Technical Note

Project: **Rudloe Drive, Quedgeley**

Subject: **Drainage strategy**

Client:	Linden Homes	**Version:**	0.0
Project No:	06396	**Author:**	[redacted]
Date:	15/07/2022	**Approved:**	[redacted]

1 Introduction

This technical note has been produced to support the reserved matters planning application and answer the objections raised over the proposed drainage strategy for the development north of Rudloe Drive in Quedgeley, Gloucester. The scheme forms part of the wider regeneration of the former RAF Quedgeley airbase, for which, a site wide drainage infrastructure strategy was developed and previously agreed for separate reserved matters planning consent in 2010.

This technical note will set out how the proposed strategy follows the principles set out in the agreed site wide infrastructure strategy and the proposals put forward for the outline planning submission, both of which are summarised in the FRA, named "Land North of Rudloe Drive, Kingsway, Quedgeley, Gloucester FRA & Drainage Strategy". The outline planning reference for the scheme is 21/00490/OUT.

2 Objections from the LLFA

In a letter, dated 21st June 2022, the LLFA raise objections to the reserved matters application for the scheme on two grounds. The following two sections detail out these objections.

2.1 Surface water attenuation

The LLFA objection, as quoted below, refers to the attenuation capacities of the two basins on site and how they are smaller than the volumes quoted on drawings previously submitted during the outline planning application stage.

"This application refers to the reserved matters for planning consent 21/00490/OUT. That application showd the site developed in a way that required two attenuation basins with a total capacity for a volume of 432m³ such that surface water could be discharged to the adjacent watercourse at 24 l/s. The plan submitted for this application only provides

attenuation storage capacity of 347m^3 to discharge surface water to the adjacent watercourse at 24 l/s. It is not clear where the layout offers any ability to reduce the attenuation storage capacity by 22%.".

2.2 Exceedance routing and ponding

The second LLFA objection, as quoted below, refers to exceedance routing and ponding on the site.

"Further, the drawing showing surface water flow direction arrows shows (Sht 7 of land-north-of-rudloe-drive-2200533rem-plans-2-of-2.pdf) a point of convergence at the junction of the roads in the eastern half of the development. This would suggest there will be ponding of water at this junction in front of units 38 and 39. It would be useful to have an indication of how deep this pond may get and how far it might spread".

The following sections of this report look to address these objections.

3 Site wide drainage infrastructure

The FRA for the scheme summarises the site wide infrastructure strategy, detailing the various locations and sewer capacities provided for this development. The FRA states that this strategy was previously agreed with Gloucester City Council in 2010, see below.

"A site-wide foul sewage and surface water/SuDS drainage strategy has been agreed with Gloucester City Council and approved as part of a reserved matters planning consent for the construction of balancing pond (Pond 5) on employment area FP5, planning reference 09/00114/REM, approved 9th December 2010."

This strategy is included within Appendix A.

The site wide strategy specified that the site would discharge its surface water flows through three main outfall areas, the existing sewers located within Rudloe Drive (south) and Newhaven Road (west) and 2 outfalls into the RAF tributary (north). All three areas eventually outfall into the main balancing pond (pond 5) in employment area FP5. The sewer capacities for each of these outfall locations are denoted on drawing 479-101 included within Appendix B.

4 Proposed drainage strategy

4.1 Outline planning proposed drainage strategy

The outline planning drainage strategy, included within the FRA, "Drawing 479-010 Preliminary Drainage Strategy", was developed by Phoenix Design Partnership Ltd. and is included within Appendix C.

This drainage strategy used the three outfall locations specified in the site wide drainage infrastructure as allowed for in the FRA. The drained impermeable areas for all these locations, which are denoted on the strategy drawing, are calculated based on the assumption that 60% of the catchment is impermeable. This does not consider the exact impermeable areas of the development infrastructure.

The impermeable area catchment split per outfall location is documented below in table 1. The FRA states that the two attenuation basins can discharge into the RAF tributary at a combined discharge rate of 24 l/s. The outline strategy splits this acceptable discharge rate equally with 12 l/s assigned to each basin. Based on these discharge rates and the drained impermeable areas quoted by Phoenix Design Partnership Ltd., 1.026 ha across the two basins, a total storage capacity of 432m^3 was provided.

This results in an impermeable area catchment of 1.441 ha being drained with no restriction into the existing sewers within Newhaven Road and Rudloe Drive. This represents a split of 58% of the site's catchment out-falling to existing sewers and 42% out-falling to the RAF tributary through the two attenuation basins.

Table 1: Outline planning strategy catchment areas

Outfall location	Gross catchment area	Impermeable area (assumed 60%)
Newhaven Road (existing sewer)	1.010	0.606
Rudloe Drive – Manhole S140 (existing sewer)	0.350	0.210
Rudloe Drive – Manholes S102, S104, S106, S108 (existing sewers)	1.041	0.625
RAF Tributary – Attenuation Basin (West)	0.750	0.450
RAF Tributary – Attenuation Basin (East)	0.960	0.576
Total	**4.111**	**2.467**

4.2 Reserved matters proposed drainage strategy

The proposed drainage strategy submitted for reserved matters planning submission was shown on PJA drawings 0103-P0 through 0105-P0. These have subsequently been updated for detail

design and therefore, the latest PJA drawings 0210-P1 through 0212-P1 will be referred to throughout and are included within this document in Appendix D.

The proposals, like the outline strategy, utilise the three outfall locations specified in the site wide drainage strategy from the FRA. The drained impermeable areas used however, reflect the exact areas shown on the site layout plan. The catchment area split can be seen on PJA drawing 0405-P1, included within Appendix E.

The catchment split per outfall location is documented below in table 2. Within these updated proposals, an impermeable area of 1.607 ha is being drained through the existing sewers located in Newhaven Road and Rudloe Drive without restriction. Consequently, the combined impermeable area that is drained to the RAF tributary through the two attenuation basins is 0.811 ha.

Because a larger part of the catchment is routed through the western basin (0.580 ha) compared to the eastern basin (0.231 ha), the proposed strategy makes use of the acceptable discharge rate by apportioning 20 l/s to the western basin and 4 l/s to the eastern basin. To that end, a total storage capacity of 347m^3 is provided.

The total storage capacity of the two attenuation basins has therefore reduced from the outline planning strategy to that submitted for reserved matters. This is because more of the site is being routed to the existing outfalls in Newhaven Road and Rudloe Drive compared to the RAF tributary. The percentage of the site's catchment out-falling to existing sewers is now 66%, with the other 34% out-falling towards the RAF tributary.

This represents an 8% reduction in the overall site catchment split out-falling through the two attenuation basins into the RAF tributary (42% at outline compared with 34% at reserved matters). This, combined with the differing approach to the apportionment of the accepted discharge rate, results in the total storage capacity of the two basins reducing from one proposal to another.

Table 2: Reserved matters strategy catchment areas

Outfall location	Impermeable area (Ha)
Newhaven Road (existing sewer)	1.013
Rudloe Drive – Manhole S140 (existing sewer)	0.000
Rudloe Drive – Manhole S102, S104, S106, S108 (existing sewer)	0.594
RAF Tributary – Attenuation Basin (West)	0.580
RAF Tributary – Attenuation Basin (East)	0.231
Total	**2.418**

4.3 Allowable discharge to existing sewers

The site wide drainage infrastructure, as shown in appendix A, is designed in such a way that the sewers in Rudloe Drive flow from east to west. At the point they reach the roundabout, the sewer network changes direction and flows from south to north, up Newhaven Road, eventually out-falling into balancing pond 5.

The allowable impermeable areas that can discharge to the existing sewer outfall locations in both Newhaven Road and Rudloe drive are documented within table 3. These are taken from the sewer capacities drawing 479-101 which is included within Appendix B.

Table 3: Existing sewer allowable impermeable area discharge comparison

Outfall location	Allowable impermeable area (Ha)	Proposed impermeable area (Ha)
Newhaven Road (existing sewer)	0.609	1.013
Rudloe Drive – Manhole S140 (existing sewer)	0.582	0.000
Rudloe Drive – Manhole S102, S104, S106, S108 (existing sewer)	0.629	0.594
Total	**1.820**	**1.607**

As can be seen from table 3, the site wide infrastructure sewers within Rudloe Drive are receiving less catchment area compared with what was previously allowed for (0.594 ha compared to 1.211 ha). This difference in impermeable area offsets the increase in impermeable area that has been routed to the sewers in Newhaven Road (1.013 ha compared with 0.609 ha).

As a result, the total impermeable area that has been discharged into the existing sewers that are part of the site wide strategy, at the final outfall point in Newhaven Road, is less, compared to what was allowed for (1.607 ha compared with 1.820 ha). Showing, that although more of the proposed sites catchment area has been routed to existing sewers instead of through the two detention basins, the overall sewer capacities allowed for in the original site wide infrastructure strategy (Appendix B) have been complied with.

5 Exceedance flood routing

The sites proposed drainage networks have been designed to attenuate and convey surface water flows for the 1 in 100-year + 40% climate change rainfall event with no flooding, in accordance with current guidance.

Therefore, exceedance flow routes are shown to demonstrate the flow paths that would be followed during an event that exceeds that modelled or blockage/failure of the system. If one

of these scenarios were to occur, the flooded volume of water would be retained within the kerbs of the road carriageway, until such a time where the water dissipates in the system. Once the water within the network starts flowing again, the flooded water can flow back into the system through the proposed gullies at the designed low point of the road.

The proposed exceedance flood routes are shown on PJA drawing 0402-P1. And this is included within Appendix F.

