FLOOD RISK ASSESSMENT

PROPOSED RESIDENTIAL DEVELOPMENT, REPLACEMENT ALLOTMENTS & NEW CEMETERY, LAND NORTH & SOUTH OF JAMES ROAD CROWLAND.

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Version 1 March 2015

PROPOSED RESIDENTIAL DEVELOPMENT, REPLACEMENT ALLOTMENTS & NEW CEMETERY INCLUDING WOODLAND BURIAL PLOTS, LAND NORTH & SOUTH OF JAMES ROAD, CROWLAND.

INTRODUCTION

The Government has placed increasing priority on the need to take full account of the risks associated with flooding at all stages of the planning and development process. This seeks to reduce the future damage to property and the risk to life from incidents of flooding. Their expectations relating to flooding are contained in the National Planning Policy Framework March 2012, (NPPF), which identifies how the issue of flooding is dealt with in the drafting of planning policy and the consideration of planning applications by avoiding inappropriate development in areas at risk from flooding and to direct development away from areas at highest risk.

Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere. Local Plans should apply a sequential, risk-based approach to the location of development to avoid where possible flood risk to people and property and manage any residual risk, taking account of the impacts of climate change.

The Environment Agency's flood maps show areas that are at risk, from fluvial and tidal flooding. These maps show the limits of the flood plain of the area which could be affected by flood events, over topping or breaching of flood defences. They are based on the approximate extent of floods with a 1% annual probability of exceedance (1 in 100 year flood) for rivers and 0.5% annual probability of exceedance (1 in 200 years flood) for coastal areas under present expectations or the highest known flood. However they do not take into account of the presence of defences or the likelihood that flood return intervals will be reduced by climate change.

This Flood Risk Assessment has been prepared in support of the planning application and considers the risk of flooding from fluvial and tidal sources in accordance with National Planning Policy Framework (NPPF). It also considers the risks of localised flooding due to inadequate Foul and Surface Water Sewers, Failure of Reservoirs, Water Main pipe bursts, Sewer Blockages, Pump Failures or High Ground Water Table etc.

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APPLICATION SITE

The proposed development site is located on land to the north & south of James Road, Crowland, within the administrative area of South Holland District Council. **Plan 1**

The current proposal is to apply for outline planning permission for the redevelopment of an existing allotment with residential development and the creation of replacement allotments, a new cemetery with woodland burial plots and associated infrastructure. There will also be two new access points serving the new development, which lies either side of James Road.

The National Grid Reference for the Residential site is TF 24380 09865 and the site area is approximately 1.6Ha or thereabouts and for the new Allotments and the Cemetery is TF24622 09822 and the site area is 2.75 Ha or thereabouts.

The Site would be classed as Major Development applying the Town & Country Planning (Consultation) (England) Direction 2009 as the site is to be developed is more than 10 dwellings.

NPPF defines three levels of flood risk depending upon the annual probability of fluvial flooding occurring.

Zone 1 — Low Probability (<0.1%)

Zone 2 — Medium Probability (0.1-.0%)

Zone 3 — High Probability (>1.0%)

The proposed development site is shown to be within Flood Zone 3a "High Probability" as detailed on the Environment Agency's Flood Zone Maps without defences, and as defined in Table 1 of National Planning Policy Framework.

Table 1: Flood Zones Definition

Zone 3a - high probability

Definition
This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses
The water-compatible and less vulnerable uses of land (table 2) are appropriate in this zone. The highly vulnerable uses should not be permitted in this zone.

The more vulnerable uses and essential infrastructure should only be permitted in this zone if the Exception Test is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

Flood risk assessment requirements
All development proposals in this zone should be accompanied by a flood risk assessment.

Policy aims
In this zone, developers and local authorities should seek opportunities to:

- reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage systems;
- relocate existing development to land in zones with a lower probability of flooding; and
- create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF, the proposed residential use for the site is classified as "More Vulnerable," Table 1 of NPPF states that such uses are permitted in Flood Zone 3a subject to the exception test. The use of land for allotment and burial ground are not classified by Table 2.

