
10301 Cranbrook Town Centre

Technical Note No.9 Rv0: Drainage Strategy

20th July 2021

1 Introduction

- 1.1** Brookbanks Consulting Limited (BCL) are appointed to complete a Technical Note to set out the proposed Drainage Strategy for the Town Centre development to accompany the applications for:
- Town Centre MLR
 - Town Centre Parcel TC4 Access Road
- 1.2** This Note is prepared in order to satisfy the drainage conditions for the Reserve Matters of the above mentioned applications.
- 1.3** The outline planning permission was supported by a Flood Risk Assessment - the mitigation measures arising from which were set out in the Development Framework Plan and in the approved Landscape Biodiversity and Drainage Strategy (LBDS). The LBDS represents a strategy document to form the framework for future development at the site.
- 1.4** The LBDS document sets out that the development will utilise tier 1 or on plot measures and rely on attenuation in tier 2 strategic detention features prior to final discharge to local watercourses.
- 1.5** A Sustainable Drainage Strategy is required to be submitted in support of reserved matters applications for Cranbrook to set out the drainage principles and proposals for the detailed development, explain how the requirements of the LBDS have been met and confirm compliance with the FRA This Technical Note provides this information for the two reserved matters applications.

2 Drainage Strategy

Ground Conditions

- 2.1** The permeability of Cranbrook has been considered carefully at various points during the development of the site. The Environment Agency (EA) Groundwater Vulnerability Map Sheet 50 (1:100,000), East Devon and Somerset, indicates that the vast majority of site to be underlain by strata classified as a non-aquifer (negligible permeability) comprising the Aylesbeare Mudstone Group.
- 2.2** Bore holes have been dug and site percolation tests have been completed and formed part of the outline

application documentation. Such tests were aimed at determining if and where infiltration drainage might be possible and confirmed that the Mudstone was generally impermeable and hence precluded infiltration drainage across much of the site. Only in the very limited instances at the western end of phase 1 (west of Rockbeare Stream) - where the soils are underlain by the relatively permeable Dawlish Sandstone - was there any potential for percolation.

- 2.3** The Study Area is shown to be underlain by the Aylesbeare Mudstones and thus are likely to have extremely low to nil permeability.

Study Area

- 2.4** The Drainage Strategy has been prepared in accordance with the LBDS and is applied to the overall Town Centre development. In line with the LBDS Surface Water Drainage Strategy, the site has free discharge to the receiving strategic Phase 2C detention basin to the north west which has downstream controls prior to discharging into the existing brook.
- 2.5** Where proposed impermeable areas are over and above the planned 50% allowance for run-off to the receiving basins, additional 'on-plot' attenuation/ source control will be provided. Individual parcel reserve matters applications will rely on this Drainage Strategy and will detail 'on-plot' attenuation/ source control proposals.
- 2.6** Drawing 10301-PA-08 A included in the Appendix shows the current Town Centre parcelisation proposals. Individual development parcel details are shown in 'Drainage design schedule' included in the Appendix.

Town Centre MLR

- 2.7** BCL drawing 10301-500-405 included in the Appendix shows the already constructed MLR Phase 2 sewers which were designed to serve the Town Centre areas which drains to Basin 2C. These were approved as part of the reserved matters application reference 13/1213/MRES, approved on the 14 November 2013, shown on drawings 10222/DR/201 Rev E, 10222/DR/202 Rev E and 10222/DR/203 Rev E. Lateral connections shown were provided at the time of construction to serve future development parcels.
- 2.8** The original Drainage Strategy has been reviewed and updated where necessary to show the original lateral connections still to be utilised, any new lateral connections required and extensions to the MLR Phase 2 sewers required to accommodate the current proposals. Discharge locations for each development area have been identified on BCL drawing 10301-500-405.
- 2.9** The Phase 2 MLR sewer system drains to the Phase 2C detention basin, where flows are attenuated to greenfield rates prior to discharging to the local watercourse.
- 2.10** Detention Pond 2:C has been approved by the Environment Agency based on Catchment plan reference 10222-DR-532 showing a contributing impermeable area of 16.791ha, including this part of the Town Centre with a contributing impermeable area of 6.017ha (as scheduled in Appendix B). A copy is contained within the Appendix.

Parcel TC4 Access Road

- 2.11** Drawings 10301-500-701 & 702 show the proposed sewers within the Parcel TC4A Access Road will drain parcels TC4C, TC4D and TC4E. In addition they will collect run off from parcel TC4A (sub catchments 2b and 3). Further details of the run off rates from parcel TC4A (sub catchments 2b and 3) are provided in BCL 10667 Technical Note No. 1 – Drainage Strategy.
- 2.12** Sewers within the Parcel TC4A Access Road will connect to the Phase 2 MLR sewer system draining to the Phase 2C detention basin.

Water Quality

- 2.13** Impermeable surfaces collect pollutants from a wide variety of sources including cleaning activities, wear from car tyres, vehicle oil and exhaust leaks and general atmospheric deposition. The implementation of SuDS in development drainage provides a significant benefit in removal of pollutant from development run-off.
- 2.14** The SuDS Manual C753 describes a ‘Simple Index Approach’ for assessing the pollution risk of surface run-off to the receiving environment using indices for likely pollution levels for different land uses and SUDS performance capabilities. To deliver adequate treatment SuDS components will be selected to ensure the pollution hazards are effectively treated.
- 2.15** The conceptual drainage proposals have been developed in a manner that will allow the site wide system to be designed to encourage passive treatment of discharged flows and to improve the water quality by removing the low level silts, oils and metals associated with urban run-off. The design of the drainage system accords with the expectations of SuDS systems and the LBDS and will include a number of elements within the drainage train. Elements of the system will include any source control within development parcels, the collection and deposition of silt through the design of the highway gullies and sewer network system (as is normally and effectively the case within SuDS systems). The already constructed strategic detention feature Basin 2C includes the provision of open channel outfalls to the ordinary watercourse receptors provide a further measure to assist in managing water quality.
- 2.16** The SuDS storm water management features to be implemented will be designed to enhance the biodiversity and landscape character of the site, while also providing amenity space and acting as a functional feature to control storm discharges from the site and improve water quality.

Maintenance & Management Arrangements

- 2.17** Phase 2C detention basin is inspected and maintained by a management company employed on behalf of the Consortium and CTC.
- 2.18** The already constructed Phase 2 MLR sewer system draining to the Phase 2C detention basin is under a section 104 agreement with SWW for future adoption and maintenance. The Phase 2 MLR highways are under a section 38 agreement with DCC for future adoption and maintenance.

- 2.19** Proposed new sewers constructed in the Parcel TC4A Access Road will be offered for adoption under a section 104 agreement with SWW for future adoption and maintenance.

Foul Water Drainage

- 2.20** It is proposed that foul water flows generated will be conveyed by a traditional gravity sewer network to infrastructure constructed as part of the strategic site network. These sewers then ultimately direct flows to the adjacent foul water pumping station which pumps west to the existing network.

3 Conclusions

- 3.1** Means to discharge storm water drainage have been established that comply with current guidance and requirements of the LBDS Surface Water Drainage Strategy for the development.
- 3.2** More specifically as per the LBDS, the first 50% of the impermeable area is attenuated within detention basin 2C, with the additional area beyond this attenuated 'on-plot' by way of appropriate attenuation/ source control measures to be considered on an individual parcel basis.
- 3.3** The design accords with the tenets of the LBDS and the current drainage proposals have been developed to ensure there is no adverse effect on the overall drainage area contributing to the Basin 2C, therefore not affecting its planned storage capacity and operation both now and in the future.
- 3.4** The MLR Sewers were approved as part of the reserved matters application reference 13/1213/MRES, approved on the 14 November 2013. Proposed new sewers within the Parcel TC4A Access Road are an extension to lateral connections constructed as part of the Phase 2 MLR sewer system draining areas already allowed for within the catchment extent.
- 3.5** Foul water flows will be conveyed to the sewer network constructed as part of the infrastructure works for the wider site.

4 Limitations

- 4.1** The conclusions and recommendations contained herein are limited to those given the general availability of background information and the planned usage of the site.
- 4.2** Third party information has been used in the preparation of this report, which Brookbanks Consulting Ltd, by necessity assumes is correct at the time of writing. While all reasonable checks have been made on data sources and the accuracy of data, Brookbanks Consulting Ltd accepts no liability.
- 4.3** The benefits of this report are provided to HDD Cranbrook Ltd for the proposed development on land at

Cranbrook Town Centre only.

4.4 Brookbanks Consulting Ltd excludes third party rights for the information contained in the report.

5 Appendices

A – Drawing 10301-PA-08 C - Town Centre Parcel Structure and Areas

B – Drainage Design Schedule rev.1

C – Drainage Strategy Town Centre drawing – 10301-500-405 A.

Drainage Layout - 10222/DR/201 Rev E

Drainage Layout - 10222/DR/202 Rev E

Drainage Layout - 10222/DR/203 Rev E

D – EA Consent for Basin 2C.

