

Himley Village
Outline Application
Surface Water Drainage Strategy and
Flood Risk Assessment
December 2014

**Himley Village Development
Surface Water Drainage
Strategy and Flood Risk
Assessment**

P3Eco

December 2014

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1.0

Introduction

Alan Baxter & Associates LLP were appointed by P3Eco to produce a surface water drainage strategy and flood risk assessment and in support of an outline application on land to the north west of Bicester, north of Middleton Stoney Road and west of Howes Lane ('the Site'). The Site, also referred to as 'Himley Village', forms part of the North West Bicester eco-town which is identified for major strategic growth by Cherwell District Council (CDC).

The NW Bicester site is identified in the emerging Cherwell Local Plan 2011-2031, Eco-Town area to provide around 6000, new homes of which 1700, new homes are proposed to be delivered on the Himley Village site along with associated services, infrastructure and related social and community facilities. The allocation of the site in the emerging Cherwell Local Plan 2011-2031, follows the identification of land at NW Bicester as an eco-town in the Planning Policy Statement: Eco-Towns A Supplement to Planning Policy Statement 1 (July 2009). The PPS1 Supplement includes requirements relating to inter alia sustainability, affordable housing, low and zero carbon technologies, public transport and climate change adaptation.

A masterplan has been prepared for the whole of the NW Bicester eco-town area in response to the requirements of the supplement to PPS1. The NW Bicester masterplan was submitted to CDC in March 2014, with additional /amended information provided in May 2014. It is understood that CDC is minded to adopt the masterplan, following consultation and review (and amendment as appropriate) as non-statutory policy.

The NW Bicester masterplan area comprises approximately 400ha of which the Himley Village site constitutes approximately 90ha. The masterplan sets out the strategy for development of the eco-town area as a whole.

Planning permission was granted in 2012, for the development of some 21 ha of land within the masterplan area known as the Exemplar Phase. This permission is currently being implemented and provides 393 new homes, land for a new primary school, together with social and community facilities, business and retail accommodation. In addition A2Dominion have submitted applications for planning permission for the following:

- Application 1 – Outline application comprising some 154.82 ha of land, to provide for circa 2,600 residential dwellings, land for new primary schools, associated open space, recreation and play space, social and community facilities and employment land, access and infrastructure works;
- Application 2 – Outline application comprising some 51.27 ha of land, to provide for circa 900 residential dwellings, land for a new secondary school, new primary schools, associated open space, recreation and play space, social and community facilities and employment land, access and infrastructure works; and
- Strategic infrastructure Application – Detailed application comprising a new A4095 NW Strategic Link Road.

A Flood Risk Assessment (FRA) and Surface Water Drainage Strategy report has been submitted for each of the above planning applications.

This FRA and Surface Water Drainage Strategy report has been prepared in relation to the Himley Village site, to be referred to in this document as 'the Site'.

1.3 Previous Studies

The previous studies used to inform this report are listed below and can also be found on the Eco Bicester home page: <http://www.ecobicester.org.uk/cms/node/282>

- NW Bicester – Flood Risk Assessment 'Hyder FRA' (February 2014)
- NW Bicester – Surface Water Drainage Strategy 'Hyder SWDS' (May 2014)
- NW Bicester – Water Cycle Study 'Hyder WCS' (March 2014)

1.4 The Role of this Document

This Flood Risk Assessment and Surface Water Drainage Strategy draws on the previous reports prepared by Hyder Consulting Ltd (as listed above) for NW Bicester which have been submitted to CDC in support of Applications 1 and 2.

This document considers potential sources of flooding relevant to the site and how these may be affected by climate change; and demonstrates that the Site can be developed with appropriate consideration of flood risk mitigation, and without increasing the flood risk to third parties.

The Surface Water Drainage Strategy (SWDS) informs the FRA for the Himley Village site in order to meet the requirements of the National Planning Policy Framework (NPPF).

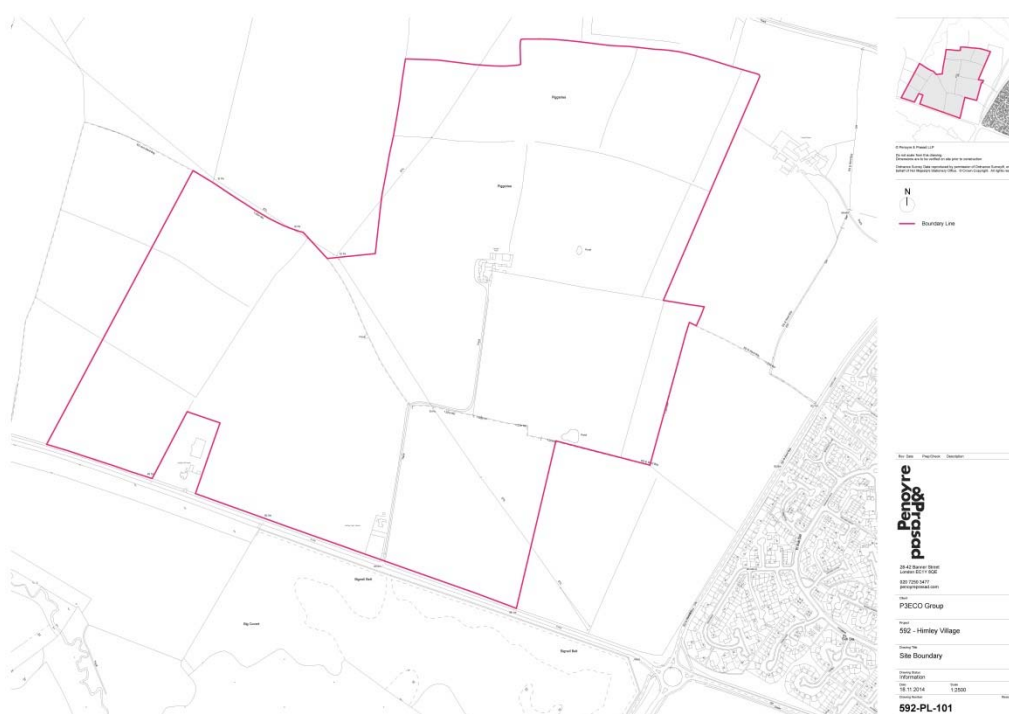
2.0 Development Context

2.1 Overall NW Bicester Masterplan and Himley Village Site Location.

The NW Bicester eco-town area is located on the north western perimeter of Bicester, Oxfordshire and has a total site area of approximately 400ha. The eco-town area is bounded by the A4095, B4100 and B4030 and bisected approximately north west to south east by the mainline Birmingham to London Marylebone railway and Bucknell Road.

The application site comprises approximately 90 ha. It is predominantly Greenfield in nature and encompasses Himley Farm and associated access. Figure 2.1 shows the location of the Himley Village site along with the key features referred to later in this report.

Figure 2.1 NW Bicester Himley Village Site Location



2.2 Planning Context

This assessment has been undertaken in accordance with current legislation, and national, regional and local plans and policies. A summary of the relevant legislation and policies and the requirements of these policies are provided below.

National Planning Policy Framework (NPPF)

The NPPF sets out Government policy on development and flood risk. Its aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas of highest risk.

The Water Framework Directive (2000/60/EEC)

The Directive provides a framework for the protection of surface (fresh) water, estuaries, coastal water and groundwater. The objectives of the Directive are to enhance the status, and prevent further deterioration, of aquatic ecosystems, promote the sustainable use of water, reduce pollution of water (especially by 'priority' and 'priority hazardous' substances) and ensure progressive reduction of groundwater pollution. Among the main features of the Directive are that all inland and coastal waters within defined river basin districts must reach at least good ecological status by 2015. The SuDS strategy proposed for the site will include appropriate measures to improve the quality of surface water runoff from the site.

The Flood and Water Management Act (2010)

The Flood and Water Management Act provides for more comprehensive management of flood risk for people, homes and businesses, and encourages the use of sustainable drainage in developments. The proposed development at Himley Village will incorporate SuDS within the detailed design to provide an appropriate mitigation of surface water flood risk.

Cherwell Local Plan Submission (2014) Policy

The emerging Cherwell Local Plan 2011 - 2031 identifies land to the north-west of Bicester as a strategic site for the provision of an eco-development under Policy Bicester 1: North West Bicester Eco-Town. This policy aims to embed the criteria of the PPS1 Supplement in local policy. The Cherwell Local Plan 2011 - 2031 is not yet adopted. Therefore, the NPPF and PPS1 Supplement are the principal planning documents against which the proposals should be considered.

2.3 Project Phasing

Development of Himley Village is expected to commence in 2016 and be undertaken in a number of discrete phases, with completion in around 2031.

The diagrams in Appendix 1, show an indicative eight phases for build out of the development. In broad terms the proposal is for construction starting from the area adjacent to Middleton Stoney Road (B4030) and moving north eastwards into the site.

3.0 Site Area and Development proposal

3.1 Site Description

The town of Bicester lies approximately 24km to the north east of Oxford, and 28km to the southeast of Banbury. The M40 runs approximately 2km to the southwest, with Junction 9 providing access to the town via the A41.

The site of the proposed Himley Village development lies to the north west of Bicester, and has an approximate site area of 90 hectares. The site is bounded by the B4030 to the south and the proposed Albion development to the east. As part of the overall NW Bicester masterplan, it is proposed to re-align the existing A4095, which is through the NW Bicester Strategic Link Road (also known as the Boulevard) and, as highlighted previously, a detailed application has been submitted to deliver this new strategic link road.

The existing application site is mainly greenfield, comprised of farm land and farm buildings with associated access. The site location plan in Figure 2.1 shows some of the key features including existing drainage ditches, which border the farmland.

3.2 Site Topography

The proposed Himley Village site slopes from the north west (approx. 96m AOD) to the south east (approx. 85m AOD). Contour plans are based on LIDAR data as detailed topographical survey of the site has not yet been undertaken. (see Figure 3.2).

Figure 3.2 NW Bicester - Existing site topography



3.3 Existing Drainage Features

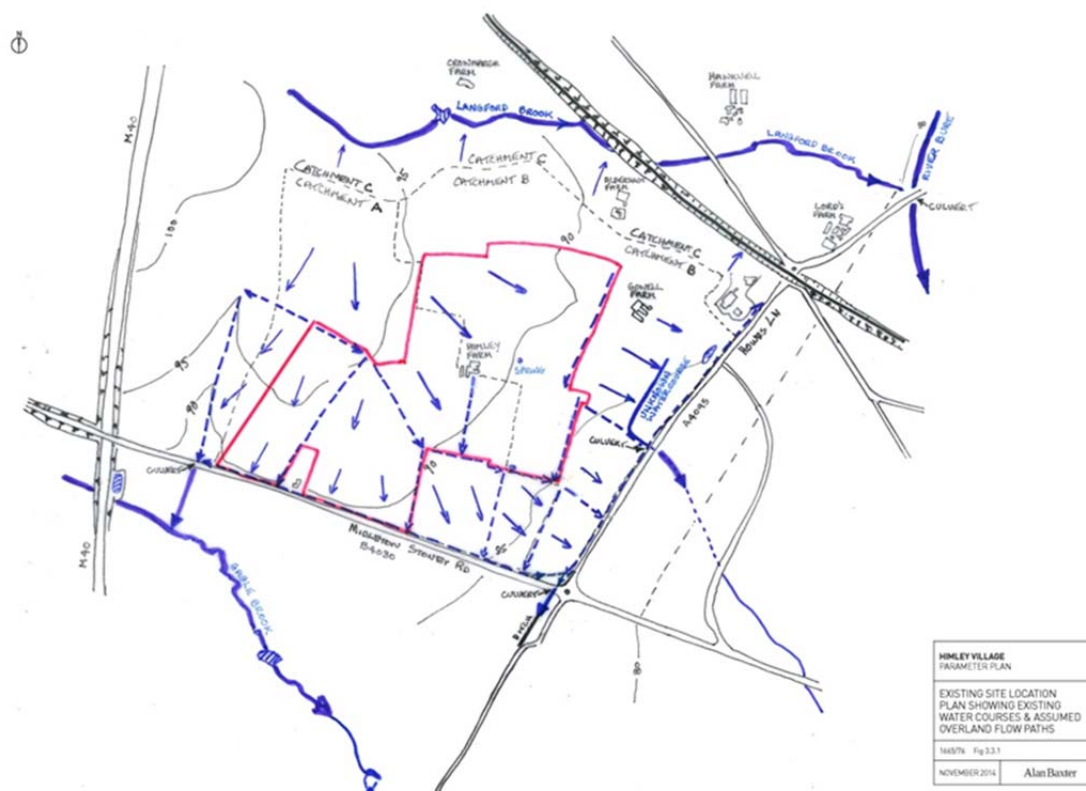
The NW Bicester masterplan site has a number of existing drainage features, which are formed from farm land drainage ditches conveying surface water to existing watercourses. Hyder's SWDS report dated May 2014, identifies three different catchment areas (Areas A, B and C) covering the NW Bicester masterplan area.

Within catchment area C, the report notes the River Bure which is classed as a "Main River" and is situated north of the railway lines and flows in a southerly direction to a culvert beneath the A4095. The Langford Brook is a tributary to the River Bure and classified as an ordinary watercourse and flows from Crowmarsh Farm and converges with the River Bure at the A4095 culvert. Hyder have carried out detailed hydraulic modelling of the River Bure and its tributaries to inform their FRA for the Exemplar site and Application 1 site.

The Himley Village site lies in catchment area A and B and is not impacted by the flood risk zones for the rivers identified in the Hyder reports.

The Himley Village site existing drainage features are formed from farm land drainage ditches conveying surface water to existing water courses as summarised in figure 3.3. To the east of the site a field drain south of Gowell's Farm flows into a culvert under the A4095, which will discharge a proportion of the existing surface water run-off from the site. The majority of the site naturally drains towards the south and south east of the site through a number of drainage ditches into a 840m long swale running parallel with the B4030. Hyder's SWDS report did not explain how surface water discharged from this, but following a recent site visit in 2014, two outlets were discovered to both the south west and south east corner of the site that are likely to discharge to Gagle Brook. See Figure 3.3.

