underlying bedrock aquifers. Where the sands and gravels are of significant extent and thickness they may be considered as aquifers in their own right.

In Area 12 sands and gravels along the River Slaney to the north and south of Enniscorthy are sufficiently thick (10 - 20 m) and extensive to be considered as a Regionally Important Aquifer with yields ranging between 500 - 1500 m³/d.

Bedrock

In Hydrometric Area 11 the Lower Carboniferous limestones of the Wexford and Ballysteen formations can yield significant groundwater supplies and are considered to be Regionally Important bedrock aquifers with yields ranging from 400 - 2,500 m³/d.

The Ordovician Volcanics and Campile Formations which are up to 1500 m thick are also considered to be Regionally Important bedrock Aquifers with yields ranging from 400 - 2000 m³/d.

Other rocks in the region are considered to be locally important to poor aquifers. These aquifers generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Hydrometric Area 13 - South Wexford

Geology

Subsoil

The subsoil in the catchments comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the Bridgetown, Battlestown, Cleristown, Corock, Dunormick, Mulmonty, Owenduff and Tintern Abbey Rivers and streams.

Bedrock

The bedrock geology is summarised below.

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Summary of Bedrock Geology of Hydrometric Area 13

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Campile Fm	Rholites and rhyolitic tuffs-these rocks stretch from Courtown in the east to west Waterford	Rf	No Data Available
Ballylane Fm	Green and grey slates-NW margins of the area	P1	No Data Available
Oaklands Fm	Green, purple and red buff slate-NW margins of the area	L1	No Data Available
Ballyhoge Fm	Slates and siltstones-central portion of the area	L1	No Data Available
Newtown Fm	Grey-green greywackes and slates-form the bedrock from the coast around Cahore Pt running SW to Taghmon		No Data Available
Ardenagh Fm	Grey-green greywackes with slate-to the east of the Ballyhoge Fm	P1	No Data Available
Cullenstown Fm	Grey-green metawackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Cullentra Fm	Grey-green metawackes and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Shelmaliere	White, purple quartzites and slates-form the bedrock to the SW of Wexford Harbour	P1	No Data Available
Ballymartin Fm	Limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	L1	No Data Available
Ballysteen Fm	Limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	Rf	No Data Available
Wexford Fm	Dolomitised limestones and calcareous shales-from the coast to the south of Wexford Harbour SW to Ballyteige Bay	Regionally Important Aquifer	No Data Available
Greenore Pt Group	Amphibolites and shists-the oldest rocks in the SE region	P1	No Data Available
Kilmore Quay Group	Amphibolites and shists-the oldest rocks in the SE region	P1	No Data Available
Ballycogly Group	Metasediments-highly deformed	P1	No Data Available

Hydrogeology

Subsoil

The subsoil deposits consist of sands and gravels, clays and tills of variable extent and thickness. These deposits play a key role in the groundwater flow regime within the catchment. The hydrogeological significance of the materials depends on their permeability. For example, low permeability clays and glacial tills offer protection to underlying bedrock aquifers, restrict recharge to them and where present in sufficient thickness confine the bedrock aquifers.

Higher permeability sands and gravels allow a high level of recharge and provide additional storage to the underlying bedrock aquifers. Where the sands and gravels are of significant extent and thickness they may be considered as aquifers in their own right.

In Area 13 some sands and gravel deposits are sufficiently thick (10-20m) and extensive to be considered as a Regionally Important Aquifer with yields ranging between 500 – 1500m³/d.

Bedrock

In Area 13 the Lower Carboniferous limestones of the Wexford and Ballysteen formations can yield significant groundwater supplies and are considered to be Regionally Important bedrock aquifers with yields ranging from 400 – 2,500 m³/d particularly where they are dolomitised to the southeast of Wexford Harbour.

The Precambrian and Lower Palaeozoic Volcanics and Campile Formations, which are up to 1500 m thick, are also considered to be Regionally Important bedrock Aquifers with yields ranging from 400 – 2000 m³/d. Other rocks in the region are considered to be locally important to poor aquifers.

