



**FLOOD STUDY
EXISTING VACANT LOT
CNR MACARTHUR DR AND HEATHCOTE RD
HOLSWORTHY, NSW**

**Revision 1
JUNE 2017**

Table of Contents

1. INTRODUCTION	3
1.1 Existing Site Description	3
1.2 Objectives.....	4
2. HYDRAULIC ANALYSIS	4
2.1 Introduction	4
2.2 Catchment Mapping	4
2.3 Drains Models.....	4
2.4 HEC-RAS Model.....	5
2.5 HEC-RAS Results.....	5
3. CONCLUSION.....	6

APPENDIX A: SURVEY PLAN

APPENDIX B: FLOOD EXTENT PLAN

APPENDIX C: CATCHMENT PLAN

APPENDIX D: DRAINS MODEL

APPENDIX E: HECRAS SECTION

1. INTRODUCTION

1.1 Existing Site Description

The property is located at the corner of Macarthur Drive and Heathcote Road in Holsworthy, NSW. The site generally grades from the south western corner, to the north-eastern corner at an average grade of 1.7%. The total site area is 1.865 hectares and is completely undeveloped apart from a 95m² concrete podium.



Figure 1: Overall Site

There is a local sag point within Macarthur Drive adjacent to the roundabout as shown in Figure 1. There is no stormwater pit within this sag point, thus the overland flow ponds up to the kerb and overflows into the site. Within the site is a natural valley which conveys the upstream catchment from Macarthur Drive, which has an approximate area of 2860m². An investigation of the 100yr ARI flood levels as a result of this upstream catchment has been undertaken with the results documented within this flood study.

There is a swale within the road reserve of Heathcote Road (northeast of the site) which conveys a significant catchment from both the site and Heathcote Road. This swale conveys flow from two directions down to a headwall in the road reserve, where 2 Ø450mm diameter pipes carry the flow underneath Heathcote Road. See Figure 1 above and the Survey Plan included in Appendix A.

There is also a sag pit within the road reserve beyond the northern boundary of the site. This pit has a significant catchment from the site and Macarthur Drive road reserve. This sag pit carries stormwater away from the site to a pit within the roundabout in Heathcote Road via a Ø 375mm diameter pipe as can be seen in Appendix A and the Drains Model layout in Appendix D.

In summary there are two points of discharge of the stormwater from the site, the 2 x 450mm diameter pipes which discharge underneath Heathcote Road and the 375mm pipe discharging towards the roundabout. It is critical to clarify the discharge points as these catchments will affect the downstream water level of the overland flow route through the site, and thus the 100yr ARI flood levels.

1.2 Objectives

Architectus Pty Ltd have engaged Xavier Knight to assess the flooding within the site, which is located at the corner of Macarthur Drive and Heathcote Road. In particular, this report aims to identify the 100yr ARI flood levels of the overland flow path through the site through DRAINS modelling and HEC-RAS modelling. This report aims to aid future development planning by providing 100yr flood levels and the flood extent of the overland flow path through the site.

2. HYDRAULIC ANALYSIS

2.1 Introduction

The hydraulic analysis of the overland flow through the site was undertaken using two programs; DRAINS and HEC-RAS River Analysis System (version 4.1.0).

A DRAINS model was generated to estimate the capacity of the 375mm pipe discharging to the roundabout in Heathcote Road and also the capacity of the 2 x 450mm pipes conveying flow underneath Heathcote Road. In assessing the capacity of these two stormwater assets, an estimate of the downstream water level at the headwall adjacent to the northern site boundary can be made and thus the 100yr flood levels of the overland flow route through the site can be justified.

A flood analysis in HECRAS was undertaken for the existing conditions to determine the 100yr flood levels of the overland flow through the site. This information is summarised in section 2.5 and the flood extent map in Appendix B.

2.2 Catchment Mapping

A catchment plan is presented in Appendix C, which shows the two catchments relevant to the HECRAS model. There is a catchment of 10 885m² with an approximate impervious fraction of 15%, which drains to the overland flow route within the site. There is a secondary catchment which conveys flow to a downstream section of the overland flow route. A secondary catchment area of 8 210m² also drains to the overland flow path; connecting in at chainage 22.5 (see Appendix A). This secondary catchment is 100% pervious.