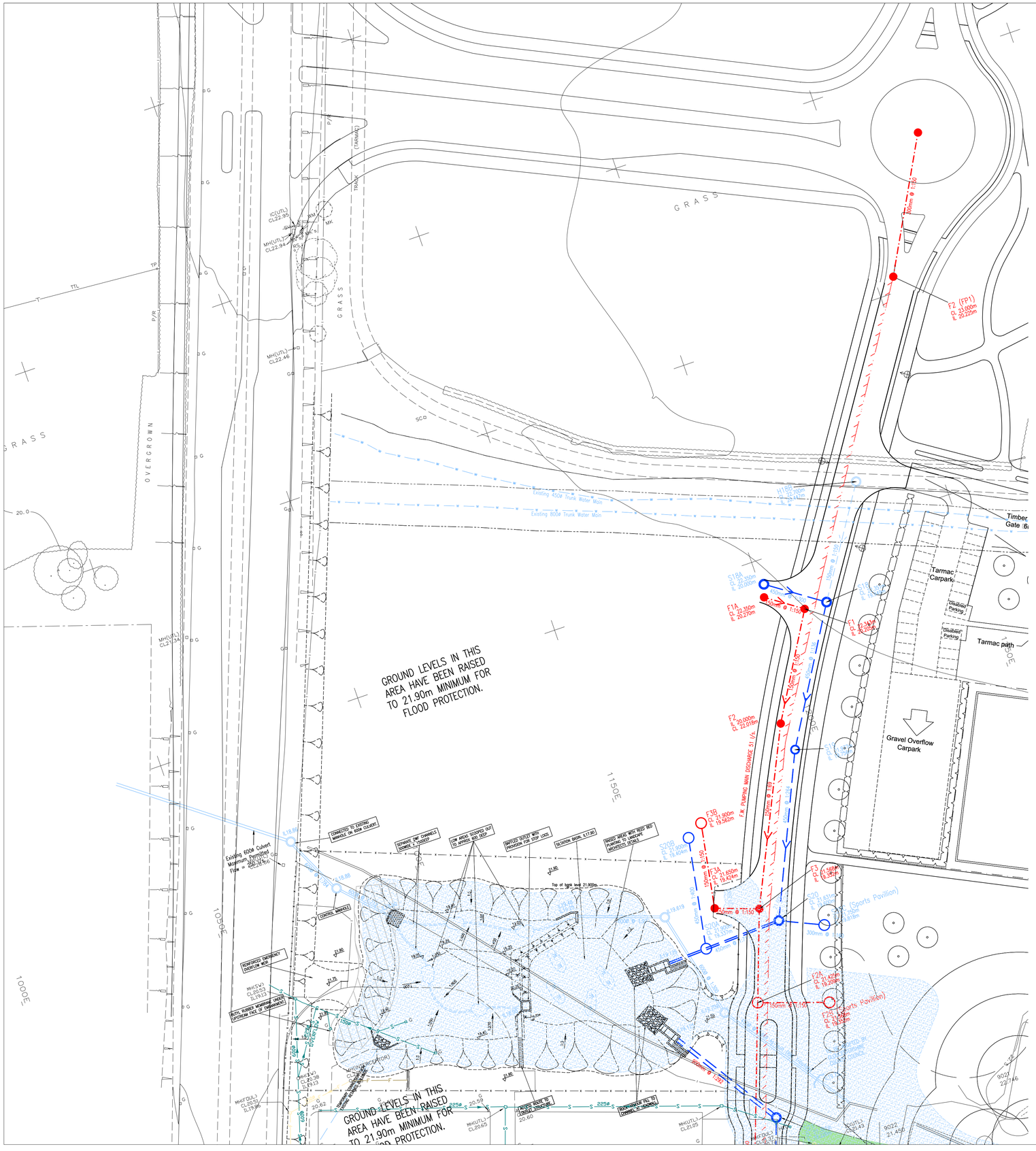
6 Conclusions

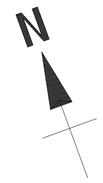
The drainage strategy for the development north of Rudloe Drive in Quedgeley, Gloucester has been developed in accordance with the site wide infrastructure strategy, that was previously agreed for reserved matters planning consent in 2010.

From the proposals submitted for outline planning to those submitted as part of the reserved matters submission, the total storage capacity of the two attenuation basins proposed for the scheme has reduced from 432m^3 to 347m^3. However, this has been managed by re-directing some of the site's impermeable areas to the existing sewers within Newhaven Road and Rudloe Drive. Despite these changes, the surface water outfall locations and design capacities, which are summarised within the FRA (Land North of Rudloe Drive, Kingsway, Quedgeley, Gloucester FRA & Drainage Strategy), have been complied with.

Furthermore, the proposed drainage networks have been designed to attenuate and convey surface water flows for the 1 in 100-year event + 40% climate change rainfall event with no flooding, in accordance with current guidance. In an exceedance event or failure/blockage of the system, any water that were to pond in the area in front of plots 38-39 (as per the designated exceedance flow paths) would be retained within the kerb heights of the existing carriageway, until such a time when it can dissipate back through the drainage network. Should any flood water volume breach the highway kerbs, there are rows of external parking both sides of the road that can accommodate surface water, before reaching the properties which are set circa 400mm above the low point in this area. Therefore the risk of flood water entering properties mitigated.

Appendix A Phoenix Design Partnership Ltd., Combined Drainage layout





Legend

Retained Buildings (Drainage to be Maintained until Demolished).

Approx Extent of Areas Where Levels are below the Predicted Flood Level and Where New Development Levels Should be Raised to a Minimum of 21.90m.

Approximate Extent of 100 Year + 20% Climate Change Flood (21.60m).

No Buildings, Permanent Structures or Raising of Ground Levels within 5m of the Top of the Bank of the Watercourse.

New Foul Sewer.
New Foul Drainage Spur to Adoptable Standard.
Existing Foul Sewer to be Retained.
Existing Foul Sewer to be Abandoned when Buildings are Demolished.
Abandoned Foul Sewer (Post Demolition/Remediation/Diversions).
Existing Private Foul Drainage Required for Retained Buildings.
Redundant Private Foul Drainage (Post Demolition/Remediation/Diversions).
New Surface Water Sewer.
New Surface Water Drainage Spur to Adoptable Standard.
Existing Private Storm Drainage to be Retained.
Existing Private Storm Drainage for Retained Buildings & Hardstandings.
Redundant Private Storm Drainage (Post Demolition/Remediation/Diversions).
FP4/5 Buffer Boundary.
Sewer Easement. Refer to Severn Trent Water for Easement/Stand-off Distances to Existing Sewers.
Required Flood Route Through FP5 From Low Point in Link Road to the RAF Tributary. Route Shown is Indicative; Final Details Will be Subject to the Development Layout and Levels.

Note:
1. The level and position of all spurs and manholes is to be checked and confirmed prior to commencing drainage design or construction.
2. Refer to drawings 0128/1001/01 & 02 for details of catchment areas and design capacities for spur connections.
3. The design of the layout is to incorporate exceedence flood routes to the Pond or RAF Tributary in accordance with good design practice.
4. Refer to the 'FP5 Drainage/SuDS Design Guide' for further advice on the FP5 drainage design.
5. All redundant drainage is to be CCTV surveyed to verify that there are no live connections prior to its removal or grouting.
6. Drainage identified as redundant or for retained buidlings and where it has not been removed or grouted can be reused subject to the developer staisfying himself that it is of suitable condition and that it has adequate capacity.

Foul Drainage Connection Details

DS MH Reference	US MH Reference	Orientation	Diameter (mm)	Gradient (1:)	Capacity (l/s)	Invert Level (m)	Design Area Drained (ha)	Flow (1l/s/ha + 10%)
F160	Spur	South	150	40	24	22.160	1.000	1.100
F107	Spur	North	150	40	24	21.770	0.500	0.550
F170	Spur	North	150	40	24	21.780	0.500	0.550
F108	Spur	South	150	40	24	21.500	0.400	0.440
F109	Spur	North	150	40	24	21.400	0.500	0.550
F109	Spur	South	150	40	24	21.225	0.200	0.220
F110	Spur	North	150	40	24	20.880	0.100	0.110
F110	Spur	South	150	40	24	21.255	0.200	0.220
F180	Spur	North	150	40	24	21.250	0.500	0.550
F190	Spur	South	150	40	24	21.210	0.200	0.220
F112	Spur	North	150	40	24	20.770	0.500	0.550
F113	Spur	North	150	40	24	20.505	0.500	0.550
F113	Spur	South	150	40	24	20.715	0.200	0.220
F114	Spur	North	150	40	24	20.420	0.100	0.110
F114	Spur	South	150	40	24	20.580	0.2	0.22
F210	Spur	North	150	40	24	22.175	0.100	0.110
F220	Spur	South	150	40	24	21.925	0.100	0.110
F211	Spur	North	150	40	24	21.175	0.100	0.110
F212	Spur	East	150	40	24	20.450	0.100	0.110
F212	Spur	South	150	40	24	20.450	0.100	0.110
F240	Spur	North	150	40	24	20.513	0.700	0.770
F14	F14A	*	150	150	12	19.891	0.700	0.770
F13	F13A	*	150	150	12	19.655	0.100	0.110
F11	F11A	*	150	150	12	19.004	1.0000	1.100
F10	Spur	West	150	150	12	19.675	0.100	0
F8	F8A	*	150	8	50	19.030	0.600	0.660
F7	F7A	*	150	93	16	18.710	0.500	0.550
F5	F5A	*	150	19	36	19.030	1.000	1.100
F4	F4A	*	150	150	12	18.886	1.000	1.100
F2A	F2B	*	150	150	12	19.352	1.000	1.100
F3A	F3B	*	150	150	12	19.562	0.600	0.660
F1	F1A	*	150	150	12	20.270	1.300	1.430