Figure 3.3 NW Bicester – Site Location Plan with Key Drainage Features



To inform the detail design, a drainage survey will be required of the existing surface water piped outlets below the B4030 and A4095 identified in Fig 3.3, to identify their current condition, invert levels, pipe diameters and gradients to confirm their existing capacity. The maintenance responsibilities for these will need to be established.

3.4 Ground Conditions

The online Environment Agency maps indicate that the bedrock below the site is designated as a secondary A aquifer, which is described by the EA as “permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.” The EA online maps show no Groundwater Protection Zones (SPZ) in the vicinity of the proposed Himley Village site.

Hyder’s SWDS further notes that the limited amount of soakaway tests carried out as part of a targeted intrusive ground investigation in 2010 indicated little infiltration.

Hyder’s SWDS also states that they consulted Cherwell District Council (CDC) who did not identify any private water supply boreholes within the Himley Village/ masterplan site boundary. An ordnance survey map does note a spring just to the east of Himley Farm. Water from this is likely to flow into the existing drainage ditches.

3.5 Development Proposals

The outline proposals for Himley Village seek to provide up to 1,700 new dwellings with associated services and infrastructure along with the provision for a new school, social and community facilities and commercial uses. It is proposed that approximately 40% of the current agricultural land will be given over to greenery and cultivation by providing orchards, allotments and a farm school. The proposal is to retain many of the existing hedgerows, within a network of green /blue infrastructure corridors.

The proposed development for the site includes the following:

- Up to 1700 residential dwellings (class C3)
- Extra-care / Retirement village (Class C2)
- Commercial floor space (class A1-A5, B1 and C1)
- Social and commercial facilities (class D1)
- A new primary school (class D1)
- Green infrastructure/Strategic landscape
- New vehicle, cycle and pedestrian routes
- Water Treatment Plant and Energy Centre
- Service infrastructure

The Design and Access Statement (DAS) that accompanies the outline planning application confirms the proposed masterplan for the site along with the proposed land use schedule.

Proposed housing character and density information is presented in the DAS.

3.1 Development Programme

The key planning and development stages associated with the site development proposals are set out in Table 3.1 below:

Table 3.1 Development Programme

Development Programme	Planned Programme
Submission of Himley Village Development Outline Planning Application	December 2014
Planning Committee	March 2015
Submission of Phase 1 Reserved Matters Application	Autumn 2015
Start Site Construction (assumed)	2016
Construction Period	Approximately 15 years

4.0 Flood Risk Considerations

4.1 Historical Flooding

The application site is currently undeveloped i.e. arable farmland with drainage ditches surrounding fields. Hyder's FRA states that the Oxford Preliminary Flood Risk Assessment (PFRA) did not highlight any flooding within the site boundary but noted that some surface water flooding events have been recorded in Bicester Town. In our discussion with the EA they confirmed that there were no known flooding issues on the Himley Village site.

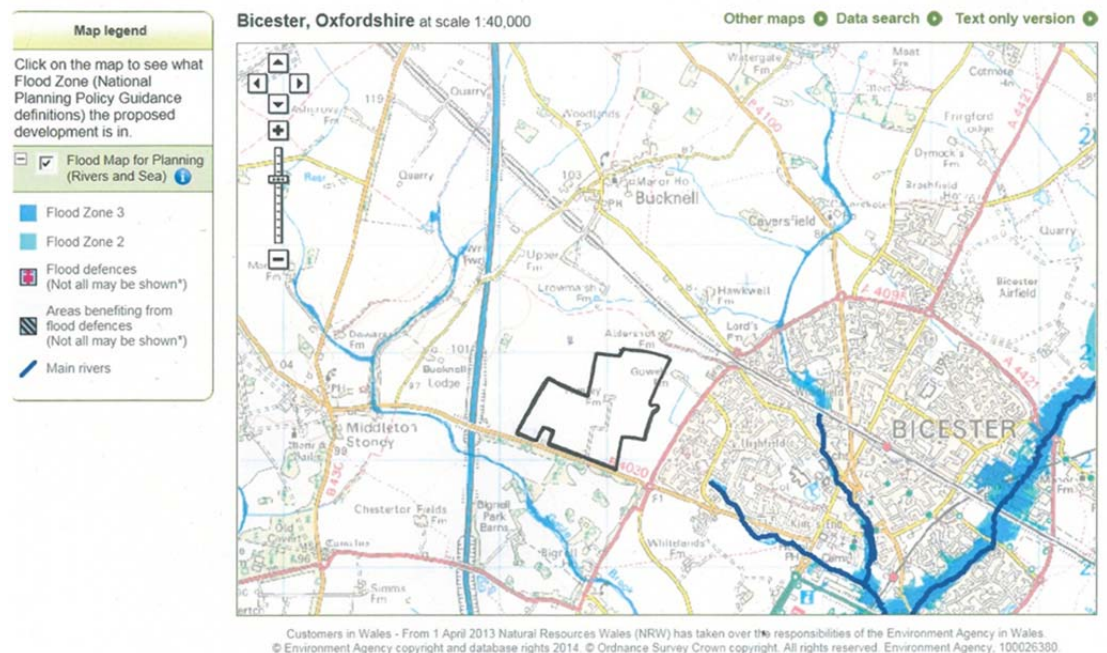
4.2 Sources of Flooding

The Hyder FRA looked at sources of flooding for the whole NW Bicester masterplan area. This report will summarise sources of flooding applicable to the Himley Village site only, and the proposed mitigation measures which are considered necessary to be developed through the detailed design process.

Fluvial

The Himley Village site is fully contained within the Low Flood Risk Zone, Flood Zone 1. The Environment Agency on-line flood map does show a narrow corridor of Flood Zone 2 associated with the River Bure, situated within the north of the masterplan area, but this is outside of the Himley Village site. Consequently all proposed development will be located within areas of low risk of flooding from fluvial sources, see Figure 4.1.

Figure 4.1 NW Bicester – Environment Agency Flood Map



Sea

The site is located approximately 150km (94 miles) from the coast and considered not at risk from flooding from the sea.

Surface Water

The existing site is greenfield and used for agricultural purposes. Surface water drainage is currently provided by ditches surrounding individual fields, which drain towards the south and east of the existing site. These surface water flow routes predominately fall within existing green corridors, which are to be retained as part of the Himley Village development. The green corridors will be defined by primary swales conveying surface water and which together with additional detention areas incorporated within the landscaping of the green corridors at points along the swales will provide the necessary attenuation as part of the drainage strategy.

As the site is entirely greenfield in its pre development state the drainage strategy is based on the principle of;

1. Source control to intercept the first 5mm depth of any rainfall event.
2. Surface water runoff for the 1 in 100 year rainfall event, to be limited to a discharge of 2 l/s/ha. This is to control the discharge from additional runoff volume.

Groundwater

Maps of Areas Susceptible to Groundwater Flooding (ASTGWF) included in the SFRA, show the proportion of each 1km grid square where geological and hydrological conditions indicate that groundwater may emerge. To the south west of the railway line which corresponds to the Himley Village site, no groundwater flood susceptibility has been defined.

The SFRA and PFRA indicate some potential groundwater flooding in the area to the north of the application site. In our discussions with the Environment Agency, they confirmed there is no known flooding to the south east of the NW Bicester masterplan area, which covers the Himley Village site.

A site investigation will need to be carried out as part of the detailed design and this could give further consideration to whether any significant groundwater flooding risk to the site exists and to identify where any risk mitigation measures are potentially required as part of the detailed design. Based on our current understanding from existing reports this seems unlikely.

Sewers

Thames Water Utilities Limited (TWUL) owns assets around the development site. There are no known public sewers within the site boundary. The modelling undertaken by Hyder of the surface water drainage of the masterplan area did not highlight any flooding issues impacting on the Himley Village site.

The SFRA highlights a report prepared by CDC which indicates that there is a known history of sewer flooding in Bicester which results from a limited capacity within the network.

Hyder's FRA confirms that Hyder spoke with Thames Water Utilities who also confirmed that the existing sewer network had limited capacity.

The surface water drainage strategy outlined in section 5, is to attenuate all drainage discharge from the site to 2 l/s/ha, to accommodate the long term storage requirements. This is less than the existing greenfield runoff rates from the site.

Artificial Sources

The Himley Village site is not closely located to any reservoirs, canals or any other raised water storage assets, therefore the site is not at risk from flooding from artificial sources.

4.3 Specific Considerations

Off Site Flood Risk

The proposed development at Himley Village will be located entirely within the Flood Zone 1. Any increased peak surface water runoff caused by the development will be stored within the primary swales and detention basins. As noted above, and set out in section 5, surface water drainage will be attenuated with a limiting discharge of 2 l/s/ha. Therefore, there should be no increase in off-site flood risk as a result of the development.

Site Access and Egress

As noted in 4.3, the proposed development at Himley Village will be located in zone 1, and therefore any road access routes crossing watercourses will be raised above the 1 in 1000 year flood levels. Therefore emergency access routes will not be affected by flooding.

Residual Risk

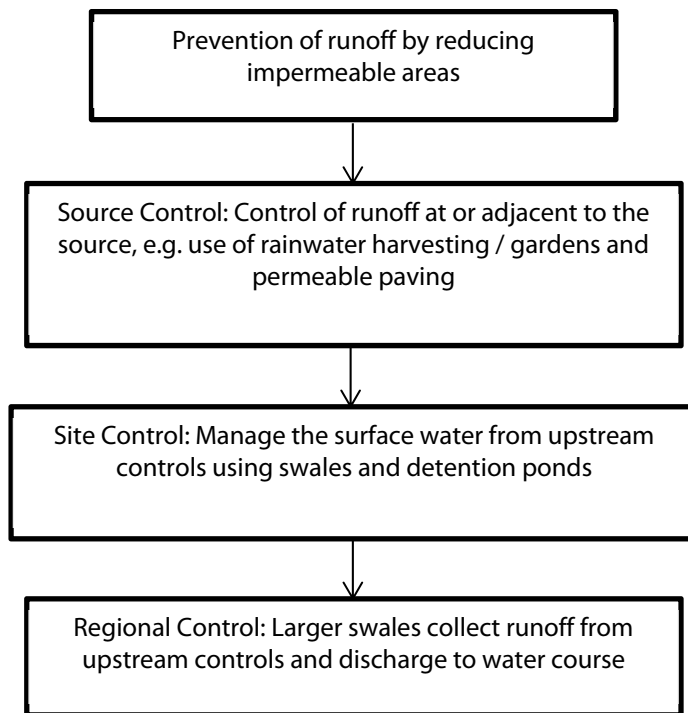
Flood risk can never be fully alleviated, and there will always be a residual risk from flooding. The NPPF states that the residual risks are those remaining after applying the sequential approach and taking appropriate mitigation actions.

As the Himley Village is in flood zone 1, the residual risk relating to the development site to be considered is from an extreme storm event which exceeds the capacity of the on-site drainage systems. This is discussed further in section 5.

5.0

Surface Water Drainage Strategy

The EA and DEFRA currently suggest that the SuDS management train (as per the CIRIA SuDS Manual) is applied when considering SuDS techniques to be adopted for new developments. This lists the order in which different SuDS techniques should be considered for a site in terms of their requirement to mitigate against surface water and flood risk¹



The overall aim of this SuDS strategy is to manage the surface water runoff close to its source to provide a more sustainable approach to drainage design, by slowing, capturing, storing and slowly releasing water to alleviate flooding and improve water quality.

The aim is to limit the extent of impermeable areas and providing source control measures to prevent runoff from the site for the first 5mm of rainfall event. This will be achieved through a variety of source control methods including, green roofs, rain gardens, rainwater harvesting at the communal and other techniques which also control runoff at the source, such as infiltration to ground through permeable paving.

Key pathways for surface water flow through the site have been identified by utilising the green corridors to convey surface water through swales for the 1% AEP + climate change. The swales as well as conveying surface water runoff will also act to attenuate water by using a series of check dams and detention basins integrated into the landscape where the natural topography can provide additional storage. Where swales intercept highway infrastructure, it is assumed culverts will convey water under the highway or a clear span structure could be used. To avoid flooding at the culvert locations due to blockages etc. secondary channels or emergency overspill mechanisms may be provided as part of the surface water strategy detailed design.

¹ Environment Agency, SuDS – A Practice Guide – October 2006

As set out in the current guidance in the CIRIA SuDS manual, maximum side slopes to swales and attenuation ponds should be 1:4. Primary swales up to 1 metre depth will convey the surface water as well as providing attenuation storage for the 1% AEP plus 30% climate change.

Three types of swales are proposed for the Himley Village development: Primary, Secondary and Tertiary. The primary swales have a base width ranging from 1m to 2m, a maximum depth 1.0m giving an overall top width /land take corridor, of approximately 10m, with some additional land take for detention basins which will sit within the proposed green corridors which will be up to 50m to 80m in width.

The secondary swales have a base width of 0.5m, a maximum depth of 0.25m with an overall top width of 2.5m, tertiary swales will be formed of semi-circular stonework channels within the streetscape.

5.1 Himley Village Estimate Storage Volumes and SuDS Strategy

The drainage strategy is to attenuate storage on line. As there will be no off line long term storage of additional surface water volume, the required attenuation storage has been calculated on limiting the site discharge to 2 l/s/ha in line with current guidance.

In evaluating the required attenuation volumes, it has been assumed that the Himley Village development will consist of 60% impermeable area. Hyder’s SWDS was based on gauged flow data which was provided by the EA in calculating greenfield runoff rates. A back calculation of the gauged flow indicates the soil type on the site is close to a soil type 2 (0.255) which has been used as the soil type for the Himley Village site. To the North of the site it is proposed that approximately 10ha is to consist of public open space which is not modified and drained by the development. As recommended by the EA, the use of the “UKSuDS” web tool has been used in providing the estimated storage volumes see Appendix 3.

