

Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath

**River Tolka
Wad River Sub-Catchment
Pluvial Flood Modelling Study
Donnycarney Area
Interim Report**

July 2009

INTRODUCTORY NOTE

This interim report (July 2009) has been produced by

- RPS Consulting Engineers
- Dublin City Council
 - Drainage Division,
 - FloodResilienCity (FRC) Project Team,
 - Flood Defence Unit,
 - Strategic Planning and Project Management Divisions,

to assess options to reduce the risk of flooding in the Donnycarney area with particular reference to severe flooding events in August 2008 and July 2009.

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1 INTRODUCTION

During the period from midnight to 9 a.m. on 2 July 2009, spells of heavy, thundery rain affected the east and northeast of the country. The rain storm was described by Met Éireann as “***an extreme event with unusually high rainfall amounts over durations of 1 to a few hours***”. Met Éireann also reported that during this time, 38.2mm of rainfall was recorded at Dublin Airport. **There is also information available that shows local areas experiencing much higher rainfall than that occurring at Dublin Airport.**

Several areas in Dublin City were affected by flooding on 2nd July 2009. One of the worst flooding locations occurred in the Donnycarney area of North Dublin, where the surface water collection system draining to the Wad River was overwhelmed at the Malahide Road, resulting in flooding of houses at Collins’ Avenue and Clanmoyle Road. This incident was similar in nature to a previous flooding event that occurred on 9th August 2008 when the surface waters followed the floodplain and the historical route of the Wad River.

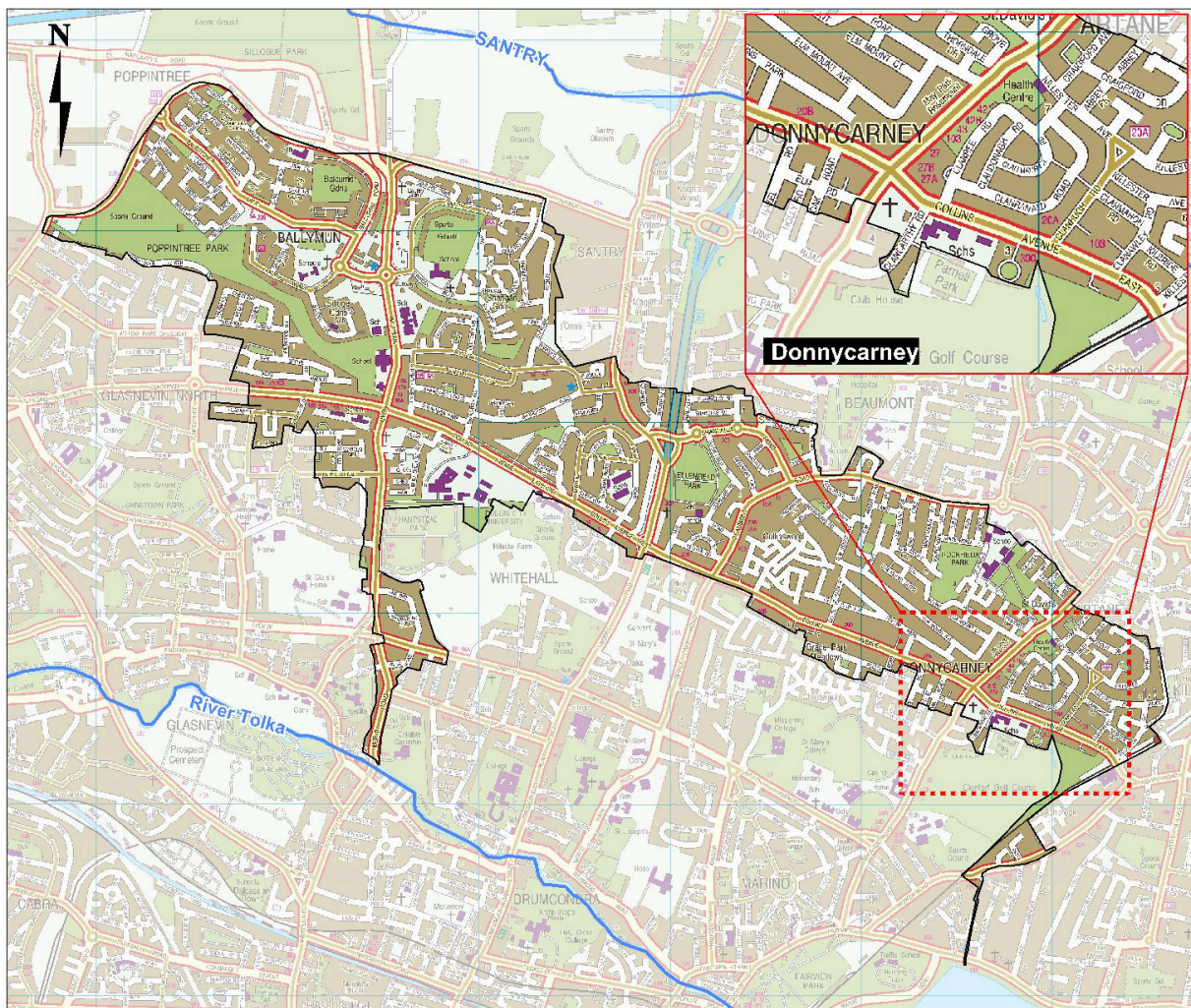


Figure 1-1.1 River Tolka - Wad River Sub-Catchment

As part of the Greater Dublin Strategic Drainage Study RPS were commissioned by DCC to carry out the River Tolka Flood Study. The Wad River Catchment is a sub-catchment of the River Tolka, connected in the Ballymun Road/Botanic Road area to the River Tolka. As a result of the severity of the flooding incident at Donnycarney, DCC commissioned RPS Consulting Engineers as part of the emergency response to analyse the flooding events, hydraulically model the Wad River Catchment using InfoWorks CS and report on possible scenarios that may alleviate flooding due to similar storm

events in the future. This report includes work, reports and studies carried out by DCC and this information is included in order to provide a single unified report. RPS acknowledges the detailed support, studies and investigations carried out by DCC.