Surface Water Drainage Connection Details

DS MH Reference	US MH Reference	Orientation	Diameter (mm)	Gradient (1:)	Capacity (l/s)	Invert Level (m)	Design Area Drained (ha)	Flow (50mm/hr) Rainfall
S100	Spur	South	375	200	141	22.545	0.420	58
S101	Spur	North	225	170	40	22.570	$	–
S110	Spur	South	375	200	141	22.465	0.540	75
S102	Spur	South	375	200	141	22.200	0.370	51
S103	Spur	South	300	200	78	22.120	0.220	31
S104	Spur	North	225	170	40	22.170	$	–
S104	Spur	South	300	200	78	22.065	0.190	26
S105	Spur	South	375	300	115	21.885	0.190	26
S106	Spur	North	225	170	40	21.955	$	–
S120	Spur	South	300	200	78	91.945	0.310	43
S108	Spur	North	225	170	40	21.770	$	–
S108	Spur	South	225	170	40	21.730	0.100	14
S130	Spur	South	225	170	40	21.980	0.090	13
S131	Spur	North	225	170	40	21.935	0.080	11
S132	Spur	East	225	170	40	21.670	0.090	13
S132	Spur	South	225	170	40	21.660	0.090	13
S140	Spur	North	450	200	228	21.450	1.097	152
S10	S10A	*	225	225	34	21.303	0.095	13
S13	S13A	*	450	300	185	20.647	0.984	137
S14	S14A	*	525	500	215	20.396	1.050	146
S15A	S15B	*	300	150	90	20.400	0.317	44
S16	S16A	*	525	500	215	19.944	1.278	178
S17	S17A	*	450	300	185	19.829	0.869	121
S18	S18A	*	450	300	185	20.000	1.131	157
S20A	S20B	*	450	400	160	19.401	0.581	81
S20	S20C	*	300	160	87	19.818	0.200	28
Headwall	S520	*	225	167	40	22.200	12l/s Max (#)	–
Headwall	S530	*	225	167	40	21.950	12l/s Max (#)	–

* Connection to Unbenched Upstream (US) Manhole.
# Discharge to be Restricted to 12l/s.
$ Alternative/Additional Outfalls for Attenuated Flows; Maximum Combined Flow for the Three Outfalls Draining Each Area is not to Exceed 12l/s.

B 16/10/2009 Highway layout updated. Spur levels amended.
A 25/07/2008 Existing foul sewer details amended.
Revisions:

Project: Kingsway Business Park, Quedgeley
Kingsway Framework Area 5□

Client: Robert Hitchins Ltd.

Drawing: Combined Drainage Layout Sheet 2 of 2

Scale: 1:500 @ A1 Date: 09/06/200□ Drawn by: □A

Drawing No: 0128/1000/02 Rev: B

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Drg.Status: FOR APPROVAL

Surface Water Drainage Connection Details

DS MH Reference	US MH Reference	Orientation	Diameter (mm)	Gradient (1:)	Capacity (l/s)	Invert Level (m)	Design Area Drained (ha)	Flow (50mm/hr) Rainfall
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S110	Spur	South	375	200	141	22.465	0.540	75
S102	Spur	South	375	200	141	22.200	0.370	51
S103	Spur	South	300	200	78	22.120	0.220	31
S104	Spur	North	225	170	40	22.170	$	–
S104	Spur	South	300	200	78	22.065	0.190	26
S105	Spur	South	375	300	115	21.885	0.190	26
S106	Spur	North	225	170	40	21.955	$	–
S120	Spur	South	300	200	78	91.945	0.310	43
S108	Spur	North	225	170	40	21.770	$	–
S108	Spur	South	225	170	40	21.730	0.100	14
S130	Spur	South	225	170	40	21.980	0.090	13
S131	Spur	North	225	170	40	21.935	0.080	11
S132	Spur	East	225	170	40	21.670	0.090	13
S132	Spur	South	225	170	40	21.660	0.090	13
S140	Spur	North	450	200	228	21.450	1.097	152
S10	S10A	*	225	225	34	21.303	0.095	13
S13	S13A	*	450	300	185	20.647	0.984	137
S14	S14A	*	525	500	215	20.396	1.050	146
S15A	S15B	*	300	150	90	20.400	0.317	44
S16	S16A	*	525	500	215	19.944	1.278	178
S17	S17A	*	450	300	185	19.829	0.869	121
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F1	F1A	*	150	150	12	20.270	1.300	1.430

Legend

Retained Buildings (Drainage to be Maintained until Demolished).
Approx Extent of Areas Where Levels are below the Predicted Flood Level and Where New Development Levels Should be Raised to a Minimum of 21.90m.
Approximate Extent of 100 Year + 20% Climate Change Flood (21.60m).
No Buildings, Permanent Structures or Raising of Ground Levels within 5m of the Top of the Bank of the Watercourse.
New Foul Sewer.
New Foul Drainage Spur to Adoptable Standard.
Existing Foul Sewer to be Retained.
Existing Foul Sewer to be Abandoned when Buildings are Demolished.
Abandoned Foul Sewer (Post Demolition/Remediation/Diversions).
Existing Private Foul Drainage Required for Retained Buildings.
Redundant Private Foul Drainage (Post Demolition/Remediation/Diversions).
New Surface Water Sewer.
New Surface Water Drainage Spur to Adoptable Standard.
Existing Private Storm Drainage to be Retained.
Existing Private Storm Drainage for Retained Buildings & Hardstandings.
Redundant Private Storm Drainage (Post Demolition/Remediation/Diversions).
FP4/5 Buffer Boundary.
Sewer Easement. Refer to STW for Easement/Stand-off Distances to Ex Sewers.
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Note:
1. The level and position of all spurs and manholes is to be checked and confirmed prior to commencing drainage design or construction.
2. Refer to drawings 0128/1001/01 & 02 for details of catchment areas and design capacities for spur connections.
3. The design of the layout is to incorporate exceedence flood routes to the Pond or RAF Tributary in accordance with good design practice.
4. Refer to the 'FP5 Drainage/SuDS Design Guide' for further advice on the FP5 drainage design.
5. All redundant drainage is to be CCTV surveyed to verify that there are no live connections prior to its removal or grouting.
6. Drainage identified as redundant or for retained buidlings and where it has not been removed or grouted can be reused subject to the developer staisfying himself that it is of suitable condition and that it has adequate capacity.

N

Project: Kingsway Business Park, Quedgeley (Kingsway Framework Area 5)

Client: Robert Hitchins Ltd.

Drawing: Combined Drainage Layout Sheet 1 of 2

Scale: 1:500 @ A0 | Date: 09/06/200□ | Drawn by: □.A

Drawing No: 0128/1000/01 | Rev: C

Phoenix Design Partnership Ltd.
Unit 9, Westway Garage, Marksbury, Bath, BA2 9HN
[redacted]

Drg.Status: FOR APPROVAL

Revisions:
A 25/07/2008 Existing foul sewer details amended.
B 16/10/2009 Highway layout updated. Spur levels amended.
C 21/09/2010 Link road layout updated.

Appendix B Phoenix Design Partnerships Ltd. Drawing 479-101 Sewer design capacities

FUTURE COMMERCIAL DEVELOPMENT
GROSS AREA = 0.63Ha
NET AREA = 0.56□Ha

NEWHAVEN ROAD DISCHARGE
DESIGN GROSS CATCHMENT = 1.420Ha
DESIGN IMPERMEABLE AREA (90% IMP) = 1.2□8Ha
FUTURE EMPLOYMENT GROSS AREA = 0.630Ha
FUTURE EMPLOYMENT IMPERMEABLE AREA (90% IMP) = 0.56□Ha
BALANCE IMPERMEABLE AREA FOR RESIDENTIAL = 0.□11Ha
CLIMATE CHANGE AD□USTMENT 120%□140% = 0.609Ha
ALLOWABLE IMPERMEABLE AREA = 0.609Ha
GROSS CATCHMENT (60% IMP) = 1.015Ha

REFER TO DRAWING NO. 0128□2000 WITHIN APPENDIX C FOR DETAILS

EXISTING OUTFALL
MAXIMUM DISCHARGE
ALLOWED 12 L□S

REFER TO DRAWING NO.
0128□2000 WITHIN APPENDIX C
FOR DETAILS

EXISTING OUTFALL
MAXIMUM DISCHARGE
ALLOWED 12 L□S

REFER TO DRAWING NO.
0128□2000 WITHIN APPENDIX C
FOR DETAILS

RUDLOE DRIVE DISCHARGE
DESIGN GROSS CATCHMENT SOUTH OF RUDLOE DRIVE = 2.28Ha
DESIGN IMPERMEABLE AREA (90% IMP EMPLOYMENT) = 2.052Ha
RESIDENTIAL IMPERMEABLE AREA SOUTH SIDE = 1.13Ha
CLIMATE CHANGE AD□USTMENT 140%□120% = 1.318Ha
BALANCE IMPERMEABLE AREA FOR NORTH SIDE = 0.□34Ha
CLIMATE CHANGE AD□USTMENT 120%□140% = 0.629Ha
ALLOWABLE IMPERMEABLE AREA NORTH SIDE = 0.629Ha
GROSS CATCHMENT (60%IMP) = 1.048Ha