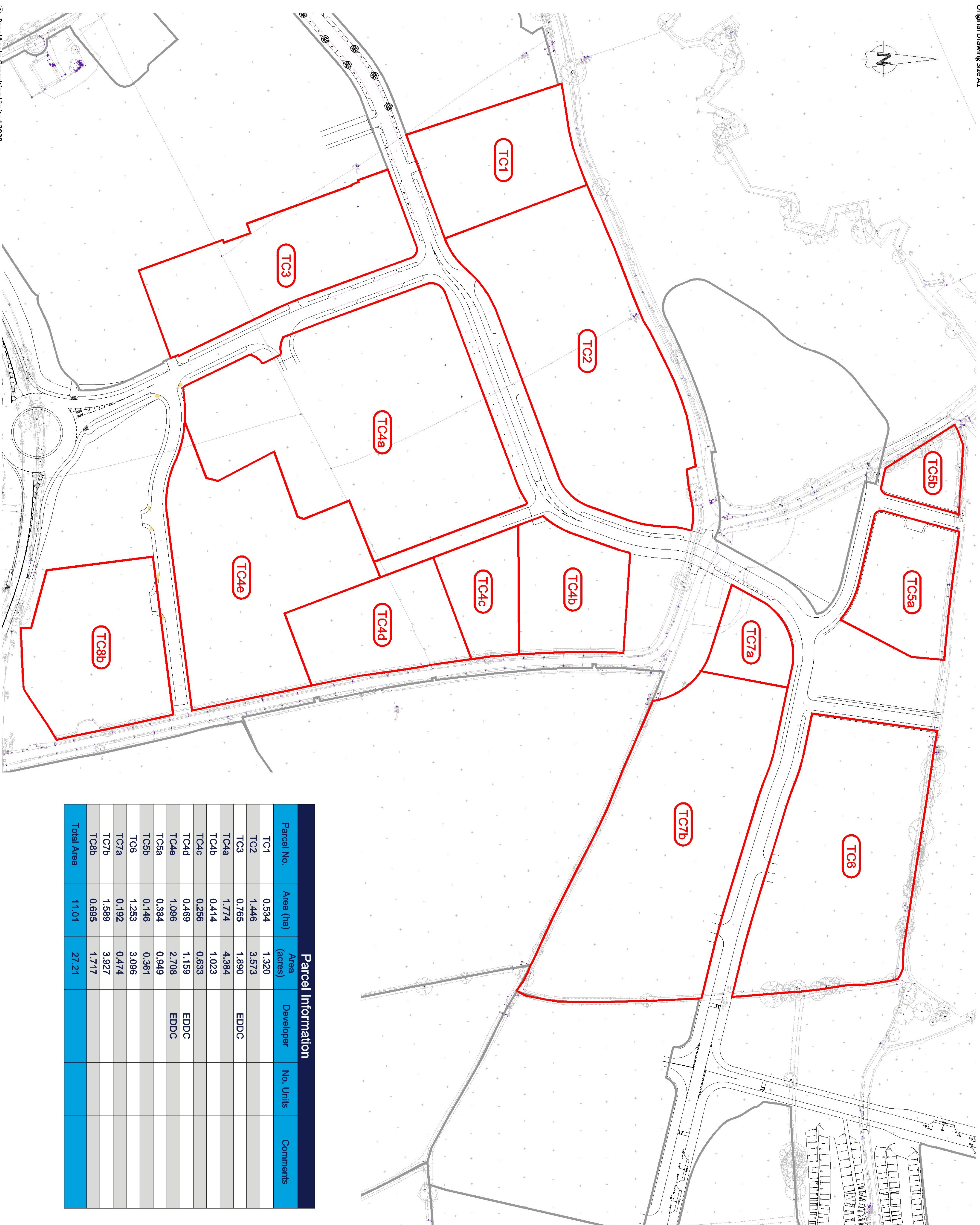
Drawing 10222-DR-532 – Catchment Plan

E - Drawing 10301-500-701 – Drainage Layout Parcel TC4 Access Road

Drawing 10301-500-702 – Drainage Longitudinal Section

Parcel TC4 Access Road - Hydraulic calculations

Appendix A



Construction Design and Management (CDM)
Key Residual Risk
 Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry, and for the work to be undertaken. The drawing may not be relied upon by any party other than the client and Brookbanks Consulting Ltd. Unless specified otherwise, the client or from other sources has been used. It has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.

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 4. No part of this drawing may be copied or duplicated without the express permission of Brookbanks Consulting Ltd.

Parcel Information

| Parcel No. | Area (ha) | Area (acres) | Developer | No. Units | Comments |
|-------------------|--------------|--------------|-----------|-----------|----------|
| TC1 | 0.534 | 1.320 | | | |
| TC2 | 1.446 | 3.573 | | | |
| TC3 | 0.765 | 1.890 | EDDC | | |
| TC4a | 1.774 | 4.384 | | | |
| TC4b | 0.414 | 1.023 | | | |
| TC4c | 0.256 | 0.633 | | | |
| TC4d | 0.469 | 1.159 | EDDC | | |
| TC4e | 1.096 | 2.708 | EDDC | | |
| TC5a | 0.384 | 0.949 | | | |
| TC5b | 0.146 | 0.361 | | | |
| TC6 | 1.253 | 3.096 | | | |
| TC7a | 0.192 | 0.474 | | | |
| TC7b | 1.589 | 3.927 | | | |
| TC8b | 0.695 | 1.717 | | | |
| Total Area | 11.01 | 27.21 | | | |

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EDNC Consortium
East Devon New Community Town Centre
Parcel Structure & Areas

| | |
|----------------|---------------------|
| Status: | Submit Date: |
| Information | Jan 2021 |
| Drawn: | Checked: |
| MSM | PAB |
| Scale: | Rev: |
| 1:1,000 | 10301-PA-08 |
| Number: | Rev: |
| 10301-PA-08 | C |

Information
 Date: 18.01.2021

Scale
 1:1,000

Number
 10301-PA-08

Rev
 C

METRES
 0 20 40 60 80 100

Appendix B

Drainage Design

Rev.-0

| Event | <u>IoH124</u> | |
|----------|---------------|-------|
| | 50ha | 1ha |
| 1 Year | 223.9 | 4.48 |
| Qbar | 287.1 | 5.74 |
| 100 Year | 694.8 | 13.90 |

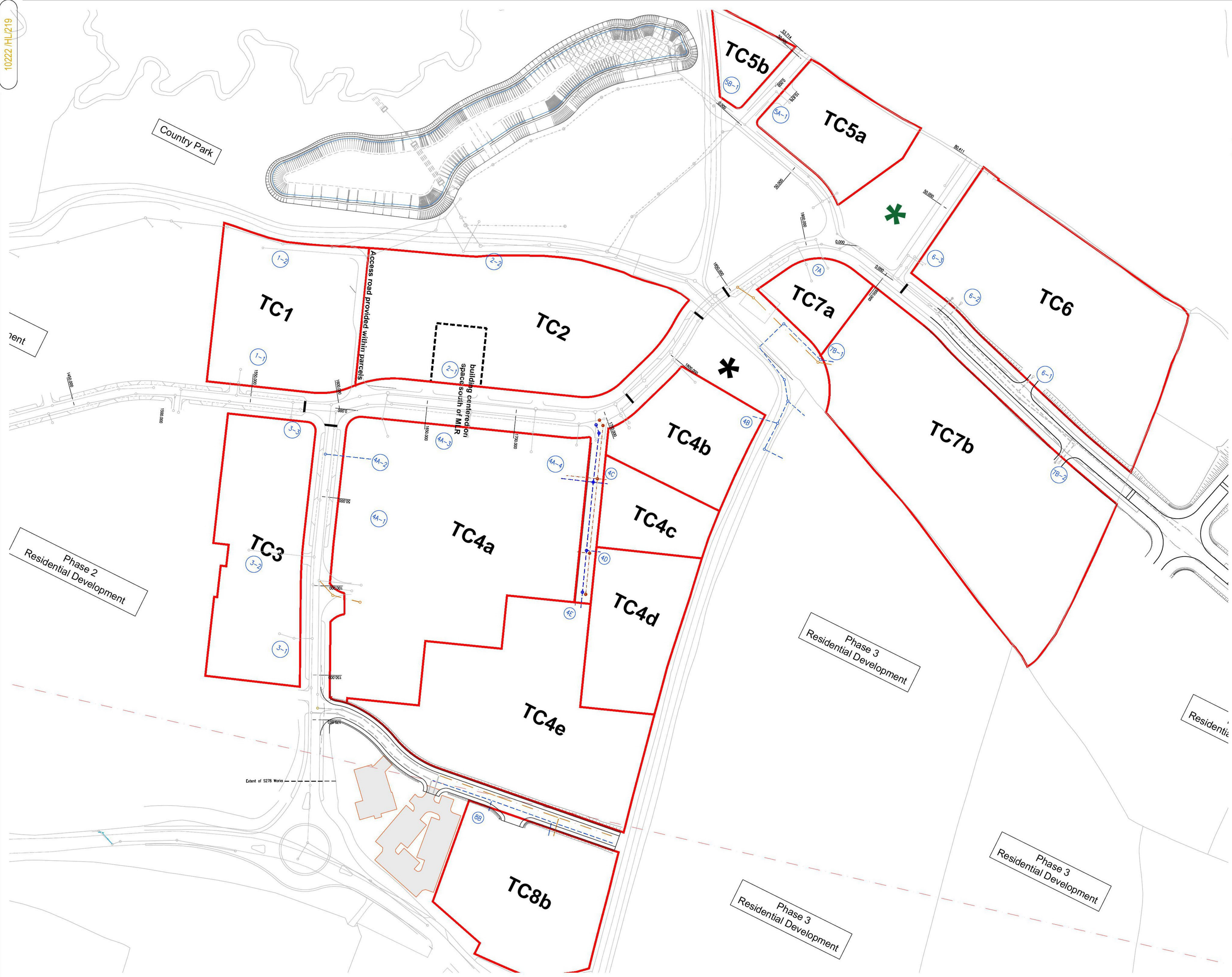
| <u>Impermeability</u> | |
|-----------------------|------|
| Residential | 0.50 |
| Infrastructure | 1.00 |
| School | 0.45 |
| Retail/Commercial | 0.90 |