This report details the assessment/model analysis of the Wad River, particularly in the Donnycarney area, having regard to:-

- Wad River Catchment
- Catchment Development History
- Extreme rainfall events – August 2008 & July 2009
- Flooding events of 9th August 2008 & 2nd July 2009
- Hydraulic Model Analysis
- Flood Risk Alleviation – Options

Preliminary recommendations are put forward for consideration by Dublin City Council, in order to alleviate flooding caused by extreme events, such as the events of the 9th August 2008 and the 2nd of July 2009, in the future. Recommendations are set out in Section 7 of this report.

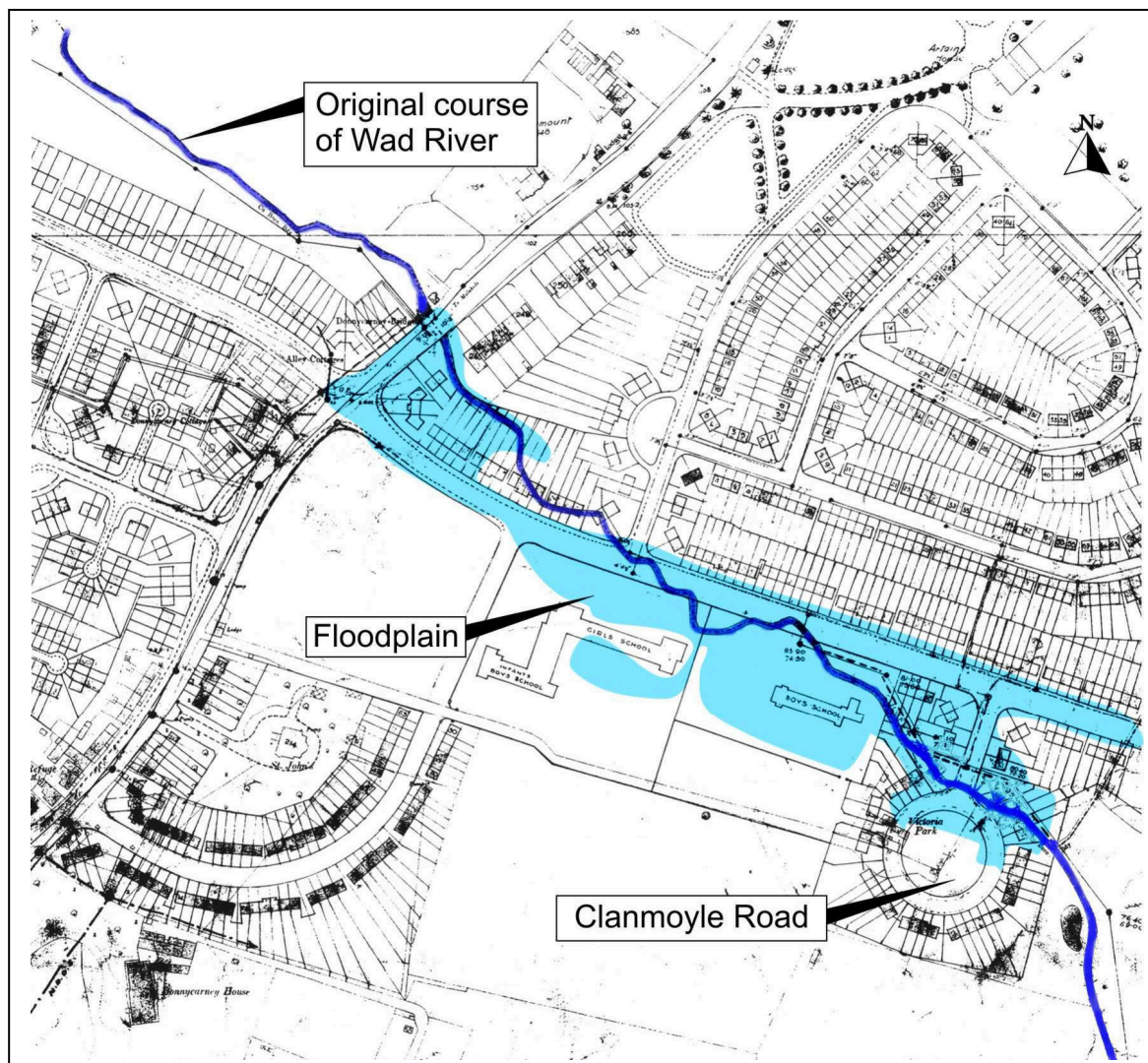


Figure 1.2 –Donnycarney area showing old course of Wad River pre-1940s, historical floodplain of Wad River and Flood Extents July 2009

2 WAD RIVER SUB-CATCHMENT

Prior to its connection to the Tolka River, the Wad River had a catchment area of approximately of 1,874 acres (758hectares). The upper part of the catchment, connected to the Rover Tolka, rises at Meakstown in Poppintree and flows south-eastward to meet the Claremont Stream. It also continues southeasterly and is joined by another branch connection from Balcurris and Balbutcher, west of Ballymun. It is joined by a branch from the Stormanstown area at the Ballymun crossroads near Wad Bridge. At these cross roads an old 36" diameter culvert parallels the new 48" and 54" diameter Wad Diversion, which takes the main flow southwards down the Ballymun Road to the Tolka River.