REFER TO DRAWING NO. 45□□103 WITHIN APPENDIX D AND DRAWING NO. 0128□2000 WITHIN APPENDIX C FOR DETAILS

EXISTING SEVERN TRENT PUBLIC
SEWERS IN RUDLOE DRIVE

PUBLIC HOUSE DEVELOPMENT AREA = 0.465Ha

RUDLOE DRIVE DISCHARGE
DESIGN GROSS CATCHMENT = 1.219Ha
DESIGN IMPERMEABLE AREA (90% IMP) = 1.09□Ha
EXISTING PUBLIC HOUSE GROSS AREA = 0.465Ha
PUBLIC HOUSE IMPERMEABLE AREA (90% IMP) = 0.418Ha
BALANCE IMPERMEABLE AREA FOR RESIDENTIAL = 0.6□9Ha
CLIMATE CHANGE AD□USTMENT 120%□140% = 0.582Ha
ALLOWABLE IMPERMEABLE AREA = 0.582Ha
GROSS CATCHMENT (60% IMP) = 0.9□0Ha

REFER TO DRAWING NO. 0128□2000 WITHIN APPENDIX C FOR DETAILS

FUTURE RESIDENTIAL DEVELOPMENT SOUTH OF RUDLOE DRIVE
PLANNING APPLICATION NO. 1□□01199□OUT

REFER TO DRAWING NO. 45□□103 WITHIN APPENDIX D FOR LAYOUT

EXISTING SWALE PROVIDING
ATTENUATION FOR RESIDENTIAL
DEVELOPMENT TO THE EAST

LEGEND
- EXISTING PUBLIC FOUL SEWER
- EXISTING FOUL SPUR
- EXISTING FOUL DRAINAGE TO BE ABANDONED
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING SURFACE WATER SPUR
- EXISTING SURFACE WATER DRAINAGE TO BE ABANDONED

Revisions

Project: Land North of Rudloe Drive
Kingsway, Quedgeley

Client:

Drawing: Sewer Design Capacities

Scale: 1:500 @ AO | Date: 19/02/2020 | Drawn by: P.A.

Drawing No: 479-101 | Rev:

PHOENIX DESIGN Partnership Ltd.

Unit 9, Westway Garage, Malmsbury, Bath. SN2 3HN | Titan House, Lewis Road, Cardiff. CF14 5BS

Drg.Status: FOR APPROVAL

Appendix C Phoenix Design Partnerships Ltd. Drawing 479-010 Preliminary Drainage Strategy

FUTUR□ COMM□RCIAL D□V□LOPM□NT
GROSS AR□A □0.63Ha
IMP□RM□ABL□ AR□A 90□ IMP□□0.567Ha
CATCHM□NT AR□A 5
N□WHAV□N ROAD DISCHARG□
D□SIGN GROSS CATCHM□NT □1.420Ha
D□SIGN IMP□RM□ABL□ AR□A □90□ IMP□□1.27□Ha
FUTUR□ □MPLO□M□NT GROSS AR□A □0.630Ha
FUTUR□ □MPLO□M□NT IMP□RM□ABL□ AR□A □90□ IMP□□0.567Ha
BALANC□ IMP□RM□ABL□ AR□A FOR R□SID□NTIAL □0.711Ha
CLIMAT□ CHANG□ AD□USTM□NT 120□/140□ □0.609Ha
ALLOWABL□ IMP□RM□ABL□ AR□A □0.609Ha
GROSS CATCHM□NT □60□ IMP□□1.015Ha
CATCHM□NT AR□A 5 1.01Ha
CATCHM□NT AR□A 1
0.75Ha GROSS
0.45Ha N□T □60□ IMP□RM□ABL□□
□□ISTING OUTFALL TO RAF TRIBUTAR□
FLOW R□STRICT□D TO 12 L/S
ATT□NUATION POND 1
□□ISTING OUTFALL TO RAF TRIBUTAR□
FLOW R□STRICT□D TO 12 L/S
ATT□NUATION POND 2
CATCHM□NT AR□A 2
0.96Ha GROSS
0.576Ha N□T □60□ IMP□RM□ABL□□
CATCHM□NT AR□A 3 1.041Ha
CATCHM□NT AR□A 4 0.35Ha
PUBLIC HOUS□ D□V□LOPM□NT
GROSS AR□A □0.465Ha
IMP□RM□ABL□ AR□A 90□ IMP□□0.41□Ha
CATCHM□NT AR□A 3
RUDLO□ DRIV□ DISCHARG□
D□SIGN GROSS CATCHM□NT SOUTH OF RUDLO□ DRIV□ □2.2□Ha
D□SIGN IMP□RM□ABL□ AR□A □90□ IMP □MPLO□M□NT□□2.052Ha
R□SID□NTIAL IMP□RM□ABL□ AR□A SOUTH SID□ □1.13Ha
CLIMAT□ CHANG□ AD□USTM□NT 140□/120□ □1.31□Ha
BALANC□ IMP□RM□ABL□ AR□A FOR NORTH SID□ □0.734Ha
CLIMAT□ CHANG□ AD□USTM□NT 120□/140□ □0.629Ha
ALLOWABL□ IMP□RM□ABL□ AR□A NORTH SID□ □0.629Ha
GROSS CATCHM□NT □60□ IMP□□1.04□Ha
FUTUR□ R□SID□NTIAL D□V□LOPM□NT SOUTH OF RUDLO□ DRIV□
PLANNING APPLICATION NO. 17/01199/OUT
CATCHM□NT AR□A 4
RUDLO□ DRIV□ DISCHARG□
D□SIGN GROSS CATCHM□NT □1.219Ha
D□SIGN IMP□RM□ABL□ AR□A □90□ IMP□□1.097Ha
□□ISTING PUBLIC HOUS□ GROSS AR□A □0.465Ha
PUBLIC HOUS□ IMP□RM□ABL□ AR□A □90□ IMP□□0.41□Ha
BALANC□ IMP□RM□ABL□ AR□A FOR R□SID□NTIAL □0.679Ha
CLIMAT□ CHANG□ AD□USTM□NT 120□/140□ □0.5□2Ha
ALLOWABL□ IMP□RM□ABL□ AR□A □0.5□2Ha
GROSS CATCHM□NT □60□ IMP□□0.970Ha
TARMAC ROAD

L□G□ND

- □□ISTING RAF TRIBUTAR□
- □□ISTING FOUL S□W□R
- □□ISTING SURFAC□ WAT□R S□W□R
- INDICATIV□ SURFAC□ WAT□R S□W□R
- INDICATIV□ FOUL S□W□R
- CATCHM□NT AR□A 1 DRAINING TO ATT□NUATION POND 1
- CATCHM□NT AR□A 2 DRAINING TO ATT□NUATION POND 2
- CATCHM□NT AR□A 3 DRAINING TO S□W□RS WITHIN RUDLO□ DRIV□
- CATCHM□NT AR□A 4 DRAINING TO S□W□RS WITHIN RUDLO□ DRIV□
- CATCHM□NT AR□A 5 DRAINING TO S□W□RS WITHIN N□WHAV□N ROAD

ATT□NUATION POND D□TAILS

- PROPOS□D ATT□NUATION POND
- GRASS MAINT□NANC□ STRIP □MINIMUM 3m WID□□
- POND SLOP□ 1 IN 3
- 2m WID□ AQUATIC B□NCH @ 1 IN 13 SLOP□ □0.15m D□□P□
- P□RMAN□NT WAT□R □MA□ 0.5m D□□P, 1:3 SLOP□□
- ON-SIT□ FLOOD □□C□□DANC□ ROUT□

Revisions

Project: Land North of Rudloe Drive Kingsway, Quedgeley

Client: Robert Hitchins

Drawing: Preliminary Drainage Strategy

Scale: 1:500 @ AO | Date: 11/03/2020 | Drawn by: M□H

Drawing No: 479-010 | Rev:

PHOENIX DESIGN Partnership Ltd.

Unit 9, Westway Garage, Marksbury, Bath. BA2 9HN ☑ | Titan House, Lewis Road, Cardiff. CF24 5BS ☐

[redacted]