Catchments

| Basin | Catchment | Land Use | Developable Area (ha) | Impermeability Factor | Impermeable Area (ha) | Sewer Connection Point(s) | | |
|-------|-----------|-------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------|-------|
| TC1 | 1 | Residential | 0.534 | 0.50 | 0.267 | 1-1,1-2 | | |
| | | | 0.534 | | 0.267 | | | |
| TC2 | 2 | Community | 1.446 | 0.50 | 0.723 | 2-1,2-2 | | |
| | | | 1.446 | | 0.723 | | | |
| TC3 | 3 | Residential | 0.765 | 0.50 | 0.383 | 3-1,3-2,3-3 | | |
| | | | 0.765 | | 0.383 | | | |
| TC4 | 4a | Retail | 1.774 | 0.50 | 0.887 | 4A-1,4A-2,4A-3,4A-4 | | |
| | | Community | 0.414 | | | | 4B | |
| | | Community | 0.256 | | | | 4C | |
| | | Residential | 0.469 | | | | 4D | |
| | | Residential | 1.096 | | | | 4E | |
| | | Road | 0.091 | | | | | |
| | | 4.100 | 2.095 | | | | | |
| TC5 | 5a | Residential | 0.384 | 0.50 | 0.192 | 5A-1 | | |
| | | Residential | 0.146 | | | | 5B-1 | |
| | | 0.530 | 0.265 | | | | | |
| TC6 | 6 | Residential | 1.253 | 0.50 | 0.627 | 6-1,6-2,6-3 | | |
| | | | 1.253 | | | | 0.627 | |
| TC7 | 7a | Residential | 0.192 | 0.50 | 0.096 | 7A | | |
| | | Residential | 1.589 | | | | 7B-1,7B-2 | |
| | | 1.781 | 0.891 | | | | | |
| TC8 | 8b | Residential | 0.695 | 0.50 | 0.348 | 8B | | |
| | | Road | 0.210 | | | | | |
| | | 8a | Existing Commercial | | | | 0.380 | 0.210 |
| | | 1.285 | 0.768 | | | | | |
| | | | 11.694 | | 6.017 | | | |

| Original Developable Area (ha) | Original Impermeable Area (ha) |
|--------------------------------|--------------------------------|
| 0.69 | 0.38 |
| 1.20 | 0.66 |
| 0.72 | 0.40 |
| 4.32 | 2.38 |
| 0.54 | 0.30 |
| 1.11 | 0.61 |
| 1.80 | 0.99 |
| 0.62 | 0.34 |
| 0.21 | 0.19 |
| 0.48 | 0.26 |
| 1.31 | 0.79 |
| 11.69 | 6.50 |

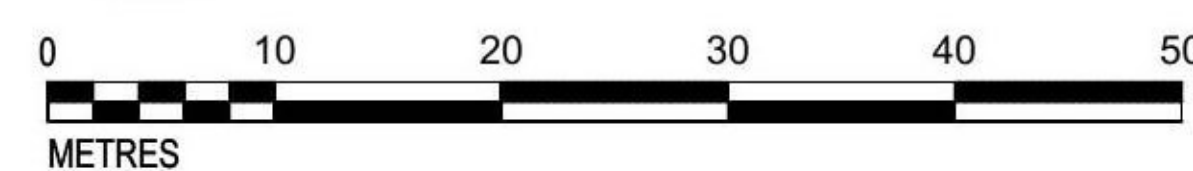
Appendix C



NOTES:

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- Town Centre Parcels
- Proposed foul water sewer
- Proposed surface water sewer
- Existing foul water sewer
- - - Existing surface water sewer
- 7B Proposed discharge point and reference.



| A | Parcelisation updated | NJO | DS | PAB | 15/06/20 |
|--------------|-----------------------|----------|---------|----------|----------|
| - | First issue | NJO | DS | PAB | 15/06/20 |
| Rev. | Revision Details | Drawn | Checked | Approved | Date |
| | | | | | |
| For Approval | | | | | 15.06.20 |
| Issue Status | | Approved | Date | | |
| Drawn | NJO | Checked | RM | Date | June 20 |



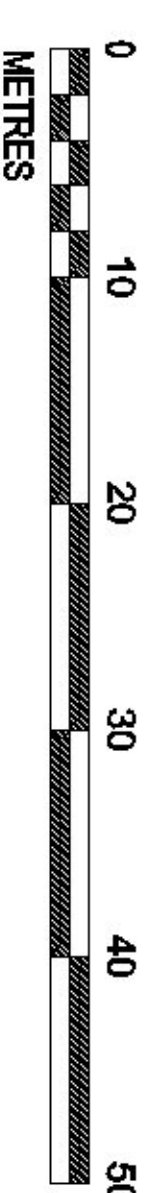
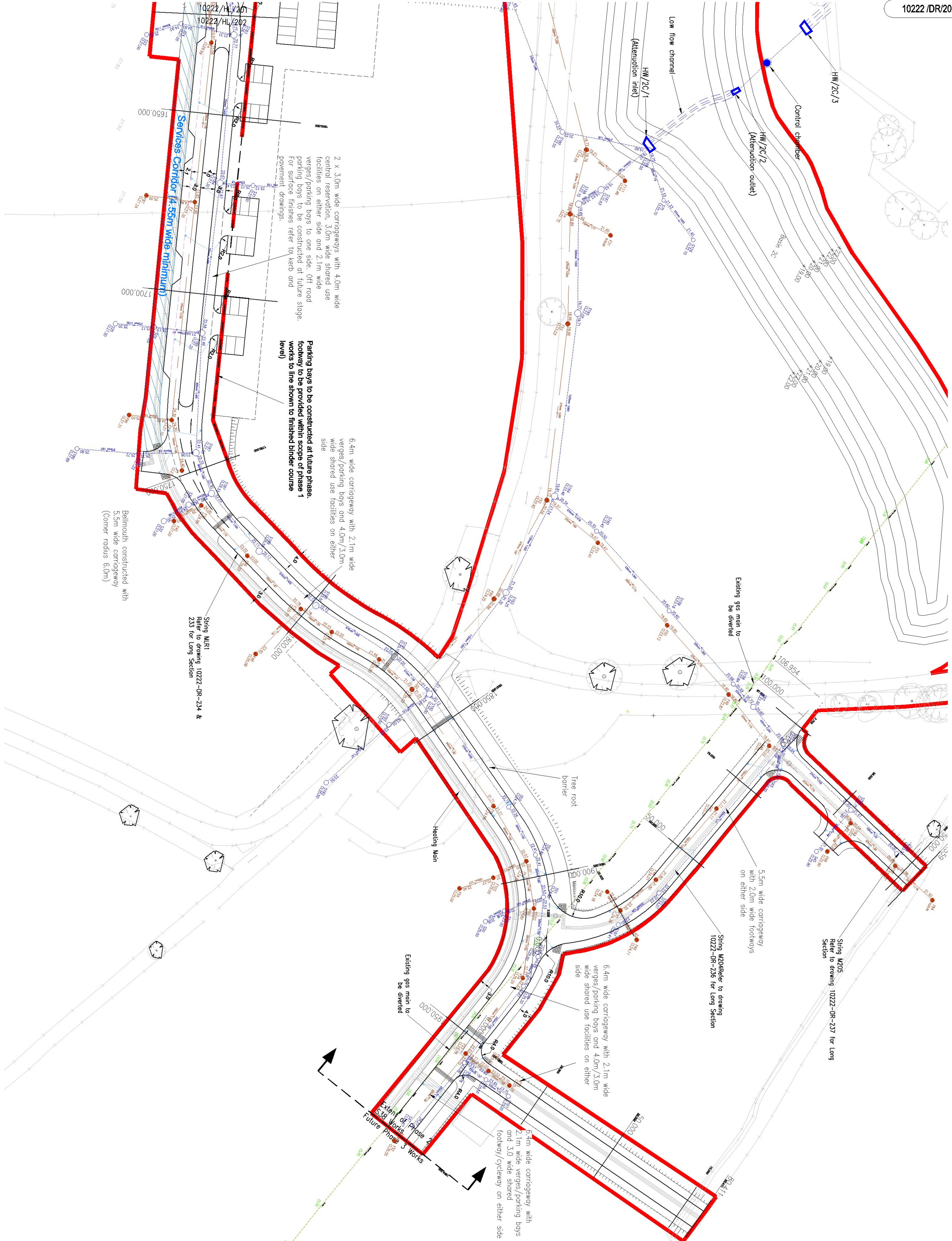
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EDNC Consortium