Table 5.1 Summary Storage Development for the 1% AEP +30% Climate Change – Himley Village

Catchment	Public Open Space	Attenuation Storage	Interception Storage
89ha	10ha	24,820m ³	1,891m ³

Primary swales and detention basins will provide the required attenuation storage with secondary swales providing additional storage. (See Appendix 2) drawing 1665/76/SK101, shows the Outline SuDS Parameter Plan and Himley Village masterplan overlay.

Water Quality and Treatment Storage

Source control measures will be used to prevent discharge of pollutants to receiving watercourses for the first 5mm depth of any rainfall event, by using infiltration and other SuDS techniques. As discussed above these will include rainwater harvesting, rain gardens, permeable paving and where possible infiltration. At the confluence of swales and the heads of selected swales course gravel infiltration beds are to be included within the SuDS

network to provide water treatment. The above techniques should assist with improving the water quality and ecology in the receiving watercourse.

Maintenance and Adoption

It is important that adequate consideration is given to the adoption and maintenance of SuDS features, to ensure their long-term performance. The proposed drainage strategy has been developed to enable uncomplicated maintenance access and simple operation of the SuDS features according to current guidance and best practice.

The primary swales and detention basins are incorporated within the green infrastructure. All SuDS features will have shallow 1:4 side slopes and depths to ensure safe operation and easy maintenance in accordance with the CIRIA SuDS Manual.

The Flood and Water Management Act 2010 (FWMA) introduces the concept of a SuDS Approving Body (SAB), to be managed by unitary authorities or county councils Lead Local Flood Authority (LLFAs). For the proposed Himley Village site this is likely to be Oxford County Council (OCC), when the SAB role is officially launched by DEFRA. Further consultation and liaison with OCC will be necessary prior to carrying out detailed design to establish the key requirements for SuDS maintenance and adoption.

The role of the SAB body will be to approve local SuDS applications of all new drainage systems where construction work will have implications for the existing drainage system. Their role will be to apply strict standards that will improve water quality as well as flood management. The SAB also has a duty to adopt and maintain the approved SuDS providing they are constructed in accordance with the approved proposals and the system operates accordingly. As part of the approval process, the SAB can require a non-performance bond to be paid which would be refunded in full once the work has been completed to the satisfaction of the SAB. The FWMA also enables the SABs to devolve the responsibility of SuDS adoption to other organisations e.g. land owners or management companies on the condition that all partners are in agreement. For Himley Village, this could potentially be the proposed Community Land Trust taking on board this responsibility.

The SAB involvement will ensure the proposed ownership responsibilities are suitable and, in particular that the responsibility of SuDS serving more than one property rests with an organisation that is both durable and accountable.

DEFRA in December 2011, published the draft National Standards for the Design, Construction, Operation and Maintenance of SuDS, which set out the national requirements on the type of drainage that would be appropriate to a given development can be determined. The final publication date of the standards is expected during 2015.

If the OCC or SAB are unable to adopt all SuDS features for any reason, then a management company or trust should be appointed to undertake the long-term maintenance of the drainage system.

Design and Exceedance

It is not feasible or sustainable to economically build a drainage system that can accommodate the most extreme events. It may be that the capacity of the drainage may be exceeded on rare occasions, with excess water flowing above ground. However, the design

of the wide green and blue corridors provides an opportunity to manage this exceedance flow and ensure that random flooding of property does not occur.

As part of the detailed design of the proposed Himley Village development sufficient flood pathways (road, footpaths, green corridor buffer zones) will be identified to ensure overland flow is safely routed away from buildings into the proposed SuDS network. The detailed design will avoid significant low spots on the site where unplanned ponding can occur and threaten buildings nearby. As part of the preliminary design, additional built in capacity is already provided by the proposed SuDS system to deal with the volumes for the site.

As discussed above, the proposed SuDS network has been located to mainly follow the overland green corridors on pre-development ground levels. These green corridors should naturally contain the exceedance flows within the proposed SuDS system. However, key existing overland flow routes should be modelled and reviewed during the detailed design stage once the proposed ground levels and SuDS features are fully defined so that key flow routes are fully intercepted and /or directed to the proposed system without increasing flood risk to the proposed development.

Phasing of the Development

As part of the development of the site it is key that the phasing of the SuDS facilities needs consideration to avoid any increased risk of flooding from a potential flood event during the construction stage. A preliminary development phasing plan is attached in Appendix 3, showing how the site is to be developed. As part of the detailed design stage, a SuDS phasing plan along with a maintenance plan is to be prepared.

5.2 Residual Risk

To reduce the residual risk to the proposed buildings within the development, the conveying primary swales and surrounding landscaped corridors will as part of the detailed design, be designed to deal with exceedance flows in accordance with the design standards as set out in Ciria C635 "Designing for Exceedance in Urban Drainage". It is also recommended that some minor topographical changes to flat areas may be necessary as well as raising property levels 300mm above surrounding ground levels, to protect against surface water ponding during an extreme rainfall event.

6.0 Conclusions

6.1 Development Description and Proposals

The Himley Village site comprises approximately 90 hectares of greenfield arable farm land and it is proposed to provide around 1700, homes with associated services and infrastructure, along with a new school, social and community facilities and commercial uses within a landscape setting.

The proposed Himley Village site forms part of the NW Bicester eco-town masterplan area as identified in the Cherwell Local Plan 2011-2031.

6.2 Flood Risk

The Himley Village site is within flood zone 1. All development is to be located within flood zone 1 including proposed green and blue corridors, and is consequently at low risk of fluvial flooding.

No detailed information is available regarding the risk of groundwater flooding at this stage and the risk is to be considered low based upon the currently available information.

Surface water primary swale routes have been identified along wide green corridors and will be incorporated into the surface water drainage strategy along with other SuDS measures.

The proposed surface water drainage strategy includes preliminary layout of the proposed primary swale layout and detention ponds to provide the required attenuation storage for the 1% AEP plus 30% climate change with discharge limited to 2 l/s/ha. The primary swales and surrounding landscaped green corridors will be designed to deal with exceedance flows for extreme events.

6.3 Impacts of Climate Change

As assessment of the potential impacts of climate change has been made by adding 30% to the estimate 1% AEP flows.

6.4 Off Site Impacts

The surface water drainage will be attenuated to a limiting discharge of 2 l/s/ha, which is less than the 1 in 100 greenfield run off rate. Consequently, there should be no increase in off-site flood risk as a result of this development.

6.5 Residual Risks

As the Himley Village site is in flood zone 1, the residual risk relating to the development site is to be considered to be from an extreme storm event which exceeds the capacity of the on-site drainage systems. These residual risks can be appropriately managed by incorporation of exceedance flow routes as part of the detailed drainage strategy.

7.0

Recommendations

The surface water drainage strategy including adoption and maintenance responsibilities of SuDS features, should be developed in consultation with the Environment Agency and SuDS Approval Body and implemented to ensure that the post development runoff rates and volumes are no greater than the pre-development rates.

The post-development overland flow routes should be modelled and reviewed during the detailed design stage, once the proposed ground levels and SuDS features are fully defined, to ensure that the key flow routes are fully intercepted and that the primary swale network, detention basins and wider landscaping of the green corridors provide for the necessary storage and attenuation of the surface water runoff.

Site specific ground investigations undertaken to inform the detailed design should further inform any risk of groundwater flooding to the site and the need for any additional mitigation measures.

The existing surface water culverts passing under the A4095 and B4030 will require a drainage survey to be undertaken. This is to identify their current condition, invert levels, pipe diameters and gradients to confirm their existing capacity and condition.

Appendix 1

Proposed Phasing

Himley Village

Phasing

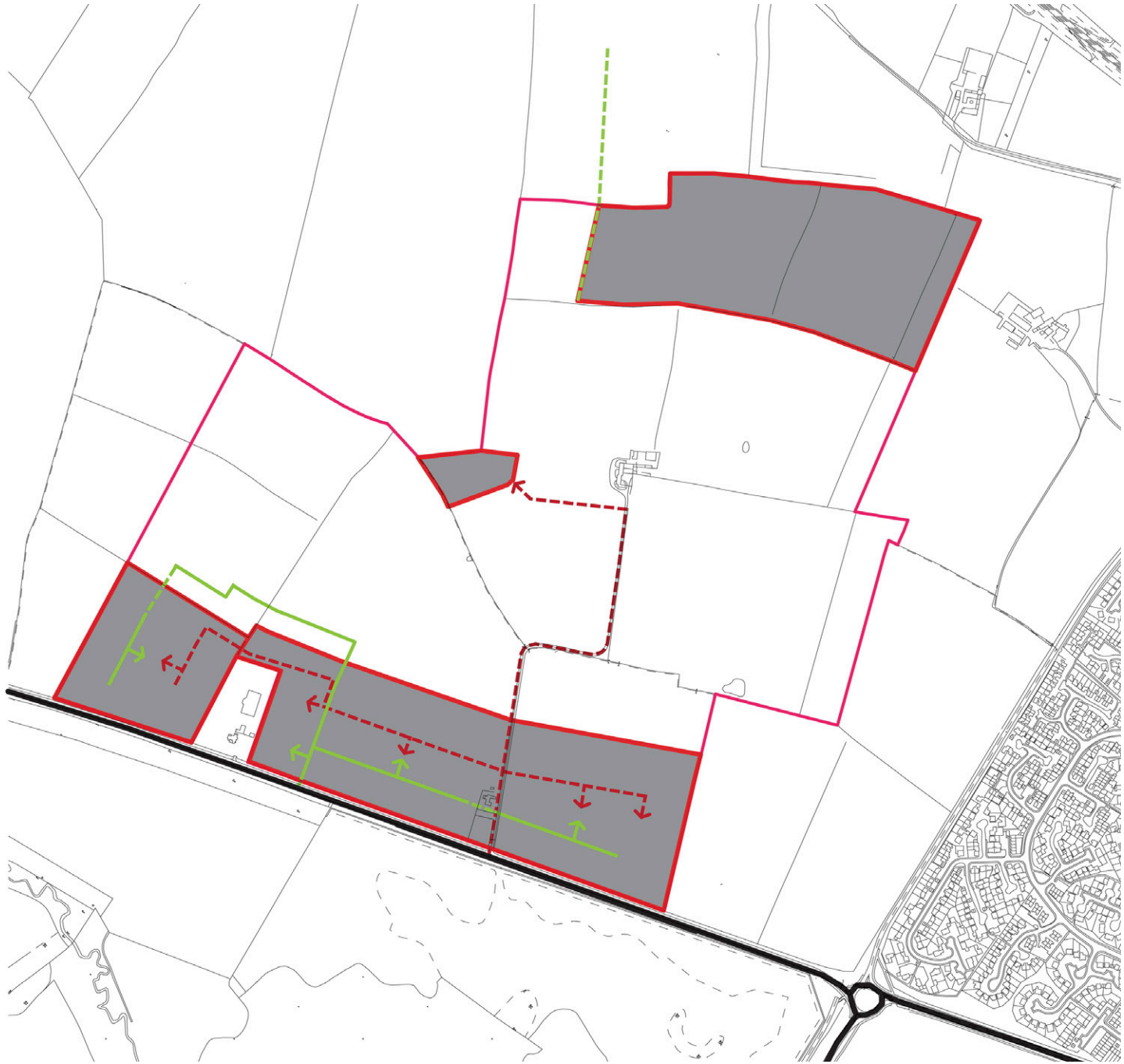
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PHASE 1

Construction

- Development begins in southernmost fields off Middleton Stoney Road
- Construction traffic off existing Himley Farm access.
- Residential access off new spine road off Middleton Stoney Road.
- Potential CLT set up accessed off extended existing Himley Farm access
- Playing Fields established with access from the north
- Circa 290 dwellings this phase plus other uses on Middleton Stoney Road

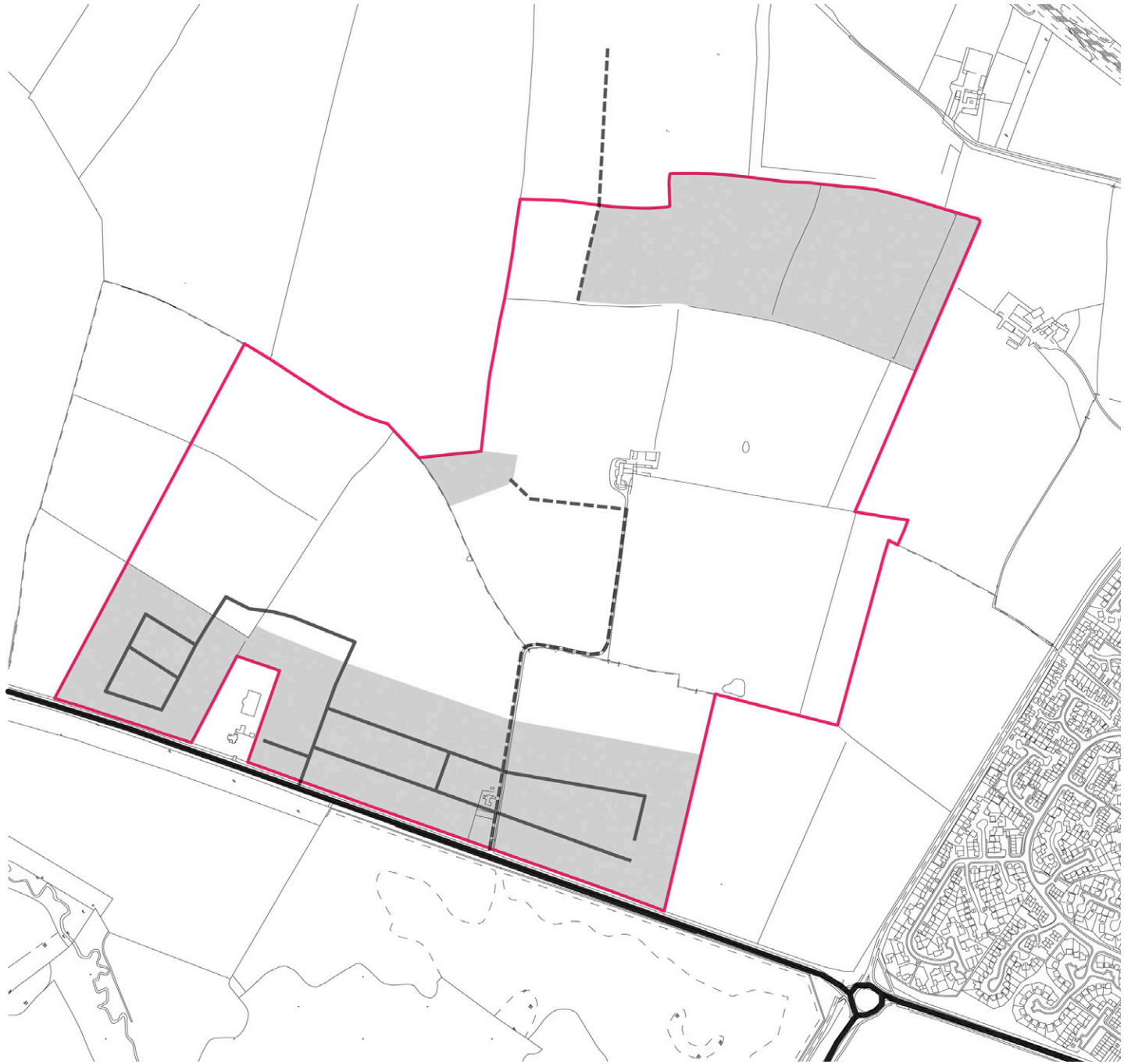
- Construction access
- Resident access
- - - Resident access - temporary



