

Reg 13(1)

**From:** Reg 13(1) [redacted]@arcadis.com>  
**Sent:** 30 September 2019 17:06  
**To:** Reg 13(1) [redacted]  
**Cc:** Reg 13(1) [redacted]  
**Subject:** FW: Northstowe Phase 1  
**Attachments:** DSCN1477.JPG; 10019646-ARC-XX-XX-VS-ZZ-P1-SEEPW.pdf

**Follow Up Flag:** Flag for follow up  
**Flag Status:** Flagged

Re

Further to our conversation we have found the email below which relates to the site meeting in 2017. Attached is the SEEPW technical memo that was prepared for the P2 / P3 works.

Was this the information you were after?

Kind regards

Reg

---

**From:** Reg 13(1) [redacted]  
**Sent:** 20 February 2017 10:45  
**To:** Reg 13(1) [redacted]@hca.gsi.gov.uk  
**Cc:** Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>  
**Subject:** Northstowe Phase 1

Hello Reg

I attended the Northstowe Phase 1 site meeting (16 Feb 2017) as requested. It was interesting to see the site – and although it was a dry and sunny day, Reg nearly managed to lose a member of the public in the clay / mud! I've left my notebook at home today unfortunately, but there were about 8 or so members of the community present, plus a councillor, and representatives from the planning authority, the fishing club, WSP, and a hydrogeologist from Wardell Armstrong (who has been engaged by Reg to provide an assessment of the issues).

Reg took us around most of the site and we saw the ponds and drainage infrastructure that the residents have concerns about. Water levels in most certainly appeared to be unseasonably low. Outside of the meeting I also visited a couple of the other ponds in the area (one of which also clearly low) and the Holy well at the church. I also went to see Reg, and visited the fishing pond Reg (appears to be very low also) Reg.

After the walk around on site there was a meeting in the portacabin on site where Reg outlined his thoughts. The meeting was cordial but the most aggrieved participant was probably Reg. He didn't say as much, but he is clearly concerned that the commissioned report will conclude that the lack of water in the area is a function of weather rather than operations on site, and if so, Reg.  
Reg

Without pre-empting the findings of the Wardell Armstrong report, and without having a look at any of the data, my own gut feeling is that the limited, temporary dewatering that has been carried out on the P1 site

is unlikely to have caused the low water levels in the surrounding area. Reg [redacted] and the Wardell – Armstrong hydrogeologist are of the same opinion. The water levels probably do reflect the generally dry conditions we had last year but it will be interesting to look at groundwater level data from your P2 site and have a look to see what the road construction has involved.

The residents seemed pleased that the HCA were represented at the meeting and was therefore listening to their concerns. As instructed I made it clear that I was only there in an 'eyes and ears' capacity and I offered no thoughts on causes. They seemed to accept that lack of rainfall may be an issue, but reserved comment until they have had the opportunity to read the proposed report. The report will be submitted to the LPA and distributed accordingly.

I'm not sure what obligations Gallaghers or the HCA have in terms of monitoring water features, but it was certainly surprising to me that Reg 13(1) [redacted] in particular isn't being regularly monitored – as that feature would constitute a protected right. I wouldn't be difficult to put a water level logger Reg 13(1) [redacted]. Neither do there appear to be any gauge boards in any of the surface water features I observed - which again was surprising to me. They are relatively inexpensive to install and would probably facilitate monitoring and the collection of baseline data.

I gather you are happy for use to provide data from Phase 2 to Reg [redacted] consultants - so I can provide this when requested if so.

Please give me a call if you have any questions,

Kind regards

Reg [redacted]

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**From:** Reg 13(1) [redacted]@hotmail.co.uk>  
**Sent:** 22 February 2017 15:23  
**To:** Reg 13(1) [redacted]  
**Cc:** Reg 13(1) [redacted]@scambs.gov.uk; Reg 13(1) [redacted]  
**Subject:** Re: Northstowe Phase 1 Groundwater  
**Attachments:** 8451-221 Phase 1 Subsurface Water Levels - Feb 17.pdf; Email to Reg 13(1) [redacted] 2017 0222.pdf

Reg 13(1)

I have received a copy of your email to Reg 13(1) [redacted] with the water levels - I assume that it is a copy of the information that we saw at the meeting last week.

I have some outstanding concerns that I hope you will sort out for me. I have attached my email as a pdf for ease of reading.

Kind Regards,

Reg 13(1)

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**From:** Reg 13(1) [redacted]  
**Sent:** 21 February 2017 23:21  
**To:** Reg 13(1) [redacted]  
**Subject:** Fw: Northstowe Phase 1 Groundwater

Hi  
Just received this, water level readings.

Regards

Reg 13(1)

On Tuesday, 21 February 2017, 17:25, Reg 13(1) [redacted]@scambs.gov.uk> wrote:

Reg 13(1)

Most of the internal monitoring points have now been lost as development progresses, but Gallagher did manage to get some latest boundary readings in the key gravels area at BH's 144, 126 and A1 and the data is presented on the attached plan. Gallagher are currently awaiting the HCA's wider monitoring results but I trust this is sufficient to respond to his immediate enquiry.

Please note that the report from Wardell Armstrong is expected to be received by April 2017.

Thanks

Reg 13(1)

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Email to Reg 13(1) (SCDC)

22 February 2017

Reg

I have received a copy of your email to Reg with the water levels - I assume that it is a copy of the information that we saw at the meeting last week.

I have some outstanding concerns that I hope you will sort out for me.

1. I would like confirmation that Reg 13(1) has been sent copies of ALL the email information and threads you have received from myself and the environment agency going back to when I first raised this matter in 2015. It is vital that Reg has all the information on this issue and fully understands the village's concerns and the time-line involved. Clearly Reg 13(1) should also be given copies of Reg 13(1) paperwork going back to 2015 in which he raises his concerns. Reg 13(1) may also have paperwork from 2015 which Reg may find useful.
2. Although it was very helpful to walk over the site in a large group I would like to have the opportunity to have another meeting with Reg 13(1) during the drafting phase of the report so that we are happy that he is considering all aspects of the concerns we are raising. I think it would be appropriate to have Reg 13(1) and a representative of the parish council there as well.

It appears from what Stratos said at the meeting last week that Gallaghers will fund no more than a survey of their work ON the phase 1 site. The suspicion must be that this report is being carried out in order that Gallagher's can comfortably deny liability for negative ground water levels on and off-site and thereby protect themselves from possible future litigation.

It has been suggested that if de-watering is carried out incorrectly then ground water levels can take 30 - 40 years to recover. Sadly Reg 13(1), the ponds of Longstanton village and our wildlife don't have that sort of timescale. This is such an important issue that perhaps HCA would consider contributing to the cost of some off-site research so the scope of this investigation can be widened. The final report needs to be fully comprehensive as clearly this issue may impact on HCA's work on phase 2.

3. I do have another concern that I thought about after the meeting last week. After contacting the Environment Agency in the autumn of 2016 I spoke to Reg 13(1) after he had been out on the phase 1 site to investigate the complaint. He made this visit on site in October 2016. During our telephone conversation Reg advised that during his visit the contractors were pumping water into the kingfisher pond.

My concern is this. If water was being pumped into the kingfisher pond in October 2016 why are the water levels so low now? It is clear that whether there is low rainfall at the

moment or not the kingfisher pond is no longer retaining water. In essence since the de-watering started out on phase 1 the kingfisher pond appears to have sprung a leak! **Never has this pond leaked water like this before, hence it had to have an overflow pipe to ensure that the pond did not get too full to stop the kingfishers from nesting.** A year or so prior to dewatering the kingfisher pond was full because the overflow pipe had been damaged during works on site. This matter was reported to the Conservation Dept at SCDC so the exact date of this can be verified. The overflow pipe was repaired in order for the kingfishers to nest that spring.

My comments on the WSP information (*see Environmental Statement Technical Appendix G – Ground Conditions Feb. 2012*) which I circulated last week remain. Gallaghers were aware of the gravel seam, aware of its porous properties, aware of the direction of flow and aware of the other ponds and wells in Longstanton that depended on the gravels for their water. It has been said that the de-watering design has taken all of this into account and the gravels were avoided whilst excavating the drains. If this is indeed the case then the only answer to a leak in the kingfisher pond is that other grounds works and/or the industrial scale gravel excavation near both **Reg 13(1)** and the kingfisher pond (also reported to SCDC) and the subsequent relocation of gravels to other parts of the phase 1 site have damaged water flow and natural ground water retaining features of the area.

If the drainage / de-watering system was indeed carefully designed specifically to have no negative impact on ground water levels in the gravels, surely all other ground works and the decision to excavate gravel for use near the new school needed to follow the same constraints? If planning consent was granted for phase 1 on the basis of the WSP information and its recognised constraints ie that there should be no impact on ground water levels in the gravels then it is clear that this condition has not been met. The cause of the problem does not matter - the fact that the kingfisher pond no long needs its overflow pipe to lose water should be proof enough. I think that **Reg 13(1)** needs to be provided with full details of what tonnage of gravel was excavated from what locations on phase 1 and where it was re-located to. I am sure that the contractors should have kept records of this work.

I would be grateful if you or Stratos can forward this email to **Reg 13(1)** and ask him to email me to confirm receipt.

Many thanks,

**Reg**



Reg 13(1)

**From:** Reg 13(1) [redacted]@arcadis.com>  
**Sent:** 01 October 2019 08:50  
**To:** Reg 13(1) [redacted]  
**Cc:** Reg 13(1) [redacted]  
**Subject:** FW: Assessment of groundwater levels for Northstowe Phase 2

Re

There is also this one.

Regards

Reg 13(1)

---

**From:** Reg 13(1) [redacted]@arcadis.com>  
**Sent:** Tuesday, October 24, 2017 10:39 AM  
**To:** Reg 13(1) [redacted]@hca.gsi.gov.uk>  
**Cc:** Northstowe Phase 2 <UA008426@arcadis.com>  
**Subject:** RE: Assessment of groundwater levels for Northstowe Phase 2

Hi Reg 13(1)

Please find attached an updated note on the groundwater modelling assessment. The note has been updated to include an analytical assessment of groundwater inflows to the drainage network.

Would you still like to meet to discuss the outcomes of the assessment?

Regards,

Reg 13(1) [redacted]@arcadis.com  
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**From:** Reg 13(1) [redacted]  
**Sent:** 09 October 2017 11:33  
**To:** Reg 13(1) [redacted]@hca.gsi.gov.uk>  
**Subject:** FW: Assessment of groundwater levels for Northstowe Phase 2

Hi Reg  
[redacted]

Please find attached a draft note on the groundwater modelling assessment. We can discuss further in our meeting tomorrow, and we will also present the groundwater model.

Regards,

Reg  
[redacted]

---

From: Reg 13(1)  
Sent: 06/10/2017 16:57  
To: Reg 13(1)  
Cc: Reg 13(1)  
Subject: Assessment of groundwater levels for Northstowe Phase 2

Hi Reg  
[redacted]

Please find the attached memo detailing the results of our assessment of the water levels at Northstowe Phase 2 with respect to the manhole invert levels. During this work we also developed a 3 dimensional model in groundwater modelling software, FEFLOW, that we will be able to use in the meeting next week if required.

Kind Regards,

Reg  
[redacted]

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Reg 13(1)

**From:** Reg 13(1) (Gallagher Estates) Reg 13(1) @gallagherestates.com>  
**Sent:** 24 May 2018 10:31  
**To:** Reg 13(1)  
**Subject:** FW: Northstowe - Groundwater levels

Re

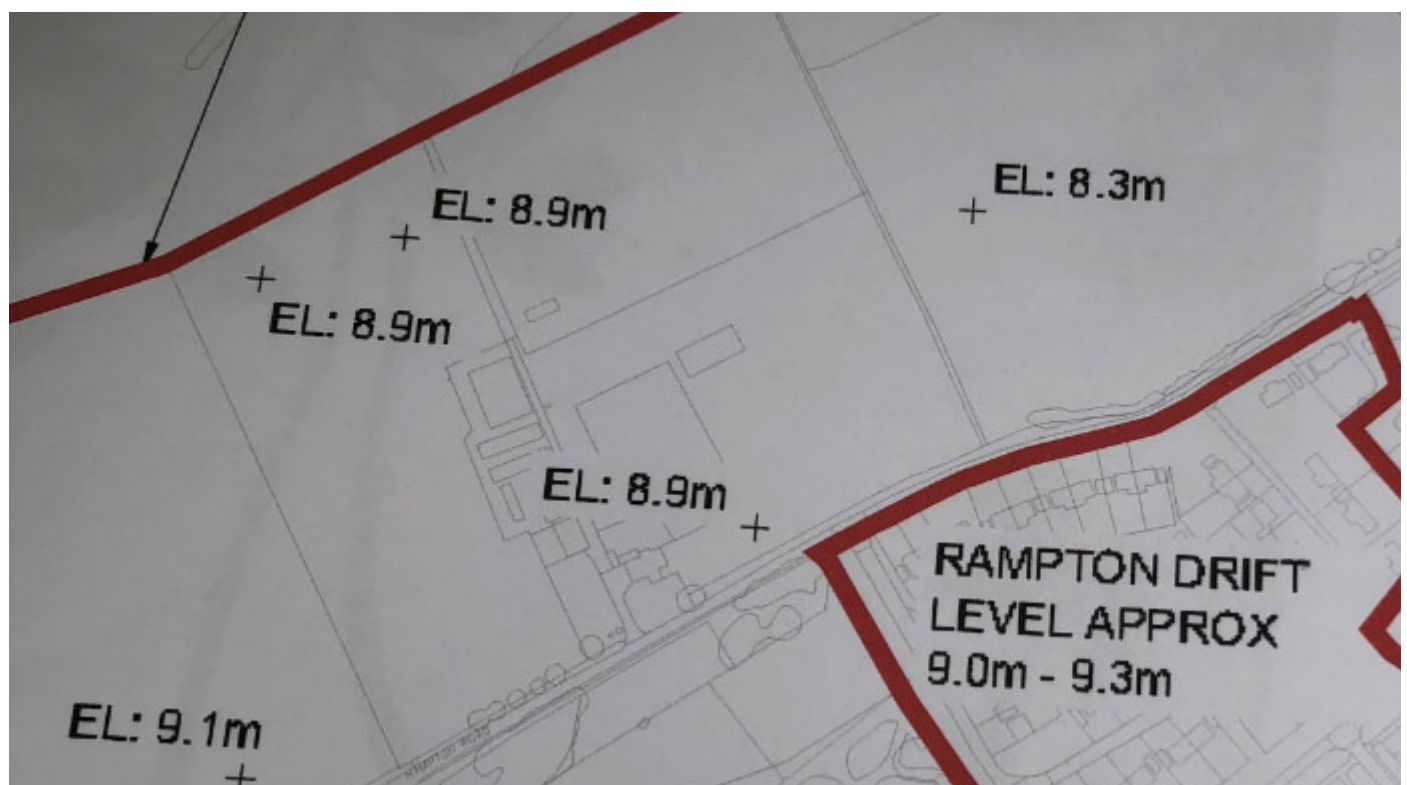
For info...

Reg 13(1)

**From:** Reg 13(1) (Gallagher Estates)  
**Sent:** 24 May 2018 09:37  
**To:** Reg 13(1)  
**Cc:** Reg 13(1) @scams.gov.uk; Reg 13(1)  
Reg 13(1) @scams.gov.uk; Reg 13(1) <parish.clerk@longstantonvillage.org>; Reg 13(1)  
Reg 13(1) @scams.gov.uk; Reg 13(1)  
Reg 13(1) @cambridge.gov.uk; Reg 13(1)  
Reg 13(1) (Gallagher Estates) Reg 13(1) @gallagherestates.com; Reg 13(1)  
(Gallagher Estates) Reg 13(1) @gallagherestates.com; Reg 13(1) Gallagher Estates)  
Reg 13(1) @gallagherestates.com>  
**Subject:** RE: Northstowe - Groundwater levels

Reg 13(1)

Further to our meeting on site yesterday I have undertaken a preliminary review of the groundwater levels as jointly measured. We dipped the water level at 1.35m below cover level and whilst we need to accurately survey the cover level we know from the information you provided that it is approximately at a level of 8.9m AOD. This therefore gives a water level of approximately 7.55m AOD.



This compares favourably with historic readings taken at BHA33 back in 2006/2007 as outlined below. i.e. prior to development works commencing. Whilst BHA33 no longer exists and we cannot therefore provide a current direct correlation, we do have a data logger on nearby BHA1 and as you are aware this gave a groundwater level of 7.60m AOD in the latest May 18 readings.