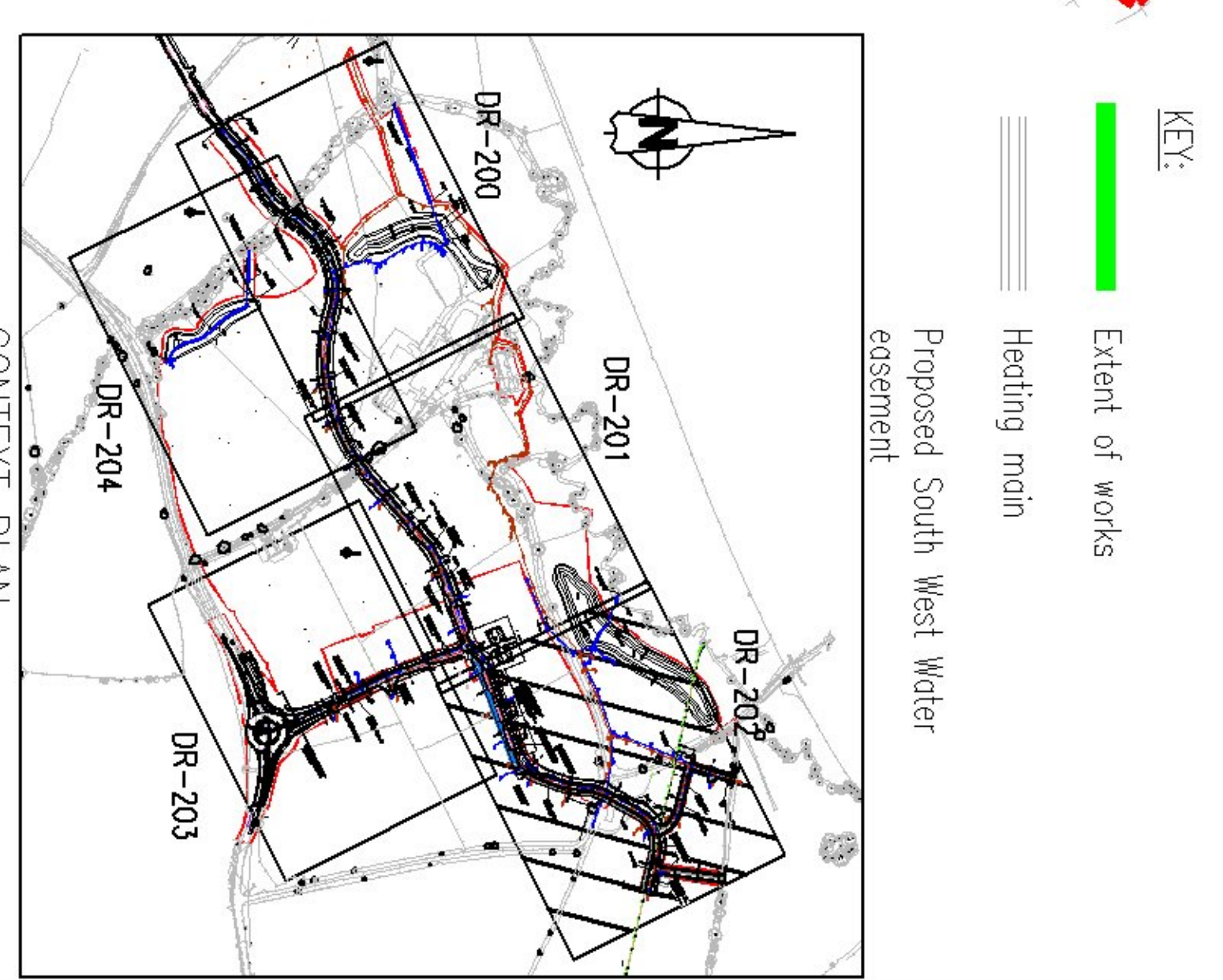
East Devon New Community Phase 2

Proposed Development Town Centre Drainage Strategy

| | | |
|-------------|---------------|------|
| Scale at A1 | Drawing No. | Rev. |
| 1:1000 | 10301-500-405 | A |



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 3. All materials and workmanship to be in accordance with the Contract Specification and the Department of Transport Specification for Highway Works, Devon County Council's Highway Construction directions & Sewers for Adoption 7th Edition.
 4. The existing services shown on this drawing are not necessarily complete nor is their location with regard to position and depth precise. It is the Contractor's responsibility to liaise with all relevant services companies to ensure that all services are accurately located and adequately protected during construction.
 5. For construction details, see BCL drawing series 10222/DR/221 - 223.
 6. For full details of the long sections of the drainage, refer to BCL drawing series no. 10222/DR/231 - 241.



| Rvw. | Revision Details | Drawn | Checked | Approved | Date |
|------|------------------------------------|-------|---------|----------|----------|
| E | Residential left roof amended | MM | RH | PAS | 19/04/13 |
| D | Drainage amendments | MM | RH | PAS | 19/04/13 |
| C | Basin Drainage amended | MM | RH | PAS | 19/04/13 |
| B | Healing Main added | MM | RH | PAS | 19/04/13 |
| A | Drainage runs amended, HP gas main | TD | RH | PAS | 19/04/13 |

TENDER

Issue Status: **PAS**

Drawn: MS | Checked: RH | Date: APR 13

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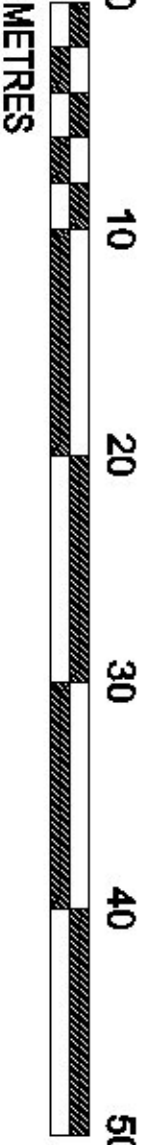
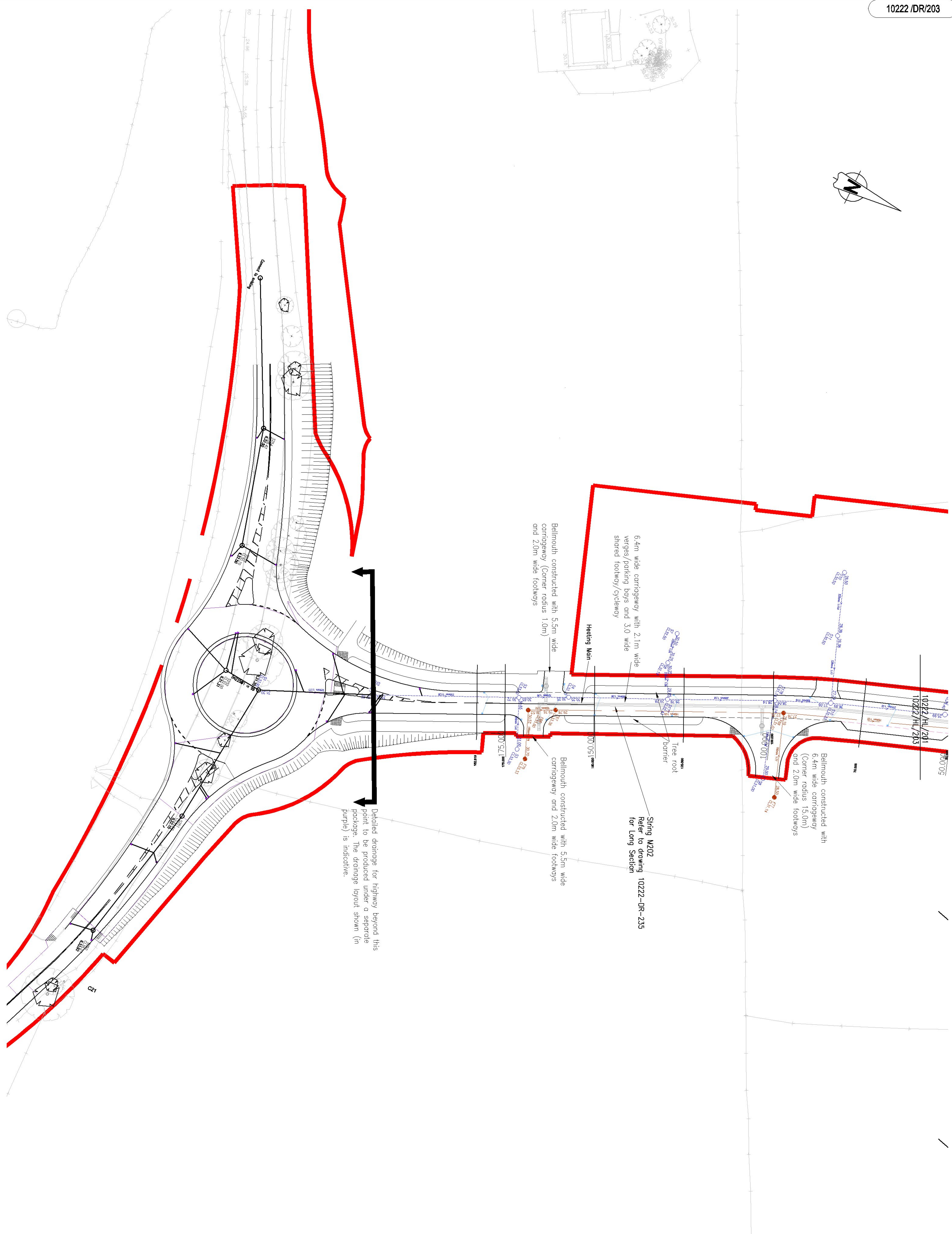
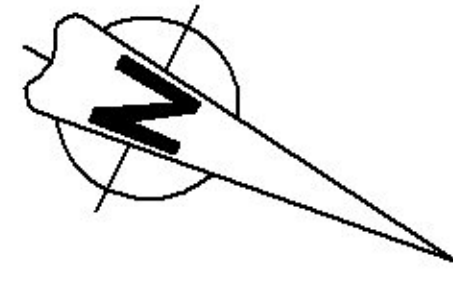
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East Devon New Community
 Phase 2 Enabling Works