PHASE 1

Complete

- Circa 290 dwellings in total
- Residential access off new spine road off Middleton Stoney Road
- CLT set up

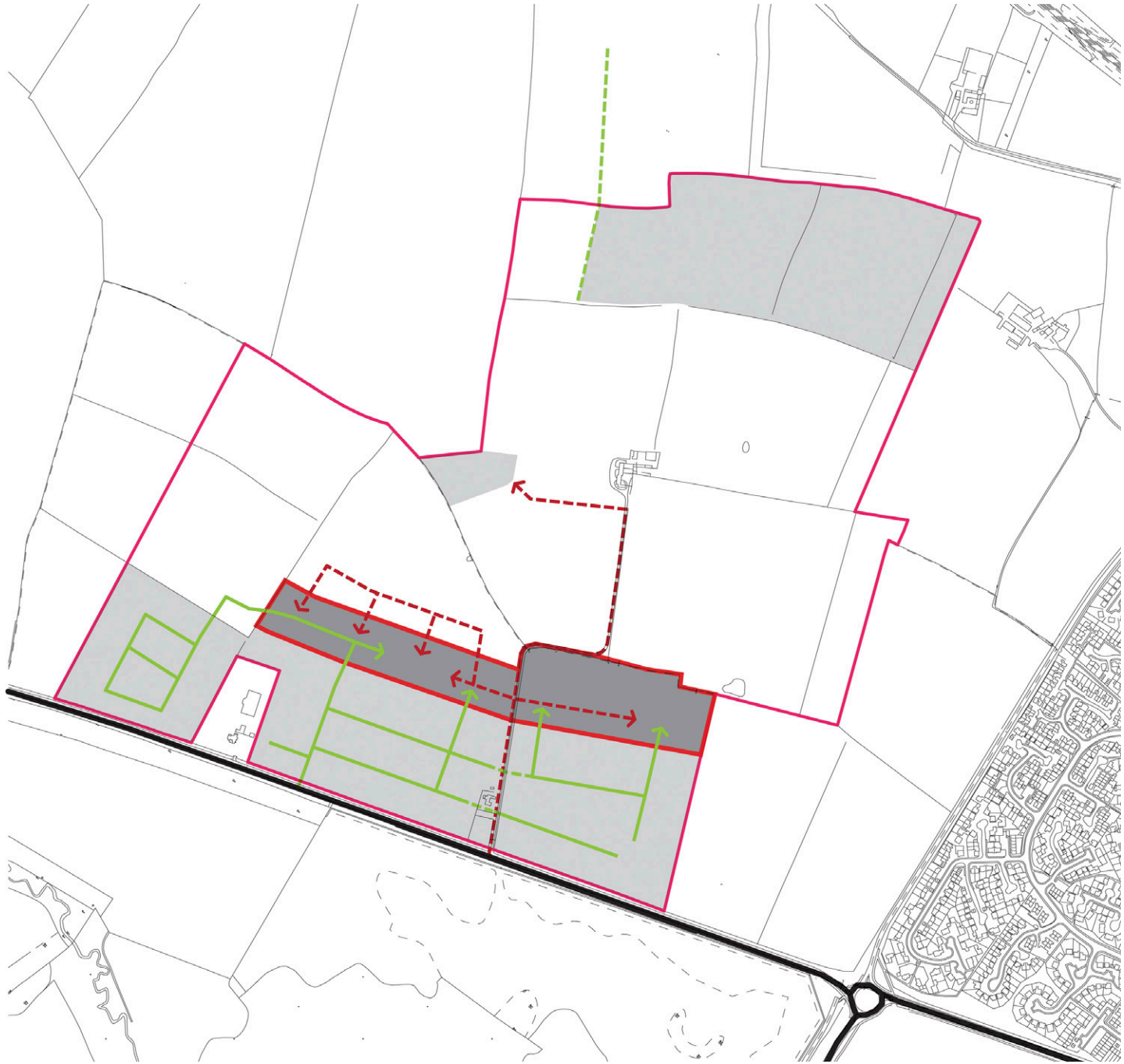


— Resident access

PHASE 2

Construction

- Development extends into northwards in central field and eastern field.
- Construction access from the north, residential access from the south
- Residential access off extended spine road
- Circa 200 dwellings this phase

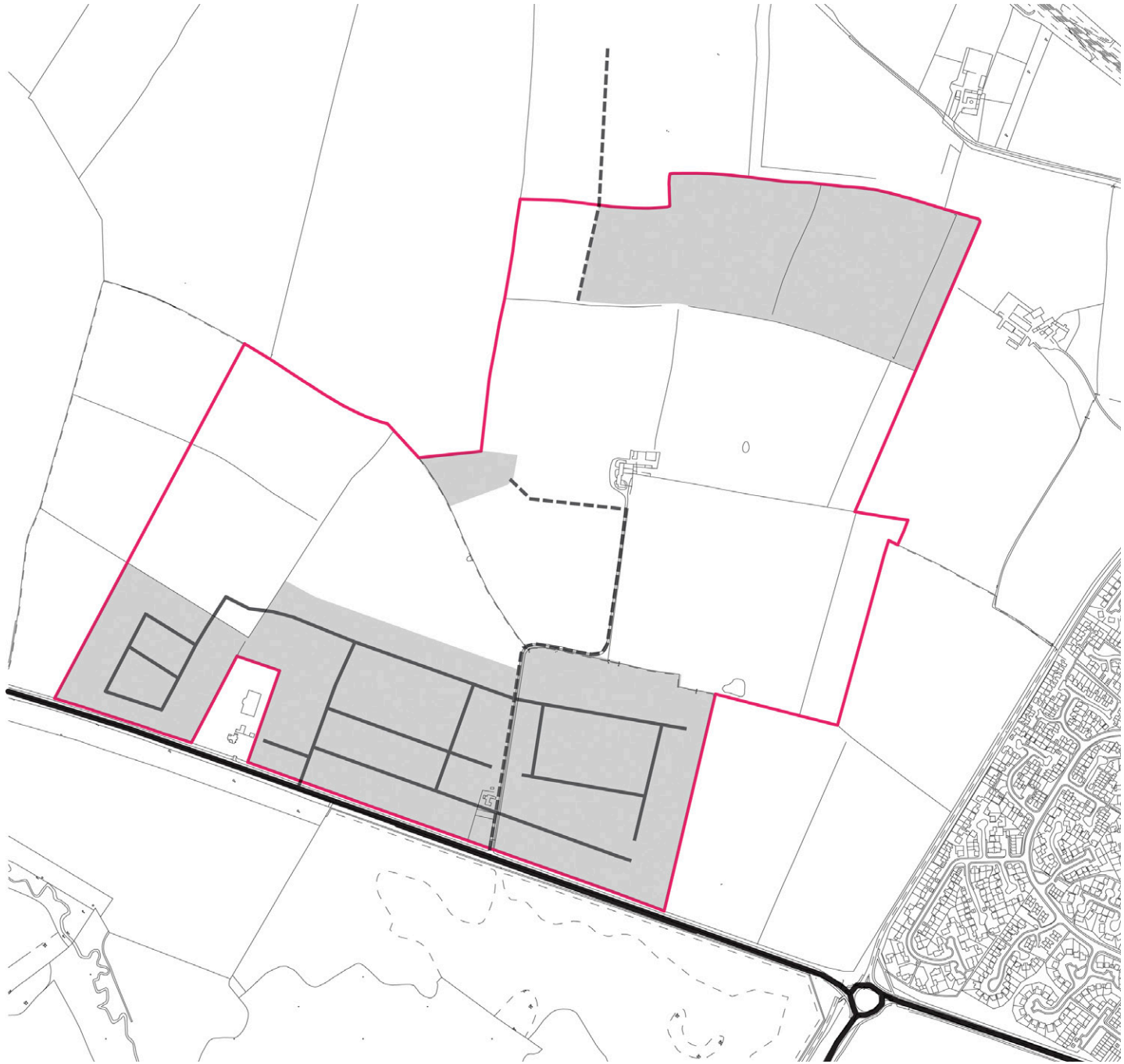


- Construction access
- Resident access
- - - Resident access - temporary

PHASE 2

Complete

- Circa 490 dwellings in total
- Residential access off new spine road off Middleton Stoney Road
- CLT in place.



— Resident access

PHASE 3

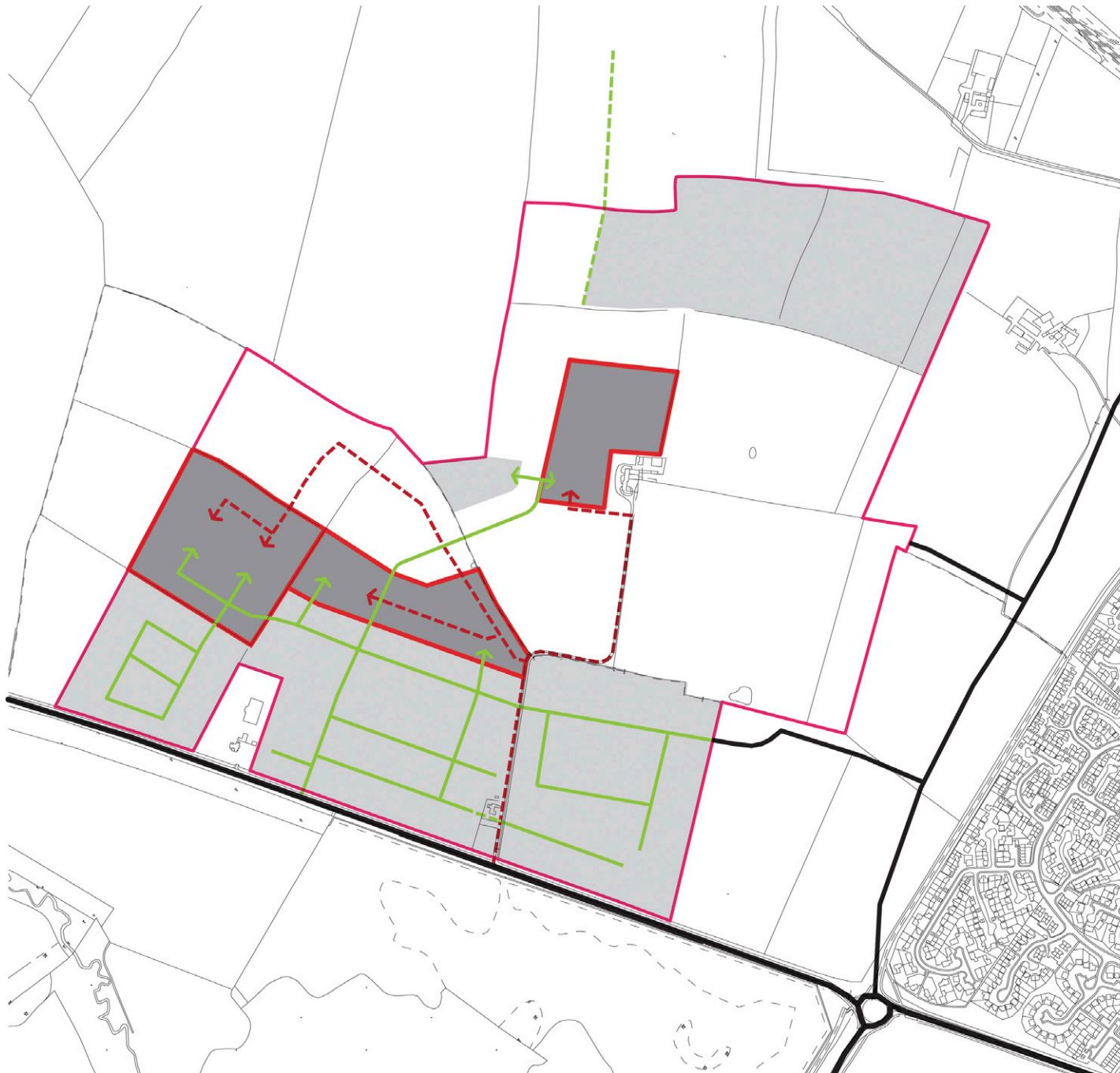
Construction

- New connections to boulevard made
- New spine road extends into the centre of the site
- Development extends north and east
- Construction access from the north, residential access from the south
- Primary School constructed
- Circa 190 dwellings in this phase plus school