As discussed we will obtain an accurate level on the cover to refine the correlation and will dip the well on an on-going basis to coincide with the download of data from the data loggers, but I trust you can take some comfort from this initial appraisal.

Kind regards

Reg  
13(1)

---

**From:** Reg 13(1) (Gallagher Estates)  
**Sent:** 17 May 2018 11:19  
**To:** Reg 13(1)  
**Cc:** Reg 13(1) (Gallagher Estates) Reg 13(1) @gallagherestates.com>  
**Subject:** Northstowe - Groundwater levels

Reg  
13(1)

Further to our discussions yesterday I am puzzled by your contention that despite the fact the groundwater levels seem to be showing recovery across Northstowe, you still don't seem to be experiencing any improvement. Reg 13(1) Clearly this is something we need to understand, so in the first instance would you be available to meet me on site next Wednesday at, say, 12.00 to review the situation ?

Kind regards

Reg  
13(1)

Reg 13(1)

Tel: 01926 339 339

DD: Reg 13(1)

Mob: Reg 13(1)

Email: Reg 13(1) [@gallagherestates.com](mailto:Reg 13(1)@gallagherestates.com)

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Reg 13(1)

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 12 March 2019 17:39  
**To:** Reg 13(1)  
**Cc:** Reg 13(1)  
**Subject:** RE: Northstowe phase 3 - SW discharge towards Oakington

Reg 13(1)

I forgot to add, that if you want to chat this through further , I'm happy to do so.

On a separate note, to help monitor and manage the water levels in Military Lake, we are already doing ground water monitoring in this area, but it would be very useful to be able to also monitor water levels within the lake on each visit to confirm how these levels correlate with each other.

Would it be possible to get a depth gauge installed within military lake so we can take readings of water levels during each visit? Is that something Sisk could do for us?

Reg 13(1)

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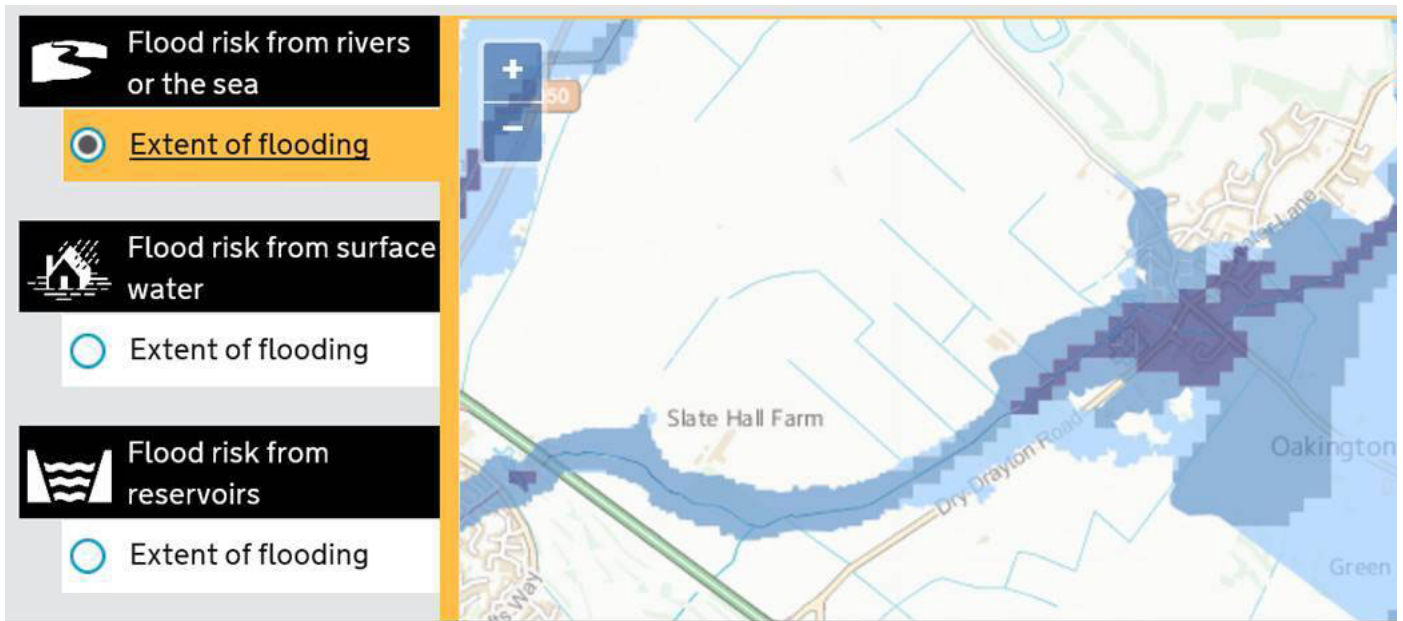
**From:** Reg 13(1)  
**Sent:** 12 March 2019 17:24  
**To:** Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @arcadis.com>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>  
**Subject:** RE: Northstowe phase 3 - SW discharge towards Oakington

Afternoon Reg 13(1)

We have been looking into this further, and using historic groundwater data that we have as well ongoing monitoring data we have contoured average groundwater levels from a combined dataset (Arcadis and WSP data) (Figure 1) and added indicators for the direction of groundwater flow.

- A groundwater divide is present in the Phase 3 area, that follows the topographical catchment split, therefore ground water from this catchment area also flows towards Oakington, and it appears to be hydraulically linked with the existing Longstanton Road Award Drain;
- Geologically:
  - There are gravel river terrace deposits on the site. These are quite thick at the highest point in the centre and have an elevated water table likely supported by recharge infiltration given the strata type;
  - There are gravels along the Cambridge Busway, where the ponds will be (gravel to 5 m bgl at BHB019A in the north of the site);
  - The area of the proposed pond in the south corner appears to be in clay superficial deposits and Kimmeridge Clay (as evidenced in the logs for BHB053 and BHB056);
  - Generally the gravel layers across the site are relatively thin and inextensive bands that daylight sporadically across the site, meaning that these appear to fill up and discharge into the existing surface water drainage. Any additional infiltration would likely cause additional flows into the drainage at an uncontrolled rate.
- In 2007 WSP did a similar exercise and got similar results (figure 2), which supports the underlying conclusion that both ground water and surface water from this part of the site flow to the south towards Oakington and therefore contribute to flows in Oakington Brook and existing flood risk in the area.

- Realistically the larger contribution towards existing flood risk in Oakington is from Bar Hill upstream, and issues arising from development of this smaller catchment from this part of the site are likely to be minimal in comparison. During flood periods ground water levels are very close to the surface and any infiltration is unlikely to be feasible or desirable.



It is not recommend to use the ponds and onsite SuDS features to infiltrate groundwater for the following reasons:

- As was found in Phase 2, it is more likely that the ponds will receive groundwater inflow than enable infiltration;
- Ground water levels in this area are high, and the ground is relatively saturated especially in the winter;
- The pond in the south corner of Phase 3 is situated in Clay (superficial deposits) over Kimmeridge Clay. It is unlikely that there will be sufficient infiltration due to the geology;
- The ponds along the Cambridge Busway are expected to need lining (though contractor will confirm) to prevent groundwater ingress as there are gravelly river terrace deposits in this area;
- The hydraulic gradient is towards the south where Longstanton Award Drain runs south-east towards Oakington, and given the interspersal of gravels and clays near the surface in this area ground water could pop out anywhere causing more flood risk downstream in a way that can't really be managed.

It is therefore recommended that :

- As both surface water and groundwater flow towards Oakington, Surface water management from the developed site is controlled through above ground lined SUDS features to reduce risk of onsite and offsite flooding as a result of groundwater ingress:
  - The principles that it will be limited to 3l/s/ha (mean annual greenfield runoff rate) for up to and including the 1 in 200 year rainfall event (existing greenfield runoff rate for the 1 in 100 year rainfall event is circa 11l/s/ha), is significant betterment from the existing scenario and will help minimise flood risk from this site towards Oakington in the future.
  - The ability to link to telemetry (either in the adjacent Longstanton Road Award drain or Oakington Brook) and have 0l/s/ha discharge for up to 48hrs when water levels in the area are raised is also a significant improvement on what happens currently
  - In shorter storm events, water will be managed onsite and let out more slowly than currently;
  - In winters when there is a culmination of saturated ground and prolonged rainfall events, where currently surface water flood risk is seen, ground water overtops into the existing drainage. For the development proposals a combination of reviewing plot levels and accommodating surface water flood risk within the landscape / wooded areas will help manage this adjacent to Longstanton Road (similar to existing). Discharge from the site will still be at the mean annual greenfield runoff rate that is likely to be below the existing greenfield runoff rates from this site for the times of flood risk that they are concerned about.

- Management of surface water above ground gives more control and flexibility to ongoing management and monitoring of how this is working long term and affecting the downstream catchment.
- Existing ground water levels downstream and within Oakington
  - There is some limited recharge to ground water levels currently, but most of the site is quite impermeable and therefore, from the information that we have to date, this is likely to be low.
  - Flood risk to proposed properties from maintaining recharge to ground water levels post development is high.
  - There are limited opportunities for maintaining recharge of the river terrace deposits at the high point across the site, especially as this appears to overtop at the low points within the site, which could well be near Longstanton Award Drain or adjacent to the Cambridge Guided Busway, and would still therefore need to be managed onsite.
  - We would recommend ongoing monitoring of ground water levels now, and during construction to ascertain any impact on ground water levels downstream.



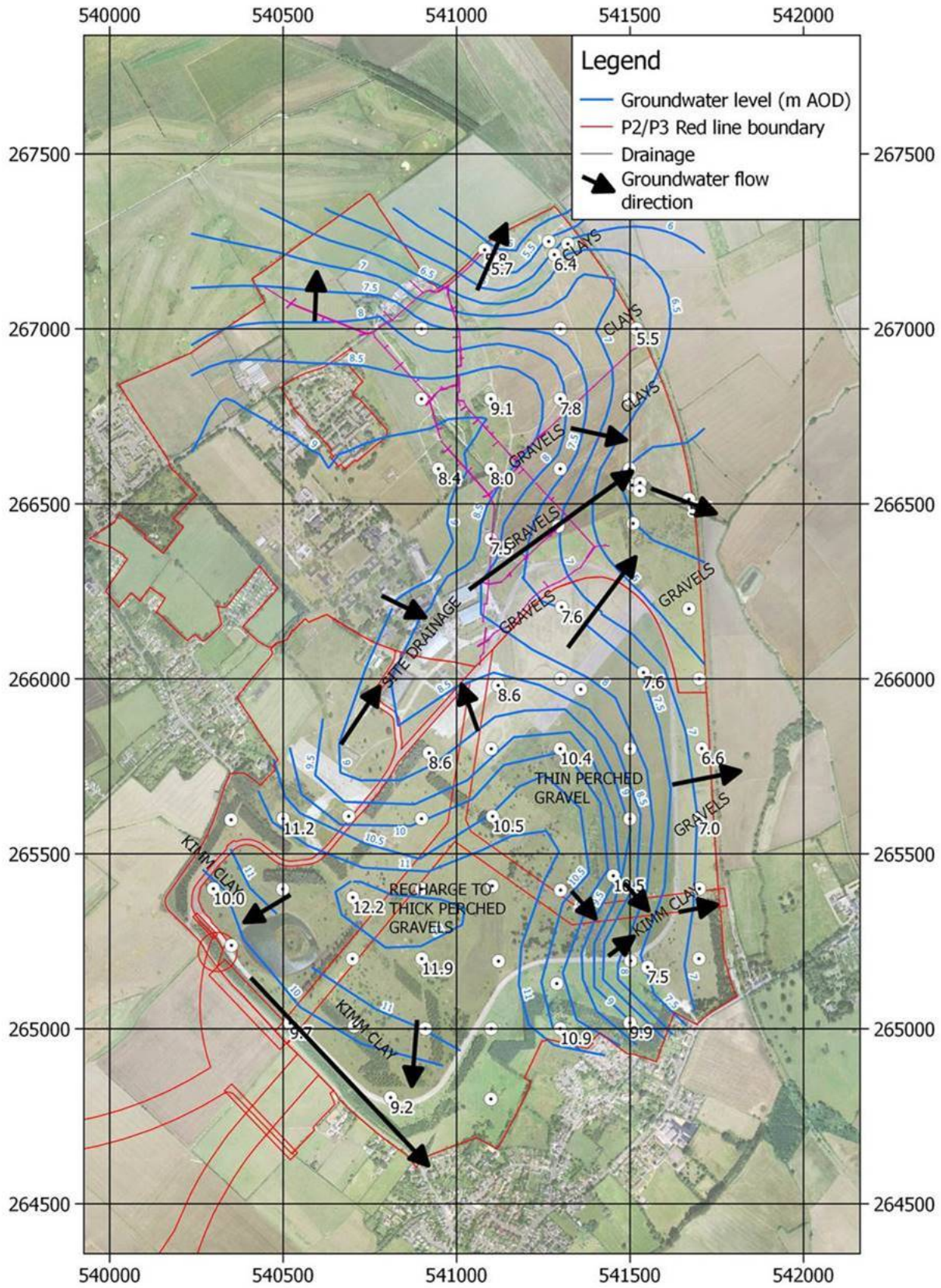


Figure 1

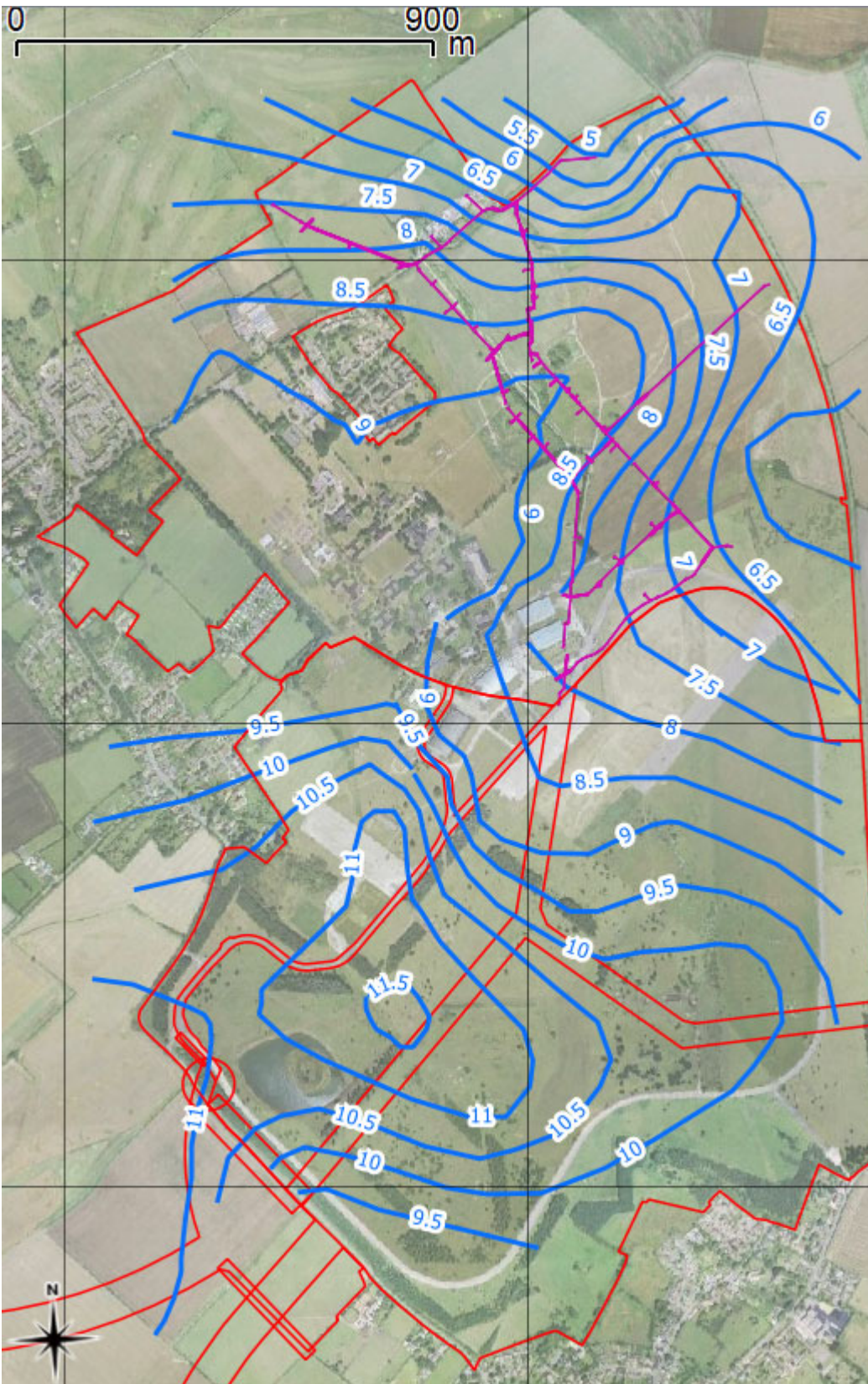


Figure 2 WSP water level (Appendix B2, Interim Factual Report: Northstowe Cambridgeshire, Zone B, December 2007)

Kind Regards

Reg 13(1)

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 M. Reg 13(1)

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**From:** Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>  
**Sent:** 15 February 2019 08:17  
**To:** Reg 13(1) [redacted] <[\[redacted\]@arcadis.com](mailto:[redacted]@arcadis.com)>; Reg 13(1) [redacted] <[\[redacted\]@arcadis.com](mailto:[redacted]@arcadis.com)>  
**Cc:** Reg 13(1) [redacted] <[\[redacted\]@Arcadis.com](mailto:[redacted]@Arcadis.com)>; Reg 13(1) [redacted] <[\[redacted\]@arcadis.com](mailto:[redacted]@arcadis.com)>  
**Subject:** Northstowe phase 3 - SW discharge towards Oakington

Hi Reg 13(1) [redacted]

I met with the Oakington Parish Council Chairman early this week, and ran through the responses to their queries (thanks again for these)

Apart from continuing to suggest that flows should be pumped over the ridge to the northeast catchment they were concerned with receiving culvert and profile of discharge over time linked to groundwater level.