Hydrometric Area 14 – The Barrow River Catchment

Geology

Subsoil

The subsoil in Area 14 comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the River Barrow and associated tributaries. Substantial thickness of sand and gravel deposits have been found along the River Barrow in Carlow.

The presence of sand and gravels is often reflected in the topography as esker ridges, hummocks and hollows (kames and kettle holes) or in large fan shaped outwash deposits. Glacial tills and sand and gravels are often founded as mixed deposits throughout the upper and middle portions of the catchment.

Peat deposits are also wide spread particularly in Counties Offaly and Laois. Two main types of peat are distinguishable. Blanket bog which is characteristic of upland areas with excessive rainfall, such as Slieve Bloom and raised bogs which are characteristic of lowland areas with poor drainage. Lake deposits comprising fine silty alluvium have also been mapped in the northern portion of the catchment around Monasterevin.

Marl deposits comprising white, sometimes shelly, calcium carbonate materials are found in the northwestern reaches of the catchment around Portarlinton and east of Tullamore.

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Bedrock

The bedrock geology of Area 14 is summarised below.

Summary of the Bedrock Geology of Hydrometric Area 14

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Calp Fm	Dark, well bedded fine grained limestones and calcareous mudstones – central portion of the upper catchment	L1	Moderate-High
Allenwood Fm	Poorly bedded coarse grained limestones-northwestern portion of the catchment	Rf	High
Edenderry Fm	Poorly bedded, oolitic limestone-northwestern portion of the catchment	Lm	Moderate
Lucan Fm	Well bedded fine grained limestones and calcareous mudstones-northwestern portion of the catchment	L1	Moderate-High
Cadamstown Fm	Medium to coarse grained pale coloured sandstones with red and green siltstones-bedrock of Slieve Bloom	Rf	Low-Moderate at the centre of the Fm, Extreme at the edges
Lower Lst Shales	Underlying the foothills of Slieve Bloom	Pu	Ranges from Moderate-Extreme
Waulsortian Fm	Pale grey, crystalline, fossiliferous fine grained limestone that is often dolomitised-central and north Laois	L1-Rk	Moderate-High
Ballysteen Fm	Dark grey fine to coarse grained muddy limestone- in South Offaly and central and northern Laois	P1	Low-High
Boston Hill Fm	Nodular and irregularly bedded limestones-NE of Area 14	L1	Mainly High, Low at the centre of the Fm
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with thin clay layers-primarily found around Stradbally in Co.Laois	Rk	Low-Moderate at the north of the Fm, High-Extreme at the south of the Fm
Tullow Pluton	Granite-part of the Leinster Batholith.	P1	High
Maulin Fm	Dark grey-blue slate, phyllite and schist-across the catchment from northeast to southeast	L1	High-Extreme
Ballylane Fm	Green and grey slate with siltstone	P1	Extreme
Milford Fm	Varied limestone successions (partly dolomitised) dominantly coarse grained-extending from Kildare along the eastern margins of the catchment to Leighlinbridge in Co.Carlow	Regionally Important	Moderate-High
Butlersgrove Fm	Dark, grey argillaceous limestone	Rk	High-Extreme
Campile Fm	Rhyolites, rhyolitic tuffs and felsic volcanics-found in the SE of Area 14	Rf	No Data Available

Hydrogeology

Subsoil

The subsoil deposits consist of sands and gravels, clays and tills of variable extent and thickness. These deposits play a key role in the groundwater flow regime within the catchment. Higher permeability sands and gravels allow a high level of recharge and provide additional storage to the underlying bedrock aquifers. Where the sands and gravels are of significant extent and thickness they may be considered as aquifers in their own right.

Many Locally Important sand and gravel aquifers occur in Offaly and Laois. Regionally Important sufficiently thick (10 - 20 m) and extensive enough to be considered as a Regionally Important Aquifer with yields ranging between 400 - 1500 m³/d have been identified at Dangan in Co. Offaly, in South Laois along the River Barrow. Further sand and gravel aquifers have been identified along the Barrow in County Carlow around Carlow town.