--- Construction access

— Resident access

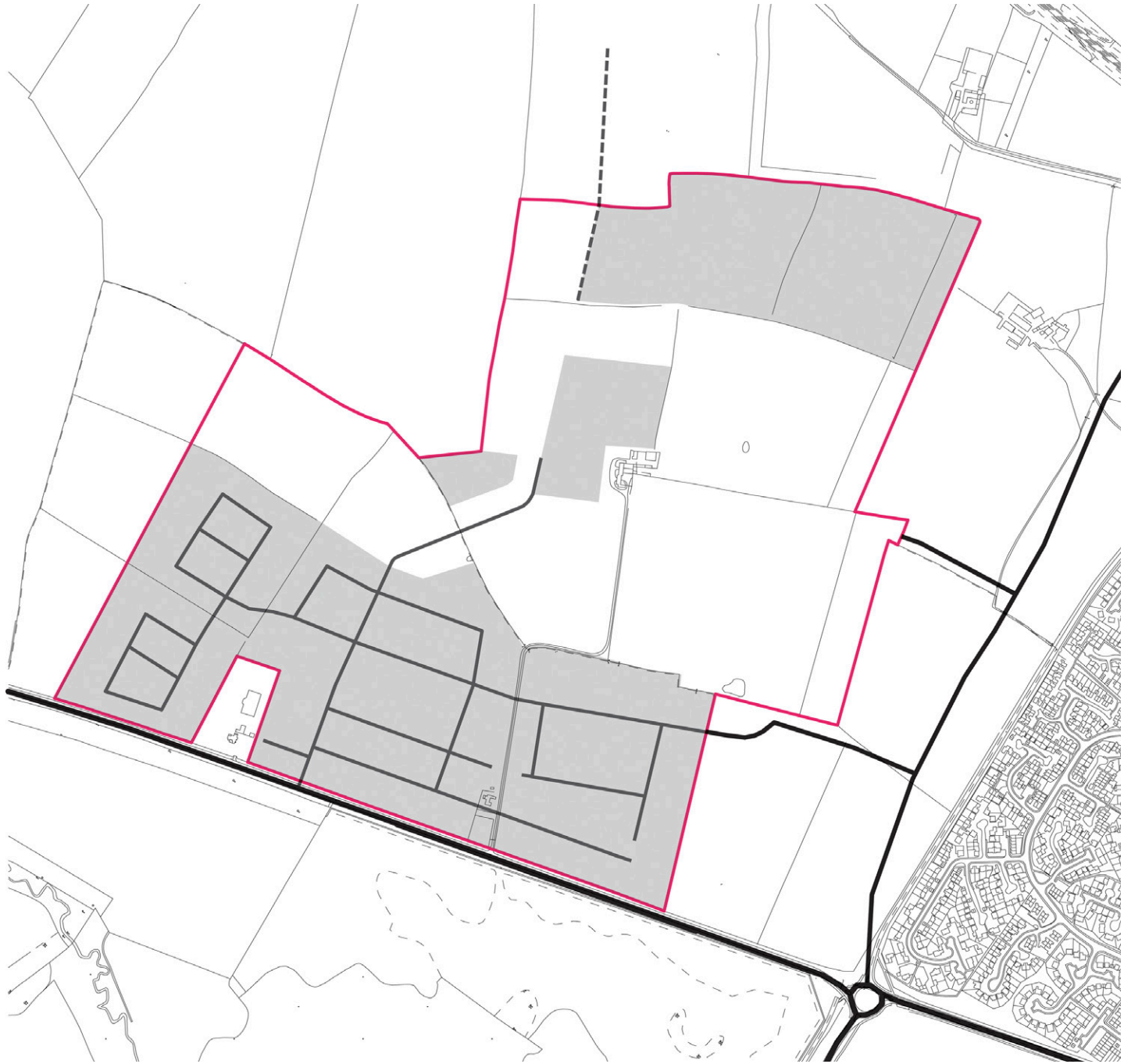
- - - Resident access - temporary



PHASE 3

Complete

- Circa 680 dwellings in total
- New connections to boulevard made
- Primary School in place.

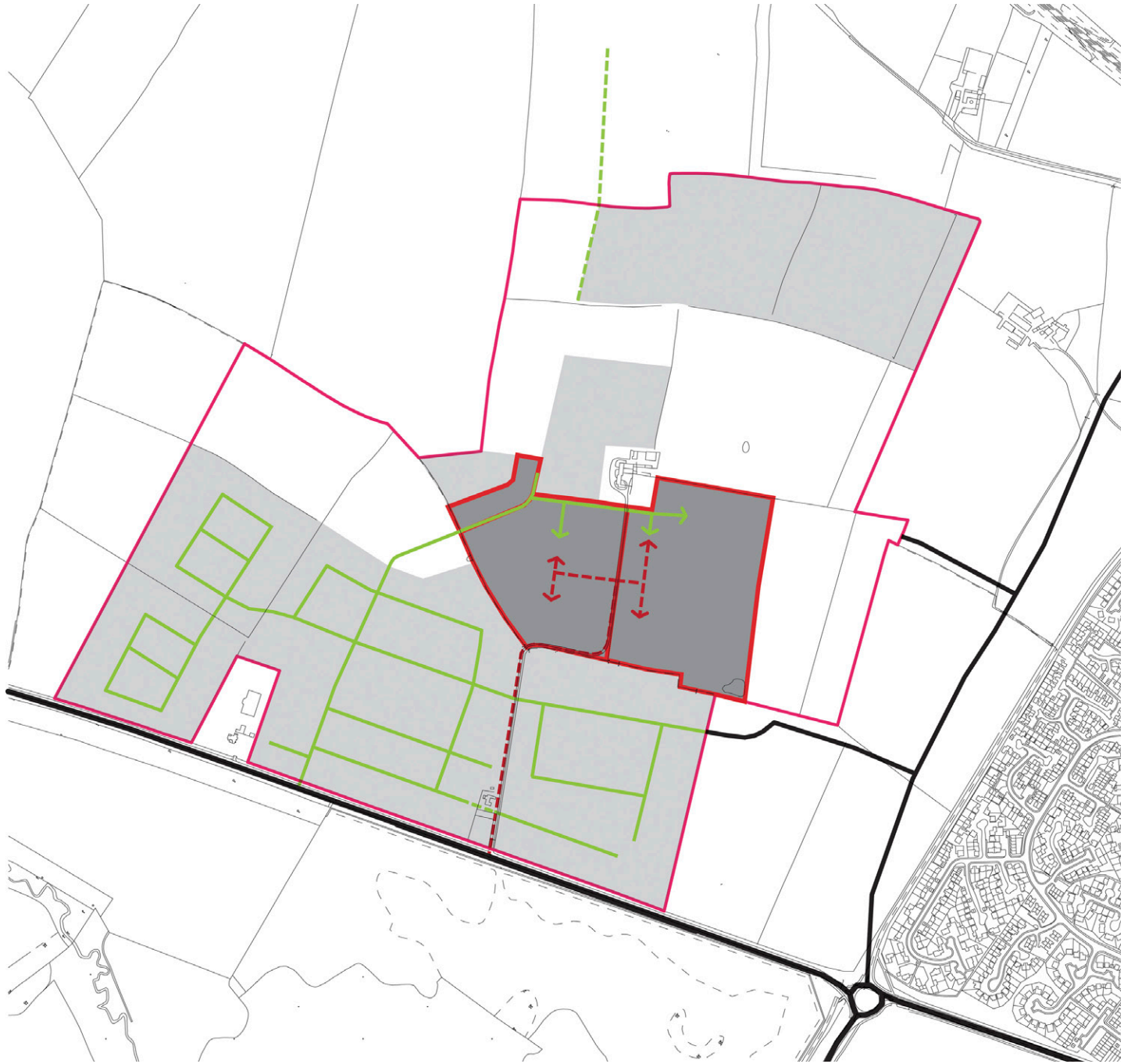


— Resident access

PHASE 4

Construction

- Development extends to central fields
- Village Green and associated residential units developed.
- Circa 300 dwellings in this phase

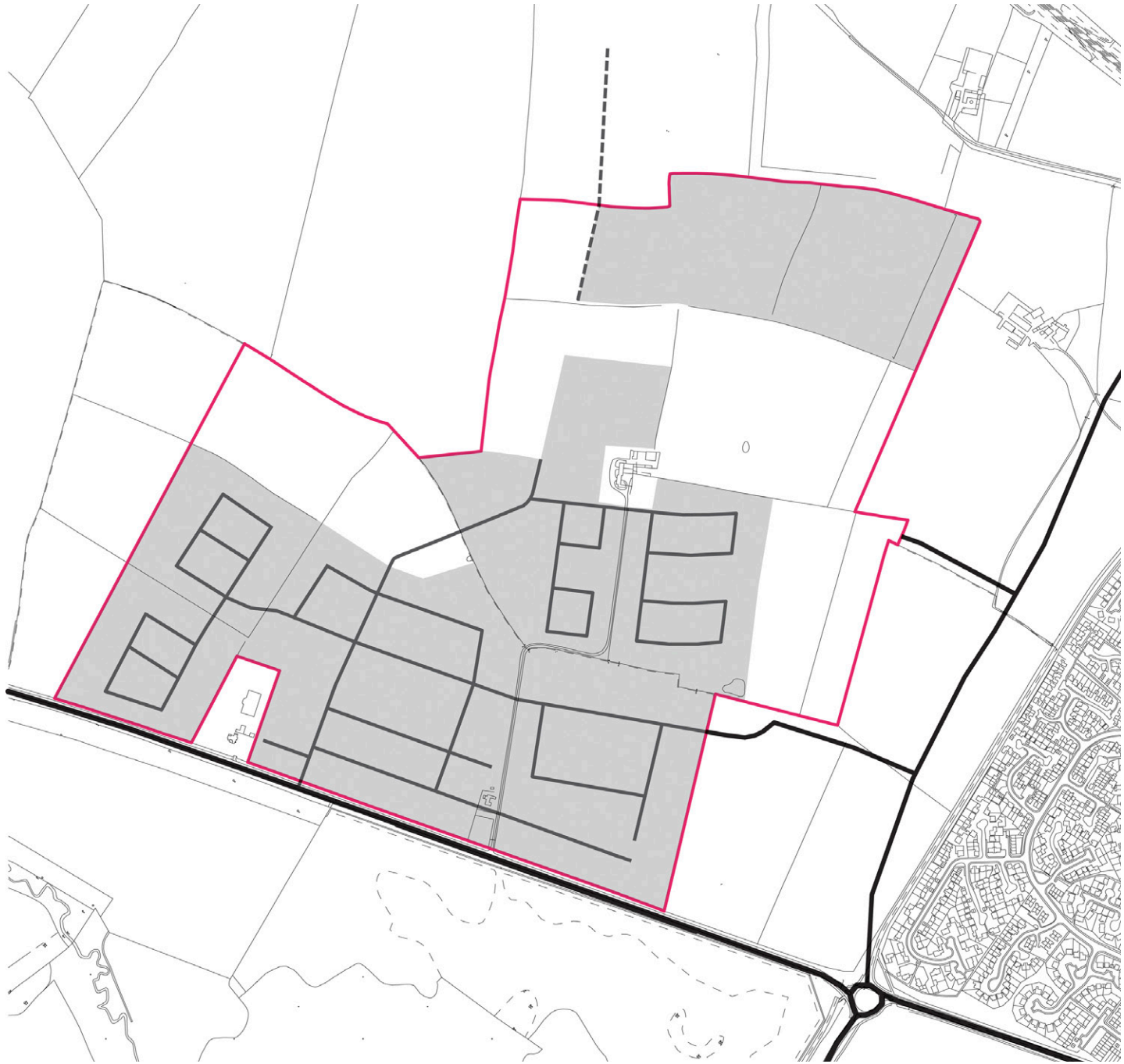


- Construction access
- Resident access
- Resident access - temporary

PHASE 4

Complete

- Circa 980 dwellings in total
- Residential access off new spine road off Middleton Stoney Road and new road connection to boulevard
- Village Green, Primary School, CLT in place.