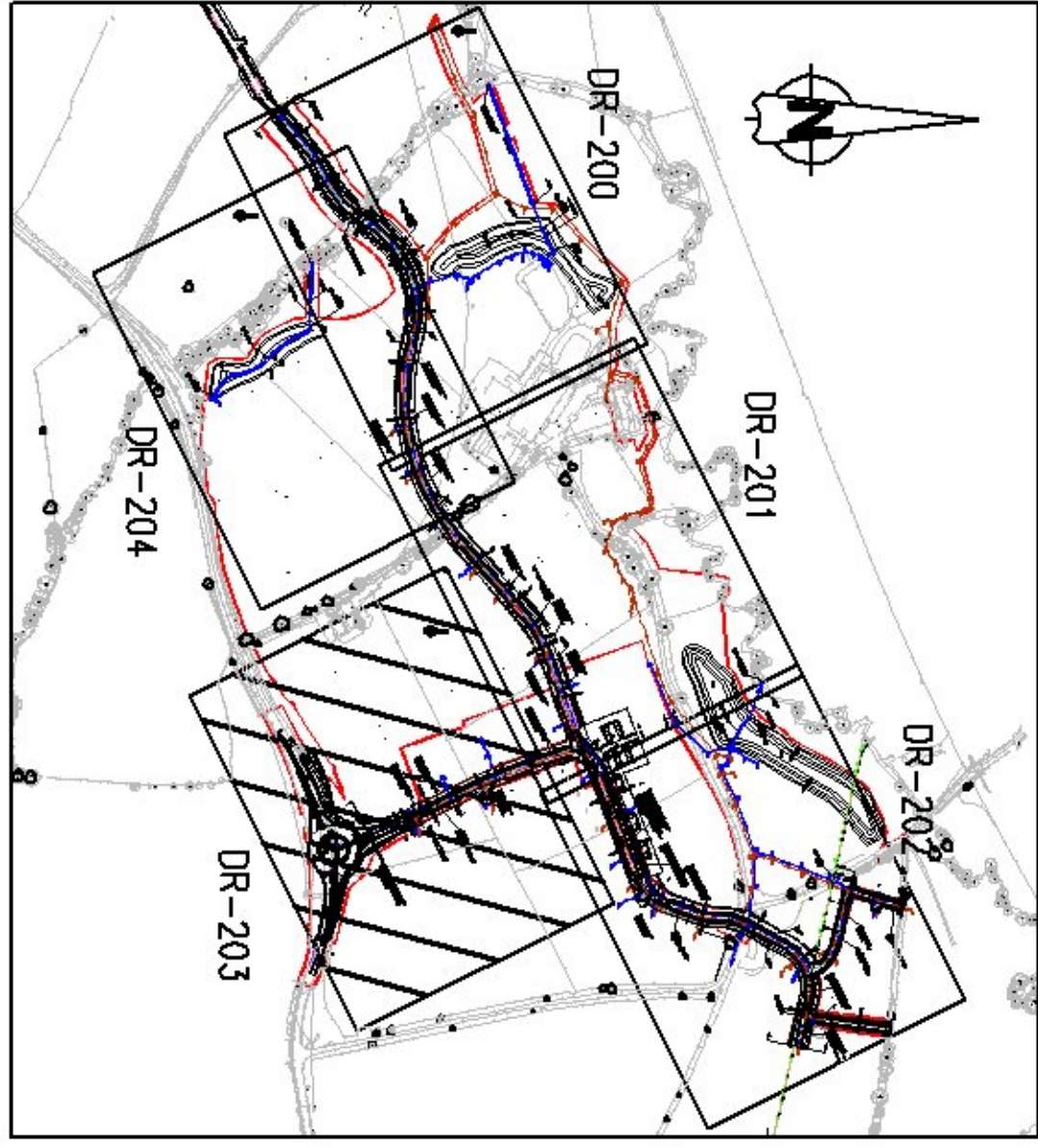
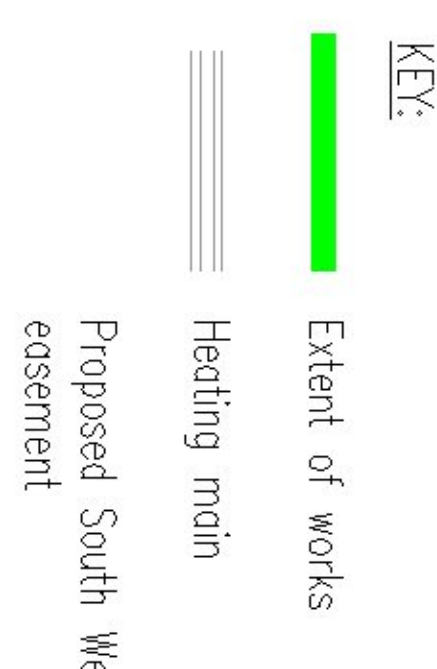
Proposed Development
 Phase 2 MLR Highway Works
 Drainage Layout (Sheet 3)

Scale: A1 | Drawing No: 10222 /DR/202 | Rev: E



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4. The existing services shown on this drawing are not necessarily complete nor is their location with regard to position and depth precise. It is the Contractor's responsibility to liaise with all relevant services companies to ensure that all services are accurately located and adequately protected during construction.
5. For construction details, see BCL drawing series 10222/DR/221 - 223.
6. For full details of the long sections of the drainage, refer to BCL drawing series no. 10222/DR/231 - 241.



| Rev. | Revision Details | Drawn | Checked | Approved | Date |
|------|--|-------|---------|----------|----------|
| E | Residential kerb radii amended | MM | RH | PAS | 16/04/13 |
| D | Drainage amendments | MM | RH | PAS | 16/04/13 |
| C | Basin Drainage amended | MM | RH | PAS | 16/04/13 |
| B | Heading Main added | MM | RH | PAS | 16/04/13 |
| A | Drainage runs amended, HP gas main added | TP | RH | PAS | 16/04/13 |

| Issue Status | Drawn | MS | Checked | RH | Date | Approved | Date |
|--------------|-------|----|---------|----|--------|----------|----------|
| TENDER | MS | MS | RH | RH | APR 13 | PAS | 06.04.13 |

Brookbanks Consulting

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EDNC Consortium

East Devon New Community
Phase 2 Enabling Works

Proposed Development
Phase 2 MLR Highway Works
Drainage Layout (Sheet 4)

Scale: A1 1:500
Drawing No. 10222 /DR/203
Rev. E

Appendix D

creating a better place



Mr Robin Hanick
Brookbanks Consulting Ltd.
6150 Knights Court
Solihull Parkway
Birmingham
B37 7WY

Our ref: FDC/D/2013/133
Your ref:
Date: 13 January 2014

Dear Mr Hanick

LAND DRAINAGE BYELAWS

FLOOD DEFENCE CONSENT REFERENCE: FDC/D/2013/133

PROPOSED CONSTRUCTION OF 3 SURFACE WATER STORAGE LAGOONS TO SERVE PHASE 2 OF THE CRANBROOK DEVELOPMENT

We are pleased to enclose the Environment Agency's formal consent for the above named works as required by the Land Drainage Byelaws.

Please find enclosed start and completion notification cards for the works. These should be completed and returned at the appropriate stages of the works.

If you require further information, please contact Tom Walling on the details below.

Please quote our reference on all correspondence.

Yours sincerely



Tom Walling
Partnerships & Strategic Overview Team (Devon)

Direct Line 01392 354154
Direct Email tom.walling@environment-agency.gov.uk



LAND DRAINAGE BYELAWS

Flood Defence Consent reference: FDC/D/2013/133

Control of structures and obstructions in, over or under watercourses, those within main river floodplains or those likely to effect operational access or flood defence assets

1. To: EDNC Consortium
c/o Brookbanks Consulting Ltd.
6150 Knights Court
Solihull Parkway
Birmingham
B37 7WY

2. In pursuance of **Land Drainage Byelaws** the Environment Agency HEREBY **GRANTS** ITS CONSENT in relation to the matters specified hereto.

3. Watercourse: Rockbeare Stream & Cranny Brook

Location: Phase 2 Cranbrook New Community, Broadclyst

Map Reference: Basin 2A – SY 00871-95366
Basin 2B – SY 00684-95621
Basin 2C – SY 01226-95827

Description of Works:

Construction of three surface water storage basins to serve new development. The basins will be grass-lined ponds with restricted outflows being linked to the receiving watercourses by control chambers feeding open swale features. All works in accordance with application of 18/11/13.

Drawings and documents referred to:

- 10222-LP-101 Site Location Plan
- 10222-DR-532 Drainage Catchment Areas
- 10222-DR-500 to 502 Basin 2A, 2B & 2C Setting Out Details
- 10222-DR-221 to 223 Construction Details Sheet 1 to 3
- 10222-DR-231 to 241 Details Catchment Area Plan
- 10222-CDM-001 Design Risk Assessment
- EA initial Consent at Planning Stage
- Windes Hydraulic Modelling Details

4. Signed on behalf of the Environment Agency

.....

Dated..... 13/1/14

George Arnison

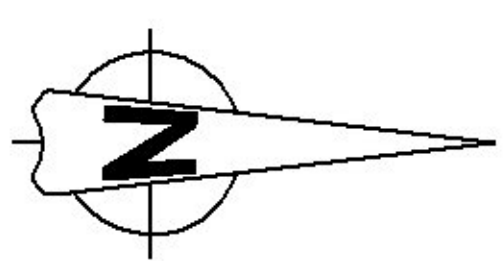
Partnerships & Strategic Overview Team Leader (Devon)