I know that you are organising to CCTV and survey the culvert more fully; and that it is likely we will need to do some remedial works to this (but it may be difficult if it passes through and under residential plots) – so that is one thing.

However; the aspect of how this particular part of the catchment responds to both quick rainfall events and/or prolonged rainfall events that may increase the groundwater level that then combines or exasperates overland flows may need some further considered thought and possible modelling; to help arrive at the best discharge (and possible groundwater recharge) solution. Could it be some release to groundwater, some flow to surface, some attenuation?

I have said that we would have a meeting with Reg [redacted] of the Oakington Flood Mitigation group to discuss in circa 3 to 4 weeks. Therefore, please can you start to think about this.

Best regards

Reg 13(1) [redacted]  
[redacted]



Reg 13(1) [redacted]  
Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>

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Reg 13(1)

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 20 June 2019 19:12  
**To:** Reg 13(1)  
**Cc:** Reg 13(1)  
**Subject:** Northstowe Phase 3 - Flood Risk Impacts on Oakington  
**Attachments:** Oakington\_NonTech\_For\_Issue\_140619.pdf; 10019646-ARC-XX-XX-VS-ZZ-P1-SEEPW.pdf

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Reg 13(1)

Hopefully you received a Huddle notification earlier that we have issued the following two reports:

#### Flood Risk summary note for Oakington Parish Council

- This summarises the modelling work that was undertaken as part of the Phase 2 development proposals including
  - Topographical survey of Oakington Brook (And surrounding Tributaries) – also include on the link if you wanted to release the PDFs of the survey
  - Summary of the modelling work undertaken and what this shows – that the 2014 event was a significant rainfall event, in excess of the 1 in 100 year rainfall event
  - That the catchment is significant and only a very small proportion of this is Northstowe, so there is very limited impact from Oakington

#### Ground Water Summary Note (not intended for issue to the PC, we will do a summary of this that you can release)

- This shows that some groundwater within Northstowe Phase 3 is conveyed towards Oakington
  - This appears to pop out into the Surface Water network along Longstanton Road to discharge towards Oakington as Surface Water
- Therefore any reduction in groundwater flows across the Northstowe Phase 3a development appears to have limited / negligent impact on Oakington
- In addition managing the groundwater / surface water from the development proposals within the onsite attenuation and limiting this to the mean annual greenfield runoff rates (3l/s/ha) for up to and including the 1 in 200 year rainfall event (including an allowance for climate change), with the additional benefit of the option for 0l/s discharge for up to 48hrs, is a significant improvement / benefit to Oakington in more extreme rainfall event (current 1 in 100 year runoff rate is circa 11l/s/ha)

Kind Regards

Reg 13(1) @arcadis.com  
Arcadis Consulting (UK) Ltd | Cornerblock 2 Cornwall Street Birmingham | B3 2DX | UK  
M. (Reg 13(1))

[www.arcadis.com](http://www.arcadis.com)



Be green, leave it on the screen.

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**SUBJECT**  
Oakington Non-Technical Summary Report

**DATE**  
13 June 2019

**DEPARTMENT**  
Water Management and Resilience

**COPIES TO**

**TO**  
Reg 13(1)

**OUR REF**  
10019646-AUK-NS-P3-RP-IE-2-1-Oakington Flood Risk Report

**PROJECT NUMBER**  
10019646

**FROM**  
Reg 13(1)

---

## Background

This memo has been produced for the residents of Oakington to describe the work carried out on behalf of the Homes and Communities Agency (HCA) to assess the current and future flood risk in the village. This assessment has been carried out as part of the Northstowe new town development work which is currently entering Phase 3a and involves construction work on lands immediately north of Oakington.

Arcadis Consulting (UK) Limited (Arcadis) was commissioned by the HCA to appraise any changes to local flood risk resulting from the development, and to assess any opportunities to reduce flood risk to the community of Oakington. As a result, Arcadis have produced this summary memo setting out the work undertaken to date.

## Flood Modelling

Flood modelling is the practice of using computer software to predict where, when, and how flooding might affect a given area. A range of data is used to build up a digital picture of the area and different sizes of flood events are simulated. This is known as a 'flood model'. The flood model is then used to produce a map of predicted flood extents and depths. This can be compared with information on real floods to assess how accurate the flood model is.

In the case of Oakington and Northstowe, Arcadis took an existing Environment Agency approved flood model for the Oakington Brook, Beck Brook and Washpit Brook and added extra, more up to date information to define the local area in and around Oakington. The aim of this exercise was to make sure that the flood model gave the best possible representation of flood risk within Oakington and the surrounding area. The following specific improvements to the model were made:

- Addition of the drain and ditch network around the village, using newly collected information on the sizes and locations of the drains;
- Inclusion of information showing the location of, and ground levels along, the Cambridge Guided Busway; and
- Addition of information on the existing ground levels across the Northstowe site.

Arcadis used survey data obtained by EDI Surveys in 2015 to update the model. Eight additional watercourses were added into the model to enhance the level of detail in the Oakington area. Two drains associated with Northstowe were added, including Award Drain 171 and its culverts running parallel to Longstanton Road. The modelled watercourses and drains are shown in Figure 1.

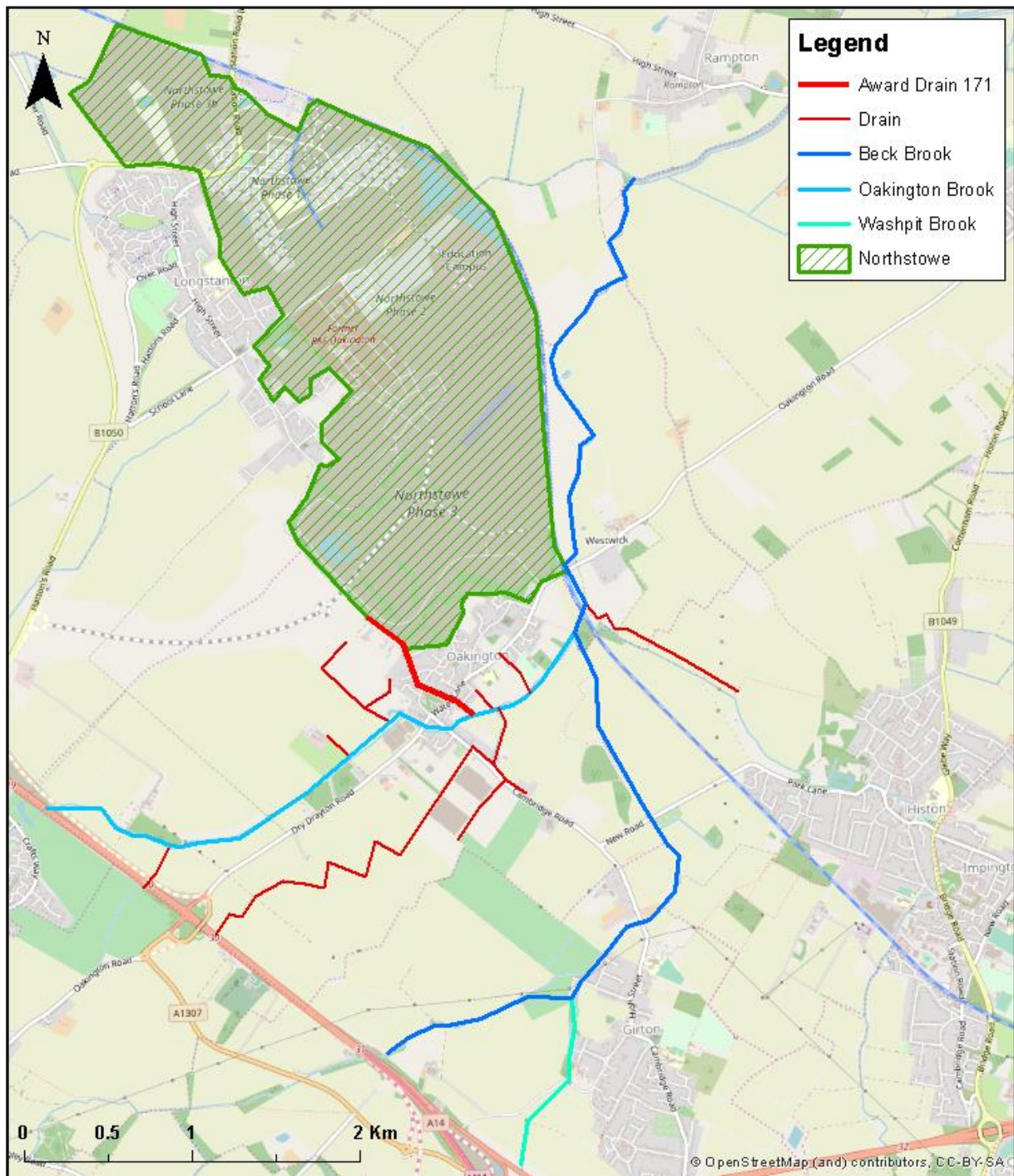


Figure 1: Watercourses and drains included in the flood model



Rain falling during the August 2014 flood event was captured by a local rain gauge 'Uttons Drove Pluvio'. Arcadis used the rainfall data for the period 8th-9th August 2014 from this gauge to reconstruct the storm conditions for this event.

Arcadis adapted the model to specifically simulate the flood conditions which affected the Oakington area in August 2014. This was achieved using industry-standard software, which analysed the August 2014 event rainfall data combined with the ground and watercourse conditions in Oakington at the time. The August 2014 event was simulated in the computer model and a map of the predicted flood extents was created. This map was compared to the actual flooding which was recorded in Oakington and, in December 2016, the Environment Agency agreed that the Arcadis model flood extents matched well with the flooding reported in the August 2014 event. A consultation meeting held with the Oakington Flood Management Group on 2<sup>nd</sup> November 2016 also confirmed the modelled flooding correlated well with the August 2014 event based on their local knowledge and records. This meant that the model could be used to assess the impacts of different storm events with confidence.

## Causes of Flooding in Oakington

High water levels in the Oakington Brook which then overtop the banks are the main source of flood risk in Oakington. These high water levels are fed by water running off the surrounding areas into the Oakington Brook. In most cases, water is channelled into the Oakington Brook by the drainage ditch network. Figure 1 shows that many of these ditches flow from areas outside the Northstowe development.

The Arcadis flood model captures the flow in the drains and Oakington Brook for each of their catchments. Figure 2 shows the areas that contribute flows to the Oakington Brook as it flows through the village. The ability of the flood model to produce mapped predictions which are a close reflection of the August 2014 event are testimony to the complex interactions influencing flood risk in Oakington, of which runoff from the Northstowe development is only one factor.

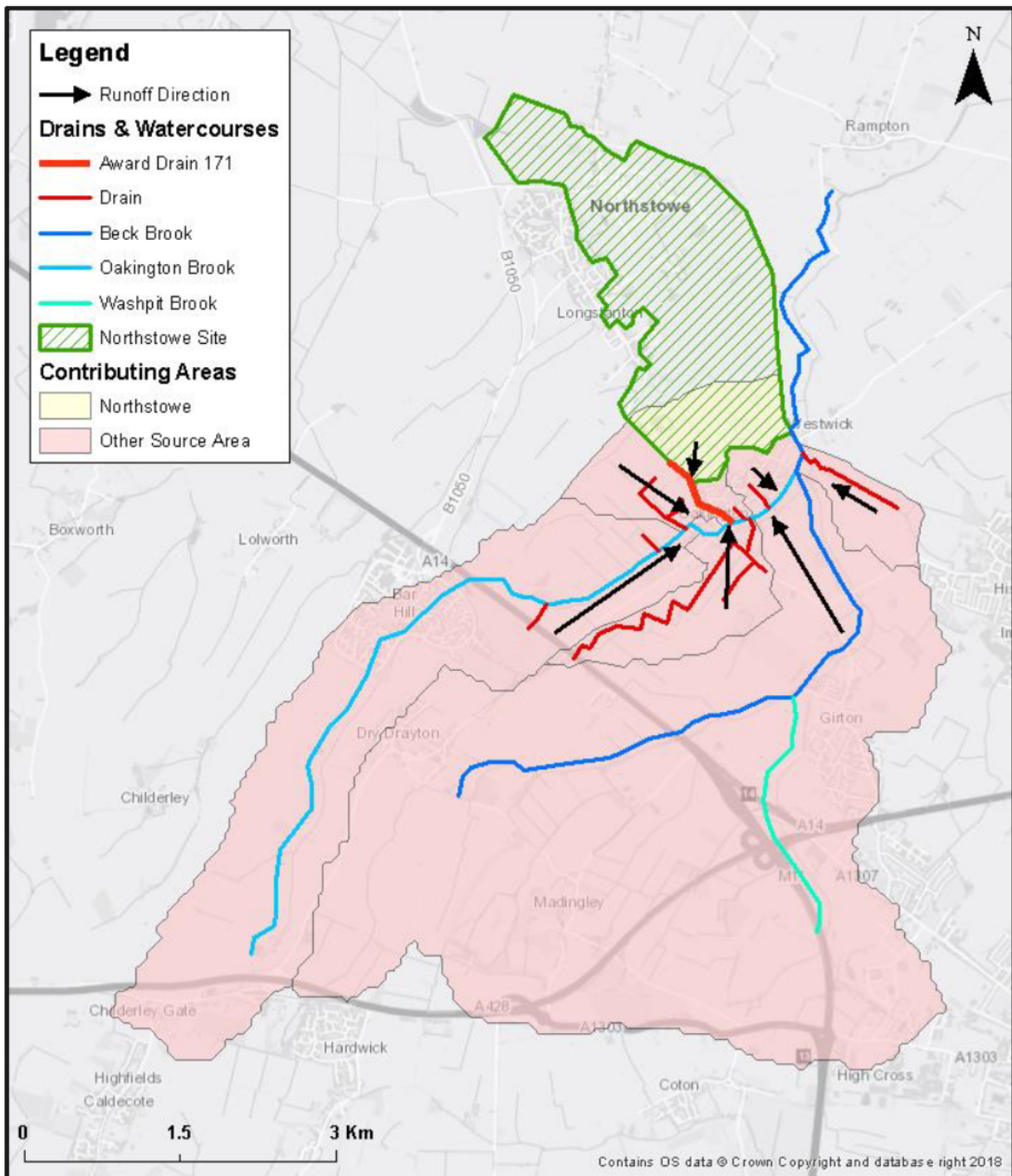


Figure 2: Areas that contribute flow to the Oakington Brook as it passes through the village

Flood events can be classified by how rare they are. For example, very large flood events such as the August 2014 event are considered to be rarer than much smaller floods which could, for example, occur on a yearly basis and would only affect smaller areas. In order to describe these events, the term 'Annual Exceedance Probability' (AEP) is used. This is the chance that a flood of a certain size will occur in any given year. For example, a flood which has a 1% AEP has a 1 in 100 chance of occurring in any given year.

Flow estimations suggest that the August 2014 event was rare. The estimated AEP was 0.1% or a 1 in 1000 chance of occurring in any given year.

The location and depth of flooding predicted by the model for the August 2014 event (Figure 3b) matches well with the location and depth of flooding predicted when a 0.1% AEP (1 in 1000 chance of occurring in any given year) is run through the model (Figure 3a).