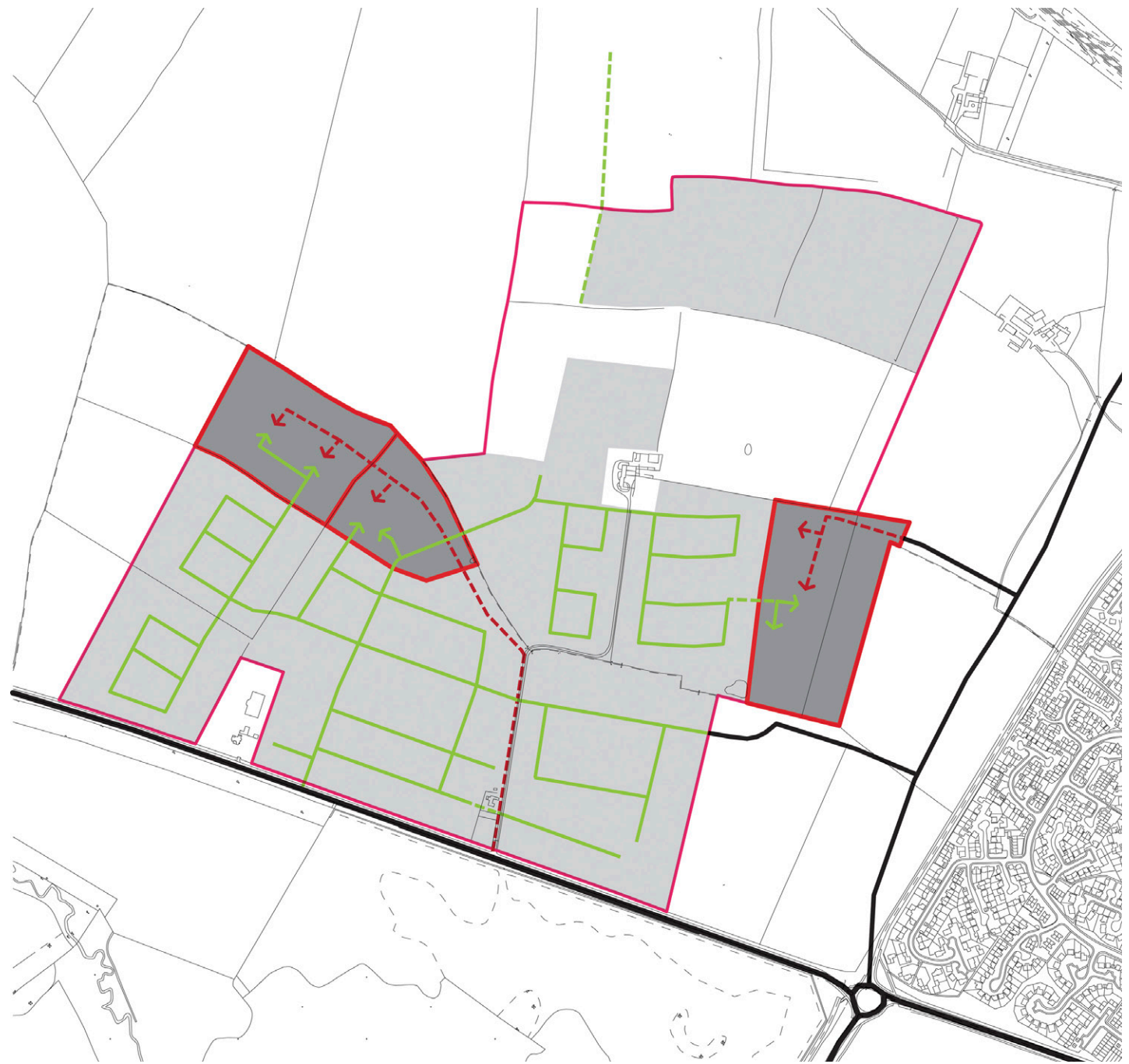


— Resident access

PHASE 5

Construction

- Development extends to final parts of eastern and central fields
- Village Green and associated residential units developed.
- Circa 210 dwellings in this phase

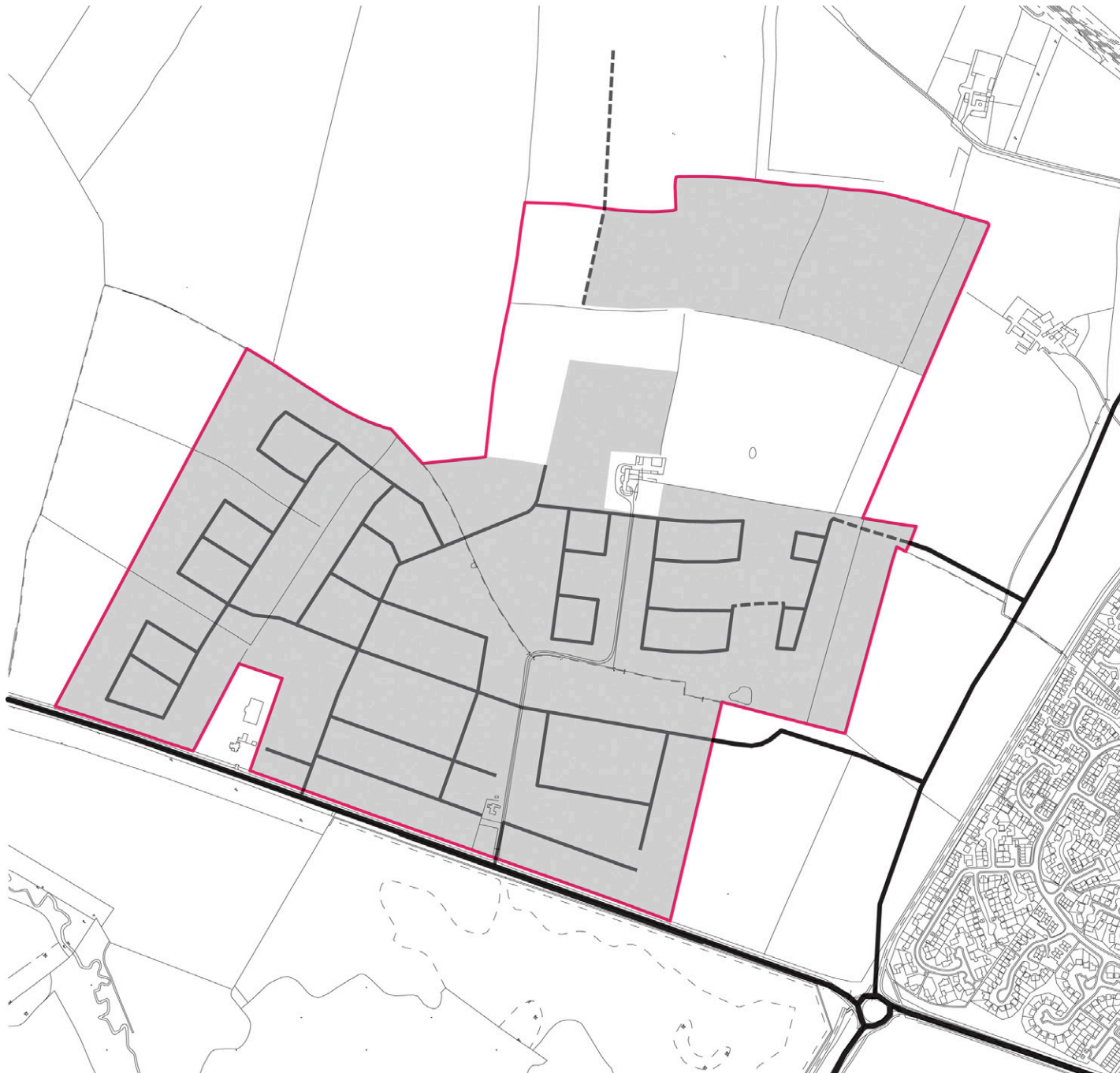


- Construction access
- Resident access
- - - Resident access - temporary

PHASE 5

Complete

- Circa 1,190 dwellings in total
- Southern and central fields complete
- Residential access off new spine road off Middleton Stoney Road and new road connections to boulevard
- Village Green, Primary School, CLT in place.

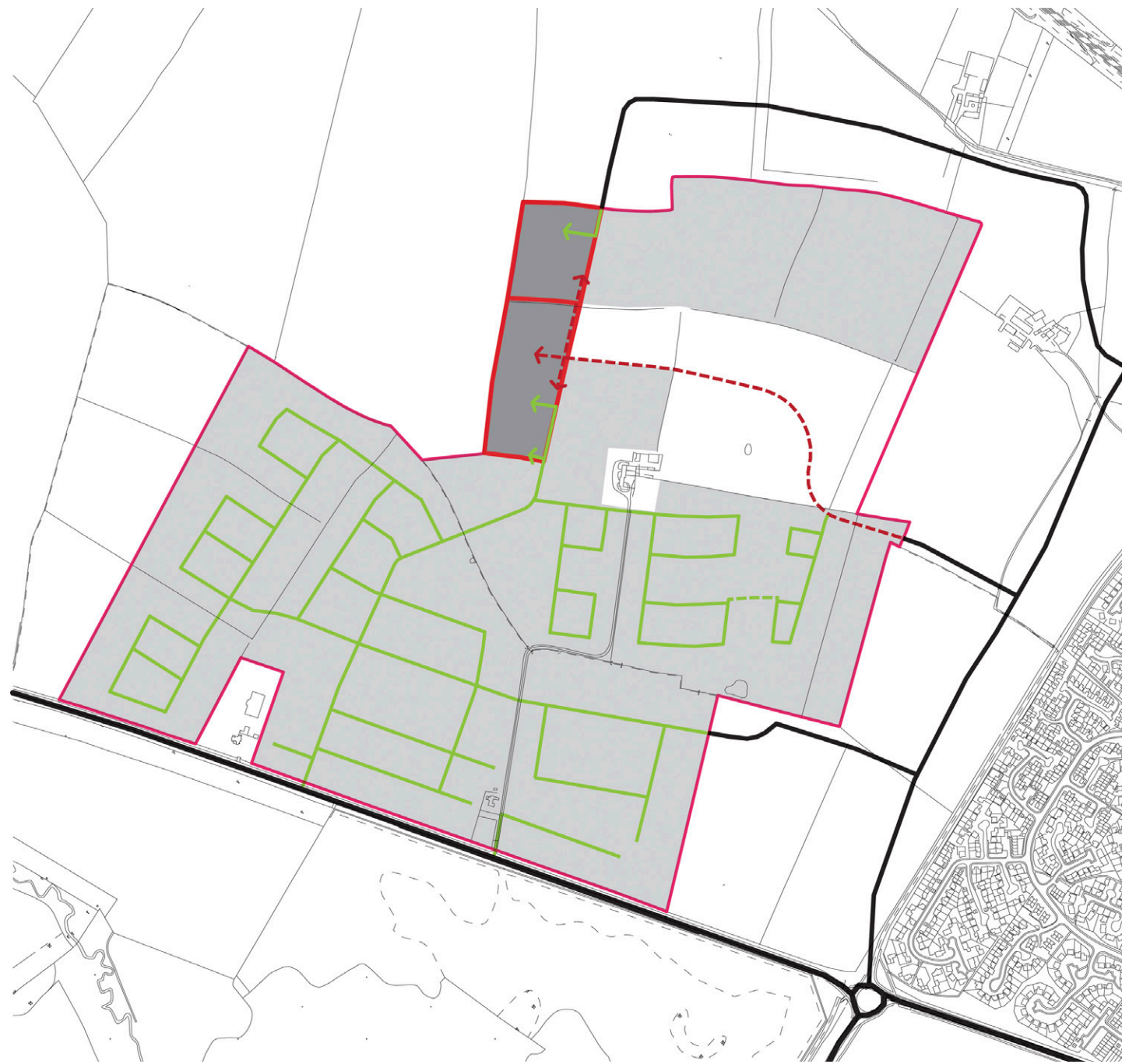


— Resident access

PHASE 6

Construction

- Development extends to the final parts of the western fields
- Construction access off new boulevard
- Northern link to wider masterplan in place
- Circa 145 dwellings in the phase

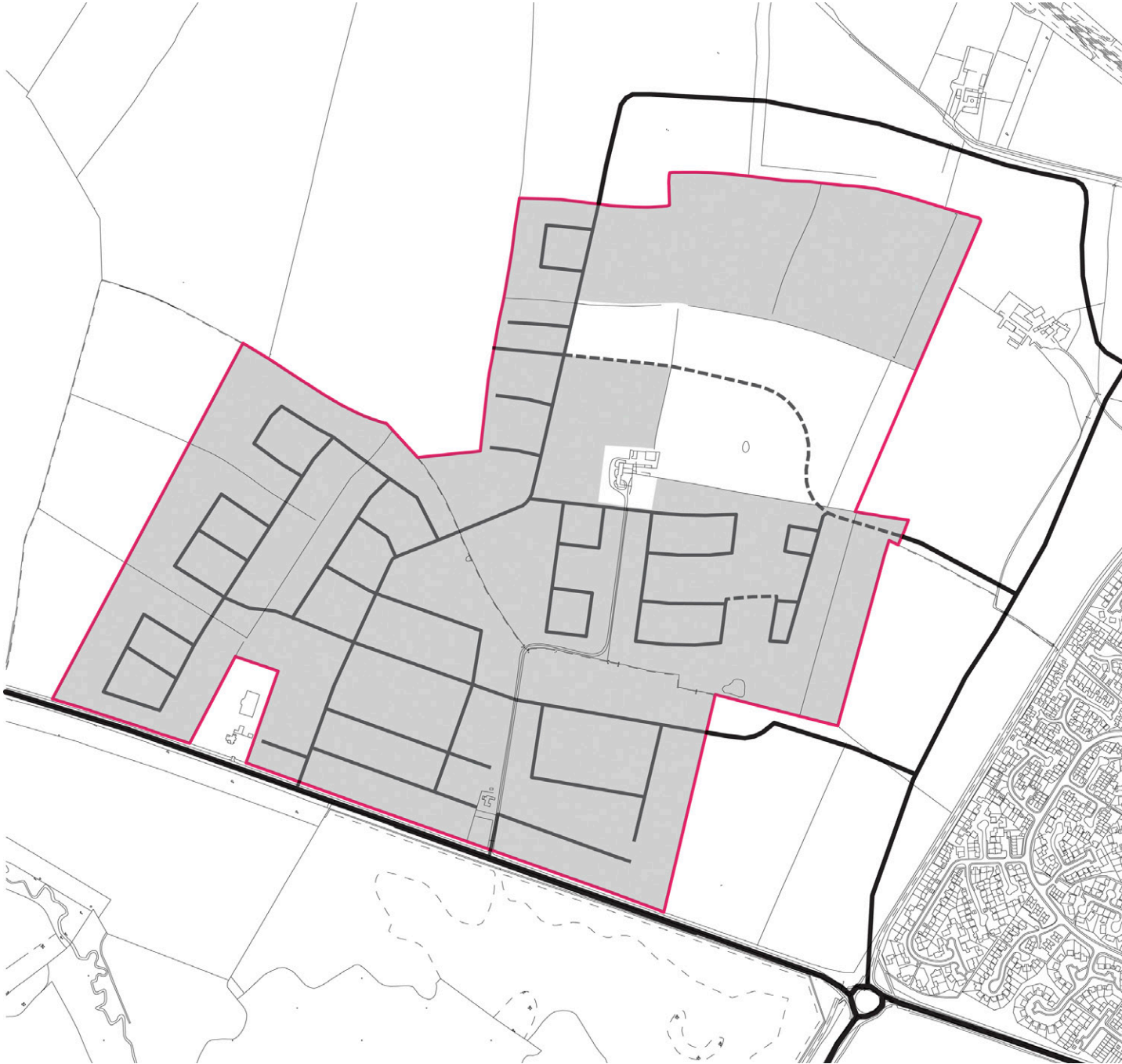


- - - - - Construction access
- - - - - Resident access
- - - - - Resident access - temporary