Bedrock

In Area 14 the Clogrennan, Ballyadams, Allenwood, Milford and Waulsortian formations are considered to be Regionally Important bedrock aquifers with yields ranging from 400 - 2,500 m³/d. Many of these formations have enhanced yields due to karstification. These include the Milford, Ballyadams Allenwood and Waulsortian Formations. The Campile Formation in the south of the catchment is also considered to be a Regionally Important Aquifer.

Many of the Ordovician and Devonian sedimentary rocks are considered to be Locally Important Aquifers. Some of the locally important aquifers can produce high yielding wells locally. Other formations such as the Moyadd Coal Formation along the Castelecomer Plateau and Lower Limestone Shales are considered poor aquifers and generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Hydrometric Area 15 - The Nore River Catchment

Geology

Subsoil

The subsoil in Area 15 comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the River Nore and associated tributaries. The presence of sand and gravels is often reflected in the topography as esker ridges, hummocks and hollows (kames and kettle holes) or in large fan shaped outwash deposits. Significant deposits are also found along the River Nore River. Glacial tills and sand and gravels are often founded as mixed deposits throughout the upper and middle portions of the catchment in Offaly, North and South Tipperary and Kilkenny.

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Peat deposits are also wide spread particularly in Counties Offaly, North and South Tipperary. Two main types of peat are distinguishable. Blanket bog which is characteristic of upland areas with excessive rainfall, such as Slieve Bloom and raised bogs which are characteristic of low land areas with poor drainage. Lake deposits comprising fine silty alluvium have also been mapped primarily in the North Tipperary.

Marl deposits comprising white sometimes shelly calcium carbonate materials are found in Offaly and South Tipperary.

Bedrock

The bedrock geology of Area 15 is summarised below

Summary of the Bedrock Geology of Hydrometric Area 15

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Cadamstown Fm	Red and green siltstones and mudstones-bedrock of Slieve Bloom	Rf	High
Lower Lst Shales	Foothills of Slieve Bloom	Pu	Moderate
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with clay layers-lowlands to the south of Slieve Bloom	Rk	Moderate-High
Aghmacart Fm	Dark shaly micrite, peloidal limestone-to the NW of Slieve Ardagh extending from the southern foothills of Slieve Ardagh to the northern catchment boundary	Pl	Moderate-Extreme
Butlersgrove Fm	Dark, grey argillaceous limestone-SE of Kilkenny City around Bennetsbridge	Rk	Moderate-Extreme
Waulsortian Fm	Pale grey, crystalline, fossiliferous fine-grained limestone, often dolomitised-to the west of Slieve Ardagh around Rathdowney	Rk	Low-High
Ballysteen Fm	Dark grey fine to coarse grained muddy limestone-south of Slieve Bloom extending from north of Roscrea to the northern margins of the catchment in Co.Laois	Pl	High with patches of Low and Extreme Vulnerability
Porters Gate Fm	Devonian bedrock-south of the Ballysteen limestone around Thomastown	Rf	Low
Kiltorcan Fm	Devonian bedrock-south of the Ballysteen limestone around Thomastown	Rf	High-Extreme
Coolbaun Fm	Westphalian Coal Measure-core of the Castlecomer Plateau Syncline	Lm	Moderate at the centre of the Fm, Extreme at the edge
Bregaun Flagstone	Namurian Shales and sandstones-beneath the Coal Measures	Pl	Extreme with patches of Low Vulnerability
Kilsheelin Fm	Siltstones-beneath the Coal Measures	Rk	Extreme
Clogrenan Fm	Cherty bluish limestones-exposed along the margins of the Castlecomer Plateau	Rk	High-Extreme
Lickfinn Fm	Sandstone, shale, fireclay and coal seams-the core of Slieve Ardagh	Lm	Low-Extreme
Maulin Fm	Dark grey-blue slate, phyllite and schist-to the southern end of Area 15	Ll	High-Extreme
Ballylane Fm	Green and grey slates-to the southern end of	Pl	Extreme

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	Area 15		
Oaklands Fm	Green, purple and red buff slate to the southern end of Area 15	LI	Extreme

Hydrogeology

Subsoil

Many Locally Important sand and gravel aquifers occur in Offaly, Laois, Tipperary and Kilkenny. Regionally Important sand and gravel aquifers sufficiently thick (10-20 m) and extensive to be considered as a Regionally Important Aquifer have been identified at Roscrea in North Tipperary, The Nore Valley and Killnamanagh Aquifers in Co Kilkenny, North, West, and South of Camross in Co Laois.