Drg.Status: FOR APPROVAL

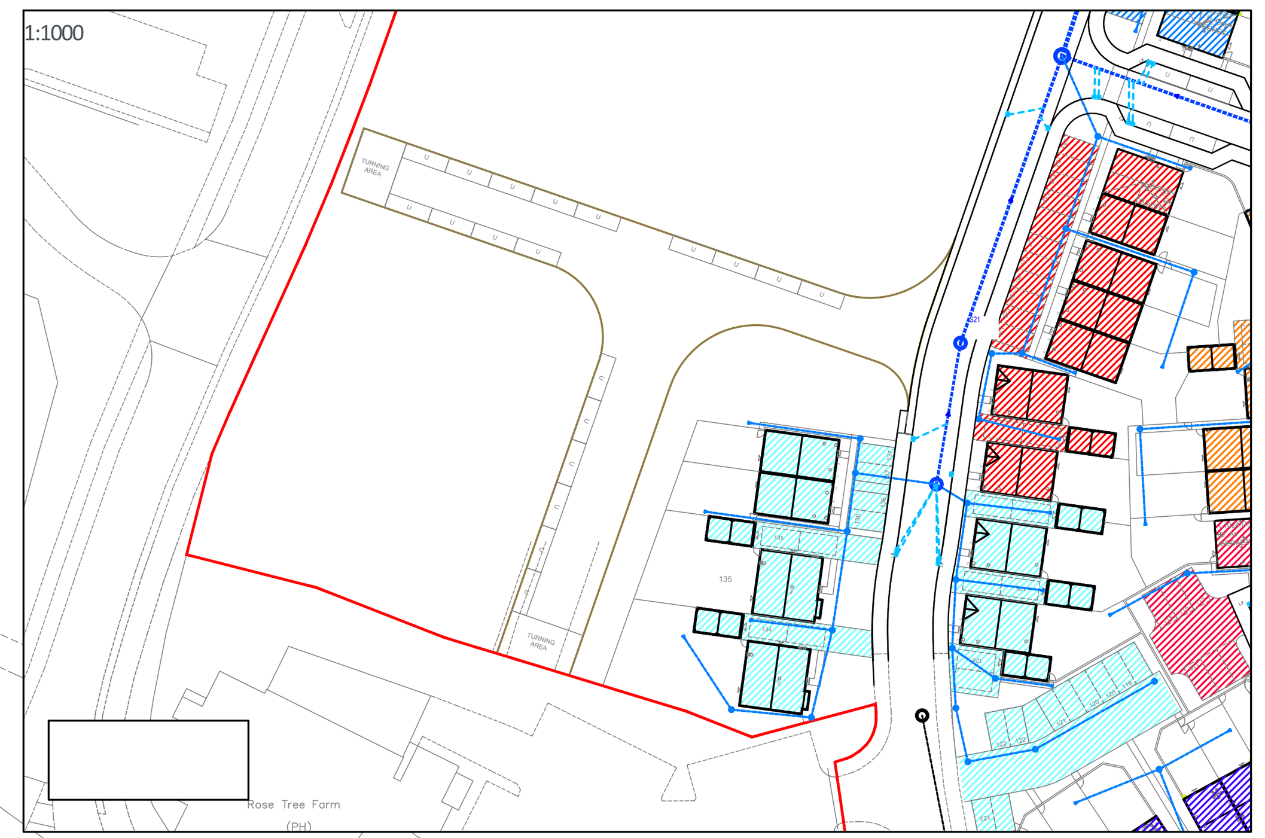
Appendix D PJA Drainage strategy

N
Sheet 2
TS PITCH / PLAY AREA
BCP 138-139,149-150
BCP 145-148
BCP 140-143
L1214/D4 side D Opp LEVERTON
L1024/D3 D Opp BECKET
L1024/D3 D Opp BECKET
L1214
L1214
S40
PRELIMINARY SCHEME
For comment and review only.
Design is based upon information available at the time.
information becomes available.
Design is subject to full review upon receipt of comments from
Development Control
LA Planning Authority
Environment Agency
LA Highways Department
Sewerage Undertaker
Existing drainage within this area and beyond to be confirmed.
INFORMATION
Linden HOMES

N
F13
S34
EX F13
F111
S105
F112
S106
F113
S107
F114
S108
S109
F240
S140
F15(Ex)
S8(EX)
L1024/D3
D_As
BECKET
L1024/D3
D_Opp
BECKET
PRELIMINARY SCHEME
For comment and review only
Impermeable area to existing 0.026Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3
Existing manhole references taken from
Sheet 1
Sheet 3
Sheet 2
KEY
Site Boundary
Proposed Finished Floor Level
Storm Sewer
Storm Drains
Foul Sewers
Storm Sewers
Control Chamber
Sewer Easement
INFORMATION
Linden
HOMES

BCP 30,53-55
IL: 22
3000
BCP 25-29
F21
Sheet 3
Levels references taken from information provided in drawing 0128/1001/01 Rev. Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3
Private Drainage and SUDs to be developed through detailed design
use the correct manufacturers fixing equipment.
adjusted to match surrounding levels.
600 frame and grating to BS EN 124
compacted in accordance with Table 6/4.
using either air test or water test, in accordance with BS EN 1610.
PRELIMINARY SCHEME
For comment and review only.
Design is based upon information available at the time.
information becomes available.
Design is subject to full review upon receipt of comments from
Development Control
LA Planning Authority
Environment Agency
LA Highways Department
Sewerage Undertaker
F23
CL: 23.991
IL: 21.588
F24
CL: 24.437
IL: 21.23
F110
F109
F108
F107
S104
S103
S102
S101
L1024/D3
B_As
BECKET
L1214
Impermeable area to existing 0.041Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3
Impermeable area to existing 0.395Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3
INFORMATION
Linden
HOMES

Appendix E PJA Drainage catchment plan



Connections to Existing

MH	Road Area (m²)	House/drive Area (m²)	Combined Area (Ha)	UC - 6%	Area (m2)	Area (Ha)
S101	0	743	0.074	787.58	787.58	0.079
S104	0	408	0.041	432.48	432.48	0.043
S106	0	575	0.058	609.5	609.5	0.061
S108	0	259	0.026	274.54	274.54	0.027
S140	0	0	0.000	0	0	0.000
Total	0	1985	0.199	2104.1	2104.1	0.210

Surface Water Network 1 (Pond RHS)

Pipe	Road Area (m²)	House/drive Area (m²)	Combined Area (Ha)	UC - 6%	Area (m2)	Area (Ha)
1.000	0	1294	0.129	1371.64	1371.64	0.137
1.001	0	0	0.000	0	0	0.000
1.002	0	294	0.029	311.64	311.64	0.031
1.003	0	742	0.074	786.52	786.52	0.079
1.004	0	0	0.000	0	0	0.000
Total	0	2330	0.233	2469.8	2469.8	0.247

Surface Water Network 2 (Rudloe Drive Manhole S102)

Pipe	Road Area (m²)	House/drive Area (m²)	Combined Area (Ha)	UC - 6%	Area (m2)	Area (Ha)
1.000	340	245	0.059	259.7	599.7	0.060
1.001	193	254	0.045	269.24	462.24	0.046
1.002	208	0	0.021	0	208	0.021
1.003	197	619	0.082	656.14	853.14	0.085
2.000	237	352	0.059	373.12	610.12	0.061
1.004	479	219	0.070	232.14	711.14	0.071
1.005	0	611	0.061	647.66	647.66	0.065
Total	1654	2300	0.395	2438	4092	0.409

Surface Water Network 3 (Newhaven Road)

Pipe	Road Area (m²)	House/drive Area (m²)	Combined Area (Ha)	UC - 6%	Area (m2)	Area (Ha)
1.000	261	202	0.046	214.12	475.12	0.048
1.001	277	250	0.053	265	542	0.054
1.002	111	380	0.049	402.8	513.8	0.051
1.003	0	845	0.085	895.7	895.7	0.090
1.004	465	109	0.057	115.54	580.54	0.058
2.000	429	1139	0.157	1207.34	1636.34	0.164
2.001	1495	0	0.150	0	1495	0.150
1.005	657	609	0.127	645.54	1302.54	0.130
3.000	600	515	0.112	545.9	1145.9	0.115
1.006	179	1606	0.179	1702.36	1881.36	0.188
1.007	0	0	0.000	0	0	0.000
Total	4474	5655	1.013	5994.3	10468.3	1.047

Surface Water network 4 (LHS Pond)

Pipe	Road Area (m²)	House/drive Area (m²)	Combined Area (Ha)	UC - 6%	Area (m2)	Area (Ha)
1.000	372	397	0.077	420.82	792.82	0.079
1.001	245	937	0.118	993.22	1238.22	0.124
1.002	0	0	0.000	0	0	0.000
1.003	241	0	0.024	0	241	0.024
1.004	0	349	0.035	369.94	369.94	0.037
1.005	62	0	0.006	0	62	0.006
2.000	199	251	0.045	266.06	465.06	0.047
2.001	225	455	0.068	482.3	707.3	0.071
2.002	315	789	0.110	836.34	1151.34	0.115
2.003	336	358	0.069	379.48	715.48	0.072
1.006	0	0	0.000	0	0	0.000
3.000	0	0	0.000	0	0	0.000
1.007	0	264	0.026	279.84	279.84	0.028
Total	1995	3800	0.580	4028	6023	0.602