PHASE 6

Complete

- Circa 1,335 dwellings in total
- Northern link to wider masterplan established

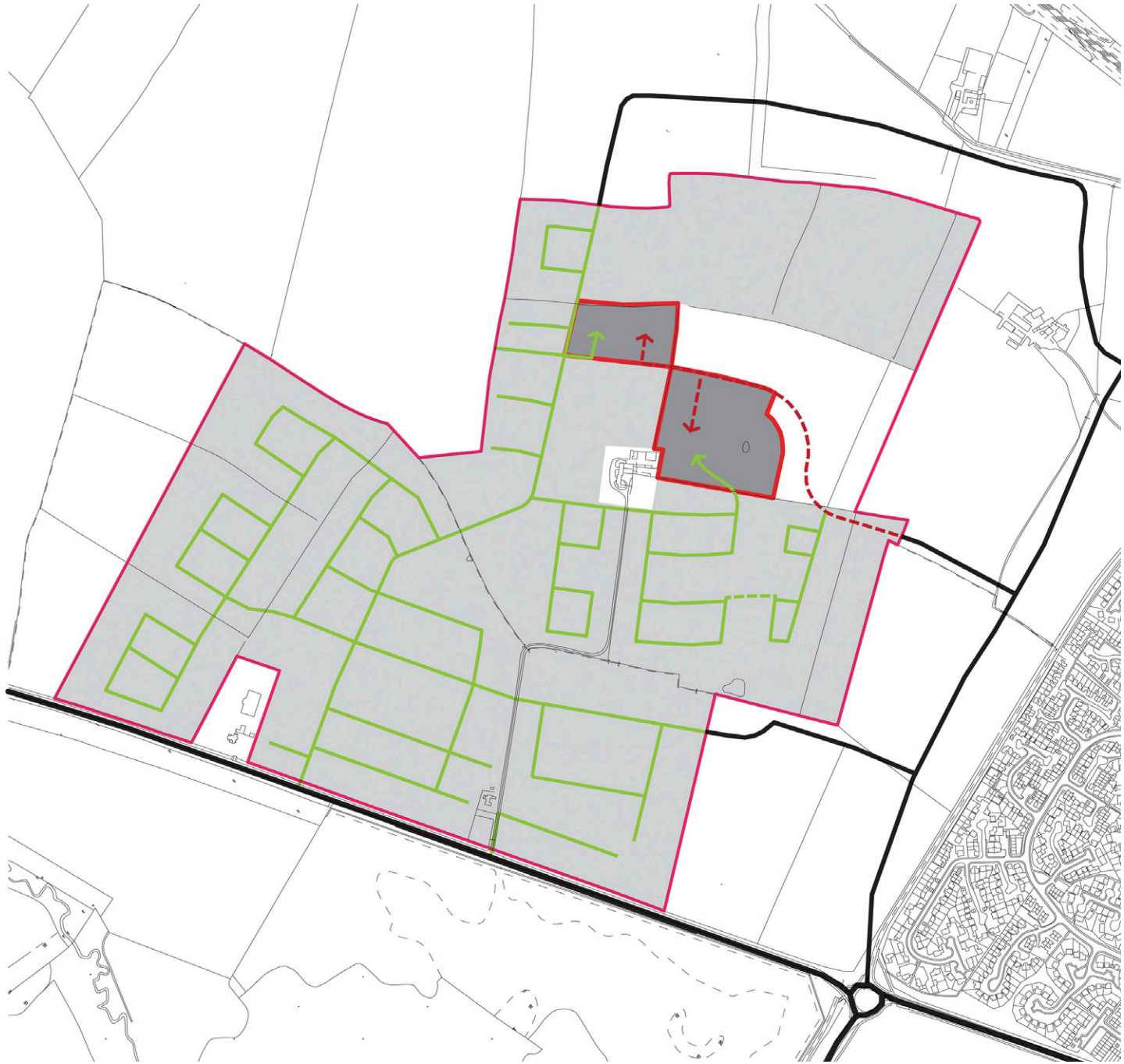


— Resident access

PHASE 7

Construction

- Development extends eastwards along new construction access route
- Circa 145 dwellings in this phase

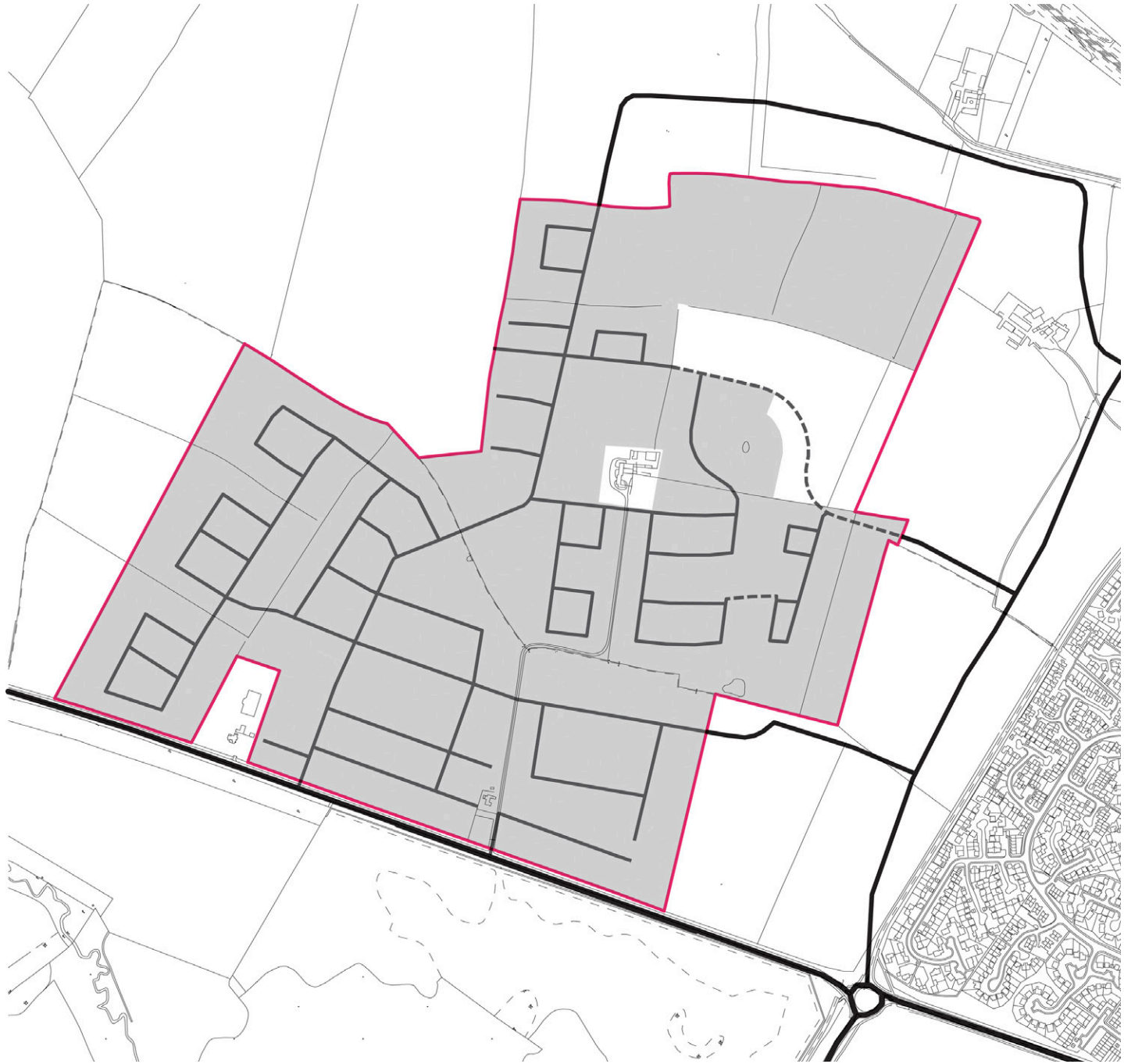


- - - - - Construction access
- Resident access
- - - - - Resident access - temporary

PHASE 7

Complete

- Circa 1,480 dwellings in total
- Development extending eastwards as boulevard is more established