Please turn over for informatives

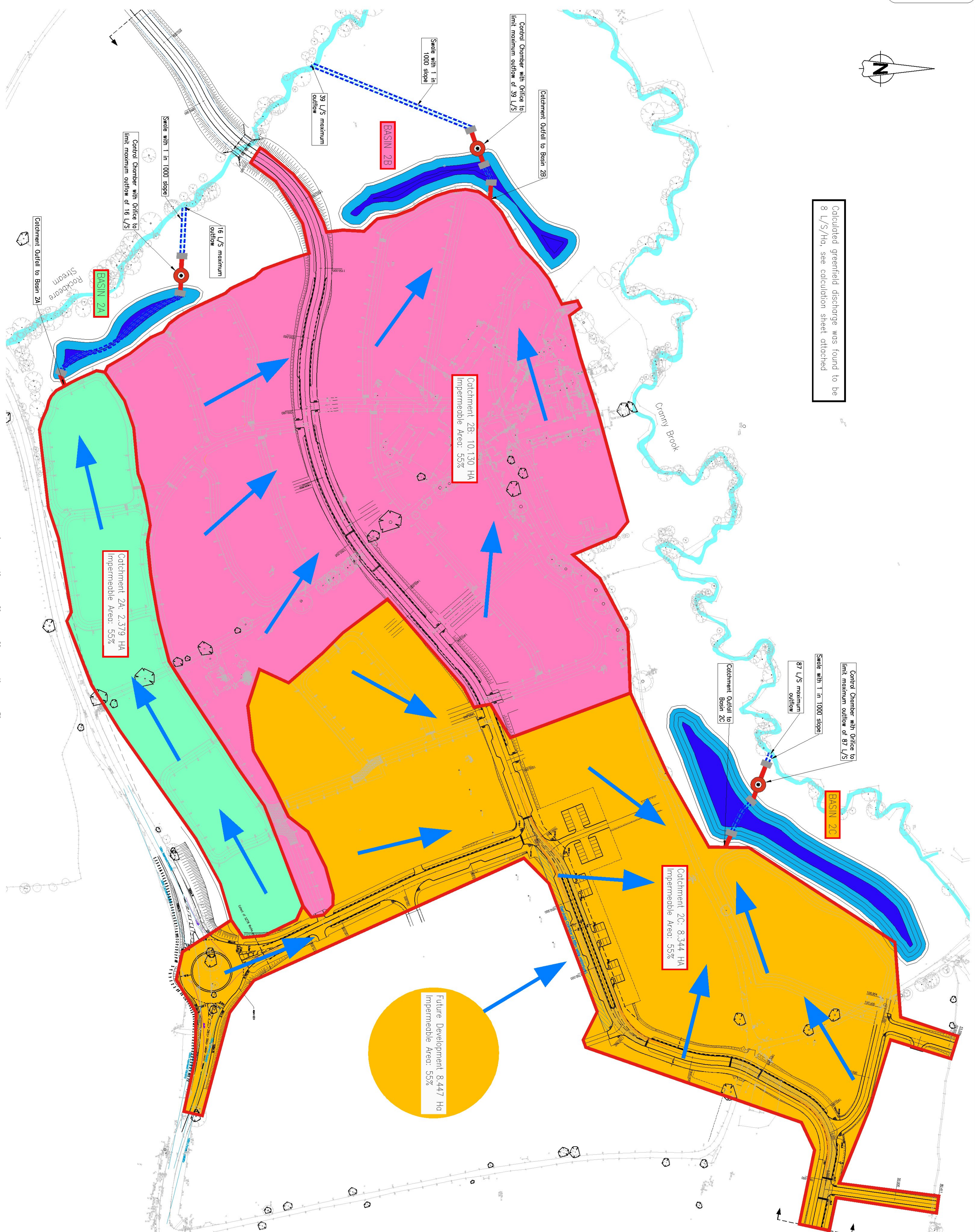


INFORMATIVES

1. The works shall be carried out in accordance with the approved plans, drawings and documents.
2. You must give a minimum of seven days notice of commencement of the works and immediate notification of completion of works shall be given by the return of the notification cards.
3. You should ensure compliance with Environment Agency Pollution Prevention Guidelines (PPG5).
4. This Consent does not remove the necessity for you to obtain other licences, consents, approvals (including byelaw consents) or permissions (including planning permission) which may be required in law or in order to comply with any duties or responsibilities for conservation or protection of the environment.
5. It is your responsibility to ensure that you obtain the consent / permission of any owners or occupiers of land affected by the works.
6. This Consent does not confer any rights of entry or rights over property.
7. The Environment Agency does not accept any responsibility for the design and construction of the works referred to and any liability for any loss or damage which may arise out of their design, construction, maintenance or use.
8. **The Landscape Biodiversity Drainage Strategy (LBDS) for Cranbrook specifies design criteria for the swale features, both to provide biodiversity enhancement and a safe profile. The Environment Agency supports the LBDS in providing minimum access 1 in 6 slopes, maximum 1 in 4 side slopes and a channel with a 1m base approximately 300mm deep.**
9. **The swale features should be orientated such that they discharge towards the flow in the receiving watercourse.**
10. **All arisings from excavation of the basins should be appropriately managed to ensure that they do not contribute to flood risk. It would be unacceptable to stockpile, or landscape, the material in the designated floodplain area where land levels would be raised.**
11. **It is suggested that the route of the swale for Basin '2B' be reviewed. It appears to be orientated upstream and there may be a shorter option by discharging to the Cranny Brook, as opposed to the Rockbeare Stream.**
12. **A 'stable' section of main river channel should be chosen to locate the outfall from the swale features. Disturbance to 'unstable' sections of channel, where erosion and movement is evident, should be minimised.**
13. **The above information must be brought to the attention of your contractor.**



Calculated greenfield discharge was found to be 8 L/S/ha, see calculation sheet attached



NOTES:

1. Do not scale from this drawing.
 2. This drawing is based on topographical survey conducted by others for the EDNC Development Consortium, supplemented around the site boundary by Ordnance Survey digital data.
 3. Crown Copyright (reproduction in whole or part is prohibited without the prior permission of Ordnance Survey). Brookbanks Consulting accept no responsibility for the accuracy of this information.
 4. Outline consent from the EA at planning stage attached – refer to document 'EA – 5.7.06'.
 5. The 'Development Flooding & Drainage Final Strategy' report mentioned in the letter is also attached herein – refer to document '1284FR401 RV Z'.
- Section 4.22 of the above report refers to 'Appendix B of the Environment Statement Strategy (attached herein)', which is a calculation of Greenfield Flow from the site. The Greenfield flow was found to be 8 litres/s/ha, which formed the basis of the Drainage Outflow Strategy now modelled as per out submission.

NOTES:

- Basin 2A Catchment Area
- Basin 2B Catchment Area
- Basin 2C Catchment Area
- Development Parcels
- Proposed Silt with 60mm base width and max 1 in 3 side slopes
- Proposed Headwall
- Proposed Control Chamber with office and weir controls
- Flow direction for designed sewers

| Rev. | Revision Details | Drawn | Checked | Approved | Date |
|-------|------------------|---------|---------|----------|----------|
| DRAFT | Issue Status | PAS | | | 23.07.13 |
| Drawn | LJS | Checked | RH | Approved | Date |
| | | | | | JUL 13 |

Brookbanks Consulting

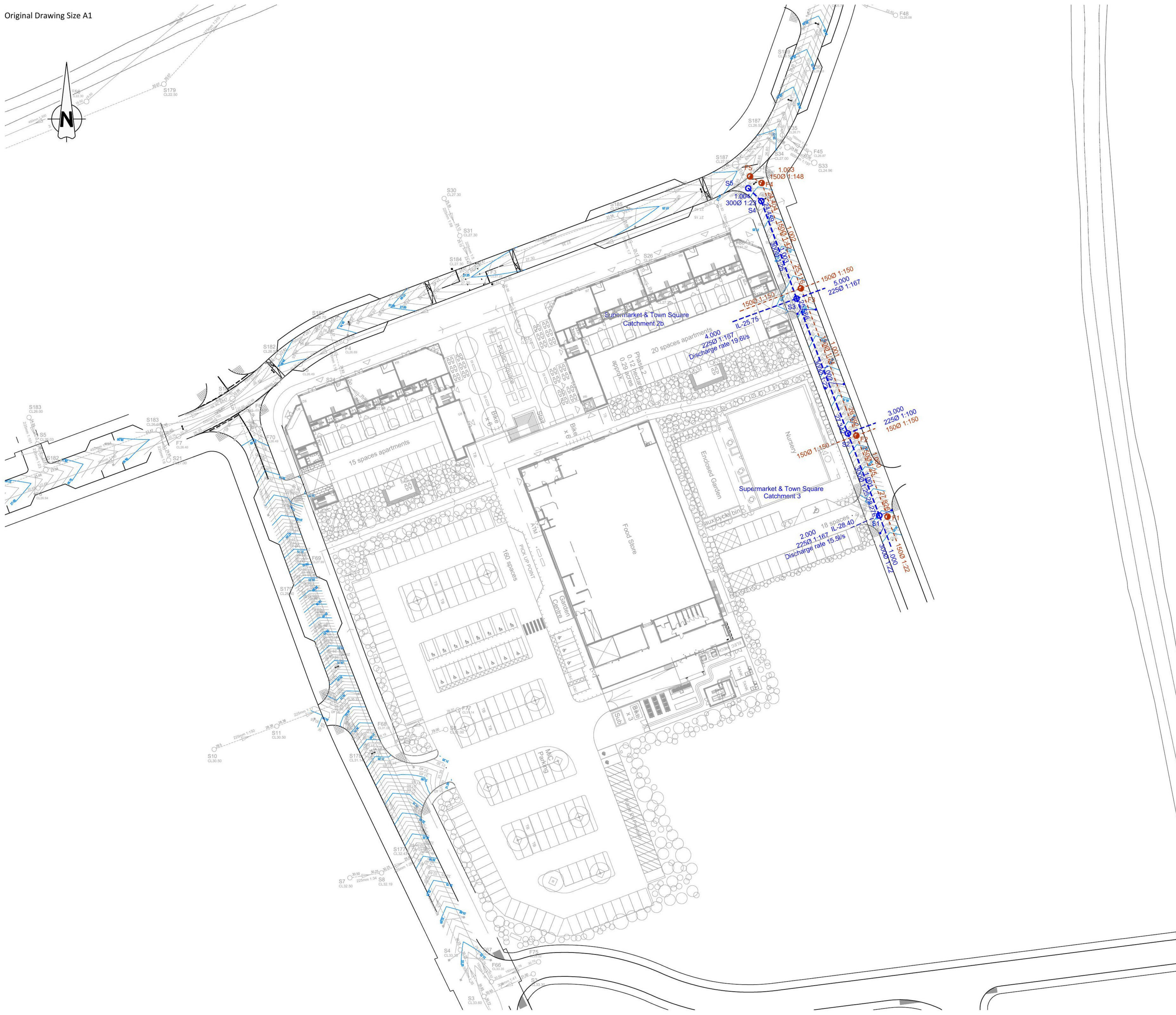
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EDNC Consortium

Cranbrook Development
 Phase 2 Enabling Works

Proposed Surface Water Drainage Catchment Areas and Flows

Appendix E



Construction Design and Management (CDM)

Key Residual Risks

- Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.
- 1) Overhead and underground services
 - 2) Street Lighting Cables
 - 3) Working adjacent to water courses and flood plain
 - 4) Soft ground conditions
 - 5) Working adjacent to live highways and railway line
 - 6) Uncharted services
 - 7) Existing buildings with potential asbestos hazards

NOTES:

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3. Brookbanks Consulting Ltd has prepared this drawing for the sole use of the client. The drawing may not be relied upon by any other party without the express agreement of the client and Brookbanks Consulting Ltd. Where any data supplied by the client or from other sources has been used, it has been assumed that the information is correct. No responsibility can be accepted by Brookbanks Consulting Ltd for inaccuracies in the data supplied by any other party. The drawing has been produced based on the assumption that all relevant information has been supplied by those bodies from whom it was requested.
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KEY:

- Existing laid storm drainage
- Existing laid foul drainage
- Proposed storm drainage
- Proposed foul drainage
- Existing gully to remain
- Proposed gully and connection
- Primary contour
- Secondary contour

