

Preliminary Hydrological and Hydraulic
Assessment of Ditches and Watercourse
Tributaries of Pinkeen River East for
Kilmartin LAP 2012-2018

OCT 2012

HYDROLOGICAL AND HYDRAULIC ANALYSIS OF DITCHES AND
WATERCOURSE TRIBUTARIES OF PINKEEN RIVER EAST FOR KILMARTIN
LAP 2012-2018, DUBLIN 15.

Job Title: Kilmartin LAP.

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1.0 INTRODUCTION

The purpose of the report is to provide input into the strategic flood risk assessment for the Kilmartin LAP 2012-2018 relating to fluvial flooding of the existing ditches and watercourses within the LAP lands which discharge to the Pinkeen (east) River. Additionally, a short section of the Pinkeen River east itself, adjacent to the LAP lands have been included as part of this assessment and a brief assessment of the Pinkeen River west is also included.

The scope of the report includes a hydrological assessment of the catchment contributing to the flow in the rivers, ditches and watercourses and preliminary hydraulic calculations and modelling of the network to determine potential areas of flooding in extreme events. Additionally, preliminary flood zone mapping of zones A, B and C are produced for input into the LAP process.

2.0 DESCRIPTION OF CATCHMENT & WATERCOURSES

The overall catchment for the Pinkeen River east at node 1 has a contributing catchment area of approximately 4.93km² and is 3.19km long originating to the north-east of the Hollystown Village and the Ratoath Road to the east and covers the entire LAP lands. The catchment mainly consists of farmland, a golf-course, some areas of woodland, Hollystown village and a small amount of developed area.

The overall catchment for the Pinkeen River west has a contributing catchment area of approximately 12.26km² and is 19.2km long originating approximately 2km to the south-east of the Dunshaughlin Village. The catchment also mainly consists of farmland but there is a larger amount of rural development and small villages within its boundary than the adjacent Pinkeen River east catchment.

The cross-section of the Pinkeen River west that is relevant to this report is located directly to the west of the LAP lands. This river is included as part of this report to assess whether flooding from the river at this location, which may occur during extreme rainfall events, could exacerbate flows or flooding within the Pinkeen River east located approximately 1km to the east which in turn may cause flooding of the LAP lands. However, it is the Pinkeen River east itself that will be the main subject of this report.

The Pinkeen River east contains a number of meanders, junctions and tributaries and could be defined as irregular in alignment, the approximate gradient is moderately flat at 3.65m per km.

The ditches and watercourse tributaries function mainly as land drains for the farmlands and golf-course. The main channel of the ditches and watercourse system runs approximately east to west for approximately 2km before it turns to the south-west to discharge to the Pinkeen River east. This section of the watercourse and ditch is a deep open channel with a clean gravel and soil bed, with heavily vegetated sloped banks on both sides. Cross-sections and levels of ditches and watercourses are contained in Appendix A. (Photographs of the watercourses are provided within the SUDS report).

3.0 CATCHMENT HYDROLOGY

No gauges are located on this stream; therefore no maximum annual flow data is available to determine flow at the proposed locations of analysis along the ditch and watercourse system.

Notwithstanding the above, a hydrological analysis of the system was undertaken using the Flood Studies Report (FSR) Statistical Method, the FSR Unit Hydrograph Method and the UK Institute of Hydrology Report 124 methods. Without any gauge data it was not possible to calibrate these mathematical models and determine the most relevant to the stream, therefore, a conservative approach has been applied whereby the average flow value calculated from the 3 models is adopted for the Pinkeen East and the maximum flow value calculated from the various methods for the Pinkeen West. Design return periods of 1 in 100 years and 1 in 1000 years have been used as is required by the Greater Dublin Strategic Drainage Study (GDSDS) and the Planning System and Flood Risk Management Guidelines, 2009. Additionally a 20% increase in flow has been used to account for climate change as is required under these guidelines.

Areas and parameters for the hydrological models were obtained from 3 separate existing site surveys, a site inspection, Ordnance Survey (OS), Discovery Series mapping and Google maps of the area. Some sections of the ditches, watercourses and rivers were covered in a detailed survey and these cross-sections are identified in the appendix, other sections were estimated and assumed from less detailed survey information relating to that area and other available information mentioned above.

Using this data together with rainfall data from Met Eireann and soil and rainfall maps contained within the Flood Studies Report, flows for the 1 in 100 year and 1000 year return periods were calculated.