The final catchment which is relevant to the hydraulics of the site is the catchment which flows to the two swales as depicted in Figure 1. This catchment consists of a section of Heathcote Road and also of a portion of the site. A total area of 14 823m², with a pervious fraction of 88%, is conveyed through the two swales to the headwall in Heathcote Road reserve adjacent to the north eastern boundary.

2.3 Drains Model

A DRAINS model was generated to assess the flows coming off the upstream catchments in the 100yr storm event and the hydraulic grade line at the headwall adjacent to the north-eastern boundary.

The upstream catchment in Macarthur Drive, which has an area of 10 885m², conveys a flow of 0.485m³/s through the overland flow path. This value has been input into the HECRAS model at chainage 172.5m. The secondary catchment which has an area of 8 210m², has a flow of 0.356 m³/s. This value has been input into the HECRAS model at chainage 22.5m.

The hydraulic grade line at the headwall is approximately 9.41m AHD. This has been set as the known downstream water surface level in the HECRAS model.

The node layout and results of the DRAINS model is depicted in Appendix D.

2.4 HEC-RAS Model

The HEC-RAS Modelling was undertaken to provide accurate 100yr ARI flood levels through the site given the upstream overland flows. HEC-RAS uses cross sections from 12D and the existing/proposed terrain as well as boundary conditions to calculate water levels from the input flow. For the Development site, chainages were set at 12.5m centres and totalled 15 cross sections from chainage 172.5m (upstream) to 0m (downstream).

The following parameters have been used in the hydraulic analysis:

- Manning's 'n' for the landscape channel area = 0.03
- Manning's 'n' for the left bank = 0.03
- Manning's 'n' for the right bank = 0.03

The boundary conditions used for the HEC-RAS model was a normal depth of 0.014 at the upstream end of the site and the known water surface level of 9.41m AHD at the downstream end. Due to the nature of the flow in the catchment, a mixed flow analysis was adopted. This meant that the nature of the flow could be either supercritical or subcritical depending on the condition of the streams. The energy slope was unknown and substituted with the slope of the channel at the location of 0.5%.

A flow of 0.485m³/s was input into chainage 172.5m. A secondary flow of 0.356 was added at chainage 22.5m.

The results for the analysis are shown in table 1 below, which demonstrate the 100yr water surface level at each chainage. Two typical sections through the overland flow path at chainages 160m and 10m, which have been output from HECRAS, are included in Appendix D. The flood extent plan in Appendix B demonstrates the flood extent within the overland flow path through the site in the 100yr storm event.

2.5 HEC-RAS Results

Table 1 – Flood Level Summary

River Station (m)	Profile (ARI)	Q Total (m ³ /s)	Existing W.S. Elevation (m)
172.5	100 Yr	0.485	13.15
160	100 Yr	0.485	12.86
147.5	100 Yr	0.485	12.45
135	100 Yr	0.485	12.14
122.5	100 Yr	0.485	11.88
110	100 Yr	0.485	11.80
97.5	100 Yr	0.485	11.68
85	100 Yr	0.485	11.50
72.5	100 Yr	0.485	11.08
60	100 Yr	0.485	10.83
47.5	100 Yr	0.485	10.73
35	100 Yr	0.485	10.56
22.5	100 Yr	0.841	10.38
10	100 Yr	0.841	9.86
00	100 Yr	0.841	9.41