Bedrock

In Area 15 the Clogrennan, Cadamstown, Ballyadams, Kilsheelin, Kiltorcan, Porters Gate and Waulsortian formations are considered to be Regionally Important bedrock aquifers with yields ranging from 400 - 2,500 m³/d. Many of these formations have enhanced yields due to karstification. These include the Ballyadams, Kilsheelin and Waulsortian Formations.

Many of the other rocks are considered to be Locally Important Aquifers such as the Aghmacart Limestone, Ballysteen Limestone, Butlersgrove Formations. Some of the locally important aquifers can produce high yielding wells locally. Other formations such as the Moyadd Coal Formation along the Castlecomer Plateau, the granites and Lower Limestone Shales are considered poor aquifers and generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Hydrometric Area 16 - The Suir River Catchment

Geology

Subsoil

The subsoil in Area 16 comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the River Suir and associated tributaries. The presence of sand and gravels is often reflected in the topography as esker ridges, hummocks and hollows (kames and kettle holes) or in large fan shaped outwash deposits. Significant deposits are also found along the River Suir. Glacial tills and sand and gravels are often founded as mixed deposits throughout the upper and middle portions of the catchment in North and South Tipperary and South Kilkenny and North Waterford.

Peat deposits are common in North Tipperary. Two main types of peat are distinguishable. Blanket bog which is characteristic of upland areas with excessive rainfall, and raised bogs which are

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characteristic of low land areas with poor drainage. Some Peat deposits are also found in West Waterford. Lake deposits comprising fine silty alluvium have also been mapped primarily in the North Tipperary and Kilkenny.

Bedrock

The bedrock geology of Area 16 is summarised below.

Summary of the Bedrock Geology of Hydrometric Area 16

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Cappagh White Fm	Red and white sandstones-northern margins of Area 16	L1	High-Extreme
Kiltorcan Fm	Yellow and red sandstones and green mudstones-northern margins of Area 16	Rf	Extreme with small areas of Low
Galtymore Fm	Devonian thick-bedded pale red sandstones-western margins of Area 16 and foothills of the Knockmealdowns	P1	Extreme
Inchacomb Fm	Greywacke and dark green shale-western margins of Area 16	P1	High-Extreme
Ballysteen Fm	Fossiliferous dark grey muddy limestones along the foothills of the Silvermines	L1	High-Extreme
Knockmealdown Fm	Medium grained pink-purple sandstones – the Knockmealdown Mountains	L1	High-Extreme
Waulsortian Fm	Massive unbedded limestone-underlies much of the northern portion	Rk	High
Aghmacart Fm	Dark shaly micrite, peloidal limestone-basin floor of the northern portion of Area 16	P1	High
Ballyadams Fm	Grey thick-bedded coarse grained fossiliferous limestone with thin clay layers-lowland valley floors	Rk	Moderate-Extreme
Lagganstown Fm	Lowland valley floors	P1	Moderate-Extreme
Ballindysert Fm	Grey slates and greywackes	L1	High-Extreme
Hollyford Fm	Sandstones and Shales	Pu	High-Extreme
Durrow Fm	Fossiliferous limestones, some oolitic, and shales	P1	Moderate-High
Suir Fm	Pale-grey coarse limestones with shelly bands	Rk	Extreme with Moderate Vulnerability to the north of the Formation
Clogrenan Fm	Cherty bluish limestones–exposed along the margins of the Castlecomer Plateau	Rk	High-Extreme
Kilsheelin Fm	Siltstones-beneath the Coal Measures	Rk	Ranges from Low-Extreme

Hydrogeology

Subsoil

The subsoil deposits consist of sands and gravels, clays and tills of variable extent and thickness. Many Locally Important sand and gravel aquifers occur in North Tipperary and Waterford. The

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Birdhill gravel aquifer extends from east of Silvermines in Tipperary to Co. Clare and has an approximate area of 38 square kilometres. Other deposits occur along the River Suir around Lismore in Waterford and Newport along the Tipperary Limerick border. No Regionally Important sand and gravel aquifers have yet been delineated within the catchment area though some may be present.