Flow Q in Pinkeen River East		
<u>Node</u>	Q for 100 year (m ³ /s)	Q for 100 year (m ³ /s)
1	3.608	5.177
2	3.113	4.492
3	0.693	0.988
4	0.565	0.806
5	0.488	0.696
6	0.331	0.473
7	1.693	2.430
8	1.042	1.499
9	0.470	0.672
10	0.330	0.476
11	0.073	0.100

Table 1

Flow Q in Pinkeen River West	
Q for 100 year (m ³ /s)	Q for 100 year (m ³ /s)
10.04	13.71

Table 2

The extreme event flows calculated above include an additional 20% to account for future climate change.

It should be noted that the maximum flow values above are considered conservative, as the area of each contributing catchment has been somewhat overestimated as it is assumed that all field drainage ditches discharge to the stream, this may not be the case in all circumstances. Finally, the mathematical models do not account for any natural flood storage which may occur within the catchment in the ditches, pipes and fields which would reduce the rate and volume of flooding.

The flood flows calculated are based on the existing catchment conditions and do not include any potential future development within the contributing catchment boundary.

4.0 CATCHMENT & WATERCOURSES HYDRAULIC ANALYSIS

An analysis of the ditches, watercourse and river for the Pinkeen River east system was undertaken using CIRIA Manual CP/40 – ‘Hydraulic Design of Culverts’ and a steady flow analysis was undertaken in HECRAS 1d Hydraulic Modelling Software.

Gradient and cross sections of the channels were produced using topographical survey information. A conservative estimate of Manning’s coefficient of friction was applied to channel beds and side slopes based on a site inspection, these values were obtained from CIRIA Manual CP/40 –‘Hydraulic Design of Culverts’. Manning’s n values are shown in table 3.

Location	Description	Manning’s n value
River bed	Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush.	0.100
River Banks	Brush, medium to dense brush in summer.	0.100

Table 3

Hydraulic analysis of the Pinkeen East determined used output from the 1d HECRAS model to produce a 3D ground surface in the 3D ground modelling software PDS for water levels at each node and for each design return period. This water surface level was compared to the model of the existing ground surface which was created as a combination of the three topographical surveys. This allowed preliminary flood maps to be produced to identify zones A, B and C representing the following:

Zone A – High probability of flooding (more than 1% probability or more than 1 in 100 years)

Zone B – Moderate probability of flooding (0.1% to 1% probability or between 1 in 100 and 1 in 1000 years)

Zone C – Low probability of flooding (less than 0.1% probability or less than 1 in 1000 years)

The resultant flood mapping for the Pinkeen is shown in Appendix B.

5.0 RESULTS AND CONCLUSION

Following hydrological and hydraulic analysis of the Pinkeen, flood zone mapping for the Kilmartin LAP lands was produced, see Appendix B. This indicated that the majority of the LAP lands are contained within flood zone C, however some small sections of the lands, mainly the drainage channels, are within zones A and B. These areas may warrant more detailed site specific flood risk analysis before development is permitted in these zones.

Analysis of the flooding extents of the Pinkeen West indicated that there is out of bank flooding for the 100 year and 1000 year flows but, due to topographical constraints, this is not sufficient to enter or impact the Pinkeen East catchment. Flooding from the Pinkeen West is therefore contained within its own catchment.

APPENDIX A
CROSS-SECTIONS AND DITCH / WATERCOURSE LAYOUT

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NOTES:

- DO NOT SCALE FROM THE DRAWING.
- SWAY TO THE COORDINATE SYSTEM.
- SURVEY TO BATHYMETRIC DATUM.

LEGEND:

- OPENING DRAINAGE DITCH
- DITCHES WATERCOURSE
- FRITCHES LIFT
- DIRECTION OF FLOW
- CONTAINS STAGNANT WATER
- NO STAGNANT WATER
- PIEDMONT NUMBER
- RESET TO HEIGHT
- FRESH CROSS-BRANCHES
- ECOLOGICAL VALUE
- LIMITED ECOLOGICAL VALUE
- EXISTING SET CHARGE
- NODE 1
- LAP LANDS
- COUNTY BOUNDARY

REVISIONS:

NO.	DATE	DESCRIPTION	BY	CHKD.
1	02/12/2022	PREPARED	DALE	DALE
2	02/12/2022	REVISED	DALE	DALE

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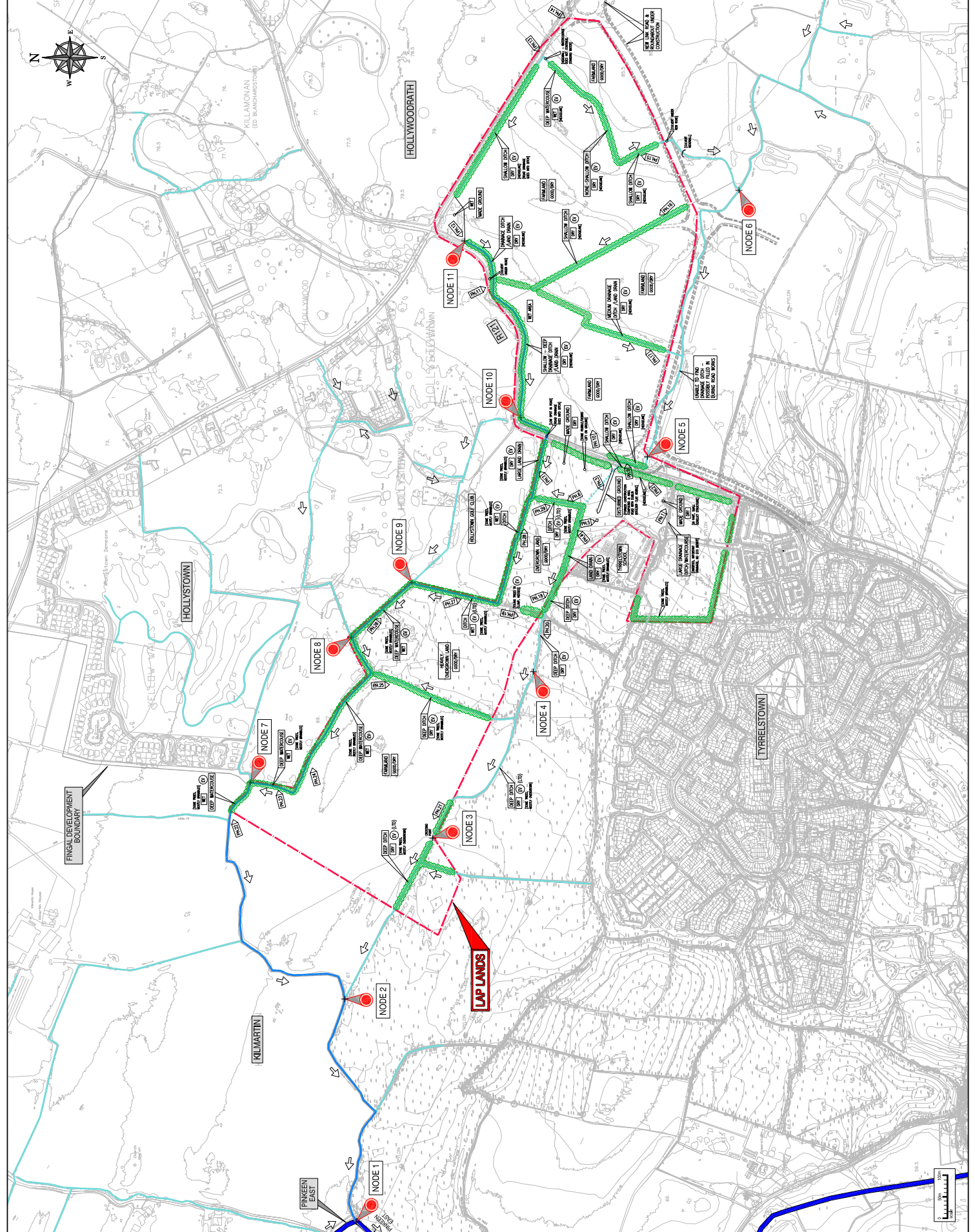
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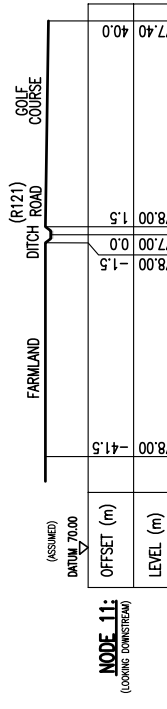
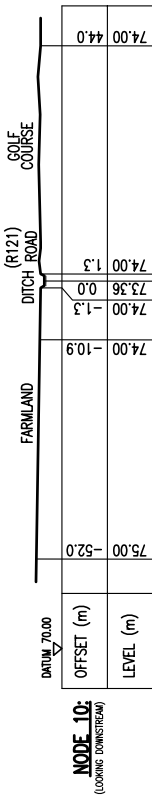
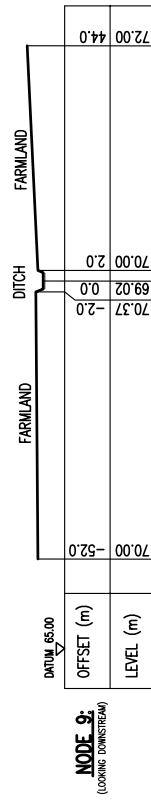