First Issue MSM MSM PAB 09.07.21



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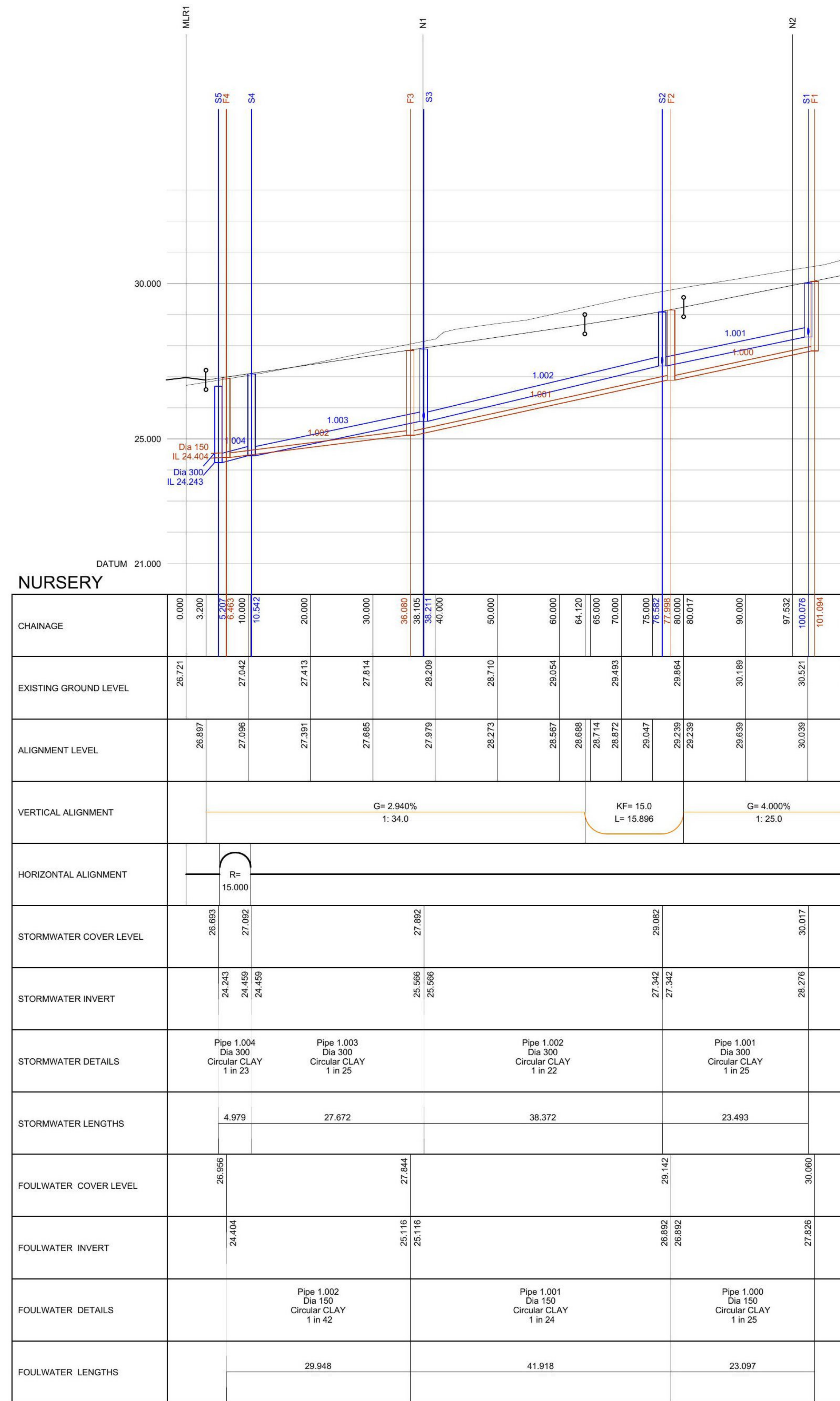
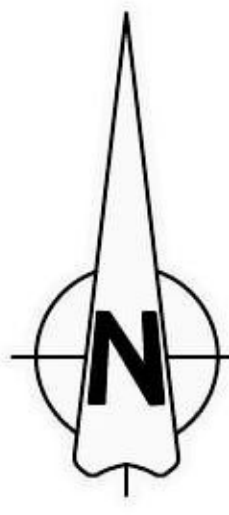
EDNC Consortium

East Devon New Community
 Town Centre Parcel TC4
 Access Road

Drainage Layout

| Status | Status Date | |
|----------|---------------|------------|
| Approval | June 2021 | |
| Drawn | Checked | Date |
| MSM | MSM | 11.06.2021 |
| Scale | Number | Rev |
| 1:500 | 10301-500-701 | - |

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.



Construction Design and Management (CDM)
Key Residual Risks
 Contractors entering the site should gain permission from the relevant land owners and/or principle contractor working on site at the time of entry. Contractors shall be responsible for carrying out their own risk assessments and for liaising with the relevant services companies and authorities. Listed below are Site Specific key risks associated with the project.
 1) Overhead and underground services
 2) Street Lighting Cables
 3) Working adjacent to water courses and flood plain
 4) Soft ground conditions
 5) Working adjacent to live highways and railway line
 6) Unchartered services
 7) Existing buildings with potential asbestos hazards


- NOTES:**
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EDNC Consortium
 East Devon New Community
 Town Centre Parcel TC4
 Access Road
 Drainage Longitudinal Section

| Status | Status Date |
|-------------|---------------|
| Approval | June 2021 |
| Drawn | Checked |
| MSM | NO |
| Scale | Number |
| 1:500,1:100 | 10301-500-702 |
| | Rev |
| | - |

UNTIL TECHNICAL APPROVAL HAS BEEN OBTAINED FROM THE RELEVANT LOCAL AUTHORITIES, IT SHOULD BE UNDERSTOOD THAT ALL DRAWINGS ARE ISSUED AS PRELIMINARY AND NOT FOR CONSTRUCTION. SHOULD THE CONTRACTOR COMMENCE SITE WORK PRIOR TO APPROVAL BEING GIVEN, IT IS ENTIRELY AT HIS OWN RISK.

| | | |
|--|--|---|
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| Date 09/07/2021 File SW Network 1.MDX | Designed by Brookbanks Checked by N.J.Onions | |
| Micro Drainage | Network 2020.1 | |

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm








Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

| | | | |
|--------------------------------------|--------|---------------------------------------|-------|
| Return Period (years) | 2 | PIMP (%) | 100 |
| M5-60 (mm) | 20.800 | Add Flow / Climate Change (%) | 0 |
| Ratio R | 0.400 | Minimum Backdrop Height (m) | 1.500 |
| Maximum Rainfall (mm/hr) | 100 | Maximum Backdrop Height (m) | 1.500 |
| Maximum Time of Concentration (mins) | 30 | Min Design Depth for Optimisation (m) | 1.200 |
| Foul Sewage (l/s/ha) | 0.000 | Min Vel for Auto Design only (m/s) | 1.00 |
| Volumetric Runoff Coeff. | 0.750 | Min Slope for Optimisation (1:X) | 500 |

Designed with Level Soffits

Network Design Table for Storm

| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|-------|------------|----------|-------------|-------------|-------------|-----------------|--------|----------|----------|--------------|---|
| 1.000 | 8.804 | 0.400 | 22.0 | 0.550 | 5.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit |  |
| 2.000 | 8.257 | 0.049 | 168.5 | 0.000 | 5.00 | 15.5 | 0.600 | o | 225 | Pipe/Conduit |  |
| 1.001 | 23.493 | 0.934 | 25.2 | 0.003 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit |  |
| 3.000 | 7.805 | 0.078 | 100.1 | 0.230 | 5.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit |  |
| 1.002 | 38.372 | 1.776 | 21.6 | 0.057 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit |  |
| 4.000 | 18.122 | 0.109 | 166.3 | 0.000 | 5.00 | 19.6 | 0.600 | o | 225 | Pipe/Conduit |  |
| 5.000 | 8.089 | 0.048 | 168.5 | 0.130 | 5.00 | 0.0 | 0.600 | o | 225 | Pipe/Conduit |  |

Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | E I.Area (ha) | E Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|-------|--------------|-------------|-----------|---------------|-------------------|------------|----------------|-----------|-----------|------------|
| 1.000 | 72.80 | 5.04 | 28.676 | 0.550 | 0.0 | 0.0 | 0.0 | 3.37 | 237.9 | 108.4 |
| 2.000 | 72.23 | 5.14 | 28.400 | 0.000 | 15.5 | 0.0 | 0.0 | 1.00 | 39.9 | 15.5 |
| 1.001 | 71.49 | 5.26 | 28.276 | 0.553 | 15.5 | 0.0 | 0.0 | 3.15 | 222.5 | 122.6 |
| 3.000 | 72.46 | 5.10 | 27.495 | 0.230 | 0.0 | 0.0 | 0.0 | 1.31 | 52.0 | 45.1 |
| 1.002 | 70.41 | 5.45 | 27.342 | 0.840 | 15.5 | 0.0 | 0.0 | 3.40 | 240.1 | 175.7 |
| 4.000 | 71.28 | 5.30 | 25.750 | 0.000 | 19.6 | 0.0 | 0.0 | 1.01 | 40.2 | 19.6 |
| 5.000 | 72.25 | 5.13 | 25.689 | 0.130 | 0.0 | 0.0 | 0.0 | 1.00 | 39.9 | 25.4 |

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 Birmingham B37 7WY

Town Centre Parcel TC4
 Access Road Sewers
 SW Network 1



Date 09/07/2021
 File SW Network 1.MDX

Designed by Brookbanks
 Checked by N.J.Onions

Micro Drainage

Network 2020.1

Network Design Table for Storm


| PN | Length (m) | Fall (m) | Slope (1:X) | I.Area (ha) | T.E. (mins) | Base Flow (l/s) | k (mm) | HYD SECT | DIA (mm) | Section Type | Auto Design |
|-------|------------|----------|-------------|-------------|-------------|-----------------|--------|----------|----------|--------------|-------------|
| 1.003 | 27.672 | 1.107 | 25.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.004 | 4.979 | 0.216 | 23.1 | 0.030 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |
| 1.005 | 6.980 | 1.163 | 6.0 | 0.000 | 0.00 | 0.0 | 0.600 | o | 300 | Pipe/Conduit | |