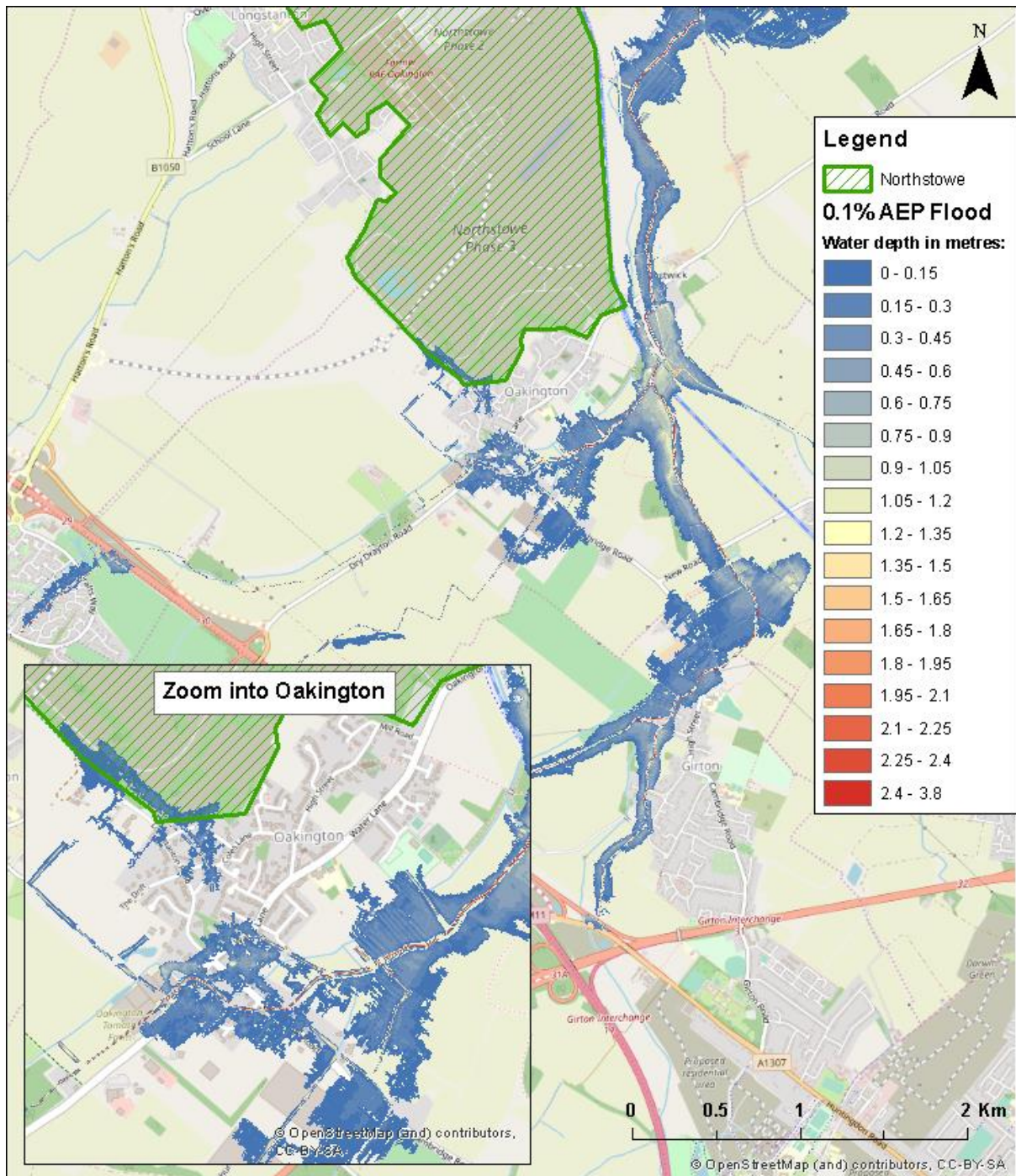


Figure 3a: 0.1% AEP predicted flood extent and depths from the Arcadis model

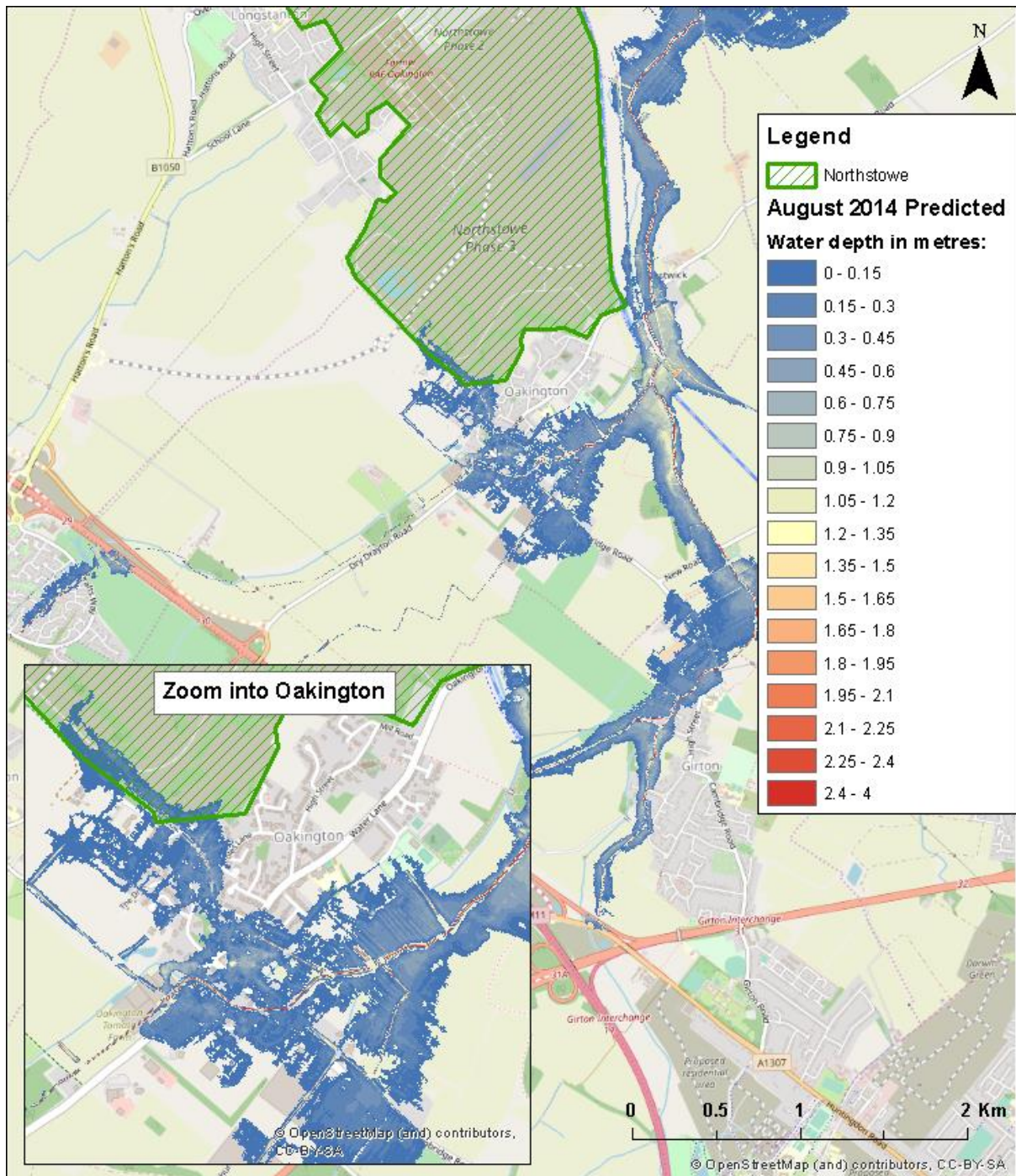


Figure 3b: August 2014 event predicted flood extent and depths from the Arcadis model

## Managing Rainwater Runoff from the Northstowe Development

As a sustainable development, a range of measures will be put in place on the Northstowe development to prevent any increases in the amount of surface water running off the site into the drainage network which feeds into the Oakington Brook. Measures that will be included are:

- Retaining existing vegetation and the military lake to attenuate surface water runoff from the Northstowe site.
- Actively managing surface runoff: all design options for Phase 3a include creating ponds at Northstowe. These are designed to aid drainage and store surface water, reducing surface water runoff towards Longstanton Road and Oakington.

The measures on the Northstowe development site will ensure that any runoff from the developed site is no greater than the runoff from the existing site. These measures can only manage the risk of runoff from water originating from the Northstowe site. Where flood risk in Oakington is influenced by water sources originating from beyond the Northstowe site, risks they pose will not be reduced by measures on the Northstowe site.

**SUBJECT**  
Northstowe Phase 3B: Hydrogeological assessment of  
groundwater levels due to a reduction in recharge

**DATE**  
17/05/2019

**DEPARTMENT**  
Hydrogeology, Part of SER

**COPIES TO**

**TO**  
Reg 13(1)

**OUR REF**  
10019646-ARC-XX-XX-VS-ZZ-P1-SEEPW

**PROJECT NUMBER**  
10019646

**FROM**  
Reg 13(1)  
Reg 13(1)  
Reg @arcadis.com

---

## 1. Introduction

This memorandum describes an assessment of the change in groundwater levels that may occur at the Northstowe Phase 3 site (see Figure 1 for location) because of interception of rainfall by the surface water drainage scheme and subsequent reduction in the amount of groundwater recharge.

The following information sources have been used in the assessment:

- Ordnance Survey Terrain data (Ordnance Survey, 2018);
- Web Map Services (WMS) layers for British Geological Survey (BGS) superficial and bedrock mapping (British Geological Survey, 2019)
- Interim Factual Report: Northstowe, Cambridgeshire, Zone B. English Partnerships & Gallagher Longstanton Ltd, December 2007 (English Partnerships & Gallagher Longstanton Ltd., 2007); and
- Northstowe Phase 2 Groundwater Levels, Arcadis, 2017., UA008426-ARC-XX-XX-VS-P1.3-GWLevels (Arcadis (c), 2018).





## 2. Hydrogeology

The materials and geology present at the Northstowe Phase 3 site as described in the Interim Factual Report for Zone B (English Partnerships & Gallagher Longstanton Ltd., 2007) is analogous to that of Northstowe Phase 2, which has been summarised previously by Arcadis in 2017). Essentially, a non-extensive layer of River Terrace Deposits (comprised of sandy clays, clays and gravels) that overlie bedrock of the Kimmeridge Clay Formation and Woburn Sands Formation in the south east. The thickness of the River Terrace Deposits is variable (up to 7 m thick), though it is absent along the southern edge of the site and towards Oakington. East of the site, the township of Oakington is situated on outcrop Woburn Sands Formation.

Figure 2 provides a plan showing the geology, groundwater levels, groundwater flow direction and borehole locations at Northstowe Phase 3. The topography of the area rises from the north-east towards the south-west, however the Military Lake is situated in a localised low point. Groundwater monitoring has shown that the groundwater level at Northstowe Phase 3 is at its highest elevation in the centre of the site around BHB040 and in proximity (230 m north-east) of the Military Lake. This area forms an apparent groundwater mound with groundwater flowing away in all directions away from it towards the perimeter drains.

The Military Lake being situated in a topographic low has no superficial geological cover and lies immediately on the Kimmeridge Clay Formation. Groundwater levels around the lake suggest that groundwater flows towards it and are likely to provide some support to the lake water level. Anecdotal reports from site personnel also indicate that it overflows to the east after periods of 'higher' rainfall.

The hydraulic conductivity of the River Terrace Deposits and Kimmeridge Clay has been previously described by at between 8 m/d to 12 m/d and 0.1 m/d to 16 m/d, respectively (Arcadis (c), 2018).

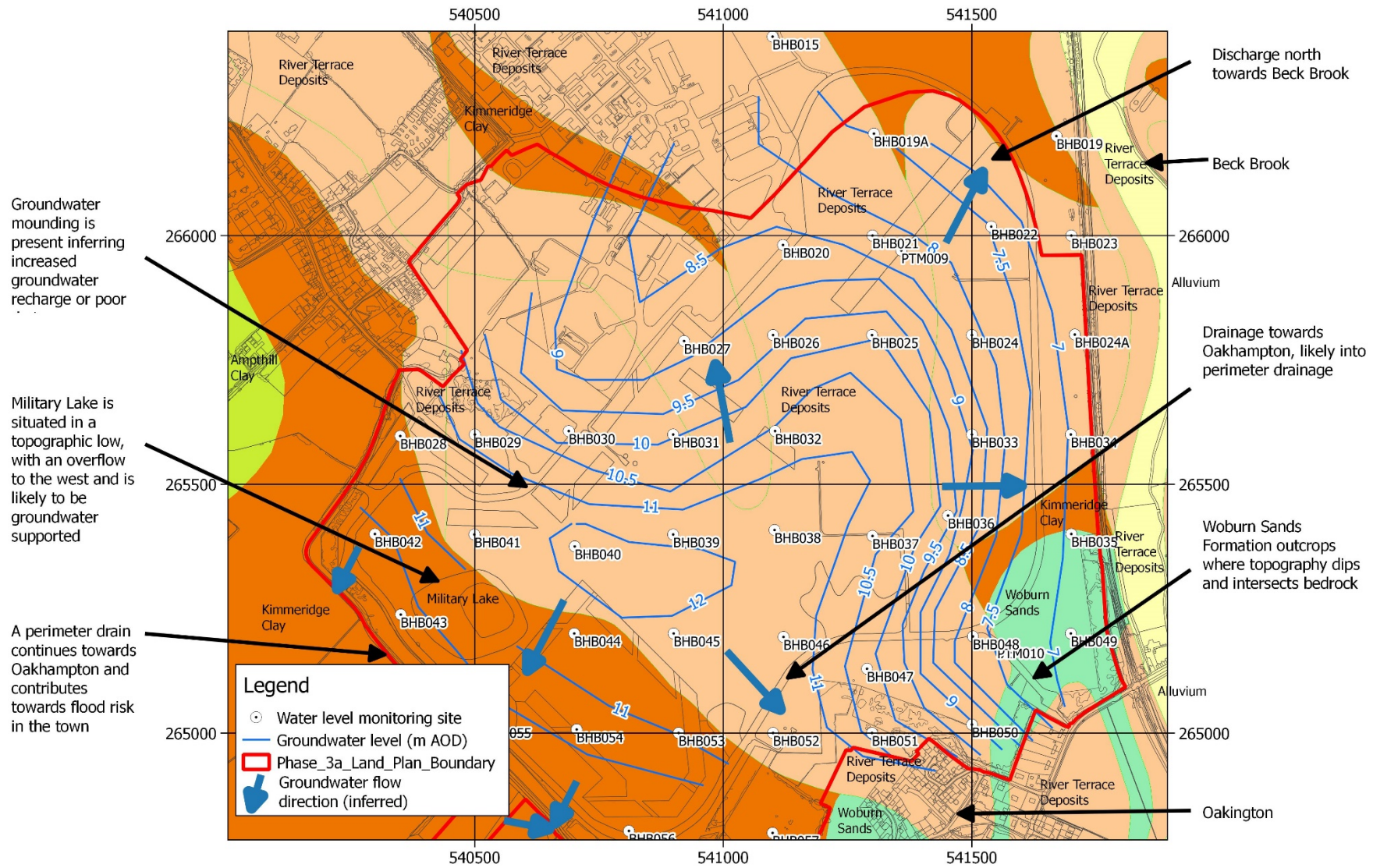


Figure 2 Hydrogeology at Northstowe Phase 2

### 3. Groundwater modelling

#### 3.1 Model cross sections

Two cross sections have been produced using groundwater modelling software (SEEPW). The location of the cross sections are shown on Figure 3, which are approximately perpendicular to each other. The cross section locations have been chosen to show the predicted change in the groundwater level towards the Military Lake and towards Oakington.

The hydraulic conductivity applied in the models is  $1.1 \times 10^{-4}$  m/s (equivalent to 9.5 m/d) for the River Terrace Deposits and  $1 \times 10^{-5}$  m/s (equivalent to 0.9 m/d) for the Kimmeridge Clay Formation. A fully saturated model has been assumed for simplicity (although this will over-estimate seepage rates and is therefore conservative). These values are based on site investigation data and were reported in the hydrogeological assessment for Phase 2 (Arcadis (c), 2018).