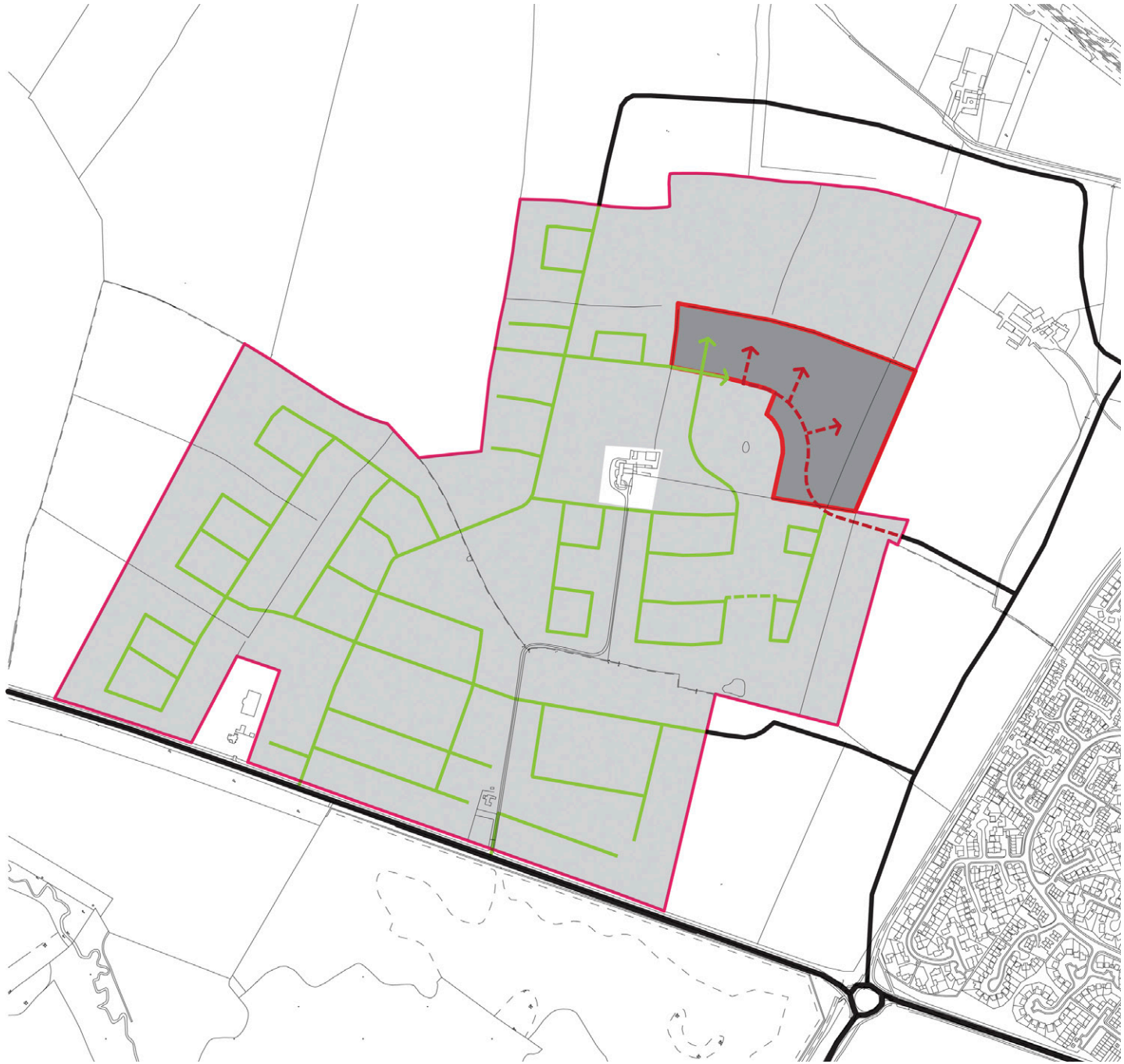


— Resident access

PHASE 8

Construction

- Final phase to the north east
- Circa 220 dwellings in this phase

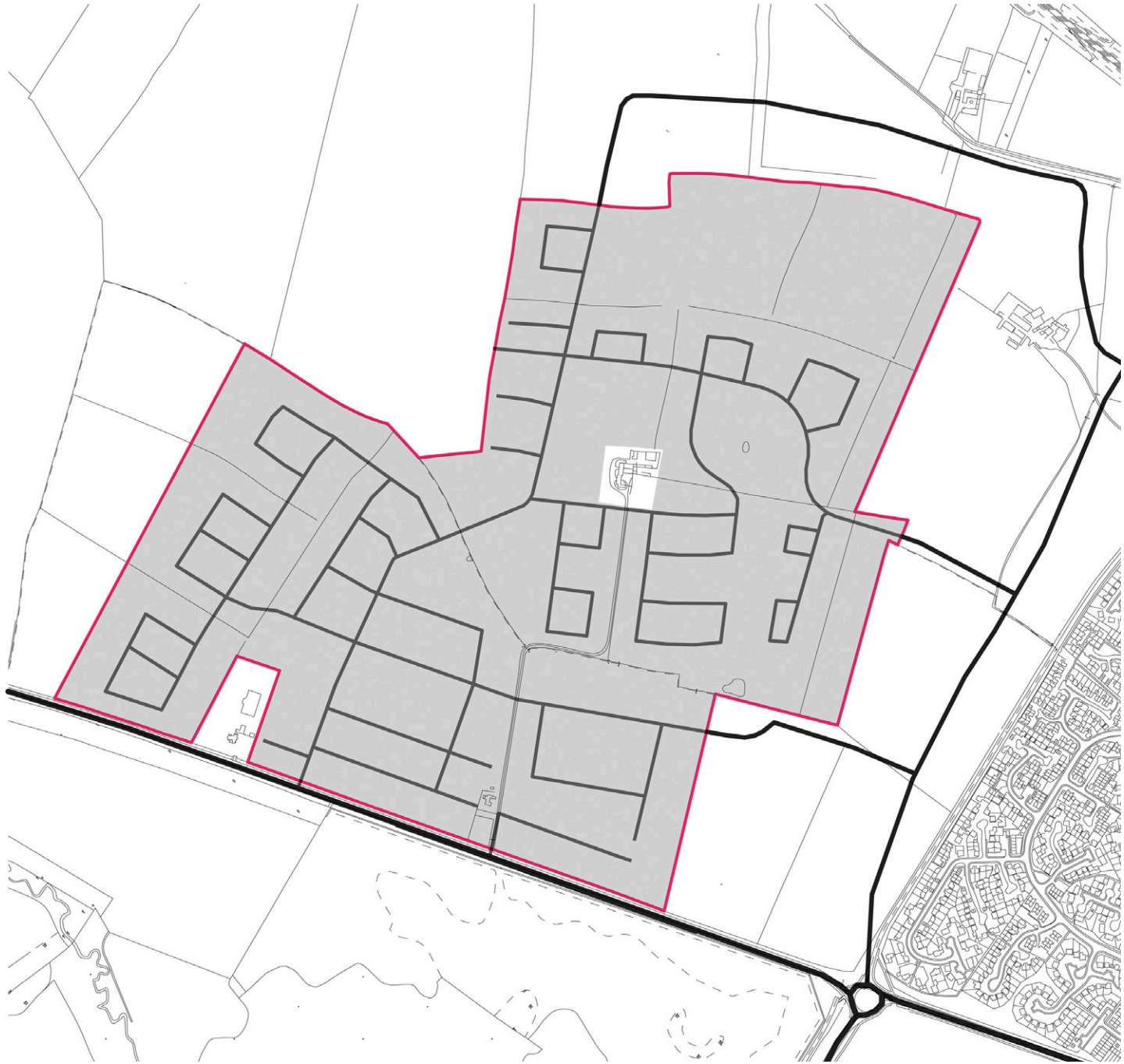


- Construction access
- Resident access
- - - Resident access - temporary

PHASE 8

Complete

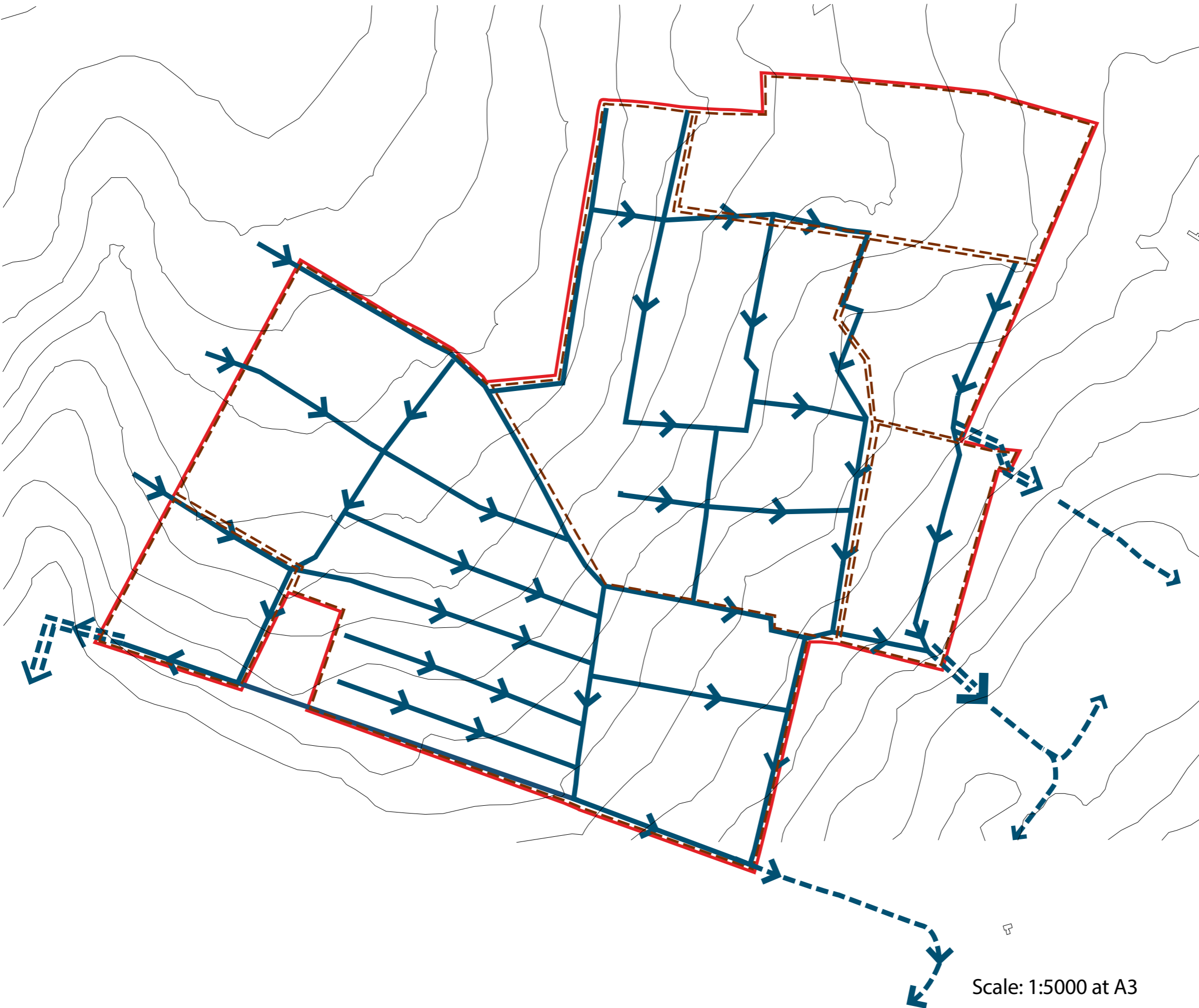
- Circa 1,700 dwellings in total
- Himley Village complete







— Resident access

Appendix 2

Outline SuDS Parameter Plan

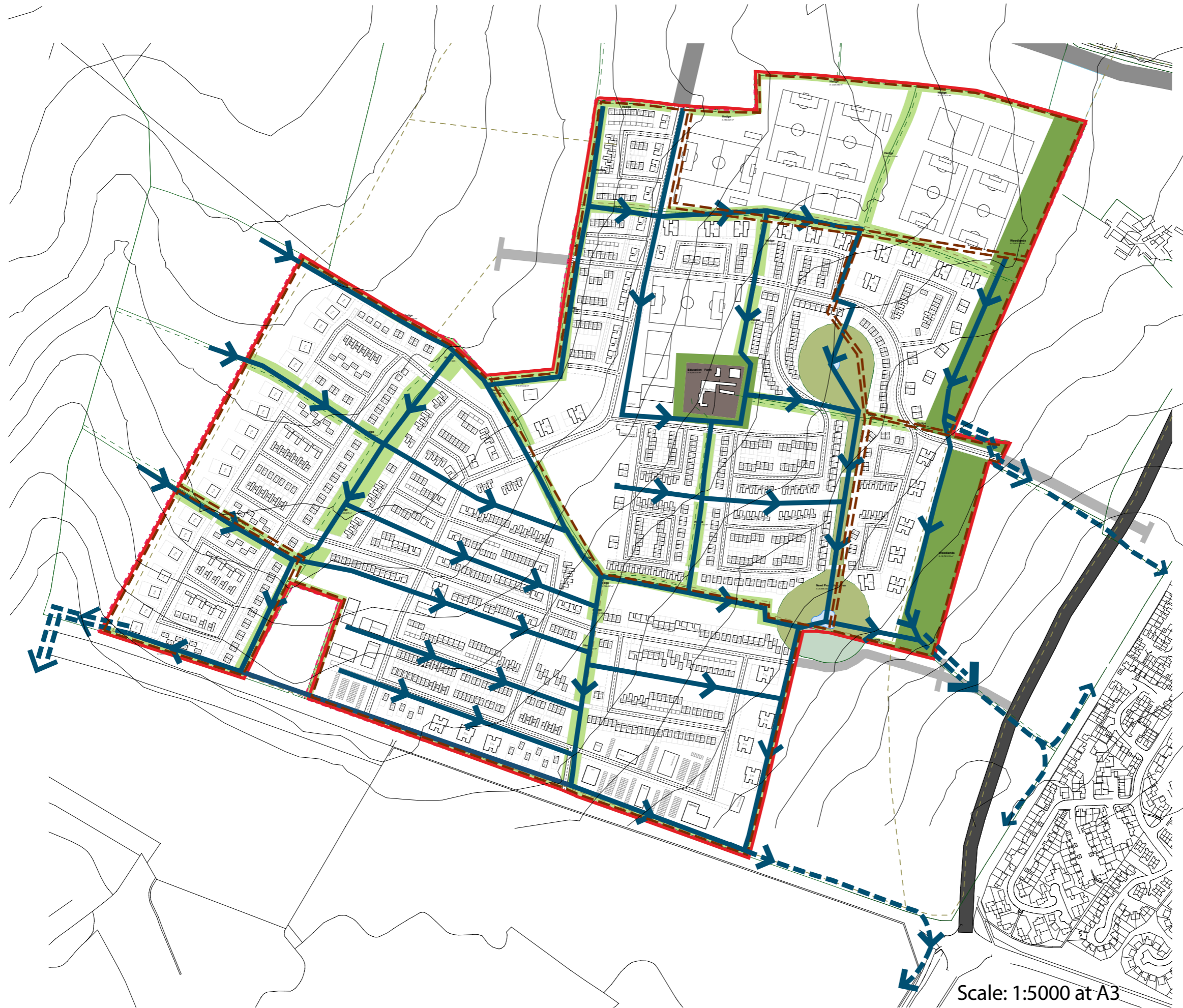






-  Site boundary
-  "Catchment area"
-  Primary swales and direction of flow
-  Discharge into existing watercourse

Note:
Approx. swale attenuation volume for each catchment to be distributed in proportion to the area drained for the 1 in 100 year rainfall event and to be discharged at the surface water outlets at a rate of 2 l/s/ha

HIMLEY VILLAGE PARAMETER PLAN	
OUTLINE SUDS PARAMETER PLAN	
1665/76 SK101. REV D	
DECEMBER 2014	Alan Baxter

Scale: 1:5000 at A3



-  Site boundary
-  "Catchment area"
-  Primary swales and direction of flow
-  Discharge into existing watercourse

Note:
Approx. swale attenuation volume for each catchment to be distributed in proportion to the area drained for the 1 in 100 year rainfall event and to be discharged at the surface water outlets at a rate of 2 l/s/ha

HIMLEY VILLAGE PARAMETER PLAN	
OUTLINE SUDS PARAMETER PLAN OVERLAYED ON MASTERPLAN	
1665/76 REV B	
DECEMBER 2014	Alan Baxter

Scale: 1:5000 at A3

Appendix 3

UK SuDS Greenfield Runoff and Surface Water Storage

Greenfield runoff estimation for sites

Site name: Himley Village
Site location: Bicester, Oxford

Site coordinates
Latitude: 51.90630° N
Longitude: 1.18505° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: gcppm13047ds / 89
Date: 3 Nov 2014

Site characteristics

Total site area	89	ha
Significant public open space	10	ha
Area positively drained	79	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Specify SPR manually
SOIL type	2
HOST class	N/A
SPR	0.26

Hydrological characteristics

	Default	Edited	
SAAR	628	628	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.91	0.91	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Greenfield runoff rates

	Default	Edited		
Qbar	11.12	84.75	l/s	1.07
1 in 1 year	67.15	72.03	l/s	0.91
1 in 30 years	181.70	194.91	l/s	2.47
1 in 100 years	252.01	270.34	l/s	3.42

Please note that a minimum flow of 5 l/s applies to any site

Surface water storage requirements for sites

Site name: **Himley Village**
Site location: **Bicester, Oxford**

Site coordinates
Latitude: **51.90594° N**
Longitude: **1.18573° W**

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: **gcppm10w42x8 / 62.4**
Date: **7 Nov 2014**

Site characteristics

Total site area	89	ha
Significant public open space	10	ha
Area positively drained	79	ha
Impermeable area	47.4	ha
Percentage of drained area that is impermeable	60	%
Impervious area drained via infiltration	10	ha
Return period for infiltration system design	100	year
Impervious area drained to rainwater harvesting systems	10	ha
Return period for rainwater harvesting system design	100	year
Compliance factor for rainwater harvesting system design	66	%
Net site area for storage volume design	62.4	ha

Methodology

Greenfield runoff method	IH124
Volume control approach	Flow control to max of 2 l/s/ha or

Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Specify SPR manually
SOIL type	1
HOST class	N/A
SPR	0.26

Hydrological characteristics

	Default	Edited	
SAAR	628	628	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.4	0.4	
FEH/FSR conversion factor	0.91	0.91	
Hydrological region	6	6	
Growth curve factor: 1 year	0.85	0.85	
Growth curve factor: 10 year	1.62	1.62	
Growth curve factor: 30 year	2.3	2.3	
Growth curve factor: 100 year	3.19	3.19	

Design criteria

Climate change allowance factor	1.3
Urban creep allowance factor	1.1
Interception rainfall depth	5 mm

Greenfield runoff rates

	Default	Edited	
Qbar	11.12	84.75	l/s
1 in 1 year	79.00	84.75	l/s
1 in 30 years	79.00	84.75	l/s
1 in 100 years	79.00	84.75	l/s

Please note that a minimum flow of 5 l/s applies to any site

Estimated storage volumes

	Default	Edited	
Interception storage	1,891.20	1,891.20	m ³
Attenuation storage	25,262.04	24,820.12	m ³
Long term storage	0.00	0.00	m ³
Treatment storage	4,492.80	4,492.80	m ³
Total storage	27,153.24	26,711.32	m ³

Alan Baxter

Prepared by Philip Howard
Reviewed by Alan Fleet
Issued December 2014

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