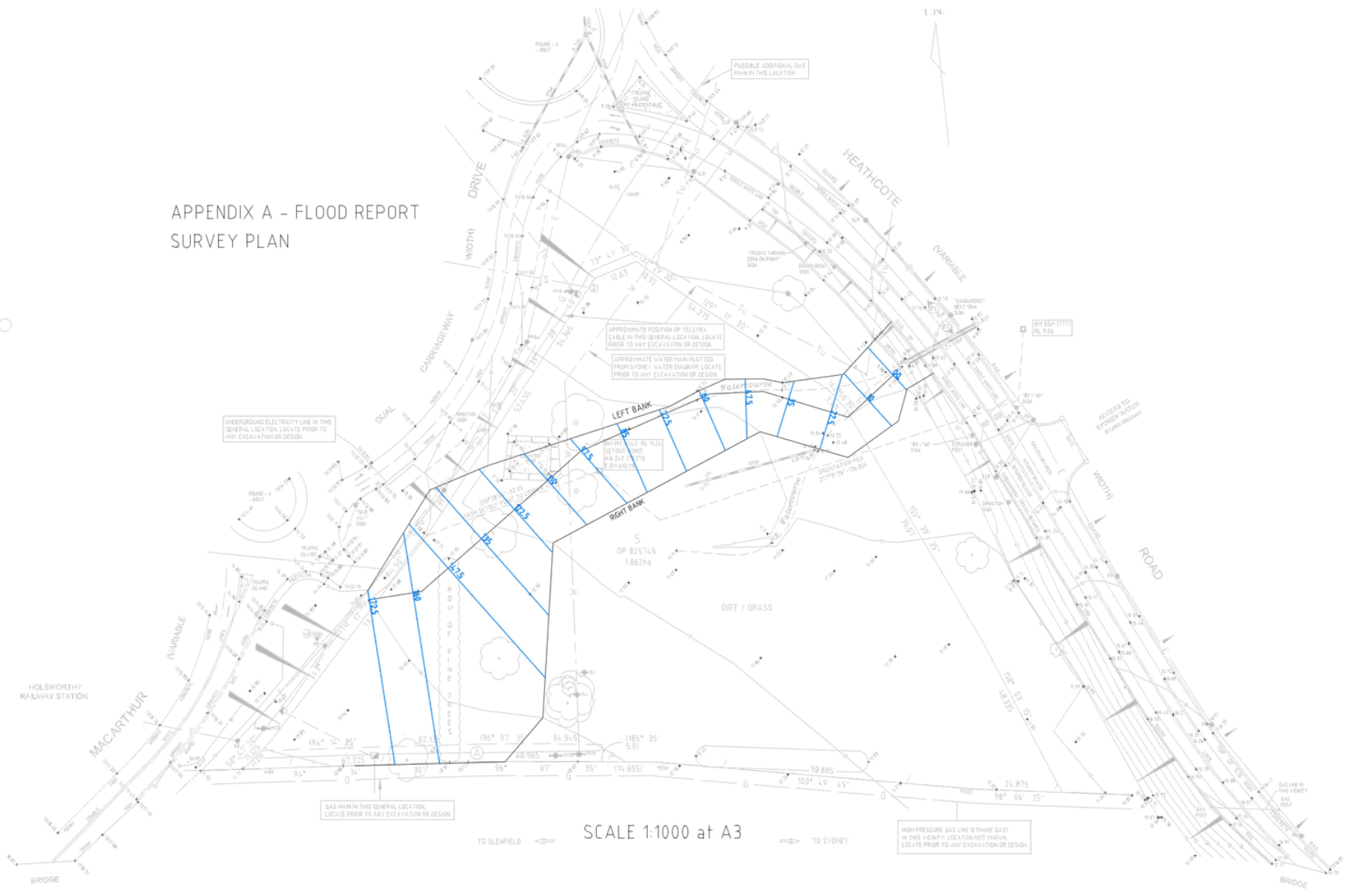
3. CONCLUSION

The site contains an existing overland flow path which conveys the flow from an upstream catchment in Macarthur Drive. A combination of this flow and the flow from within the site generate the water surface levels for the 100yr storm event which are presented in table 1. The 100yr flood extent within the overland flow path is shown in Appendix B.