A small overflow connection to the old Wad River course runs parallel to the Collins Avenue extension. It continues in this direction crossing the M1 motorway running under Ellenfield Road. It is joined by a small watercourse at Celtic Park Road and continues to the Donnycarney Bridge on Malahide Road. The section upstream of the Malahide Road, as far as Larkhill, was historically known as Clonturk Valley.

From Donnycarney Bridge the Wad River (in culvert) heads for the northern front gardens of Collins Avenue East, opposite the Church, and crossing over the avenue makes its way along the frontage of the schools on the southside of Collins' Avenue, under houses across Clanmoyle Road (40m south of Collins' Avenue) and into Clontarf Golf Club grounds.

In the grounds of Clontarf Golf Club, the Wad Culvert passes beneath the main interceptor sewer of the North Dublin Drainage Scheme (NDDS), which does connect to the wad via an emergency overflow from a storm retention tank. The Wad is then joined by a long railway drain which takes surface water run-off from the Killester area. Passing under the railway line the culvert then joins the original course of the Wad River on the southeast side. From here it travels under Howth Road onto Clontarf Road and discharges into the sea at Clontarf seafront. The total length of the Wad River in culvert is approximately 8km.

2.1 CATCHMENT DEVELOPMENT HISTORY- OVERVIEW

The Wad River was culverted in the Donnycarney area in the 1940s to accommodate development. Clanmoyle Road housing was built circa 1947/1948 within the floodplain of the Wad River, and in some cases houses were built directly over the old course of the river. Refer **Figure 1.2**.

Development extended west of the Malahide Road in the 1950's, this included the development of Collins Avenue, 1959 (special works programme). By this time most of the area within the lower catchment had been quite extensively developed. In the northern catchment the Ballymun flats Scheme was carried out between 1965 and 1969. This area is currently undergoing regeneration which began in 1998 and is scheduled for completion in 2012. The Ballymun regeneration programme involves replacing the 1960's high rise development with conventional housing as well as associated initiatives designed to address the physical landscape and social environment. This development drains via Ballymun Road to the River Tolka.

2.2 DEVELOPMENT POST 1970

Research carried out for this report, which included an exercise that overlaid 1970's orthophotography on 2005 OSi maps, highlighted the influence of development since the 1970s. Developments within the catchment, excluding the Ballymun Regeneration Scheme, which have occurred since the 1970s include:

- An area adjacent to Rockfield Park of housing developments namely Thorndale road, Thorndale grove and St. David's;
- Grace Park Meadows, off Collins Park Avenue (see **Figure 2-2** on page 6);
- Collins Wood- Built on the Veterinary Research Laboratory Site circa 1995 (see **Figure 2-2** on page 6);
- A school adjacent to Ellenfield Park(see **Figure 2-2** on page 6);
- An area parallel to Collins Avenue Extension- Crestfield Close; and
- Numerous Buildings on the DCU campus (adjacent to Albert College).

Large commercial and residential developments have been constructed in recent years in the vicinity of Shanowen road and Shanliss road.

There has also been an increase to the overall paved area of the catchment from unmonitored developments such as local residents paving over front and back gardens, building garden sheds, conservatories and patios. This type of development does not always require planning permission but can contribute significantly to surface water run-off, as it increases the overall impermeable area of the catchment.

2.3 WAD CULVERT SURVEY

A walk through survey of the Wad Culvert was carried out by DCC following flooding on the 8th August 2008 and the 2nd July 2009 and the following issues were noted:-

- Malahide Rd – pipe diameter and slope reduced for road crossing/services;
- Downstream of Clanmoyle Rd: Pipe diameter reduces to 1150mm for short length;
- Pipe (175mm diameter – marginal influence on river flow) running through the Wad Culvert, 300mm from the soffit, in the school grounds on Collins Avenue of unknown origin (See **Figure 2-1**).