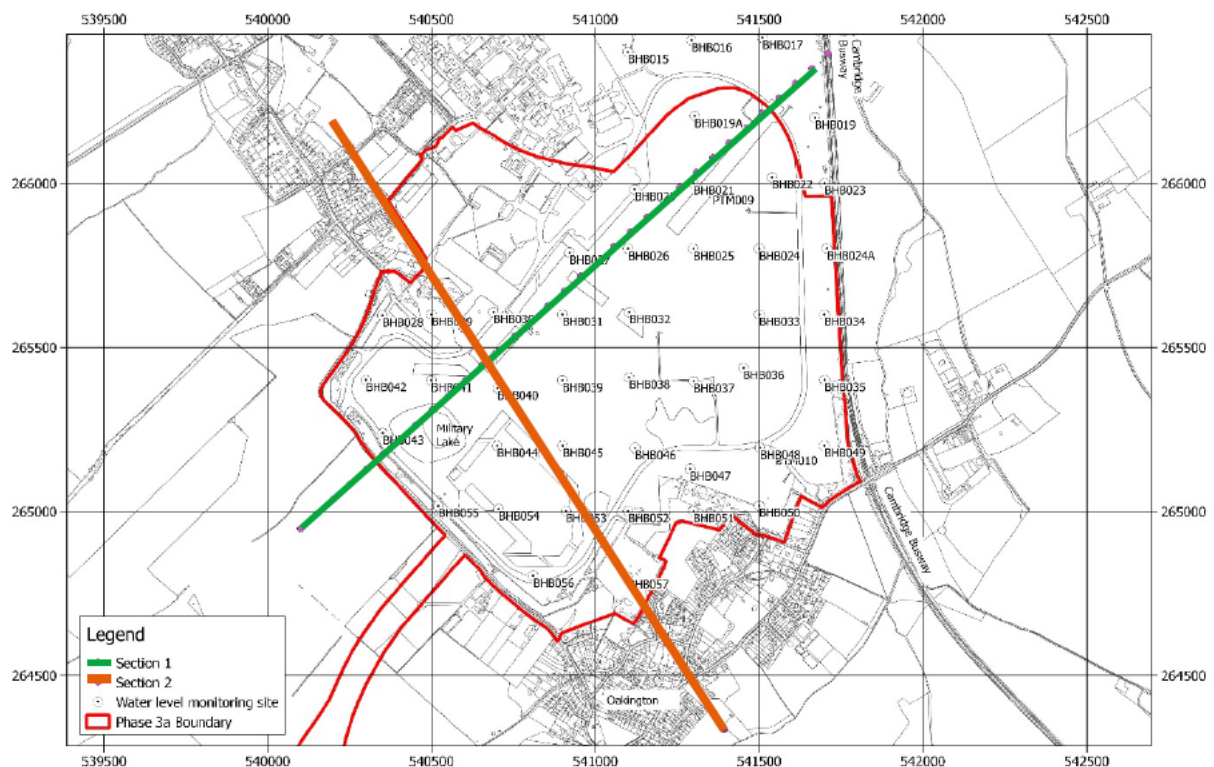


Figure 3 Cross section locations

##### 3.1.1 Model Section 1

Model Section 1 (Figure 4) is orientated north-west to the south-east, with the purpose to assess potential groundwater level change effects caused by a reduction in recharge after construction of hardstanding at the site. The cross section is based on our interpretation of geological mapping and site derived borehole information. The cross section shows where the River Terrace Deposits form the ground on Northstowe Phase 3 and then pinch out along the south-eastern edge of the site. The geology directly underlying Oakington is the Woburn Sands Formation, which stratigraphically overlies the Kimmeridge Clay Formation.

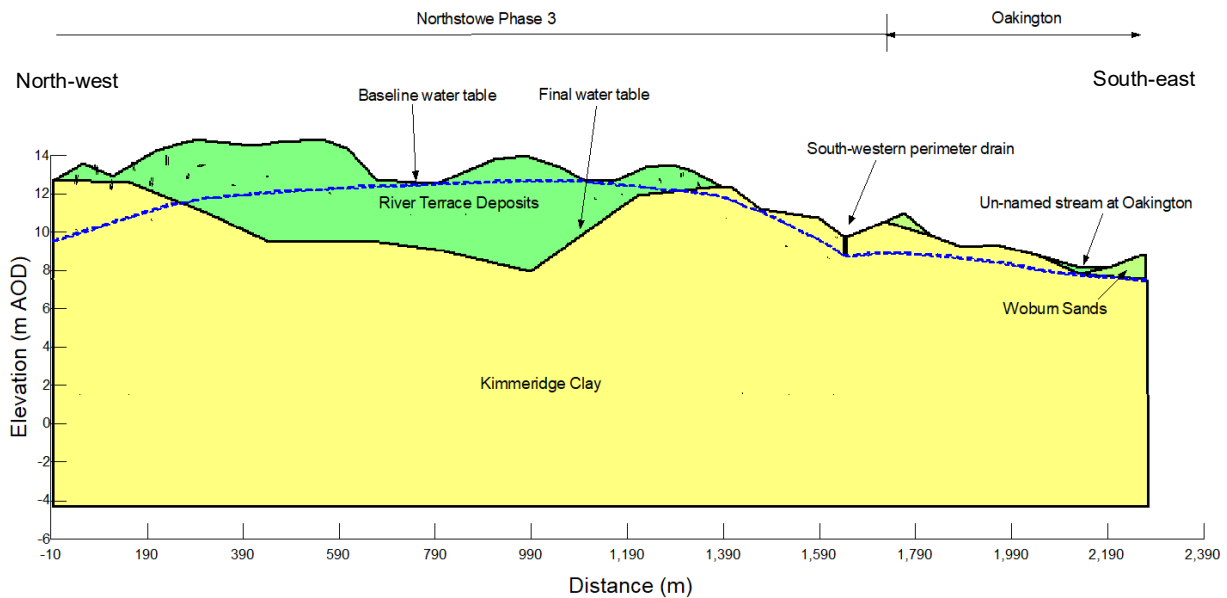


Figure 4 Model Section 1

### 3.1.2 Model Section 2

Model Section 2, shown on Figure 5, is orientated north-east to south-west, extending from the Cambridge Busway to the Northstowe Phase 3 south-western perimeter drain. The purpose of the model is to assess the potential change in groundwater levels beneath the Military Lake following development, and in turn whether there is any reduction in groundwater support provided to the lake. The cross section shows where the Kimmeridge Clay Formation dips from southwest to northeast and where the bedrock is overlain by River Terrace Deposits northeast of the lake. The topographic profile of the lake shows where it connects with groundwater (dashed blue line).

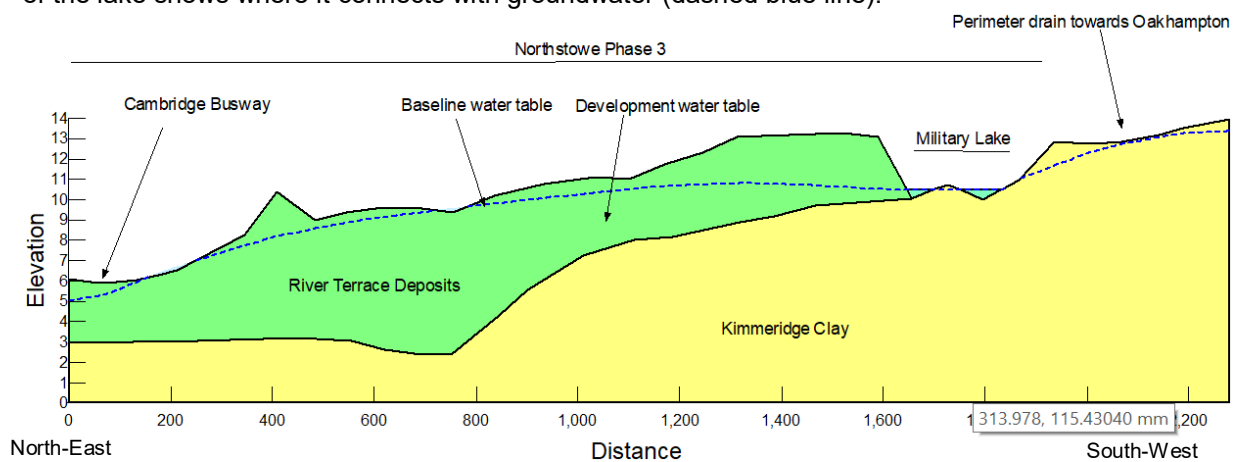


Figure 5 Model Section 2

## 3.2 Model scenarios

Two scenarios have been considered for both model cross-sections for pre- and post- development stages of Northstowe Phase 3, in which the amount of recharge is varied as follows:

- Pre-development condition, the baseline recharge rate is assumed to be 20% of average total annual rainfall for Cambridge between 1981 and 2010 (20% of 568 mm/year (Metoffice, 2019)); and

- Post-development condition, in which 20% of the baseline recharge rate (see previous bullet) is applied in areas that are proposed to be covered by the Northstowe Phase 3 (the remaining, undeveloped, areas have recharge applied as for the pre-development model).

### 3.3 Model results

#### 3.3.1 Model Section 1

Figure 6 shows the change in the groundwater level between the 'pre-development' and 'post-development' model output. As a result of the potential reduction in recharge over the Northstowe Phase 3 area, groundwater levels are predicted to lower by up to 2.5 m across the site. However, there is no predicted change in groundwater level beneath the Oakington area, as groundwater levels between the site boundary and Oakington are controlled by existing perimeter drains. The result of the post-development model indicates that groundwater flows within the perimeter drains may be lower than current (pre-development) flows.

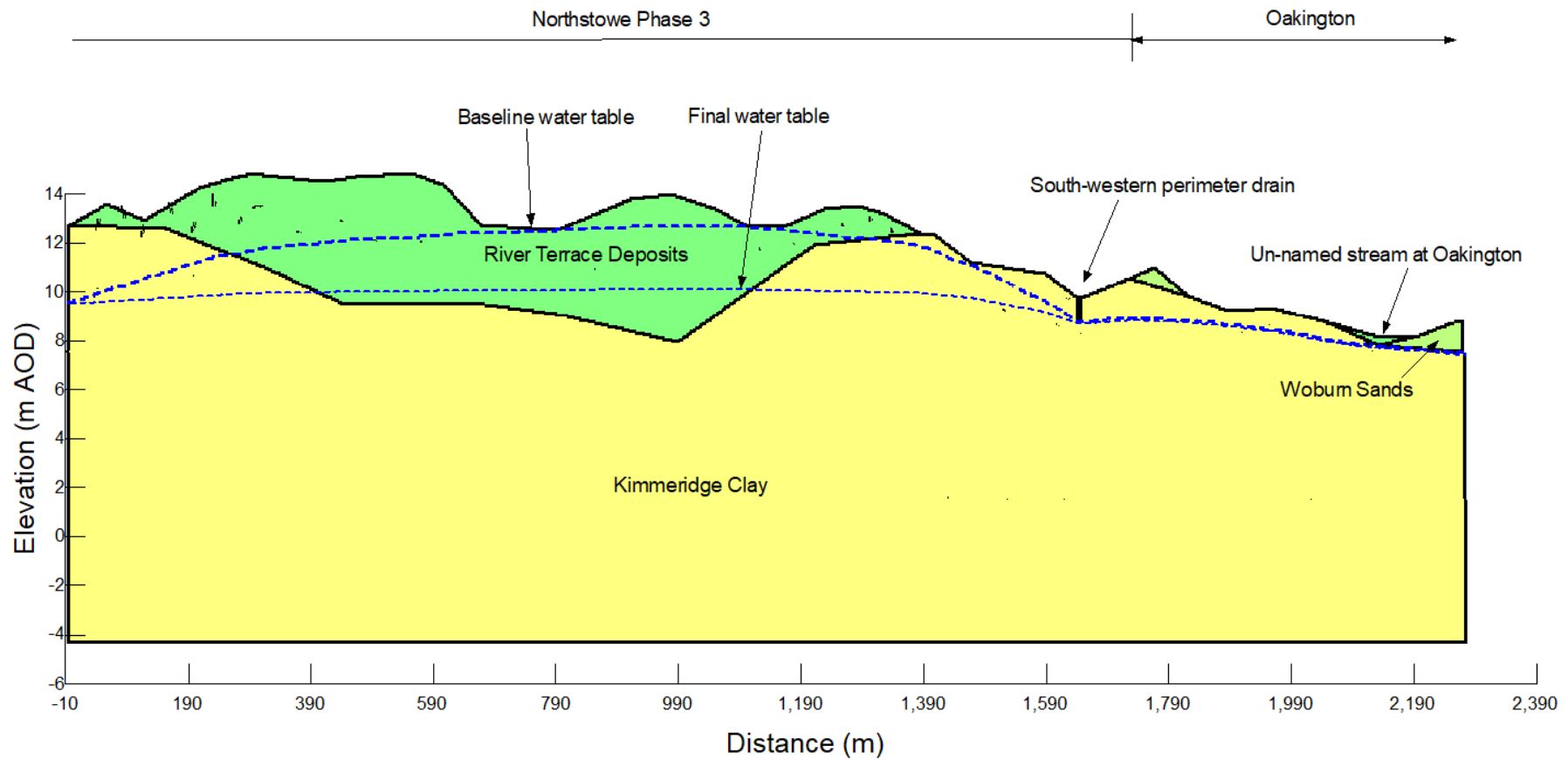


Figure 6 Results of the 'pre-development and 'post-development' model output for Section 1

### 3.3.2 Model Section 2

Figure 7 shows the results of the 'pre-development' and 'post-development' model output for Section 2. As a result of the potential reduction in recharge over the Northstowe Phase 3 area groundwater levels are predicted to lower by up to 2.5 m across the site.

Groundwater levels beneath the Military Lake do not appear to be affected, however the groundwater contribution (inflow) to the Military pond was calculated using the model to fully appreciate any effects. In the pre-development condition the groundwater contribution to the pond was calculated to be 0.29 m<sup>3</sup>/d, which reduces to 0.01 m<sup>3</sup>/d in the post-development condition.

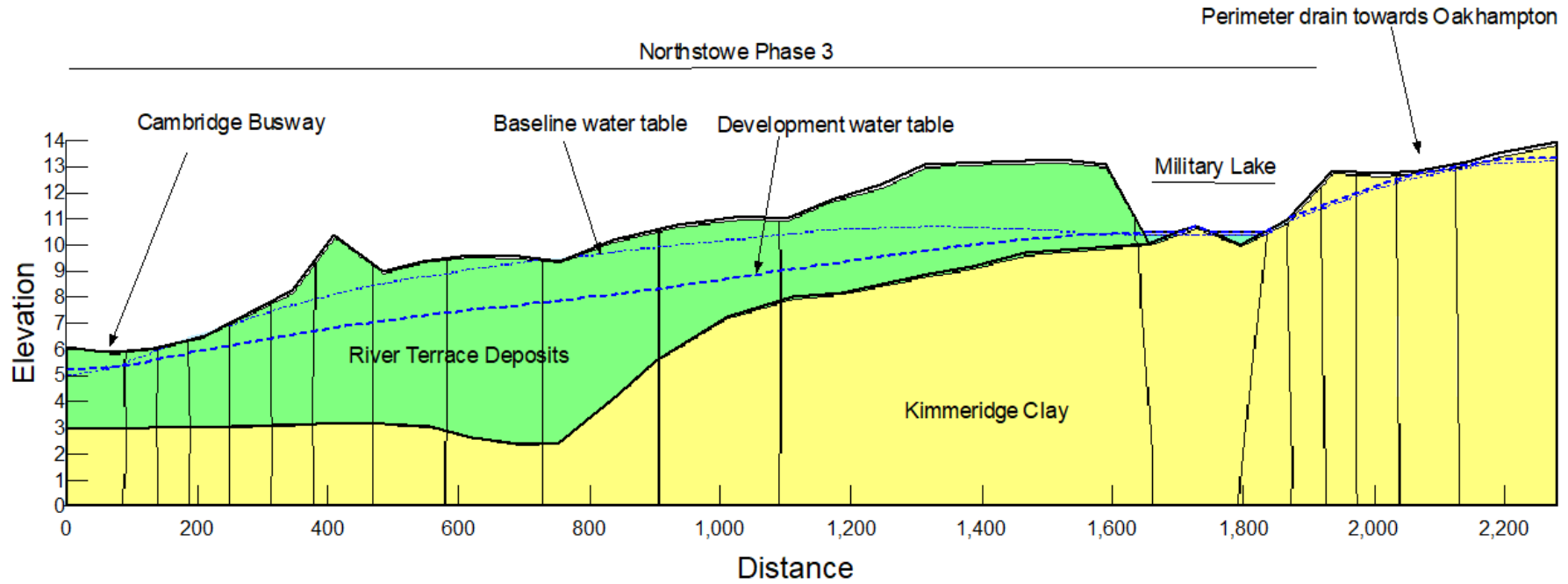


Figure 7 Results of the 'pre-development' and 'post-development' model output for Section 2



#### 4. Conclusions

Development of Northstowe Phase 3 would likely lead to a reduction in recharge to underlying groundwater that may in turn affect water features in the surrounding area. Two SEEPW model cross sections were therefore produced to assess the effects of development. The model outcomes are discussed, as follows:

- In general, the modelled reduction in recharge is predicted to lower the groundwater level beneath the development by up to 2.5 m;
- A change in groundwater level was not predicted to occur east of the Northstowe Phase 3 site perimeter drainage towards Oakington;
- Modelling of the groundwater contribution (inflow) to the Military Lake as a result of groundwater lowering post-development indicates a reduction from 0.29 m<sup>3</sup>/d (pre-development) to 0.01 m<sup>3</sup>/d (post-development). Such a change could potentially lead to a significant reduction in lake levels during the summer months.
- The reduction in groundwater levels in the River Terrace Deposits and Kimmeridge Clay and reduction in the groundwater contribution to the Military Lake will in turn likely lead to a reduction in groundwater discharging into the perimeter drains along the southern boundary of the site.