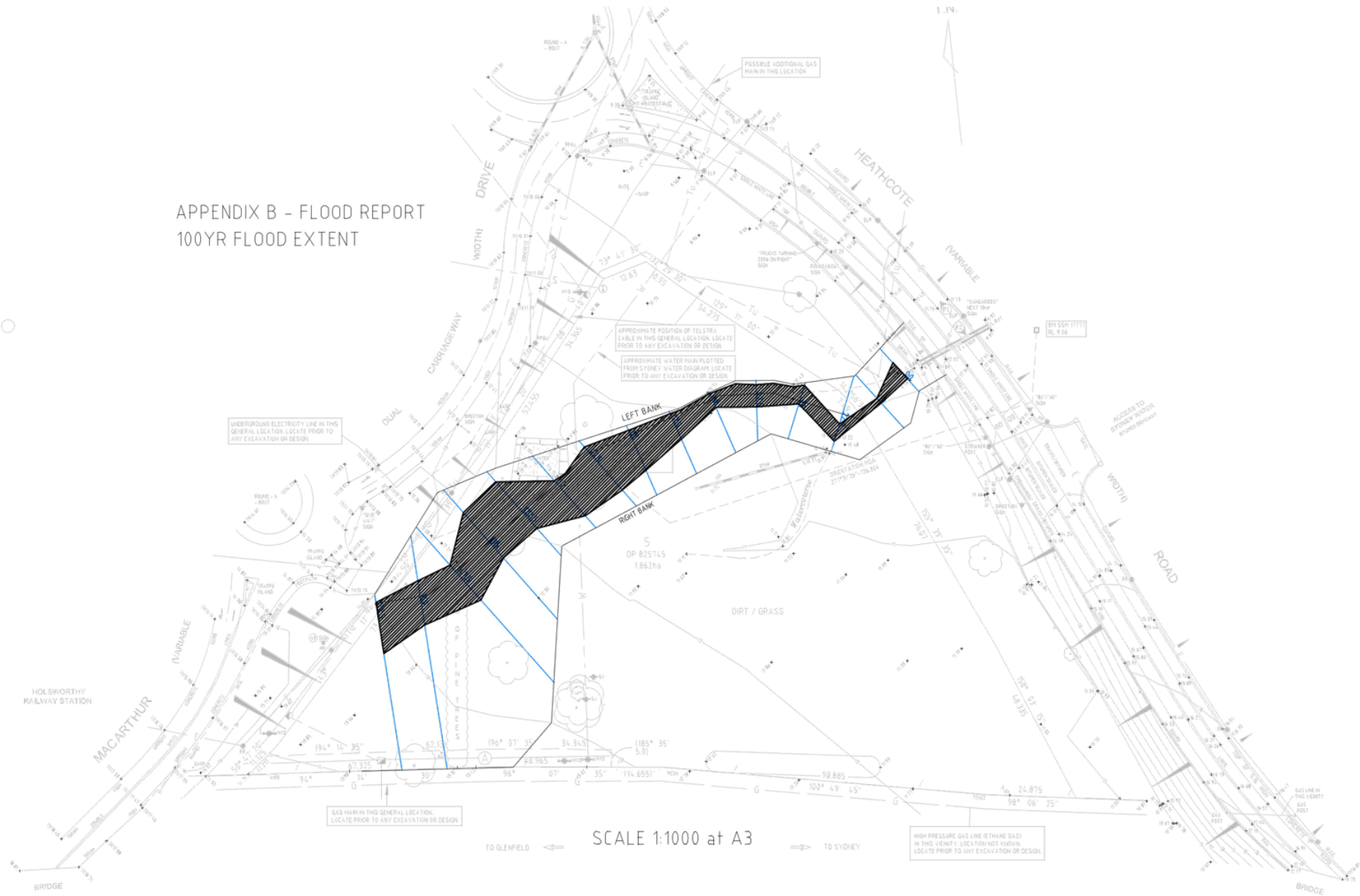
A DRAINS model has been produced to determine the downstream water level of 9.41m AHD at the headwall, which was found to be 9.41m AHD. The model demonstrates that the two Ø 450mm diameter stormwater pipes do not have the capacity to convey the flow from the entire catchment, thus the water ponds up to 9.41m AHD before it overtops the kerb in Heathcote Road road reserve and is conveyed further down Heathcote Road away from the site.

The flood levels presented in table 1, in conjunction with Appendices A, B, C, D and E have been provided to summarise the flood levels within the site and help aid the planning for future developments within the site.