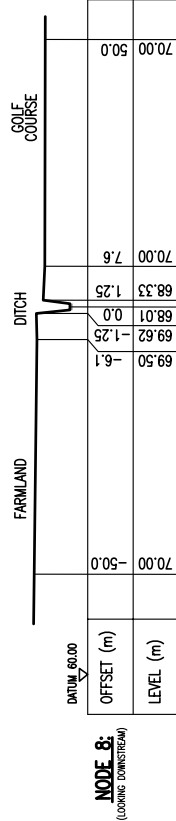
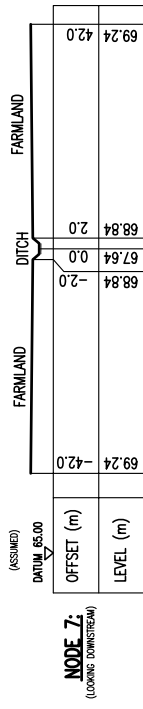
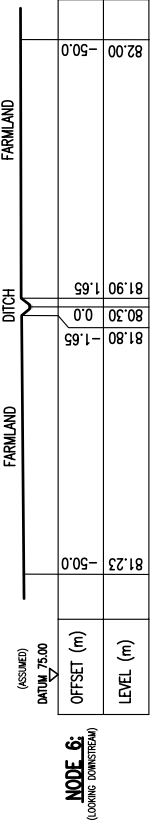
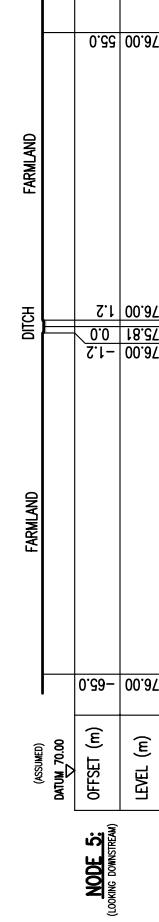
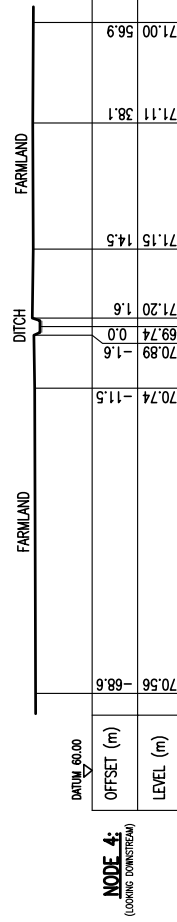
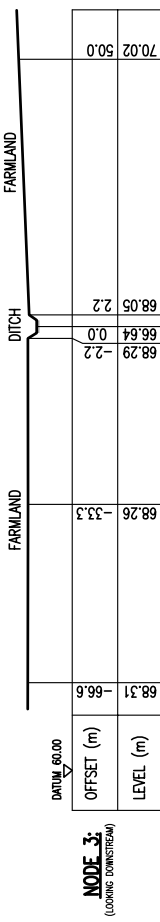
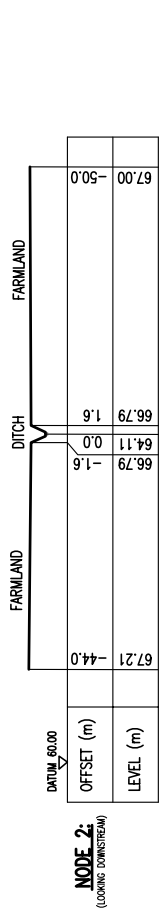
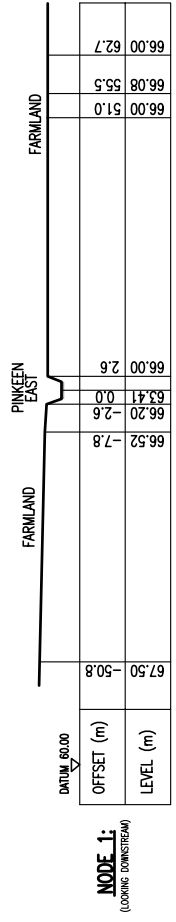
PROJECT:
KILMARTIN LAP