Bedrock

In Area 16 the Ballyadams, Kilsheelin, Kiltorcan, Porters Gate and Waulsortian formations are considered to be Regionally Important bedrock aquifers with yields ranging from 400 - 2,500 m³/d. Many of these formations have enhanced yields due to karstification. These include the Ballyadams, Kilsheelin and Waulsortian Formations.

Many of the other rocks are considered to be Locally Important to poor Aquifers such as the Aghmacart Limestone, Ballysteen Limestone, Coumshingaun and Tranearla Formations. Some of the locally important aquifers can produce high yielding wells locally. Other formations such as the Lower Limestone Shales are considered poor aquifers and generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Hydrometric Area 17 - East Waterford

Geology

Subsoil

The subsoil in the catchments comprises glacial tills and sand and gravels in the higher ground with alluvial deposition around the flood plains of the Araglin, Brickey, Dalligan, Dunhill, Mahon and the Tay Rivers and streams.

Within Area 17 Irish Sea till comprising relatively stone free, chocolate-brown calcareous silty matrix occurs in the coastal areas. Further inland the till varies from massive structureless stoney-sandy deposits to gravelly tills. Detailed information on the subsoil distribution is presented in the GSI Groundwater Protection Scheme and associated map sheets prepared on behalf of Waterford County Council in 1998.

Bedrock

The bedrock geology of Area 17 is summarised below.

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Summary of the Bedrock Geology of Hydrometric Area 17

Bedrock Formation	Composition	Aquifer Classification	Aquifer Vulnerability
Booley Bay	Dark grey to black mudstones and minor siltstones-between Tramore Bay and Waterford Harbour	Pl	High
Templetown Fm	Quartz conglomerates and minor sandstones	L1	High
Harrylock Fm	Red sandstones, siltstones and mudstones	L1	High
Campile Fm	Rhyolites, rhyolitic tuffs and felsic volcanics-much of the central portion of Area 17	Rf	High-Extreme
Bunmahon Fm	Basic to intermediate lavas, ash deposits (tuffs) and basic igneous intrusions-to the south of the Campile Fm	Rf	High-Extreme
Kilmacthomas Fm	Green and purple shales and siltstones- to the north of the Campile Fm	Rf	High
Croughan Fm	Quartz-rich pebbly conglomerates and coarse green pebbly sandstones-northern margins of Area 17	L1	Extreme
Coumshingaun Fm	Coarse boulder, cobble and pebble conglomerates with minor sandstone lens-at the foothills of the Monavullagh Mountains	L1	Extreme
Treanearla Fm	Thick-bedded conglomerates and conglomeritic sandstone-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Sheskin Fm	Interbedded conglomeritic sandstone and sandstones-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Kilnafrehan Fm	Silty mudstones-central and eastern parts of the Monavullagh Mountains	L1	Extreme
Knockmealdown Fm	Conglomerates and sandstones and yellow and white sandstones with interbedded purple mudstones-southwest portion of Area 17	L1	High-Extreme
Kiltorcan Fm	Yellow and red sandstones and green mudstones-southwest portion of Area 17	Rf	High-Extreme
Waulsortian Fm	Calcareous mudstones and coarser grained limestone-around the bay and extending west to the margins of the area	Rk	Moderate-High
Ballysteen Fm	Lower calcarenite beds overlain by silty muddy limestone-around the bay and extending west to the margins of the area	L1	Moderate-High
Gyleen Fm	Mudstones and sandstones-higher ground to the south of Dungarvan Harbour	L1	High-Extreme
Ballytrasna Fm	Pale, grey and red fine to medium grained sandstones-higher ground to the south of Dungarvan Harbour	L1	Extreme

Hydrogeology

Subsoil

The subsoil deposits are dominated by clays and tills of variable extent and thickness. These low permeability clays and glacial tills offer protection to underlying bedrock aquifers restrict recharge to

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them and where present in sufficient thickness confine the bedrock aquifers. The subsoil deposits in Hydrometric Area 17 are not considered to be significantly water bearing.