As this simple model is in 2-dimensions, it does not include the full complexity of the geology, groundwater flow conditions and drainage of the site and so the calibration and accuracy of the model is limited to along the cross section line only.

Reg 13(1)

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 15 January 2020 12:47  
**To:** Reg 13(1)  
**Cc:** Reg 13(1)  
**Subject:** RE: Northstowe groundwater level monitoring

Reg 13(1)  
Further to your email below, we are going to have an internal catch up about this tomorrow morning to discuss scope / resources / timescales etc.  
After this I will confirm suitable time for a conference call to discuss further with you.  
Kind Regards

Reg 13(1)  
**From:** Reg 13(1) @homesengland.gov.uk>  
**Sent:** Wednesday, January 15, 2020 11:14 AM  
**To:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>  
**Cc:** Reg 13(1) @arcadis.com>  
**Subject:** RE: Northstowe groundwater level monitoring

**Importance:** High

Hi Reg 13(1) et al

I think I need a bit of work doing regarding shallow groundwater levels at Northstowe. We are now receiving queries (similar to phase 1) regarding how our construction works are influencing shallow groundwater that feeds local ponds. I think we will need to look at the shallow hydro-geology; our interaction with it, the on-going groundwater monitoring data, all previous work (as we have looked at some of these issues) and also considering the phase 1 work/reports on this matter; as well as any regional trends (i.e. regionally lower groundwater even though recent very wet weather). What I think I will ultimately need is a report that will be released to public / regulators. I obviously want to understanding what is going on to make sure we have limited impact.

I think a conf call to discuss scope would be useful. Could everyone make a quick ½ hr call on one of the below:

- 16<sup>th</sup> Jan – afternoon – say 2pm (but flexible to other times)
- 17<sup>th</sup> Jan – 12:00 (noon)
- 20<sup>th</sup> Jan – morning – say 10am (but flexible)

Best regards

Reg 13(1)

Homes England

M: Reg 13(1)

OFFICIAL

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 08 November 2019 13:10  
**To:** Reg 13(1) @homesengland.gov.uk>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>  
**Subject:** RE: Northstowe groundwater level monitoring

Re  
Please find attached a plan showing all the BHs across Ph2 and 3. Some of these have been destroyed during the works, so I have asked for another one to be produced highlighting the currently available locations – when I have this I will send on to you.  
Kind Regards

Reg

---

**From:** Reg 13(1) <@homesengland.gov.uk>  
**Sent:** Monday, November 4, 2019 12:38 PM  
**To:** Reg 13(1) <@arcadis.com>  
**Cc:** Reg 13(1) <@arcadis.com>; Reg 13(1) <@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

Hi Reg – I think we need a BH monitoring location plan; showing all monitored BH's within phase 2 and 3. Please can you get this produced. Thought I had seen something like this in a report – so please double check.

Best regards

Reg 13(1)

Homes England

M: Reg 13(1)

OFFICIAL

---

**From:** Reg 13(1) <@arcadis.com>  
**Sent:** 04 November 2019 12:33  
**To:** Reg 13(1) <@homesengland.gov.uk>  
**Cc:** Reg 13(1) <@arcadis.com>; Reg 13(1) <@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

Sorry there isn't a plan – the ones highlighted in yellow on the plan are the ones that we have monitored in Phase 3.

Regards

Reg

---

**From:** Reg 13(1) <@homesengland.gov.uk>  
**Sent:** Monday, November 4, 2019 12:27 PM  
**To:** Reg 13(1) <@arcadis.com>  
**Cc:** Reg 13(1) <@arcadis.com>; Reg 13(1) <@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

Thanks Reg

Is there a plan that only shows the monitoring BH's – as the one sent is quite busy!

Best regards

Reg 13(1)

Reg 13(1)

Homes England

M: Reg 13(1)

OFFICIAL

---

**From:** Reg 13(1) <@arcadis.com>  
**Sent:** 04 November 2019 12:06  
**To:** Reg 13(1) <@homesengland.gov.uk>  
**Cc:** Reg 13(1) <@arcadis.com>; Reg 13(1) <@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

Re

Please find attached the spreadsheet with the groundwater monitoring across Phase 2 and 3.

Attached is a plan showing the locations of the wells in Phase 3. Having had a look at the plan there are some wells near (but not that near) to the pond you indicated – BHB027 and BHB042.

If you need anymore information please let me know.

Kind Regards

Reg

---

**From:** Reg 13(1) <@homesengland.gov.uk>  
**Sent:** Monday, November 4, 2019 10:03 AM  
**To:** Reg 13(1) <@arcadis.com>  
**Cc:** Reg 13(1) <@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

**Importance:** High

Hi Reg

The recent monitoring I think. The issue is the following; pond shown at location below (you can see it on satellite images) has apparently become dry (groundwater fed) since Northstowe development started (phase 1).



Reg 13(1) - This whole shallow groundwater issue is also why I am concerned regarding approach taken to drainage within phase 3 (and we may need to reconsider phase 2); and why I commented on the reports regarding consistency and need to ensure that we minimise potentially lowering of the shallow groundwater.

I want to understand from the monitoring whether it is suggesting the lowering of shallow groundwater has taken place in the past and / or whether it may still be going on.

It might be that we need a catch up call on this.

Best regards

Reg 13(1)

Homes England

M: Reg 13(1)

OFFICIAL

---

**From:** Reg 13(1) <[redacted]@arcadis.com>

**Sent:** 04 November 2019 09:23

**To:** Reg 13(1) <[redacted]@homesengland.gov.uk>

**Cc:** Reg 13(1) <[redacted]@arcadis.com>

**Subject:** RE: Northstowe groundwater level monitoring

Re

Sorry was away on leave – catch up today.

Do you want the monitoring that we have done recently across Phase 2 and 3 or do you want previous monitoring ?

Kind Regards

Reg

---

**From:** Reg 13(1) <[redacted]@homesengland.gov.uk>

**Sent:** Wednesday, October 30, 2019 10:32 AM

**To:** Reg 13(1) <[redacted]@arcadis.com>

**Subject:** Northstowe groundwater level monitoring

**Importance:** High

Hi Reg

Can you provide a plan of BH monitoring locations and a table of all of the groundwater level monitoring results.

Be very grateful if you could provide asap. Many thanks.

Best regards

Reg 13(1)

Reg 13(1)

Reg 13(1) <[redacted]@homesengland.gov.uk>



Northstowe House  
Rampton Road  
Longstanton  
Cambridge  
CB24 3EN

[@HomesEngland](#)

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Reg 13(1)

**From:** Reg 13(1) [redacted]@environment-agency.gov.uk>  
**Sent:** 22 January 2020 13:32  
**To:** Reg 13(1) [redacted]  
**Subject:** RE: Northstowe Groundwater

Thank you for speaking to me earlier Reg [redacted] I will pass on any information you can give me to the Groundwater team and I will give the pond owner a call to let him know that I have spoken to you.

If you could please pass on my number to your colleague so that I can check that all dewatering and discharge consent permits are in place.

Best wishes,

R [redacted]

Reg 13(1)

[redacted] Land and Water (Brampton)

East Anglia Area

Do you have a water abstraction or  
impoundment licence?  
Register for our digital service to manage your licence.



Are you currently abstracting  
water under an exempt activity?  
- Check now if you need to apply for a new licence



Brampton Office, Bromholme Lane, Brampton, Huntingdon, PE28 4NE

Tel: Reg 13(1) [redacted]

Email: Reg 13(1) [redacted]@environment-agency.gov.uk

Website [www.gov.uk/environment-agency](http://www.gov.uk/environment-agency)

Incident Hotline: 0800 80 70 60

Customer Contact: 03708 506 506

---

**From:** Reg 13(1) [redacted]@homesengland.gov.uk]

**Sent:** 22 January 2020 13:00

**To:** Reg 13(1) [redacted]@environment-agency.gov.uk>

**Subject:** Northstowe Groundwater

Dear R [redacted]

Further to our tel con earlier; please see below my contact details.

As discussed; we do not consider that the infrastructure works that Homes England are currently undertaking are having a direct impact on the fishing pond in Longstanton; as our initial understanding is that the groundwater within the river terrace gravels in this area flow northwards; not eastwards towards our phase 2 site.

However, as discussed, we want to understand the local groundwater regime more fully; and to this end, I will instruct our consultant team to provide us with a proposal to consider to include:

- Local waterbody /pond photographic survey - to get baseline data of existing local ponds and help determine their hydraulic feed.
- Install a number of boundary and internal monitoring boreholes
- Quarterly monitoring of all boreholes and biannual Summary Reporting of groundwater levels and interpretation of groundwater regime / flow.

Best regards

Reg 13(1)



Reg 13(1)

Reg 13(1)

Reg 13(1) [@homesengland.gov.uk](mailto:enquiries@homesengland.gov.uk)



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Reg 13(1)

**From:** Reg 13(1)  
**Sent:** 15 June 2020 13:53  
**To:** Reg 13(1)  
**Cc:** Reg 13(1)  
**Subject:** RE: Northstowe Ground Water Monitoring - May visit

Hi All

Please can you re-commence groundwater monitoring – many thanks

Best regards

Reg 13(1)

Homes England

M: Reg 13(1)

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---

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 04 June 2020 12:49  
**To:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @homesengland.gov.uk>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>  
**Subject:** RE: Northstowe Ground Water Monitoring - May visit

Hi Reg 13(1)

This is on hold for another month please

Reg 13(1)

---

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 01 June 2020 16:37  
**To:** Reg 13(1) @arcadis.com>; Reg 13(1) @homesengland.gov.uk>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>  
**Subject:** RE: Northstowe Ground Water Monitoring - May visit

Reg 13(1)

We have Reg 13(1) penciled in to undertake the groundwater monitoring (dipping) on 11<sup>th</sup> June (next Thursday) – is this OK? Would he have access to 4WD?

Regards

Reg 13(1)

---

**From:** Reg 13(1) @arcadis.com>  
**Sent:** Monday, May 18, 2020 9:33 AM  
**To:** Reg 13(1) @homesengland.gov.uk>

Cc: Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>

Subject: RE: Northstowe Ground Water Monitoring - May visit

Hi Reg 13(1) [redacted]

Are we ok to recommence Ground Water monitoring?

Kind regards,

Reg 13(1) [redacted]

Reg 13(1) [redacted]@arcadis.com  
Arcadis | 3<sup>rd</sup> Floor, Charter House, 62-68 Hills Road, Cambridge | CB2 1LA | United Kingdom  
M. + Reg 13(1) [redacted] | [www.arcadis.com](http://www.arcadis.com)



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From: Reg 13(1) [redacted]  
Sent: 11 May 2020 16:39  
To: Reg 13(1) [redacted]@homesengland.gov.uk>  
Cc: Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>  
Reg 13(1) [redacted]@arcadis.com>

Subject: RE: Northstowe Ground Water Monitoring - May visit

Hi Reg 13(1) [redacted]

Do Homes England have any objections with Arcadis, returning to the Project to complete the ground water monitoring.

Kind regards,

Reg 13(1) [redacted]

Reg 13(1) [redacted]@arcadis.com  
Arcadis | 3<sup>rd</sup> Floor, Charter House, 62-68 Hills Road, Cambridge | CB2 1LA | United Kingdom  
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AS2 – Internal

AS2 – Internal

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AS2 – Internal

Reg 13(1)

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 05 August 2020 10:46  
**To:** Reg 13(1)  
**Cc:** Reg 13(1)  
**Subject:** RE: Few's Lane Consortium

Thanks Reg

In terms of process and response, this is correct.

Phase 3 doesn't look like it would really affect Longstanton in terms of ground water levels, certainly not like Phase 1 does.

However as a quick summary on the background:

- We know that Longstanton feel that Phase 1 (Hallam Land) have been dewatering the area when they were plot raising and pumping out trenches during construction. They had a report done that states that they weren't affecting the wider area, but the local residents are sceptical. This is not related to Homes England works.
- For Phase 2 we have been undertaking ground water monitoring, and this shows anticipated seasonal fluctuations.
- Local Residents did raise anomalies again earlier this year (before COVID) and that they were noticing lower water levels in ponds, and thought it might be as a result of Sisks works onsite. But at that stage if I remember correctly it didn't tie up with pumping activities onsite. We did however confirm through that review, that the ground water monitoring done to date may not be enough to definitively rebut comments.
- We therefore agreed with Reg that we would look at a scope of works to increase monitoring on phase 2 and show the local residents that we are all taking their concerns seriously. This will involve, installing further monitoring points on the western boundary of phase 2, and monitor at this location as well, to pick up changes across the site, and on this Longstanton boundary, rather than just in the east where the remaining monitoring points are located. THIs will help to build up evidence over time and over the course of the phase 2 build out, of the fluctuations in ground water and whether these are naturally occurring or as a result of construction works onsite.
  - Due to the COVID lockdown this work was postponed, but ill talk to Reg when I'm back from leave about beginning to progress this again.

We have included flexibility in the FRA as to the types of SuDS that might be brought forward as part of reserved matters applications at detailed design, including reference that the use of SuDS that help to recharge the groundwater could be considered where deemed appropriate.

Hope this helps

Reg

---

**From:** Reg 13(1) @arcadis.com>  
**Sent:** 04 August 2020 14:49  
**To:** Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @arcadis.com>  
**Cc:** Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @homesengland.gov.uk>;  
Reg 13(1) @arcadis.com>  
**Subject:** RE: Few's Lane Consortium

Hi Reg

I am aware that Reg 13(1) is off on leave shortly so may not be able to respond, but I am not sure what the issue is that they are raising since impact on hydrogeology was scoped in to the EIA and is included in Chapter 10 of the ES. This chapter also provides an assessment of cumulative effects with committed schemes including Phases 1 and 2.

We did scope out surface water drainage and flood risk, which was accepted, on the grounds of producing the separate FRA and Drainage Strategy. However on the advice of Mills & Reeve we added a summary to the ES to ensure it formed part of it in case challenged.

We can ask for clarity tomorrow/ explain the position as we see it.

Reg 13(1)

Reg 13(1)

[@arcadis.com](mailto:Reg 13(1)@arcadis.com)

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M. Reg 13(1)

[www.arcadis.com](http://www.arcadis.com)



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From: Reg 13(1) [@homesengland.gov.uk](mailto:Reg 13(1)@homesengland.gov.uk)>  
Sent: 04 August 2020 14:17  
To: Reg 13(1) [@arcadis.com](mailto:Reg 13(1)@arcadis.com)>  
Cc: Reg 13(1) [@arcadis.com](mailto:Reg 13(1)@arcadis.com)>; Reg 13(1) [@homesengland.gov.uk](mailto:Reg 13(1)@homesengland.gov.uk)>; Reg 13(1) [@homesengland.gov.uk](mailto:Reg 13(1)@homesengland.gov.uk)>  
Subject: FW: Fews Lane Consortium

Hi Reg 13(1)

Be interested in your thoughts on the attached. We have a PPA meeting scheduled for tomorrow so any initial thoughts would be welcomed.