Figure 2-1 Obstruction in Wad Culvert

2.4 INFLOWS TO WAD CULVERT

Inflows to the Wad culvert in addition to storm runoff include:-

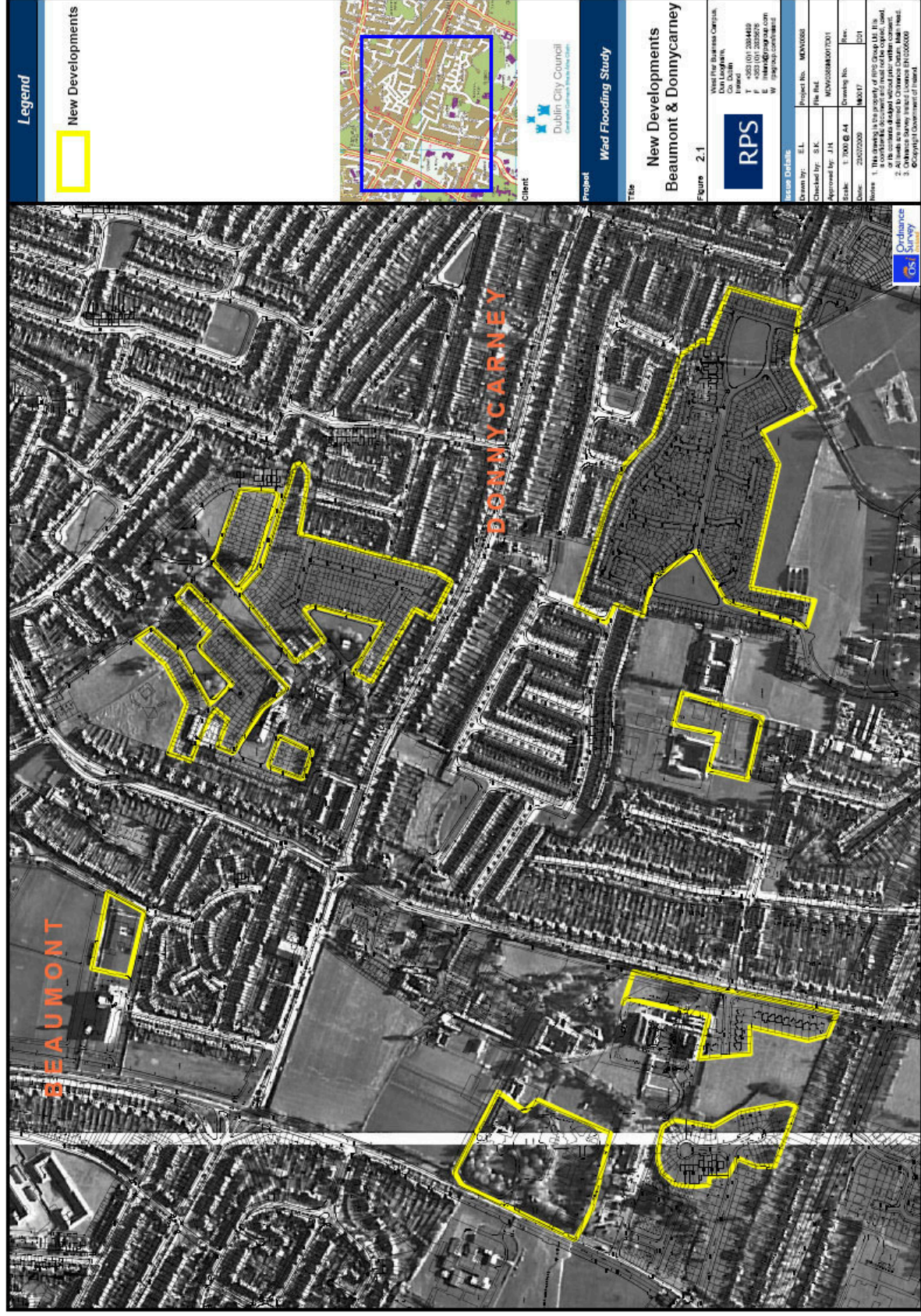
- M1/Port Tunnel drainage – runoff from small section of M1 collected and pumped to Wad River
- Overflow from NDDS foul sewer at Clontarf Golf Club downstream of Clanmoyle

2.5 SUMMARY

The following points summarise historical development issues that influence stormwater drainage in the Wad River Catchment:-

- The Wad River is an old historical river with an original catchment area of 1,874 acres (758 hectares)
- The majority of development in the Wad catchment area occurred in the 1950's and 1960's.
- Some more recent developments have also occurred, eg. Collinswood circa 1995 and the commercial and residential developments in the Shanowen area.
- There has been a significant amount of unmonitored development, such as patios, conservatories and small extensions, which would increase the overall level of impermeable area within the catchment and may contribute to overland flow and flooding.
- The Wad River was culverted over time in the floodplain of the old Wad River, including through Clontarf Golf Club.
- Developments were built in the flood plain of the Wad River.
- Clanmoyle was built directly over the Wad River and in its floodplain.
- Houses in Clanmoyle have deep basements and were built at a level in the 1940's to reduce the risk of flooding.

Figure 2-2 Development in the Wad Catchment since the 1970s



3 EXTREME RAINFALL EVENTS – AUGUST 2008 & JULY 2009

Extreme rainfall events contributed to both recent major flooding events in the Wad catchment, on the 9th of August 2008 and the 2nd of July 2009. The two extreme events are described in detail below.

3.1 9TH AUGUST 2008

The weather conditions leading up to the 9th of August event were unsettled with showers occurring on most of the preceding days, in particular on the 6th of August. The total rainfall recorded at Dublin Airport for July 2008 was 111.4mm, significantly greater than the monthly average of 50mm, indicating that the catchment wetness would have been considerably higher than normal with soils either saturated or close to saturation. Wet catchments have a reduced soakage level and thus result in higher runoff during rainfall events.

On the 9th of August 2008 a very unstable airmass followed a cold front moving eastward over Ireland. This enabled the development of thunderstorms and heavy rainfall in the east. **Table 3.1** gives a breakdown of rainfall for different durations for four Met Éireann weather stations on the 9th of August. Dublin Airport’s 00-24hour fall of 76mm on the 9th of August was the second highest daily rainfall on record.

Table 3.1 Maximum Rainfall (mm) for different durations - 9th August 2008

Location	5min	30min	1hr	2hr	4hr	5hr	12hr	18hr	24hr
Dublin Airport	4.9	19	35.9	44.3	53.8	67.6	67.7	76.2	76.2
Phoenix Park	6.7	20.6	33.5	38.8	45.4	52.1	52.3	58.7	58.7
Casement Aerodrome	5.2	13.9	19.6	23.5	28.6	33.5	33.5	40.9	40.9
Lucan	8.9	28	43	56	70	84	86	93	93

An examination of rainfall data for North Dublin and surrounding areas reveals significantly varying rainfall patterns over short distances, as indicated in **Table 3.2**. Indeed such degrees of variability, and the localised nature of intensities, indicate that **there is a possibility that more extreme rainfall downpours occurred in some areas.**

Table 3.2 Rainfall Recorded at Stations in the Vicinity of North Dublin – 9th August 2008

Location	Duration 18hrs Rainfall mm	Duration 5hrs Rainfall mm
Naas	36	26.5
Celbridge (Ardglass)	81.6	73.6
Naas CBS	30.3	22.3
Straffan (Turnings)	53.3	45.3
Dublin Botanic Garden	57.4	50.6
Casement Aerodrome	40.9	35.8
Leixlip (Water Works)	85.8	77.8
Glenasmole	48.6	41.7
Enfield	29.3	20
Dublin Airport	76.2	68.3
Phoenix Park	58.8	52.6
Lucan	92.8	84

Minute rainfall data from the synoptic station at Dublin Airport for 9th August 2008 was provided by Met Éireann through DCC. This data is presented here as a bar chart in Figure 3-1.