Network Results Table

| PN | Rain (mm/hr) | T.C. (mins) | US/IL (m) | Σ I.Area (ha) | Σ Base Flow (l/s) | Foul (l/s) | Add Flow (l/s) | Vel (m/s) | Cap (l/s) | Flow (l/s) |
|-------|--------------|-------------|-----------|---------------|-------------------|------------|----------------|-----------|-----------|------------|
| 1.003 | 69.59 | 5.60 | 25.566 | 0.970 | 35.1 | 0.0 | 0.0 | 3.16 | 223.2 | 217.9 |
| 1.004 | 69.45 | 5.62 | 24.459 | 1.000 | 35.1 | 0.0 | 0.0 | 3.29 | 232.5 | 223.2 |
| 1.005 | 69.35 | 5.64 | 24.243 | 1.000 | 35.1 | 0.0 | 0.0 | 6.46 | 456.5 | 223.2 |

Free Flowing Outfall Details for Storm

| Outfall Pipe Number | Outfall Name | C. Level (m) | I. Level (m) | Min I. Level (m) | D,L (mm) | W (mm) |
|---------------------|--------------|--------------|--------------|------------------|----------|--------|
| 1.005 | 6 | 26.950 | 23.080 | 0.000 | 0 | 0 |

| | | |
|--|--|---|
| Brookbanks Consulting | | Page 3 |
| 6150 Knights Court Solihull Parkway Birmingham B37 7WY | Town Centre Parcel TC4 Access Road Sewers SW Network 1 |  |
| Date 09/07/2021 File SW Network 1.MDX | Designed by Brookbanks Checked by N.J.Onions | |
| Micro Drainage | | Network 2020.1 |

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details


Rainfall Model FSR M5-60 (mm) 20.700 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|-------|------------|--------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|----------------------|
| 1.000 | - 15 | Winter | 1 | +0% | 30/15 | Summer | | | 28.827 | -0.149 |
| 2.000 | - 60 | Summer | 1 | +0% | 30/15 | Summer | | | 28.512 | -0.113 |
| 1.001 | 1 15 | Winter | 1 | +0% | 30/15 | Summer | 100/15 | Summer | 28.424 | -0.152 |
| 3.000 | - 15 | Winter | 1 | +0% | 30/15 | Summer | | | 27.656 | -0.064 |
| 1.002 | 2 15 | Winter | 1 | +0% | 30/15 | Summer | 100/15 | Summer | 27.513 | -0.129 |
| 4.000 | - 15 | Summer | 1 | +0% | 30/15 | Summer | | | 25.868 | -0.107 |
| 5.000 | - 15 | Winter | 1 | +0% | 30/15 | Summer | | | 25.827 | -0.087 |
| 1.003 | 3 15 | Winter | 1 | +0% | 30/15 | Summer | | | 25.806 | -0.060 |
| 1.004 | 4 15 | Winter | 1 | +0% | 1/15 | Summer | | | 25.012 | 0.253 |
| 1.005 | 5 15 | Winter | 1 | +0% | 100/15 | Summer | | | 24.419 | -0.124 |

| PN | US/MH Name | Flooded Volume (m ³) | Flow / Overflow Cap. (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|-------|------------|----------------------------------|----------------------------|------------------------|-----------------|------------|----------------|
| 1.000 | - | 0.000 | 0.50 | | 78.9 | OK | |
| 2.000 | - | 0.000 | 0.50 | | 15.5 | OK | |
| 1.001 | 1 | 0.000 | 0.48 | | 94.1 | OK | 4 |
| 3.000 | - | 0.000 | 0.83 | | 32.9 | OK | |
| 1.002 | 2 | 0.000 | 0.61 | | 134.7 | OK | 6 |
| 4.000 | - | 0.000 | 0.54 | | 19.6 | OK | 9 |
| 5.000 | - | 0.000 | 0.60 | | 18.7 | OK | 1 |
| 1.003 | 3 | 0.000 | 0.85 | | 170.3 | OK | |
| 1.004 | 4 | 0.000 | 1.49 | | 173.6 | SURCHARGED | |
| 1.005 | 5 | 0.000 | 0.64 | | 173.9 | OK | |

| | | |
|-----------------------|------------------------|---|
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| 6150 Knights Court | Town Centre Parcel TC4 |  |
| Solihull Parkway | Access Road Sewers | |
| Birmingham B37 7WY | SW Network 1 | |
| Date 09/07/2021 | Designed by Brookbanks | |
| File SW Network 1.MDX | Checked by N.J.Onions | |
| Micro Drainage | Network 2020.1 | |

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.700 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|-------|------------|--------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|----------------------|
| 1.000 | - 15 | Winter | 30 | +0% | 30/15 Summer | | | | 29.879 | 0.903 |
| 2.000 | - 15 | Winter | 30 | +0% | 30/15 Summer | | | | 29.602 | 0.977 |
| 1.001 | 1 15 | Winter | 30 | +0% | 30/15 Summer | 100/15 Summer | | | 29.587 | 1.011 |
| 3.000 | - 15 | Winter | 30 | +0% | 30/15 Summer | | | | 29.225 | 1.505 |
| 1.002 | 2 15 | Winter | 30 | +0% | 30/15 Summer | 100/15 Summer | | | 29.070 | 1.428 |
| 4.000 | - 15 | Summer | 30 | +0% | 30/15 Summer | | | | 27.250 | 1.275 |
| 5.000 | - 15 | Winter | 30 | +0% | 30/15 Summer | | | | 27.512 | 1.598 |
| 1.003 | 3 15 | Winter | 30 | +0% | 30/15 Summer | | | | 27.459 | 1.593 |
| 1.004 | 4 15 | Winter | 30 | +0% | 1/15 Summer | | | | 25.633 | 0.874 |
| 1.005 | 5 15 | Winter | 30 | +0% | 100/15 Summer | | | | 24.479 | -0.064 |

| PN | US/MH Name | Flooded Volume (m ³) | Flow / Overflow Cap. (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|-------|------------|----------------------------------|----------------------------|------------------------|-----------------|-------------|----------------|
| 1.000 | - | 0.000 | 0.97 | | 154.4 | SURCHARGED* | |
| 2.000 | - | 0.000 | 0.71 | | 22.0 | SURCHARGED* | |
| 1.001 | 1 | 0.000 | 0.79 | | 156.3 | SURCHARGED | 4 |
| 3.000 | - | 0.000 | 1.41 | | 55.5 | FLOOD RISK* | |
| 1.002 | 2 | 0.000 | 0.95 | | 210.9 | FLOOD RISK | 6 |
| 4.000 | - | 0.000 | 0.85 | | 30.7 | FLOOD RISK* | 9 |
| 5.000 | - | 0.000 | 1.14 | | 35.3 | SURCHARGED* | 1 |
| 1.003 | 3 | 0.000 | 1.28 | | 258.5 | SURCHARGED | |
| 1.004 | 4 | 0.000 | 2.26 | | 263.0 | SURCHARGED | |
| 1.005 | 5 | 0.000 | 0.97 | | 262.7 | OK | |



100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 0 Number of Storage Structures 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 20.700 Cv (Summer) 0.750
Region England and Wales Ratio R 0.400 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960,
1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 20

| PN | US/MH Name | Storm | Return Period | Climate Change | First (X) Surge | First (Y) Flood | First (Z) Overflow | Overflow Act. | Water Level (m) | Surcharged Depth (m) |
|-------|------------|--------|---------------|----------------|-----------------|-----------------|--------------------|---------------|-----------------|----------------------|
| 1.000 | - 15 | Summer | 100 | +20% | 30/15 | Summer | | | 30.350 | 1.374 |
| 2.000 | - 15 | Summer | 100 | +20% | 30/15 | Summer | | | 29.950 | 1.325 |
| 1.001 | 1 15 | Winter | 100 | +20% | 30/15 | Summer | 100/15 | Summer | 30.031 | 1.455 |
| 3.000 | - 15 | Summer | 100 | +20% | 30/15 | Summer | | | 29.225 | 1.505 |
| 1.002 | 2 15 | Winter | 100 | +20% | 30/15 | Summer | 100/15 | Summer | 29.122 | 1.480 |
| 4.000 | - 15 | Summer | 100 | +20% | 30/15 | Summer | | | 27.250 | 1.275 |
| 5.000 | - 15 | Winter | 100 | +20% | 30/15 | Summer | | | 28.025 | 2.111 |
| 1.003 | 3 15 | Winter | 100 | +20% | 30/15 | Summer | | | 27.878 | 2.012 |
| 1.004 | 4 15 | Winter | 100 | +20% | 1/15 | Summer | | | 25.908 | 1.149 |
| 1.005 | 5 15 | Winter | 100 | +20% | 100/15 | Summer | | | 24.633 | 0.090 |

| PN | US/MH Name | Flooded Volume (m ³) | Flow / Overflow Cap. (l/s) | Half Drain Time (mins) | Pipe Flow (l/s) | Status | Level Exceeded |
|-------|------------|----------------------------------|----------------------------|------------------------|-----------------|-------------|----------------|
| 1.000 | - | 0.000 | 1.56 | | 247.0 | FLOOD RISK* | |
| 2.000 | - | 0.000 | 0.76 | | 23.7 | FLOOD RISK* | |
| 1.001 | 1 | 14.531 | 0.99 | | 196.3 | FLOOD | 4 |
| 3.000 | - | 0.000 | 2.83 | | 111.2 | FLOOD RISK* | |
| 1.002 | 2 | 39.834 | 1.03 | | 228.0 | FLOOD | 6 |
| 4.000 | - | 0.000 | 0.92 | | 33.0 | FLOOD RISK* | 9 |
| 5.000 | - | 0.000 | 2.09 | | 64.4 | FLOOD | 1 |
| 1.003 | 3 | 0.000 | 1.34 | | 268.6 | FLOOD RISK | |
| 1.004 | 4 | 0.000 | 2.41 | | 281.1 | SURCHARGED | |
| 1.005 | 5 | 0.000 | 1.04 | | 281.6 | SURCHARGED | |