Thanks, Reg 13(1)

Reg 13(1)

Homes England

T: Reg 13(1)  
M: 07 Reg 13(1)

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From: Reg 13(1) [@greatercambridgeplanning.org](mailto:Reg 13(1)@greatercambridgeplanning.org)>  
Sent: 04 August 2020 13:49  
To: Reg 13(1) [@tibbonalds.co.uk](mailto:Reg 13(1)@tibbonalds.co.uk)>; Reg 13(1) [@tibbonalds.co.uk](mailto:Reg 13(1)@tibbonalds.co.uk)>; Reg 13(1) [@arcadis.com](mailto:Reg 13(1)@arcadis.com)>; Reg 13(1) [@homesengland.gov.uk](mailto:Reg 13(1)@homesengland.gov.uk)>  
Subject: Fews Lane Consortium

Hi All,

This has been forwarded to me by Councillor Cheung Johnson. I understand it is to be presented to Longstanton Parish Council meeting on Monday under the title

**20-21/53 DEWATERING OF GRAVEL SEAM**

To consider the correspondence received from Few's Lane Consortium following research into the outline applications for Northstowe Phases 3A and 3B.

As I understand it the letter is due to be put in the public domain today. I will be responding.

Thanks

Reg 13(1)



e: Reg 13(1) @greatercambridgeplanning.org | t: Reg 13(1) | m: Reg 13(1)

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**From:** Reg 13(1) @arcadis.com>  
**Sent:** 23 March 2021 16:12  
**To:** Reg 13(1)  
**Cc:** Reg 13(1) @tibbonalds.co.uk; Reg 13(1)  
**Subject:** RE: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B  
**Attachments:** Fishing Pond.pptx

Afternoon Reg 13(1)

See attached:

- King fisher pond location corrected on the plans
- Proposed additional borehole locations identified for future monitoring around the boundary of the site added

Kind regards

Reg 13(1)

---

**From:** Reg 13(1) @homesengland.gov.uk>  
**Sent:** 22 March 2021 16:56  
**To:** Reg 13(1) @arcadis.com>; Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @homesengland.gov.uk>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @tibbonalds.co.uk>; Reg 13(1) @tibbonalds.co.uk>  
**Subject:** RE: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

Hi Reg 13(1)

There remains some errors and wrongly identified pond in your email below.  
As discussed, please reissue your ppt proposal identifying additional monitoring / BH locations to enable us to capture further groundwater data.

Best regards

Reg 13(1)  
Homes England  
Reg 13(1)

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**From:** Reg 13(1) @arcadis.com>  
**Sent:** 22 March 2021 10:37  
**To:** Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @homesengland.gov.uk>; Reg 13(1) @homesengland.gov.uk>  
**Cc:** Reg 13(1) @arcadis.com>; Reg 13(1) @arcadis.com>; Reg 13(1) @tibbonalds.co.uk>; Reg 13(1) @tibbonalds.co.uk>  
**Subject:** RE: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

Hi Reg 13(1)

The powerpoint has been updated as requested and uploaded to huddle (also attached)  
<https://hca.huddle.net/workspace/37310751/files/#/folder/45608557/list>

Reg  
13(1)

---

**From:** Reg 13(1) [redacted]@homesengland.gov.uk>  
**Sent:** 18 March 2021 13:49  
**To:** Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@homesengland.gov.uk>; Reg 13(1) [redacted]@homesengland.gov.uk>  
**Cc:** Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@tibbalds.co.uk>; Reg 13(1) [redacted]@tibbalds.co.uk>  
**Subject:** RE: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

Hi Reg [redacted]

The pond you have identified within your reporting is not a fishing pond – please can you update you report accordingly.

Best regards

Reg 13(1) [redacted]  
Homes England  
Reg 13(1) [redacted]

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---

**From:** Reg 13(1) [redacted]@arcadis.com>  
**Sent:** 03 March 2021 10:44  
**To:** Reg 13(1) [redacted]@homesengland.gov.uk>; Reg 13(1) [redacted]@homesengland.gov.uk>; Reg 13(1) [redacted]@homesengland.gov.uk>  
**Cc:** Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@arcadis.com>; Reg 13(1) [redacted]@tibbalds.co.uk>; Reg 13(1) [redacted]@tibbalds.co.uk>  
**Subject:** FW: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B  
**Importance:** High

Hi All

We have taken a look at this part 1 report provided and note this is related to 2015 issues raised rather than phase 2 specifically at this stage, so presumably findings will have more bearing on phase 1 works around that time.

At the moment there isn't much new information and their conceptual model is in its infancy. They have no specifics of how they think there is or isn't continuity between pond and site.

- Their conclusions are that there is no reason for a natural decline in levels due to a decline in recharge/rainfall;
- Their groundwater level and rainfall data presented is only up to 2015. But the baseline conclusion seems fair at first glance;
- They do however suggest kingfisher pond is connected to the aquifer, and therefore changes in groundwater levels in the aquifer will be reflected in the pond (these can be natural and seasonal or related to lowered groundwater due to abstractions within the sands and gravels in that area)

They have key boreholes BH111, BH124, BH125 which are located offsite (see below) within the sands and gravels.

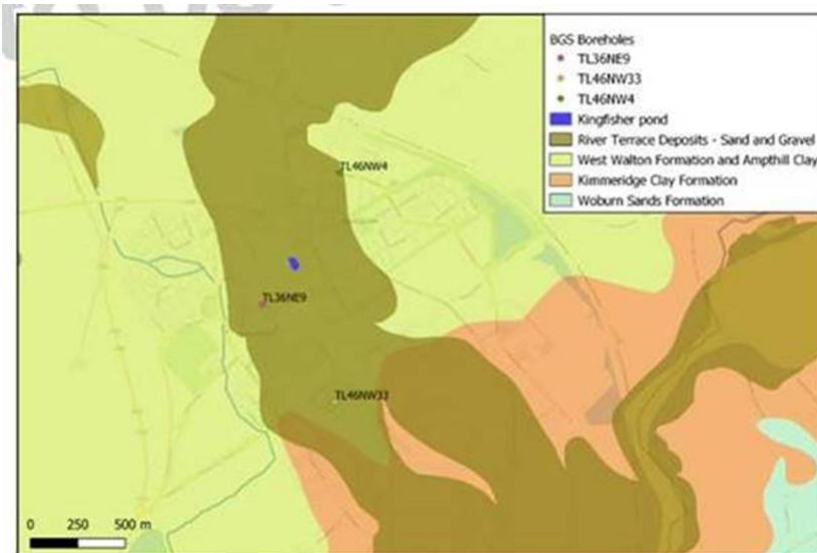


Figure C.4: Map highlighting locations of BGS borehole logs of interest at Longstanton.

HR Wallingford proposed a three stage approach, of which only stage 1 has been reported on in this report:

1. **Review the hydrology and hydrogeology of the Kingfisher Pond and surrounding area prior to concerns being raised about its condition (2015) and develop a conceptual model of the area.**
2. Review the more recent hydrology and hydrogeology and determine if the Kingfisher Pond has changed since 2015 and, if there is a change;
3. Determine the cause of the changes in the hydrology and hydrogeology of the Kingfisher Pond.

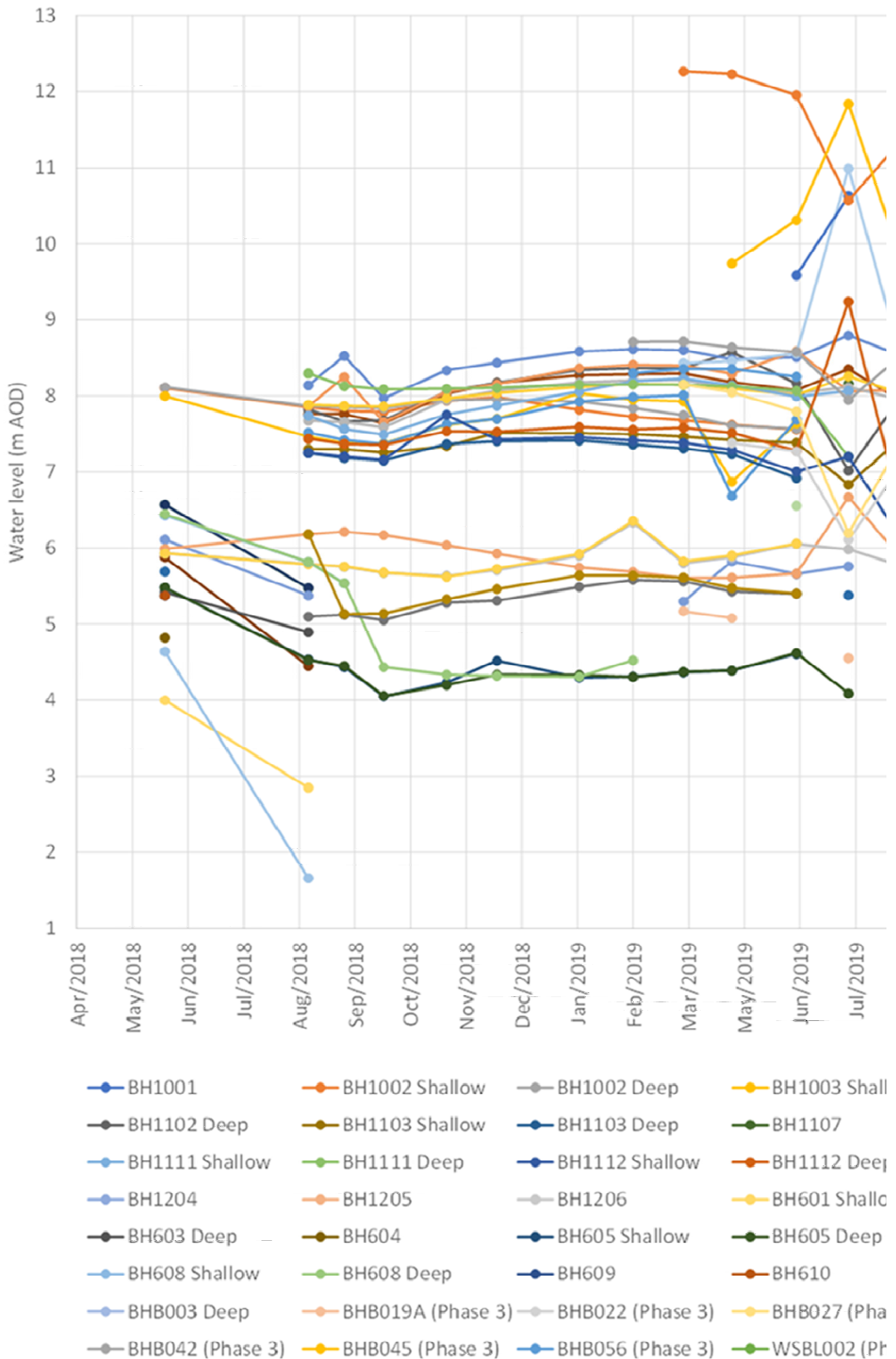
We have previously noted that the location of kingfisher pond may be more affected by phase 1 than by works at the eastern edge of phase 2, however ground water / hydraulic gradients do tend to fall in both direction (North east across phase 1 and to the east through phase 2).

We have attached some information however illustrating how phase 3A may affect that pond (later phases of development as works will be starting on the eastern side of the site)

It may be that now is the time to think again about longer term monitoring across the western edge of phase 2 as we all as to the south of phase 3A for more robust datasets for the future works. I know we put this off last year due to Covid / lockdowns etc.

As a recap from the review of available monitoring datasets within the site (Phase 2), generally as reported previously,

- A shallow depth to water was common and there was a seasonal variation.
- in July 2019 the depth to water seems to get disturbed. Some sites rising, some falling. Likely due to water management and changes on site.
- The 2021 groundwater levels in the winters of 2019 and 2020 are higher than was observed in 2018. This likely reflects the two very wet winters and is concurrent with construction and fairly widespread surface water flooding around the site..
- It is possible that some sites suffered a fall in GWL in the summer of 2019 - BHB027; BHB022; BH1112.
- The sites that suffered a fall in groundwater levels recovered in 2020. This may well be related to the pumping out of the ponds at the time during their construction.
- The flows for these above listed sites in 2020 do appear to be 0.5 m lower than in 2018. It is not yet obvious that this is caused by the site rather than just a seasonality.



Reg  
13(1)

---

**From:** Reg 13(1) [redacted] <[\[redacted\]@arcadis.com](mailto:[redacted]@arcadis.com)>  
**Sent:** 01 March 2021 12:38  
**To:** Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>; Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>; Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>  
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**Subject:** RE: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

Hi Reg  
13(1)

Thanks – I have copied Reg 13(1) [redacted] and Tibbalds in to this as we are having various email conversations.

Is there a view from yourselves on what if anything we should do on this issue?

Kind regards

Reg  
13(1)

---

**From:** Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>  
**Sent:** 01 March 2021 10:06  
**To:** Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>; Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>  
**Cc:** Reg 13(1) [redacted] <[\[redacted\]@arcadis.com](mailto:[redacted]@arcadis.com)>  
**Subject:** FW: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B  
**Importance:** Low

Hi all – Please see below – for info. R

Reg 13(1) [redacted]  
[redacted]  
[redacted]

Homes England

T: Reg 13(1) [redacted]

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**From:** Reg 13(1) [redacted] <[\[redacted\]@greatercambridgeplanning.org](mailto:[redacted]@greatercambridgeplanning.org)>  
**Sent:** 01 March 2021 09:46  
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**Cc:** Reg 13(1) [redacted] <[\[redacted\]@homesengland.gov.uk](mailto:[redacted]@homesengland.gov.uk)>  
**Subject:** FW: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

For info

Reg 13(1) [redacted]  
[redacted]

Reg 13(1) [redacted] [redacted] [redacted]



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Sent: 28 February 2021 14:45

To: Reg 13(1) @greatercambridgeplanning.org>

Cc: Cllr John Batchelor (South Cambs - Linton) <[Cllr.Batchelor2@scambs.gov.uk](mailto:Cllr.Batchelor2@scambs.gov.uk)>; Cllr Pippa Heylings (South Cambs - Histon & Impington) <[Cllr.Heylings@scambs.gov.uk](mailto:Cllr.Heylings@scambs.gov.uk)>; Cllr Anna Bradnam (South Cambs - Milton & Waterbeach) <[Cllr.Bradnam@scambs.gov.uk](mailto:Cllr.Bradnam@scambs.gov.uk)>; Cllr Martin Cahn (South Cambs - Histon & Impington) <[Cllr.Cahn@scambs.gov.uk](mailto:Cllr.Cahn@scambs.gov.uk)>; Cllr Peter Fane (South Cambs - Shelford) <[Cllr.Fane@scambs.gov.uk](mailto:Cllr.Fane@scambs.gov.uk)>; Cllr Tumi Hawkins (South Cambs - Caldecote) <[cllr.hawkins@scambs.gov.uk](mailto:cllr.hawkins@scambs.gov.uk)>; Cllr Judith Rippeth (South Cambs - Milton & Waterbeach) <[Cllr.Rippeth@scambs.gov.uk](mailto:Cllr.Rippeth@scambs.gov.uk)>; Cllr Deborah Roberts (South Cambs - Foxton) <[Cllr.Roberts@scambs.gov.uk](mailto:Cllr.Roberts@scambs.gov.uk)>; Cllr Heather Williams (South Cambs - The Mordens) <[Cllr.WilliamsH@scambs.gov.uk](mailto:Cllr.WilliamsH@scambs.gov.uk)>; Cllr Richard Williams (South Cambs - Whittlesford) <[Cllr.WilliamsR@scambs.gov.uk](mailto:Cllr.WilliamsR@scambs.gov.uk)>; Cllr Nick Wright (South Cambs - Caxton & Papworth) <[Cllr.Wright@scambs.gov.uk](mailto:Cllr.Wright@scambs.gov.uk)>; Cllr delaMare-Lyon <[cldr.delamare-lyon@longstanton-pc.gov.uk](mailto:cldr.delamare-lyon@longstanton-pc.gov.uk)>; [cldr.burns@longstanton-pc.gov.uk](mailto:cldr.burns@longstanton-pc.gov.uk); Cllr Brash-Hall <[cldr.brash-hall@longstanton-pc.gov.uk](mailto:cldr.brash-hall@longstanton-pc.gov.uk)>; [cldr.castelino@longstanton-pc.gov.uk](mailto:cldr.castelino@longstanton-pc.gov.uk); [cldr.harrison@longstanton-pc.gov.uk](mailto:cldr.harrison@longstanton-pc.gov.uk); [cldr.mcphater@longstanton-pc.gov.uk](mailto:cldr.mcphater@longstanton-pc.gov.uk); [cldr.mukadam@longstanton-pc.gov.uk](mailto:cldr.mukadam@longstanton-pc.gov.uk); [cldr.owen@longstanton-pc.gov.uk](mailto:cldr.owen@longstanton-pc.gov.uk); [cldr.owens@longstanton-pc.gov.uk](mailto:cldr.owens@longstanton-pc.gov.uk); [cldr.pokala@longstanton-pc.gov.uk](mailto:cldr.pokala@longstanton-pc.gov.uk); [cldr.street@longstanton-pc.gov.uk](mailto:cldr.street@longstanton-pc.gov.uk); [clerk@longstanton-pc.gov.uk](mailto:clerk@longstanton-pc.gov.uk); Cllr Alex Malyon (South Cambs - Longstanton) <[Cllr.Malyon@scambs.gov.uk](mailto:Cllr.Malyon@scambs.gov.uk)>; Cllr Sarah CheungJohnson (South Cambs - Longstanton) <[Cllr.cheungjohnson@scambs.gov.uk](mailto:Cllr.cheungjohnson@scambs.gov.uk)>; Reg 13(1) 1) @greatercambridgeplanning.org>

Subject: Timing of HR Wallingford report in relation to Northstowe Phases 3A and 3B

Dear Reg 13(1),

Last summer, the district council spent nearly £10,000 on a report from HR Wallingford into the status of the aquifer underlying Northstowe and Longstanton.