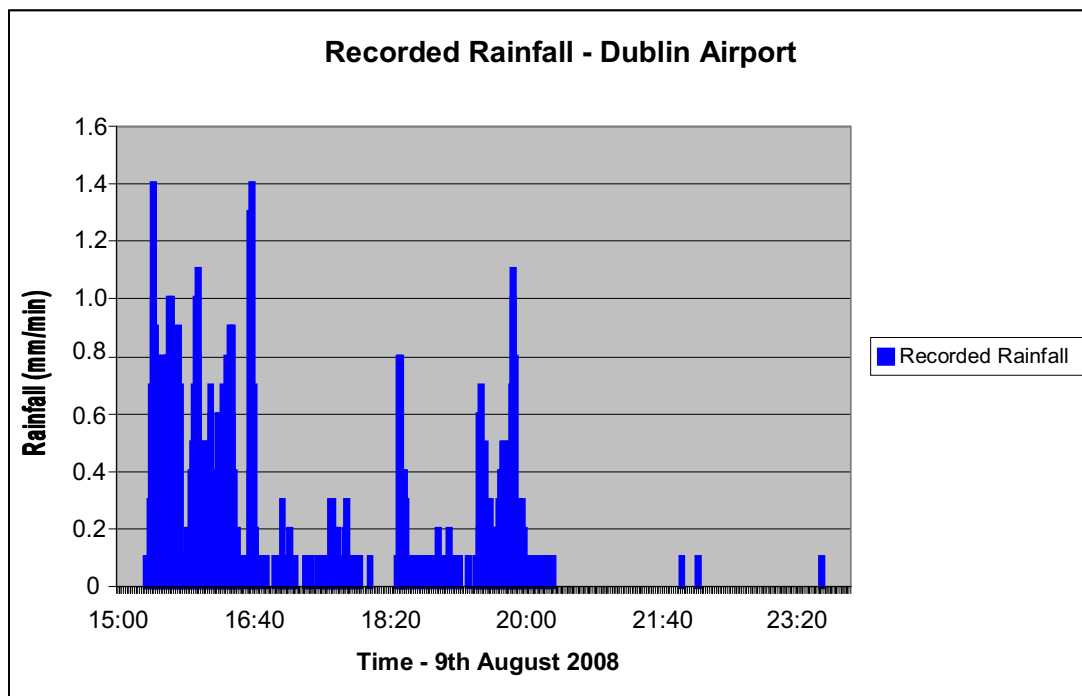


Figure 3-1 Recorded Rainfall Data from 9th August 2008

3.2 2ND JULY 2009

Met Éireann issued a general warning for heavy rain on the 1st of July 2009. During the period from midnight to 9 a.m. on 2 July 2009, spells of heavy, thundery rain affected the east and northeast of the country. The Dublin area was particularly badly affected. Rainfall totals in the 9-hour period were around 40 – 50mm in the worst affected areas, see **Table 3.3**.

Records show that the amount of rainfall forecast for the complete day fell in just 2 hours over Dublin with the following areas worst effected:

- Donnycarney (Wad Catchment)
- Ballsbridge/Bath Avenue
- East Wall

Table 3.3 Rainfall totals in the 9-hour period

Location	Rainfall (mm)
Dublin Airport	38.2
Botanic Gardens	44.4
Phoenix Park	22.5
Dunsany Grange	24.0
Casement Aerodrome	17.9
Bayside Sutton	33.9
RDS Simonscourt	42.2
Sandyford	42.8

As indicated in **Table 3.3** considerable variations occur in the quantity and intensity of rainfall over some short distances. For example rainfall quantity for the Phoenix Park is measured at 22.5mm whilst approximately 4km away rainfall quantity for the Botanic Gardens is measured at 44.4mm. It can therefore be concluded that **this was a heavy rainfall event with localised extremities that in some areas may well have had peaks in excess of those recorded at the stations.**

Minute rainfall data from the synoptic station at Glasnevin for 2nd July 2009 is presented as a bar chart in **Figure 3-2.**