APPENDIX A - FLOOD REPORT
SURVEY PLAN



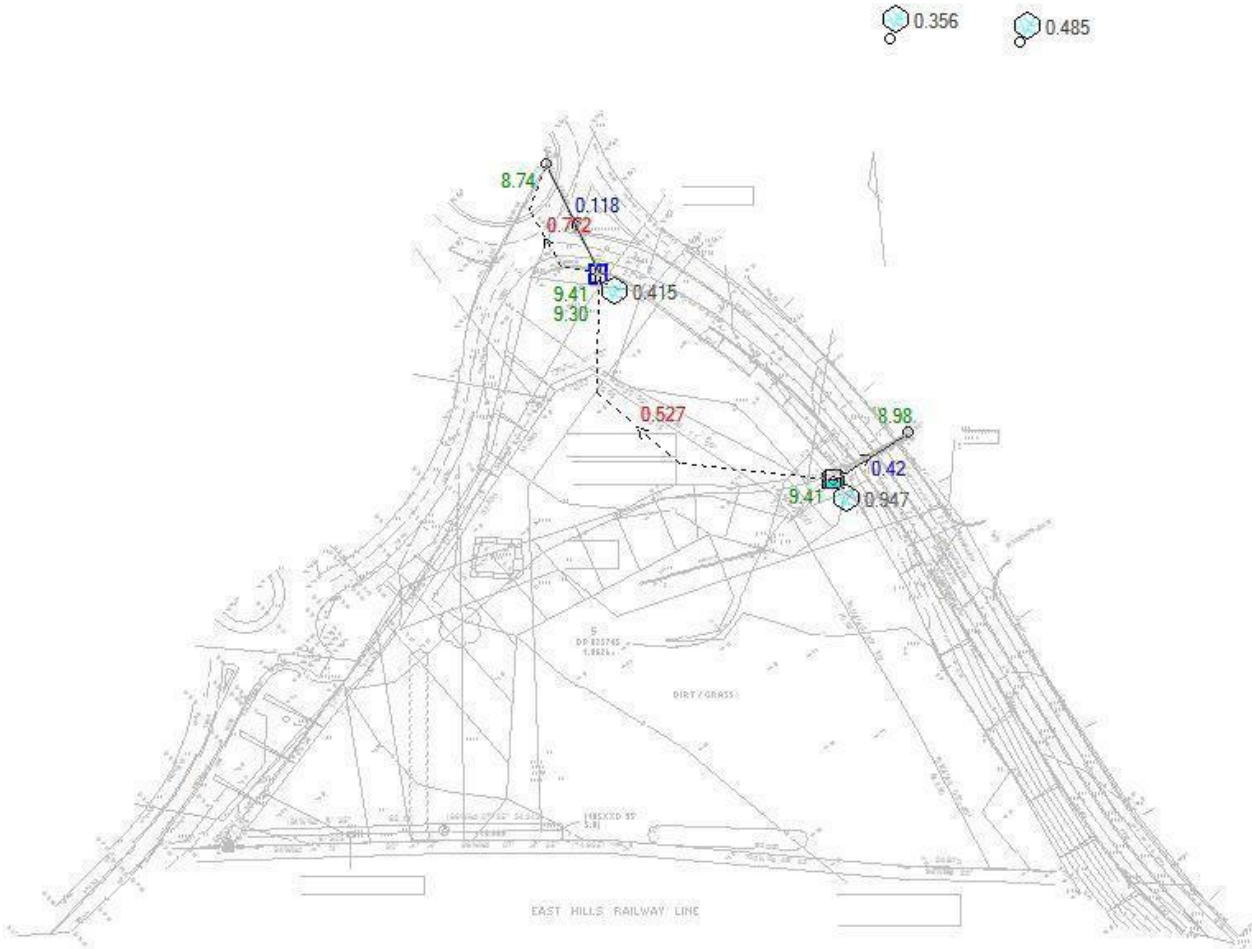
APPENDIX B - FLOOD REPORT
100YR FLOOD EXTENT



APPENDIX C - FLOOD REPORT
CATCHMENT PLAN



APPENDIX D: DRAINS MODEL



APPENDIX E: HECRAS SECTIONS

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