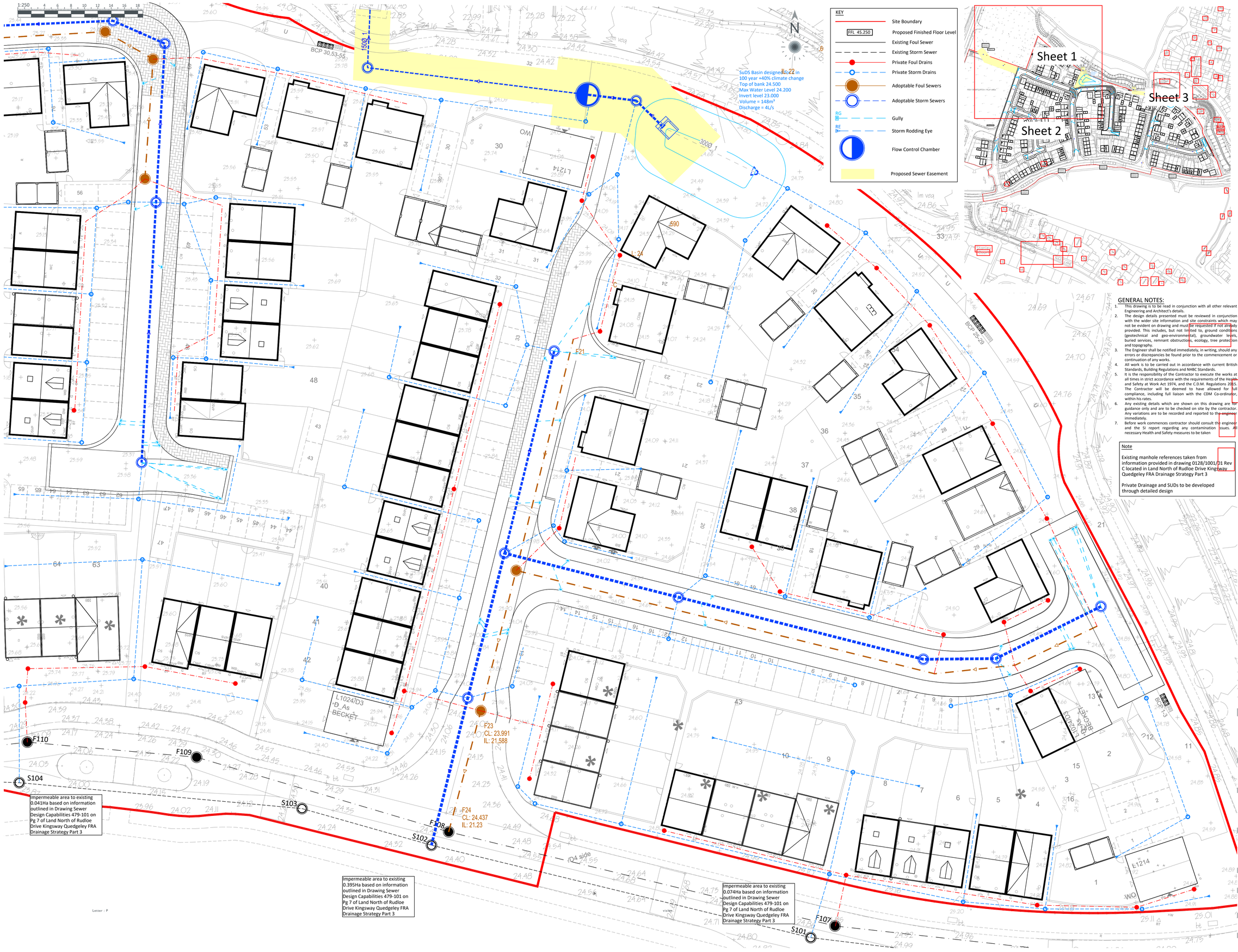
INFORMATION

Linden HOMES

RDQUE

Appendix F PJA Flood routing plan

N
RTS PITCH / PLAY AREA
LEUCHARS CLOSE
WYCOMBE ROAD
Drain
KEY
Adoptable Storm Sewers
RG
Highway Road Gully
Flow Control Chamber
Proposed Finished Floor Level
Site Boundary
Flow Direction Arrow
Major Contour
INFORMATION
Linden
HOMES



These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

DRAINAGE NOTES:

1. Drainage works to start at the outfall connection and work upstream. Any discrepancies of existing invert levels to be reported immediately as this may alter the design.
2. The Contractor shall be responsible for checking all tie-ins for line and level with existing foul and surface water systems before commencing any works.
3. All drainage work is to be strictly in accordance with the requirements of the Building Regulations 2015, Approved Document Part H, "Drainage and waste disposal".
4. All existing land drains encountered on site during construction are to be re-connected.
5. Temporary protection to be provided to drainage work during construction as necessary.
6. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
7. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
8. All pipes to be 100 or 110mm dia. and laid at 1 in 80 unless stated otherwise.
9. All concrete is to be in accordance with BS EN 206-1, BS 8500 and the recommendations of BRE Special Digest (Concrete in Aggressive Ground).
- Unless specified otherwise, in situ concrete shall be designated mix Gen 3 (Grade C20), or an equivalent mix subject to the approval of the Engineer.
- The following types of pipe may be used unless noted or agreed otherwise;
  Pipes up to 300mm diameter to be Structured Walled to BS EN 13476, Polypropylene to BS EN 1852, PVC-U to BS EN 1401 or Vitrified Clay to BS EN 295.
  Pipes over 300mm diameter to be Concrete to BS 5911, Structured Walled to BS EN 13476, Polypropylene to BS EN 1852 or PVC-U to BS EN 1401.
10. Both Clay and Concrete pipes shall be strength class 120 (100/150mm min crushing strength 28kN/m). Thermoplastic pipes shall have a minimum ring stiffness of SN4.
11. Pipes which run adjacent to buildings shall be installed in strict accordance with Part H, Clauses 2.23 to 2.25. Diagrams 7 and 8 are of particular relevance and shall be complied with.
12. All pipes, chambers and fittings shall be installed, bedded and backfilled in accordance with the manufacturers instructions subject to the following minimum requirements table.

Location	Cover to crown	Bedding Clay/Concrete Pipe	Bedding Plastic Pipe	Backfill
Roads (HGV)	>1.2m <1.2m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granula
Drives / car parking	>0.9m <0.9m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granular
Hard and soft Landscaping	>0.6m <0.6m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete	Suitable as dug material

13. Pipes Penetrating Walls.
    An opening is to be formed through walls to give pipes at least 50mm clearance all round. Brickwork over shall be supported by a lintel. Opening to be masked each side with rigid sheet material.
    Pipes embedded in walls shall have joints formed within 150mm of either wall face. Adjacent rocker pipes of max 600mm length with flexible joints shall continue the pipework.
14. All pipes beneath buildings to be B&S in concrete. Where cover is less than 300mm the concrete is to be cast integrally with the floor slab.
15. All drains in the vicinity of existing or proposed trees to be constructed in accordance with the requirements of NHBC Practice Note 3.
16. Ventilation shall be provided at the head of the foul drainage runs.
17. The first flexible joint in pipes adjoining a manhole shall be a maximum length of 600mm from the inside face of the manhole, connecting to a rocker pipe. The length of the rocker pipe shall be as follows;

Pipe Dia	Length of Rocker Pipe
150-600mm	600mm
675-750mm	1000mm
over 750mm	1250mm

18. All manholes and inspection chambers situated in areas subject to vehicular loading to have class D400 covers and frames to BS EN124 and those not subject to vehicular loading may have class B125 covers and frames.
19. Manholes located within block paved areas to have 150mm deep cover frames and bedded suitable for the size of blocks in use. The concrete hauching is NOT to be broken out to allow for block paving installation.
20. Drainage frames must be tied to manhole risers by use of manufacturers ties (eg. Polypipe ref FRX500 fixing kit and FRX501 black ties.) The ground works contractor will be held fully responsible for any accidents due to incorrect fitting or failure to use the correct manufacturers fixing equipment.
21. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
22. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption, current Edition" and the Adopting Water Authority's recommendations
23. Requirement for Land Drains to be assessed on site by the Site Manager
24. Road gullies shall be trapped 450Ø x 900mm deep with Class D 400 frame and grating to BS EN 124.
25. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
26. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.

GENERAL NOTES:

1. This drawing is to be read in conjunction with all other relevant Engineering and Architect's details.
2. The design details presented must be reviewed in conjunction with the wider site information and site constraints which may not be evident on drawing and must be requested if not already provided. This includes, but not limited to, ground conditions (geotechnical and geo-environmental), groundwater levels, buried services, remnant obstructions, ecology, tree protection and topography.
3. The Engineer shall be notified immediately, in writing, should any errors or discrepancies be found prior to the commencement or continuation of any works.
4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
6. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.
7. Before work commences contractor should consult the engineer and the SI report regarding any contamination issues. All necessary Health and Safety measures to be taken

Note

Existing manhole references taken from information provided in drawing 0128/1001/01 Rev C located in Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Private Drainage and SUDs to be developed through detailed design

PRELIMINARY SCHEME
For comment and review only.
Design is based upon information available at the time.
Design is subject to full review as additional information becomes available.
Design is subject to full review upon receipt of comments from
- Development Control
- LA Planning Authority
- Environment Agency
- LA Highways Department
- Sewerage Undertaker

P1	15.07.22	Updated for drainage technical note.	SVJ

Seven House - High Street
Longbridge - Birmingham
B31 2UQ - [redacted]
- Bristol
Exeter - London - Reading
pja.co.uk

CLIENT
Linden HOMES

PROJECT

DRAWING TITLE

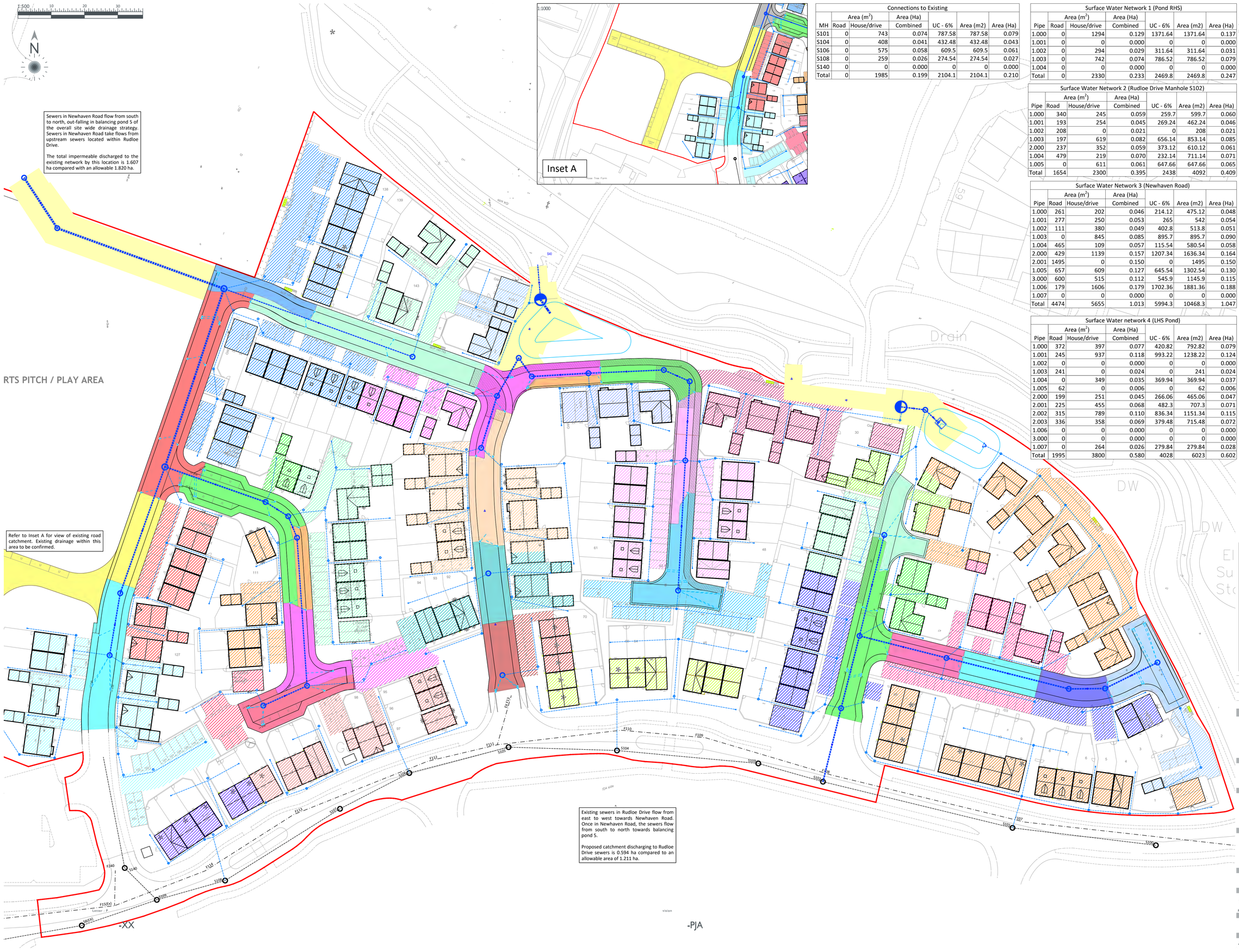
DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION

BIM DRAWING REFERENCE

SCALE	DRAWN	REVIEWED	DATE

Appendix E PJA Drainage catchment plan



Connections to Existing

MH	Area (m^2) Road	Area (m^2) House/drive	Area (Ha) Combined	UC - 6%	Area (m2)	Area (Ha)
S101	0	743	0.074	787.58	787.58	0.079
S104	0	408	0.041	432.48	432.48	0.043
S106	0	575	0.058	609.5	609.5	0.061
S108	0	259	0.026	274.54	274.54	0.027
S140	0	0	0.000	0	0	0.000
Total	0	1985	0.199	2104.1	2104.1	0.210

Surface Water Network 1 (Pond RHS)

Pipe	Area (m^2) Road	Area (m^2) House/drive	Area (Ha) Combined	UC - 6%	Area (m2)	Area (Ha)
1.000	0	1294	0.129	1371.64	1371.64	0.137
1.001	0	0	0.000	0	0	0.000
1.002	0	294	0.029	311.64	311.64	0.031
1.003	0	742	0.074	786.52	786.52	0.079
1.004	0	0	0.000	0	0	0.000
Total	0	2330	0.233	2469.8	2469.8	0.247

Surface Water Network 2 (Rudloe Drive Manhole S102)

Pipe	Area (m^2) Road	Area (m^2) House/drive	Area (Ha) Combined	UC - 6%	Area (m2)	Area (Ha)
1.000	340	245	0.059	259.7	599.7	0.060
1.001	193	254	0.045	269.24	462.24	0.046
1.002	208	0	0.021	0	208	0.021
1.003	197	619	0.082	656.14	853.14	0.085
2.000	237	352	0.059	373.12	610.12	0.061
1.004	479	219	0.070	232.14	711.14	0.071
1.005	0	611	0.061	647.66	647.66	0.065
Total	1654	2300	0.395	2438	4092	0.409

Surface Water Network 3 (Newhaven Road)

Pipe	Area (m^2) Road	Area (m^2) House/drive	Area (Ha) Combined	UC - 6%	Area (m2)	Area (Ha)
1.000	261	202	0.046	214.12	475.12	0.048
1.001	277	250	0.053	265	542	0.054
1.002	111	380	0.049	402.8	513.8	0.051
1.003	0	845	0.085	895.7	895.7	0.090
1.004	465	109	0.057	115.54	580.54	0.058
2.000	429	1139	0.157	1207.34	1636.34	0.164
2.001	1495	0	0.150	0	1495	0.150
1.005	657	609	0.127	645.54	1302.54	0.130
3.000	600	515	0.112	545.9	1145.9	0.115
1.006	179	1606	0.179	1702.36	1881.36	0.188
1.007	0	0	0.000	0	0	0.000
Total	4474	5655	1.013	5994.3	10468.3	1.047

Surface Water network 4 (LHS Pond)

Pipe	Area (m^2) Road	Area (m^2) House/drive	Area (Ha) Combined	UC - 6%	Area (m2)	Area (Ha)
1.000	372	397	0.077	420.82	792.82	0.079
1.001	245	937	0.118	993.22	1238.22	0.124
1.002	0	0	0.000	0	0	0.000
1.003	241	0	0.024	0	241	0.024
1.004	0	349	0.035	369.94	369.94	0.037
1.005	62	0	0.006	0	62	0.006
2.000	199	251	0.045	266.06	465.06	0.047
2.001	225	455	0.068	482.3	707.3	0.071
2.002	315	789	0.110	836.34	1151.34	0.115
2.003	336	358	0.069	379.48	715.48	0.072
1.006	0	0	0.000	0	0	0.000
3.000	0	0	0.000	0	0	0.000
1.007	0	264	0.026	279.84	279.84	0.028
Total	1995	3800	0.580	4028	6023	0.602

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

GENERAL NOTES:

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3. The Engineer shall be notified immediately, in writing, should any errors or discrepancies be found prior to the commencement or continuation of any works.
4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
6. Any existing details which are shown on this drawing are for guidance only and are to be checked on site by the contractor. Any variations are to be recorded and reported to the engineer immediately.
7. Before work commences contractor should consult the engineer and the SI report regarding any contamination issues. All necessary Health and Safety measures to be taken

ADOPTABLE DRAINAGE NOTES:

1. This drawing is subject to approval by Local Authority, Building Control and / or Sewerage Undertaker. Any works undertaken prior to the granting of these approvals is carried out at at risk to others.
2. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
3. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
4. All manhole covers to comply with BS.EN.124, and be Kitemarked
5. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
6. In block paved areas 'Infill' type covers should not be used, and frames must be 150mm deep.
7. All manhole and drainage covers shall comply with BS.EN124, BS.EN13598-1 and HA104/09.
   Cover strengths to be:-
   Class E600 in areas of heavy loading.
   Class D400 in all trafficked areas (roads, hard shoulder, parking areas and services yards).
   Manhole covers on foul only sewers shall be of low leakage types in order to prevent excessive surface water ingress.
8. Drainage pipes 100mm Ø unless stated otherwise.
   Pipes to be :-
   Vitrified clay to BS EN 295 or Concrete to BS 5911 or UPVC pipes to BS EN 1452 or Thermoplastic Structured wall pipes complying with WIS 4-35-01 BSI kitemarked. Class 8kM/m² nominal short term ring stiffness.
9. All sewer pipes 300mm diameter or larger, to be concrete pipes, to BS.5911, unless noted otherwise
10. All pipes to be laid with soffits level, unless noted otherwise.
11. Where cover to pipes is less than 1200mm under carriageway - concrete bed and surround or concrete protection slab is required.
12. All concrete to drainage, manholes bases, surrounds etc to be in accordance with the BRE special digest 1 - Concrete in aggressive ground. Refer to site investigation report for sulphate requirements.
13. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
14. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.
15. Upon completion of the drainage works all drains shall be flushed out and CCTV surveyed and shown to be free of all silt and debris and to have no joint displacements or other defects. A copy of the written report and video is to be forwarded to the Engineers for comment. Any defects shall be attributable to the contractor for rectification unless indicated otherwise by the CCTV report and agreed with the Engineers.
16. Demarcation manholes and lateral drains need to be constructed in accordance with the Water UK/WRc "Design and Construction Guidance"
17. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Design and Construction Guidance" and the Adopting Water Authority's recommendations

PRELIMINARY SCHEME
For comment and review only.
Design is based upon information available at the time.
Design is subject to full review as additional information becomes available.
Design is subject to full review upon receipt of comments from

- Development Control
- LA Planning Authority
- Environment Agency
- LA Highways Department
- Sewerage Undertaker

KEY

- Private Storm Drains
- Adoptable Storm Sewers
- S104 3mØ Flow Control Chamber
- Large STW Headwall
- RG Gully
- RE Storm Rodding Eye

P1	15.07.22	Updated for revised drainage layout.	SWJ

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CLIENT
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PROJECT
Rudloe Drive Quedgeley

DRAWING TITLE
Area Contribution Plan

DRAWING ISSUE STATUS
INFORMATION

PJA JOB No.	SUB-CODE	DRAWING NO.	REVISION
06396		0405	P1

Re

BIM DRAWING REFERENCE
RDQUE

SCALE	DRAWN	REVIEWED	DATE
A1@			

Appendix F PJA Flood routing plan

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

GENERAL NOTES:

1. This drawing is to be read in conjunction with all other relevant Engineering and Architect's details.
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4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
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PRELIMINARY SCHEME
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Design is subject to full review as additional information becomes available.
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- Development Control
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- Environment Agency
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ADOPTABLE DRAINAGE NOTES:

1. This drawing is subject to approval by Local Authority, Building Control and / or Sewerage Undertaker. Any works undertaken prior to the granting of these approvals is carried out at at risk to others.
2. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
3. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
4. All manhole covers to comply with BS.EN.124, and be Kitemarked
5. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
6. In block paved areas 'Infill' type covers should not be used, and frames must be 150mm deep.
7. All manhole and drainage covers shall comply with BS.EN124, BS.EN13598-1 and HA104/09.
   Cover strengths to be:-
   Class E600 in areas of heavy loading.
   Class D400 in all trafficked areas (roads, hard shoulder, parking areas and services yards).
   Manhole covers on foul only sewers shall be of low leakage types in order to prevent excessive surface water ingress.
8. Drainage pipes 100mm Ø unless stated otherwise.
   Pipes to be :-
   Vitrified clay to BS EN 295 or Concrete to BS 5911 or UPVC pipes to BS EN 1452 or Thermoplastic Structured wall pipes complying with WIS 4-35-01. BSi kitemarked. Class 8kM/m² nominal short term ring stiffness.
9. All sewer pipes 300mm diameter or larger, to be concrete pipes, to BS.5911, unless noted otherwise
10. All pipes to be laid with soffits level, unless noted otherwise.
11. Where cover to pipes is less than 1200mm under carriageway - concrete bed and surround or concrete protection slab is required.
12. All concrete to drainage, manholes bases, surrounds etc to be in accordance with the BRE special digest 1 - Concrete in aggressive ground. Refer to site investigation report for sulphate requirements.
13. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
14. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.
15. Upon completion of the drainage works all drains shall be flushed out and CCTV surveyed and shown to be free of all silt and debris and to have no joint displacements or other defects. A copy of the written report and video is to be forwarded to the Engineers for comment. Any defects shall be attributable to the contractor for rectification unless indicated otherwise by the CCTV report and agreed with the Engineers.
16. Demarcation manholes and lateral drains need to be constructed in accordance with the Water UK/WRc "Design and Construction Guidance".
17. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Design and Construction Guidance" and the Adopting Water Authority's recommendations

KEY
- Adoptable Storm Sewers
- RG Highway Road Gully
- Flow Control Chamber
- FFL 45.250 Proposed Finished Floor Level
- Site Boundary
- Flow Direction Arrow
- Major Contour

P1	01:07:22	Updated to latest site layout and levels design	OB

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CLIENT
Linden HOMES

PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS
INFORMATION

PJA JOB No. SUB-CODE DRAWING NO. REVISION

Re

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SCALE DRAWN REVIEWED DATE

Headwalls are to be finished in stone pitching with any guardrails and ladders powder coated in a suitable landscape colour (e.g. RAL 6005). Headwall is to be put forward for S104 adoption and will therefore be subject to the undertakers specific requirements.

SuDS Basin designed for 1 in 100 year +40% climate change
Top of bank 24.500
Max Water Level 24.200
Invert level 23.000
Volume = 116m³
Discharge = 4L/s

KEY

- Site Boundary
- FFL 45.250 — Proposed Finished Floor Level
- Existing Foul Sewer
- Existing Storm Sewer
- Private Foul Drains
- Private Storm Drains
- Adoptable Foul Sewers
- Adoptable Storm Sewers
- Detention basin low flow channel
- RG — Gully
- RE — Storm Rodding Eye
- Flow Control Chamber
- Proposed Sewer Easement

Sheet 1
Sheet 2
Sheet 3

These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9.
The residual risks identified on the DRA / drawings are based on the information available at the time of design.
Any services information indicated on PJA drawings is obtained from third parties, and is given for guidance purposes only. The exact location of any services will need to be verified by the client / contractor before commencing works on site.

DRAINAGE NOTES:

1. Drainage works to start at the outfall connection and work upstream. Any discrepancies of existing invert levels to be reported immediately as this may alter the design.
2. The Contractor shall be responsible for checking all tie-ins for line and level with existing foul and surface water systems before commencing any works.
3. All drainage work is to be strictly in accordance with the requirements of the Building Regulations 2015, Approved Document Part H, "Drainage and waste disposal".
4. All existing land drains encountered on site during construction are to be re-connected.
5. Temporary protection to be provided to drainage work during construction as necessary.
6. Prior to commencing work on the drainage, all existing drains, sewers manholes and outfalls to remain shall be located, identified and a CCTV condition survey carried out. Where necessary, protection to the existing drainage infrastructure shall be provided.
7. All existing sewers and manholes abandoned due to the proposed works are to be either removed, and suitably backfilled or grouted up.
8. All pipes to be 100 or 110mm dia. and laid at 1 in 80 unless stated otherwise.
9. All concrete is to be in accordance with BS EN 206-1, BS 8500 and the recommendations of BRE Special Digest (Concrete in Aggressive Ground).
   - Unless specified otherwise, in situ concrete shall be designated mix Gen 3 (Grade C20), or an equivalent mix subject to the approval of the Engineer.
   - The following types of pipe may be used unless noted or agreed otherwise;
     Pipes up to 300mm diameter to be Structured Walled to BS EN 13476, Polypropylene to BS EN 1852, PVC-U to BS EN 1401 or Vitrified Clay to BS EN 295.
     Pipes over 300mm diameter to be Concrete to BS 5911, Structured Walled to BS EN 13476, Polypropylene to BS EN 1852 or PVC-U to BS EN 1401.
10. Both Clay and Concrete pipes shall be strength class 120 (100/150mm min crushing strength 28kN/m). Thermoplastic pipes shall have a minimum ring stiffness of SN4.
11. Pipes which run adjacent to buildings shall be installed in strict accordance with Part H, Clauses 2.23 to 2.25. Diagrams 7 and 8 are of particular relevance and shall be complied with.
12. All pipes, chambers and fittings shall be installed, bedded and backfilled in accordance with the manufacturers instructions subject to the following minimum requirements table.

Location	Cover to crown	Bedding Clay/Concrete Pipe'	Bedding Plastic Pipe	Backfill
Roads (HGV)	>1.2m <1.2m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granula
Drives / car parking	>0.9m <0.9m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete)	Type 1 Granular
Hard and soft Landscaping	>0.6m <0.6m	Class S Class 'A' (Concrete)	Class S (S1or2) Class 'A' (Concrete	Suitable as dug material

13. Pipes Penetrating Walls.
    An opening is to be formed through walls to give pipes at least 50mm clearance all round. Brickwork over shall be supported by a lintel. Opening to be masked each side with rigid sheet material.
    Pipes embedded in walls shall have joints formed within 150mm of either wall face. Adjacent rocker pipes of max 600mm length with flexible joints shall continue the pipework.
14. All pipes beneath buildings to be B&S in concrete. Where cover is less than 300mm the concrete is to be cast integrally with the floor slab.
15. All drains in the vicinity of existing or proposed trees to be constructed in accordance with the requirements of NHBC Practice Note 3.
16. Ventilation shall be provided at the head of the foul drainage runs.
17. The first flexible joint in pipes adjoining a manhole shall be a maximum length of 600mm from the inside face of the manhole, connecting to a rocker pipe. The length of the rocker pipe shall be as follows;

Pipe Dia	Length of Rocker Pipe
150-600mm	600mm
675-750mm	1000mm
over 750mm	1250mm

18. All manholes and inspection chambers situated in areas subject to vehicular loading to have class D400 covers and frames to BS EN124 and those not subject to vehicular loading may have class B125 covers and frames.
19. Manholes located within block paved areas to have 150mm deep cover frames and bedded suitable for the size of blocks in use. The concrete hauching is NOT to be broken out to allow for block paving installation.
20. Drainage frames must be tied to manhole risers by use of manufacturers ties (eg. Polypipe ref FRX500 fixing kit and FRX501 black ties.) The ground works contractor will be held fully responsible for any accidents due to incorrect fitting or failure to use the correct manufacturers fixing equipment.
21. Cover levels for manholes are approximate only and should be adjusted to match surrounding levels.
22. All works to sewers/ manholes being offered for adoption or on existing public sewers should be in accordance with "Sewers for Adoption, current Edition" and the Adopting Water Authority's recommendations
23. Requirement for Land Drains to be assessed on site by the Site Manager
24. Road gullies shall be trapped 450Ø x 900mm deep with Class D 400 frame and grating to BS EN 124.
25. All manholes, pipe trenches etc. to be backfilled with imported granular fill to Class 6F1-6F5 (Capping material) to (SHW) Table 6/1 & compacted in accordance with Table 6/4.
26. All pipelines shall be tested both before and after backfilling, using either air test or water test, in accordance with BS EN 1610.

GENERAL NOTES:

1. This drawing is to be read in conjunction with all other relevant Engineering and Architect's details.
2. The design details presented must be reviewed in conjunction with the wider site information and site constraints which may not be evident on drawing and must be requested if not already provided. This includes, but not limited to, ground conditions (geotechnical and geo-environmental), groundwater levels, buried services, remnant obstructions, ecology, tree protection and topography.
3. The Engineer shall be notified immediately, in writing, should any errors or discrepancies be found prior to the commencement or continuation of any works.
4. All work is to be carried out in accordance with current British Standards, Building Regulations and NHBC Standards.
5. It is the responsibility of the Contractor to execute the works at all times in strict accordance with the requirements of the Health and Safety at Work Act 1974, and the C.D.M. Regulations 2015. The Contractor will be deemed to have allowed for full compliance, including full liaison with the CDM Co-ordinator, within his rates.
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Note

Existing manhole references taken from information provided in drawing 0128/1001/01 Rev C located in Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Private Drainage to be developed through detailed design

ANY WORKS UNDERTAKEN PRIOR TO RECEIPT OF TECHNICAL APPROVAL FOR THEIR RESPECTIVE PROPOSALS IS DONE AT THE CONTRACTOR'S OWN RISK.

Impermeable area to existing 0.043Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Impermeable area to existing 0.398Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

Impermeable area to existing 0.078Ha based on information outlined in Drawing Sewer Design Capabilities 479-101 on Pg 7 of Land North of Rudloe Drive Kingsway Quedgeley FRA Drainage Strategy Part 3

T2	15.11.22	Revised to suit agreed planning strategy. Revised for Tender submission.	SWJ
P1	15.07.22	Updated for drainage technical note.	SWJ

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PROJECT

DRAWING TITLE

DRAWING ISSUE STATUS: TENDER

PJA JOB No. | SUB-CODE | DRAWING NO. | REVISION

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SCALE | DRAWN | REVIEWED | DATE