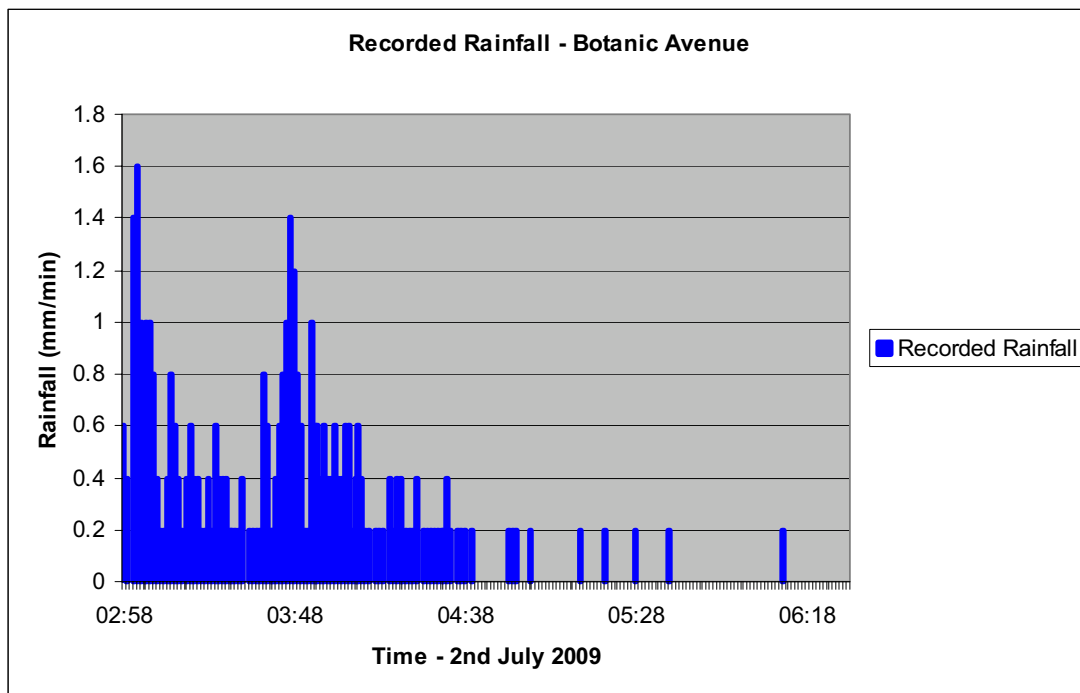


Figure 3-2 Recorded Rainfall Data from 2nd July 2009

The clock-hour rainfall of 26.5mm at 4 – 5 a.m. is the largest clock-hour rainfall ever recorded at Dublin Airport. Thus, this was an extreme event with unusually high rainfall amounts over durations of 1 to a few hours.

Close examination of the radar picture (**Figure 3-3**) shows the storm lying over the Cabra - Glasnevin area and a “hotter” spot over the Ballsbridge Bath Avenue area which is consistent with a number reports from the area.