The key question for the report to address is whether the observed changes to the aquifer have been caused by development at Northstowe.

After commissioning the report, a decision was then taken to divide the report into two parts, with the key question of whether the development has caused the observed environmental harms being relegated to Part 2.

It appears that HR Wallingford was instructed to divide the report into two parts so that none of the information on environmental impacts to be covered in Part 2 of the report would be available for the planning committee at the time a decision is made on outline permission for Phase 3A and 3B of Northstowe.

As you know, cumulative environmental impacts are material planning considerations.

The HR Wallingford report has already been paid for by the council out of public funds.

The fact that the council seems to be delaying the completion of this publicly funded environmental report until after outline permissions have been granted would seem to call into question the judgment and independence of the council's planning officers.

On Tuesday evening, the inaugural meeting of the new Northstowe Environmental Forum will be held, and we will be discussing political strategies to convince councillors to defer a decision on Northstowe Phases 3A and 3B until after the necessary environmental information is available.

In the interest of allowing the meeting to move on to other matters, I am writing to ask if the district council will agree that Part 2 of the HR Wallingford report will be available before the planning committee decides the application for outline permission for Northstowe Phases 3A and 3B?

Kind regards,

Reg 13(1)

Fews Lane Consortium Ltd

Reg 13(1)

tel. Reg

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Kingfisher Pond location

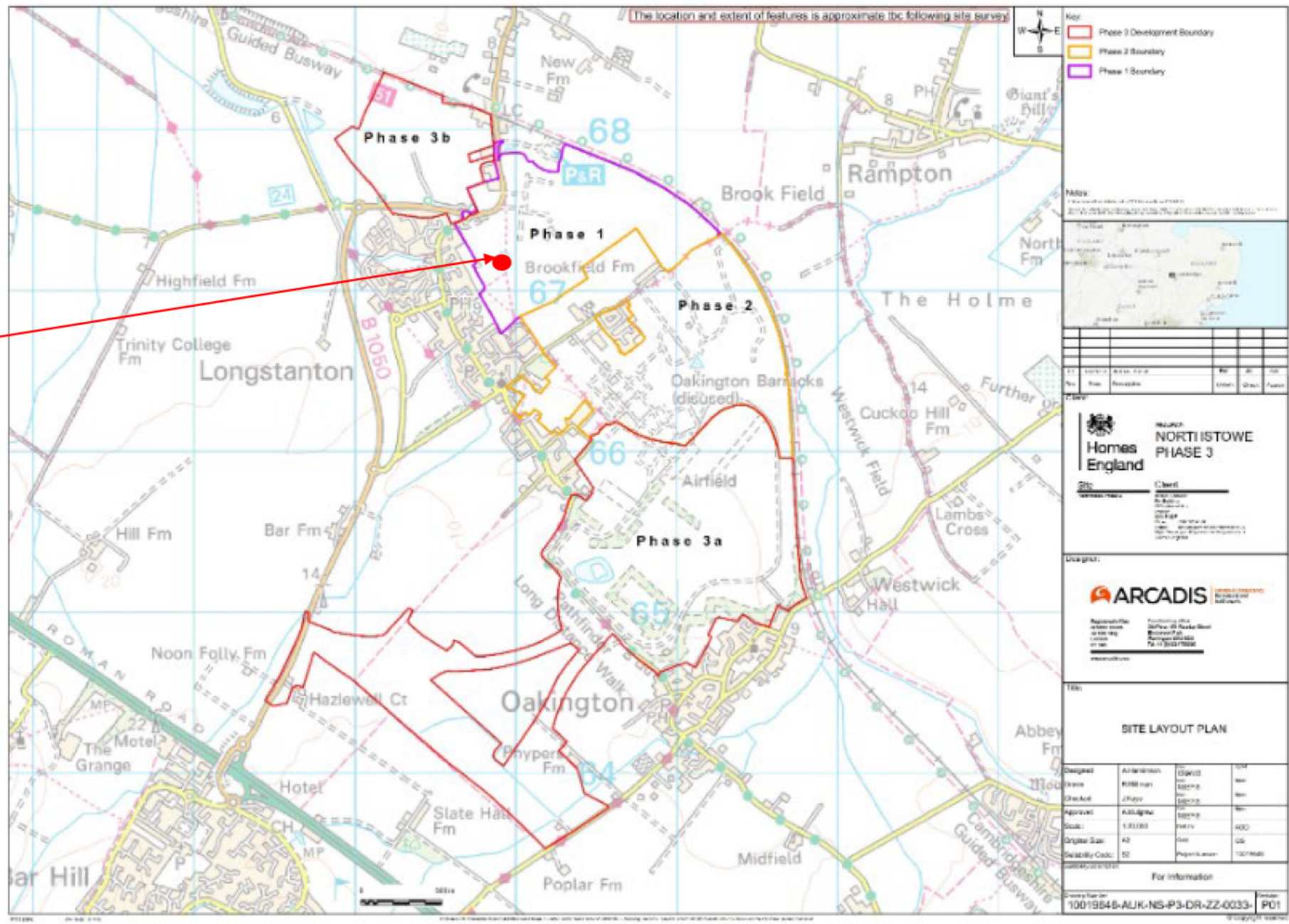
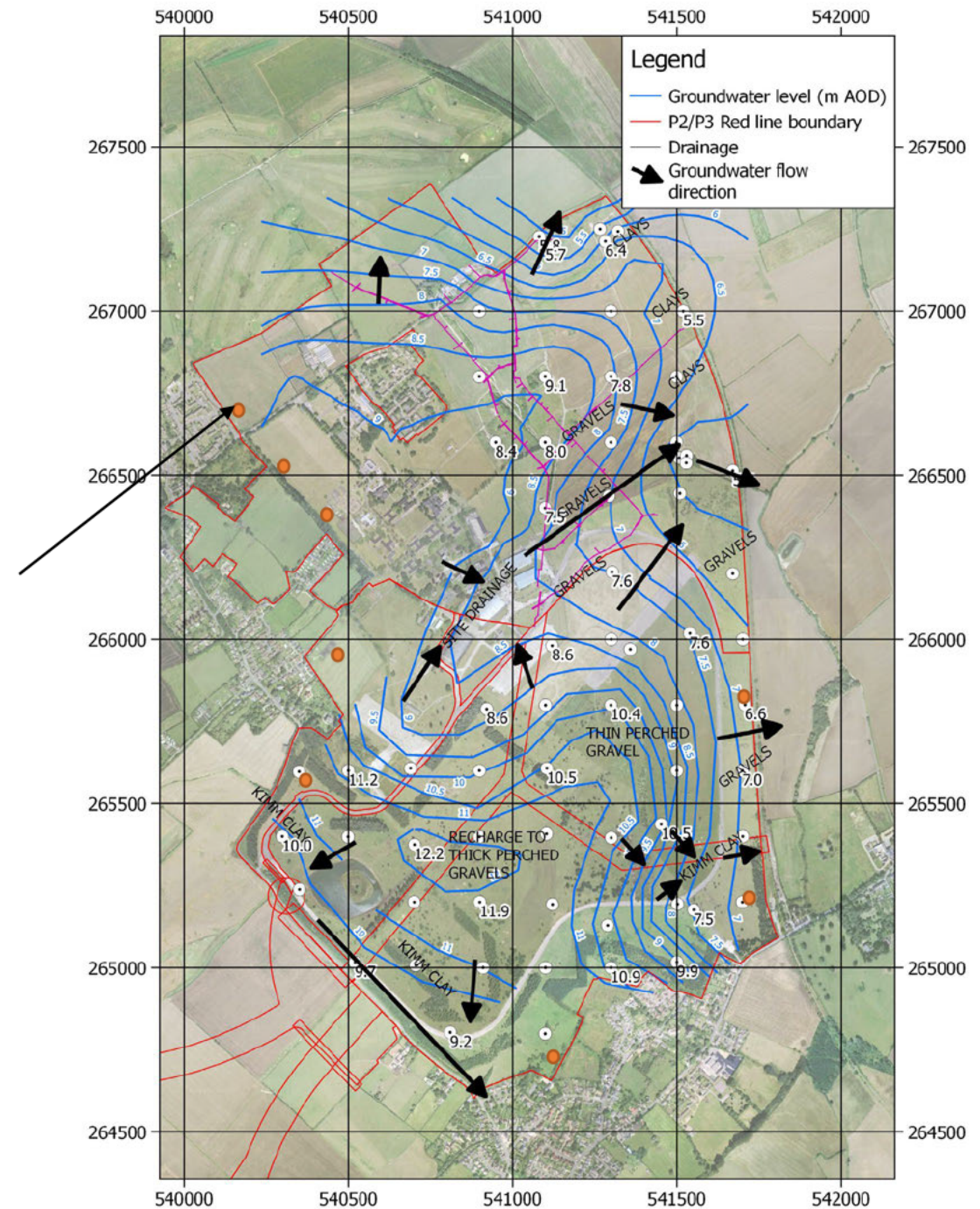


Figure 1 Site location plan

- From information available relating to ground water contours the phase 2 development works completed to date are not upstream of Kingfisher pond.
- Ongoing construction works and the future inclusion of positive drainage in this area could lead to a cone of depression in ground water levels locally within the site. From reviews undertaken looking at phase 3, this appears to regulate along the southern site boundary to existing levels as shown on the sections included below.
- Additional perimeter boreholes are recommended for ongoing observation of ground water levels along the boundaries of the site, especially where locations will be upstream (higher hydraulic gradient), to best capture the potential groundwater impacts of development.
- We suggest some perimeter boreholes, broadly at locations shown on the attached map to help monitor future groundwater dynamics.



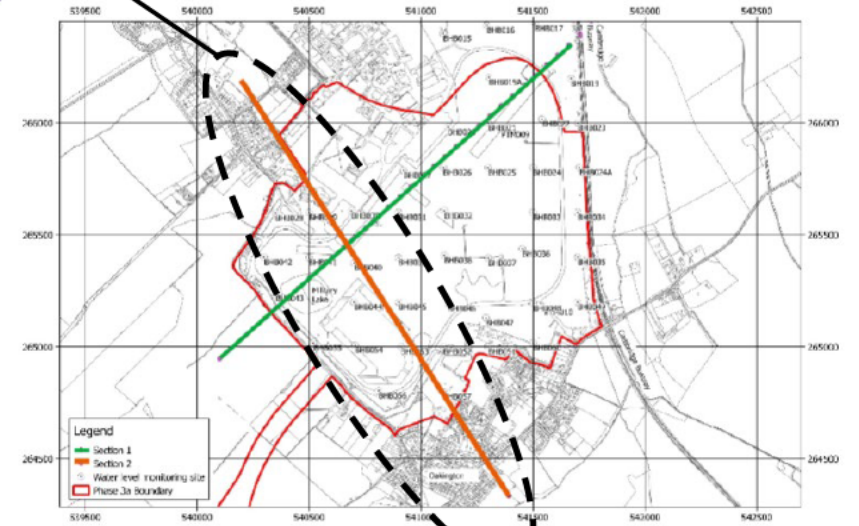
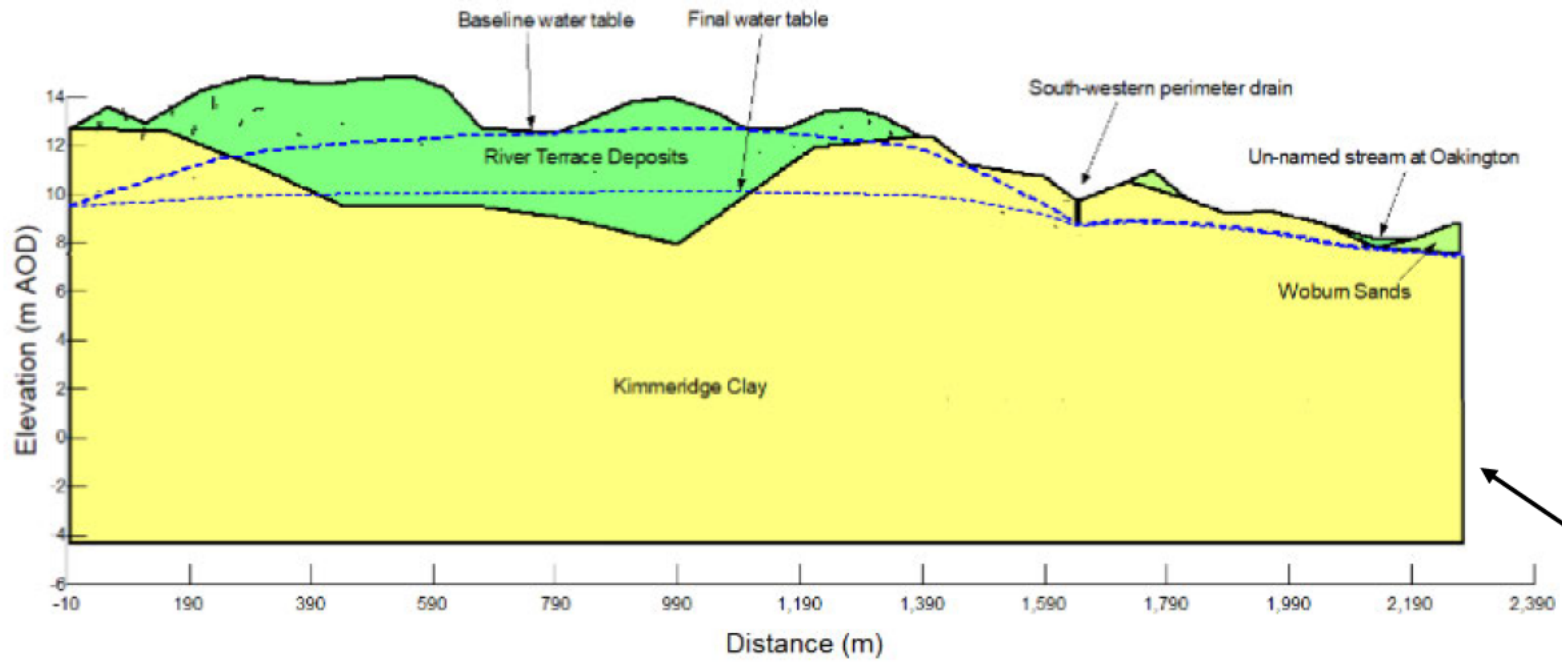


Figure 3 Cross section locations

Reg 13(1)

**From:** Reg 13(1)  
**Sent:** 01 March 2021 10:06  
**To:** Reg 13(1)  
**Subject:** FW: HR Wallingford Report - Part 1  
**Attachments:** FWM8714-RT001-BaselineConceptual-R00-02.docx

**Importance:** Low

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

Hi – PSB for info. R

Reg 13(1)

Homes England

T: Reg 13(1)

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**From:** Reg 13(1) @greatercambridgeplanning.org>  
**Sent:** 01 March 2021 10:02  
**To:** Reg 13(1) @tibbonalds.co.uk; Reg 13(1) @tibbonalds.co.uk>; Reg 13(1) @tibbonalds.co.uk>; Reg 13(1) @arcadis.com>  
**Cc:** Reg 13(1) @homesengland.gov.uk>  
**Subject:** HR Wallingford Report - Part 1

Hi All,

Attached is the draft report for Part 1 of the HRW report. HR Wallingford highlight **three** parts to their work:

1. *Once our conceptual modelling is complete we will produce a technical note (our first deliverable), which sets out, clearly and concisely, what the hydrogeology and hydrology was before the development.*
2. *Once our assessment is complete we will present a second conceptual model to stakeholders setting out what we believe the current processes are. This will be our second deliverable.*
3. *On completion of our assessment we will produce a draft report. We will assess if the Kingfisher Pond has been affected, and aim to quantify the impact. We will also answer the specific question set out in paragraph 27 of the ItQ.*

Kind Regards

Reg 13(1)

Reg 13(1)



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