DATE TITLE:
EXISTING LAP DRAINAGE & WATERCOURSES LAYOUT

CLIENT:
Fingal County Council
 Combairte Contae Fhine Gall

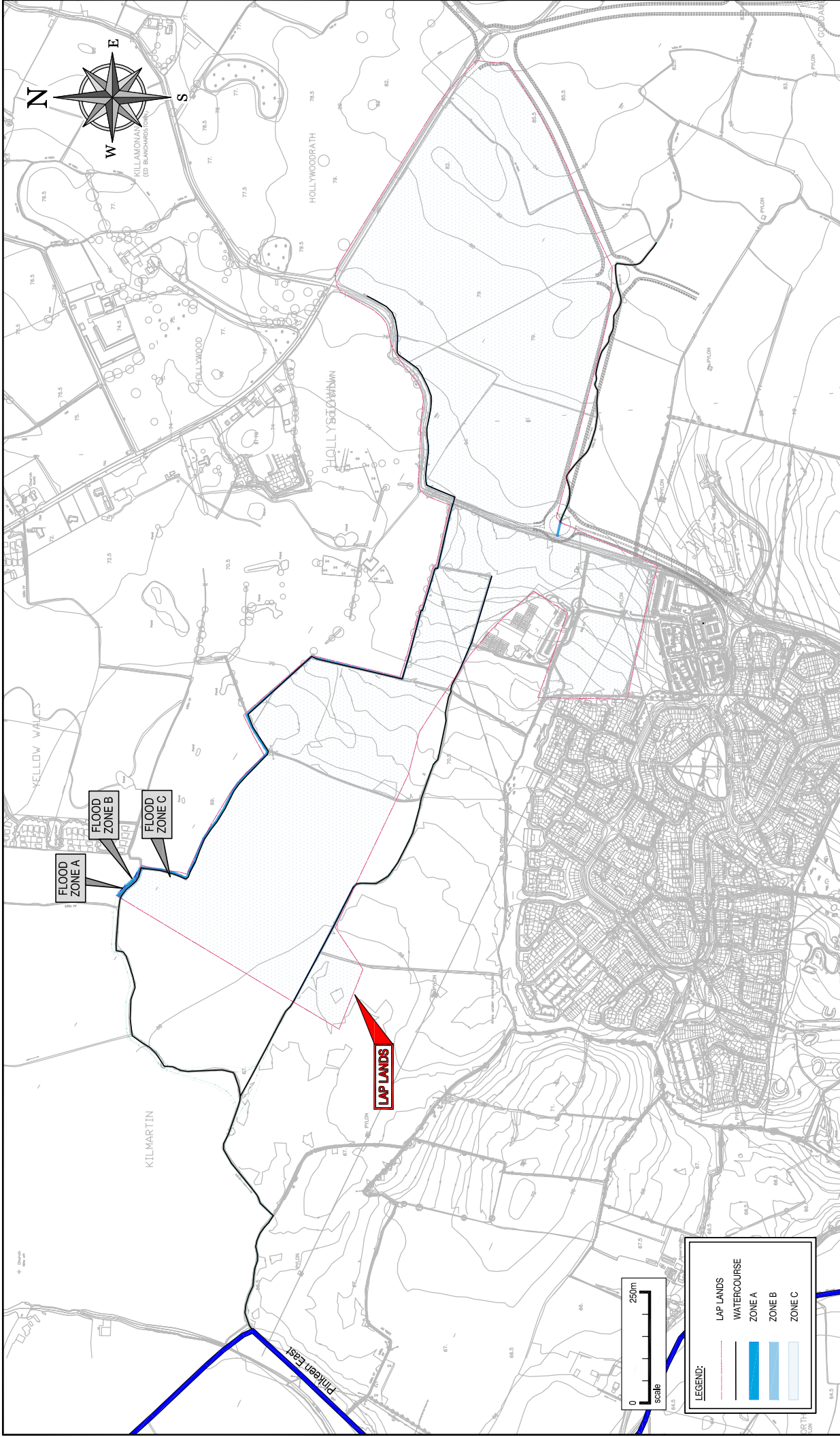
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DRG. TITLE			SCALE	NTS (A3)	DRG. NO.	123050-9011
			FILE REF. 123050-9011			

APPENDIX B
FLOOD MAPS



PROJECT KILMARTIN LAP KILMARTIN LAP FLOOD ZONES - TOPOGRAPHICAL -	NOTES 1. DO NOT SCALE FROM THIS DRAWING. 2. SURVEY TO ING CO-ORDINATE SYSTEM. 3. SURVEY TO MALIN HEAD DATUM. ORDNANCE SURVEY IRELAND LICENCE No EN.0017012 © ORDNANCE SURVEY IRELAND GOVERNMENT OF IRELAND		DUBLIN OFFICE: Herbert House, Harmony Row, Dublin 2, Ireland. PHONE +353 1 400 4000 FAX +353 1 400 4050		DESIGNED DATE	JIBK OCT 2012	PREPARED CHECKED	KULE JBK
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