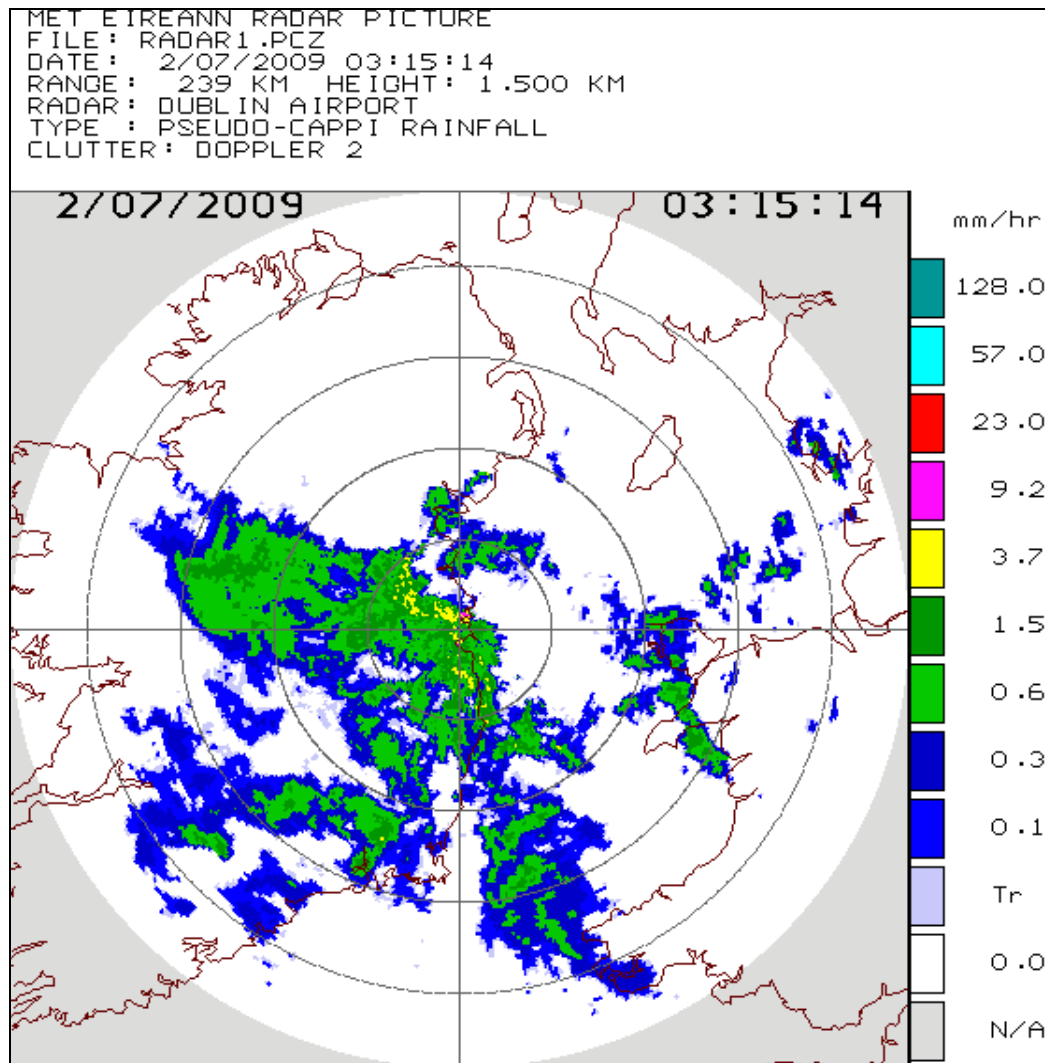


Figure 3-3 Radar Image Dublin Airport – 2nd July 2009

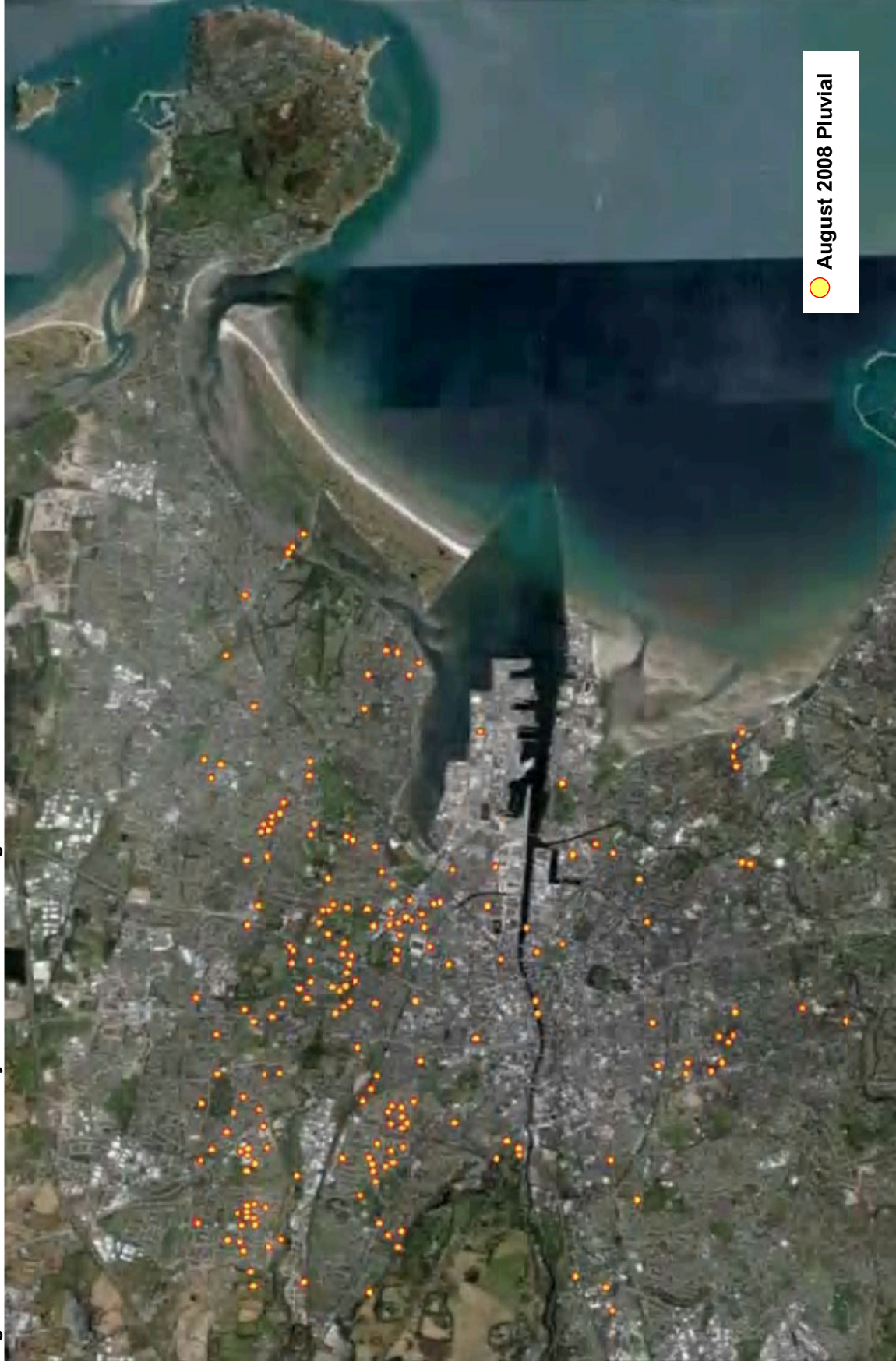
3.3 CONCLUSION

The rainfall events which occurred in North Dublin on the 9th of August 2008 and the 2nd of July 2009 were high intensity extreme events that resulted in urban pluvial flooding. The rainfall patterns recorded within each event varied, sometimes considerably, over short distances and it is possible that more extreme intensities occurred in unrecorded locations. Such heavy rainfall events, which can result in pluvial flooding, contain extremities in both intensity and duration over small geographical areas and by their nature are virtually impossible to accurately forecast.

Figure 3.4 overleaf (courtesy of DCC Flood Resilient City Project) shows a combination of the many flooding events that DCC are analysing at present. Of particular note is the spatial variation of the intense rainfall experienced during the extreme rainfall event of 9th August 2008 – shown as yellow points, dotted all over the Dublin area. This shows that, whilst weather warnings may be issued forecasting heavy rainfall or storms in areas, it is not possible to pinpoint forecast such extreme localised intense rainfalls to smaller areas, such as on a suburb by suburb basis. In other words, it is not possible to predict in advance:

- the location of flooding,
- the time of highest flood risk, and,
- the intensity of local rainfall

Figure 3-4 – FloodResilienCity Overview of Flooding – Dublin Area



4 FLOODING – AUGUST 2008 & JULY 2009

4.1 INTRODUCTION

Flooding on the 9th of August 2008 and the 2nd of July 2009 impacted numerous residents in the Donnycarney area of North Dublin. These flood events were caused by *pluvial flooding*. Pluvial flooding can be defined as urban flooding caused by extreme high intensity storms in a local area, influenced by both the drainage system and receiving river/stream infrastructure. These events are likely impacted by Climate Change.