Bedrock

In Area 17 the Ordovician volcanic rocks, Kiltorcan Sandstones and Waulsortian Limestones are considered to be Regionally Important aquifers. High yielding wells 100 - 400 m³/d have been recorded in the Campile Formation in Waterford, Wells yielding 100 - 200 m³/d have been recorded in the Kilmacthomas Formation. High well yields are also known in the Kiltorcan sandstones. High well yields are recorded in the Waulsortian Limestone at Ardmore (775 m³/d).

Other rocks in the region are considered to be locally important to poor aquifers. Some of the locally important aquifers can produce high yielding wells locally. These include many of the Devonian Sandstones and Lower Limestones. However, others such as the Bally Boley Formation are considered poor aquifers and generally can supply sufficient groundwater to sustain individual well and small group scheme supplies depending on site or area specific hydrogeological conditions.

Glossary of Terms

<i>Alluvium</i>	Detrital material which is transported by a river and deposited at points along the flood plain of a river. Commonly composed of sands and gravels.
<i>Argillaceous</i>	Fine-grained, comprising predominantly clay minerals; mudstone.
<i>Andesite</i>	Volcanic rock of intermediate composition (between rhyolite and basalt)
<i>Aquifer</i>	A geological unit that stores and transmits significant quantities of groundwater under normal hydraulic conditions.
<i>Basalt</i>	Dark fine-grained igneous rock, usually lava, rich in iron and magnesium silicates but little or no quartz.
<i>Batholith</i>	A large discordant plutonic igneous intrusion.
<i>Dolomitised</i>	The process by which original calcium carbonate rock is converted into the double calcium magnesium carbonate, either wholly or partly.
<i>Erratic</i>	A large cobble or boulder which has been transported glacially some distance from its source.
<i>Esker</i>	A steep-sided narrow ridge of sand and gravel deposited by glacial meltwater in a subglacial tunnel or between ice walls.
<i>Glacial till</i>	A direct glacial deposit of unsorted material laid down beneath the ice or dropped from the surface as the ice melted.
<i>Greywackes</i>	Usually grey or green sandstone containing a high proportion of mud.
<i>Kame and Kettle</i>	An undulating landscape in which there is a disordered assemblage of knolls, mounds or ridges of glacial drift with irregular depressions, pits or kettles that are commonly undrained and which may contain ponds or swamps.
<i>Karstification</i>	The dissolution of rock, usually limestone, by surface water or groundwater to form features such as sink holes, caves and underground drainage.
<i>Metamorphosed</i>	Alteration of rocks by heat and/or pressure often accompanied by deformation.
<i>Metasediments</i>	Metamorphosed sedimentary rock.
<i>Moraine</i>	A ridge or mound of sediment deposited at the margin of an ice sheet or glacier.
<i>Subsoil</i>	Any loose unconsolidated material which rests upon solid rock
<i>Permeability</i>	The ease with which water or other liquid can pass through a rock from the upper surface to the lower surface.
<i>Pluton</i>	An igneous intrusion of non-sheet like, usually equant geometry, formed at depth so that the rock is coarsely crystalline.
<i>Rhyolite</i>	Fine-grained volcanic igneous rock, originally lava, rich in quartz, very hard and flinty.
<i>Rhyolitic tuffs</i>	Rock formed from volcanic ash, usually comprising silt to sand-sized detritus.
<i>Syncline</i>	A fold, generally concave upwards, where the core contains the youngest rock
<i>Thrust fault</i>	A shallowly inclined fault in which the rocks above the fault-plane have been uplifted relative to those below it.