On both occasions flooding occurred at the Malahide Road, north of Collins Avenue, flowed to Collins Avenue East and along it to Clanmoyle Road following the historic floodplain of the Wad River. Each event is described separately in **Sections 4.2** and **4.3**.

4.2 FLOODING – 9TH AUGUST 2008

Dublin City Council (Drainage Division, Flood Defence Unit and Flood Resilience Project Team) carried out investigations after the flooding event in August 2008 and concluded that the flooding was a result of extreme rainfall event on the River Wad leading to culvert surcharging at Malahide Road, approximately 70m upstream from the junction with Collins Avenue East, with the resultant flood waters flowing down Collins Avenue East and into Clanmoyle Road along the floodplain of the Wad River.

A number of properties were impacted by this pluvial flooding event and these included;

- Houses 3-7 and 35-42 Clanmoyle Road and floodwater also got into the gardens of adjoining houses
- The local primary school, Scoil Chiaran and its generator house
- The generator of the secondary school Scoil Mhuire
- Houses 238, 240, 242, 244 and 246 Collins Avenue East
- 76 other properties along the North side of Collins Avenue East, between the Malahide Road and Clanhugh Road.
- Nos. 10 to 30 and Nos. 53 to 55 Collins Park reported flood waters in the underfloor voids

The depth of flood water in Clanmoyle during the August 2008 event peaked at around 250mm above the ground floor level of the worst affected house. After the August 2008 flood event additional gullies were added to the area.

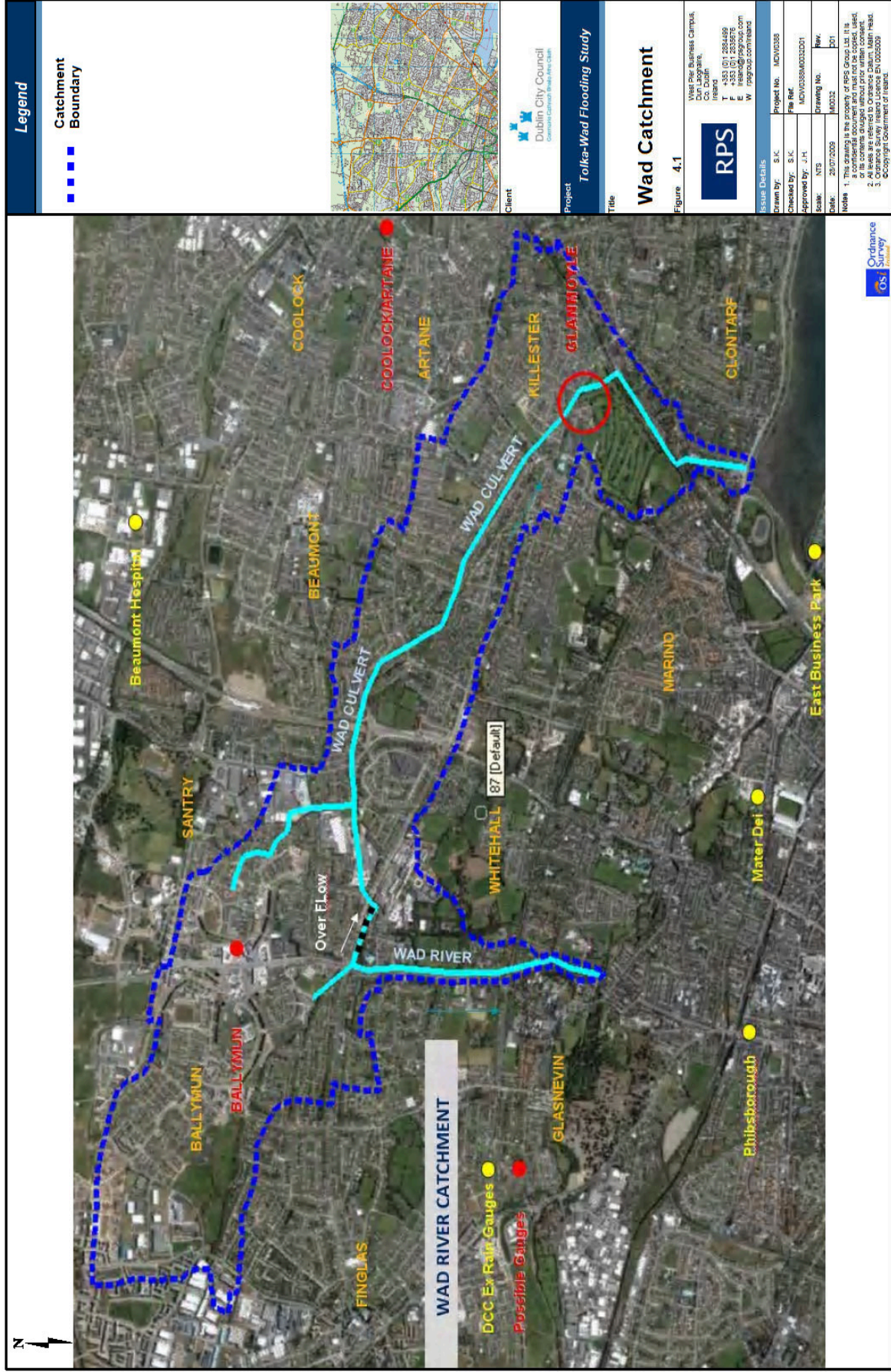


Figure 4-1: Wad Catchment