From discussions with the Environment Agency who have advised that as the burial ground and allotments would not be significantly affected if flooding occurred and there would be no increased risk to life or property, a detailed flood risk assessment would not be necessary for this part of the application.

The two amenity buildings serving the allotment and burial ground would be raised 300mm above existing ground level and all access roads and paths would be constructed using permeable materials thus mimicking the existing arrangements for the disposal of rainwater falling on the site.

This flood risk assessment therefore is applicable to the residential element of the application.

Table 2: Flood Risk Vulnerability Classification

More vulnerable

- Hospitals.
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill and sites used for waste management facilities for hazardous waste[6].
- Sites used for holiday or short-let caravans and camping, *subject to a specific warning and evacuation plan*.[7]

Site levels to Ordnance Datum have been undertaken for the site. These vary in height from 3.19mODN on the northern boundary to 1.90mODN on the southern boundary, the site average ground levels are around 2.60mODN. James road outside the proposed development is 3.02mODN with Thorney Road at a similar level. **Plan 2**

The proposed dwellings have been made safe through design and flood resistance and resilient construction. The 10 No single storey properties to be retained by the Parish Council will have a ground floor level above the 1 in 1000 year breach level to the washlands including climate change at 3.20mODN. The remainder of the proposed properties are two storeys and with all sleeping accommodation located at first floor level which provides a safe haven to residents. The minimum ground floor level for these properties would be 3.00mODN

DRAINAGE AUTHORITIES

Environment Agency

The Environment Agency is responsible for reducing the risk of flooding from designated main rivers and from the sea.

The following potential sources of flooding affecting the development site have been identified as:

- From the River Welland (Fluvial) (Crowland Washes)
- North level IDB watercourses

The Flood Zone Maps identify river catchments over 3 sq. km. These maps are a theoretical estimate of areas of land that could be inundated by floodwater during a flooding event was it not for the presence of flood defences. In practice current standards of protection would result in flood envelopes substantially less than shown by these maps. The maps make no allowance for local, site specific features.

The flood zone maps show that the residential site of the proposed development is considered at risk from fluvial flooding. These maps indicate that the area would be flooded without flood defences, which are in place along the coastal edge (with an annual probability of more than 1.33% return frequency of less than 1 in 100 years for fluvial flooding**). Map 1**

The National Flood Risk Assessment Map shows that the residential site is at Medium risk of flooding. Medium means that each year, this area has a chance of flooding of less than 1 in 30 (3.3%) but greater or equal to 1 in 100 (1%). This takes into account the effect of any flood defences that may be in this area. Flood defences reduce, but do not completely stop the chance of flooding as they can be overtopped or fail. **Map 2**

In this particular area the main river that could affect the site is the River Welland Washes located approximately 860m to the west of the site. **Map 3**

River Welland

The centre of the residential site is located approximately 860m from the Crowland Washes, a controlled flood storage area on the River Welland. Flood levels in the Washes are governed by the level in the River Welland and the structures which control flow of water between them. The Wash lands are located to the east of the River Welland and the right bank is lower than the left bank any over topping on this stretch of river will therefore be into the Washlands

				Annual Exceedance Probability Maximum Water Levels (mODN)				Bank Levels (mODN)	
Label	Easting	Northing	4% 1 in 25	1% 1 in 100	1% +CC 1 in 100	0.1% 1 in 1000	0.1%+CC 1 in 1000	Left Bank	Right Bank
Welland 26264	523195	312324	4.77	4.83	4.87	4.86	4.88	See Map	Crest
Welland 28279	522727	310477	4.85	4.95	4.99	4.00	5.00		
Welland 29693	521524	309795	4.91	5.05	5.09	5.09	5.11		

Source (Welland Catchment Flood Map Improvements Model (August 2007)

These levels will be “in-channel” levels and therefore may not represent the flood level on the floodplain, particularly where the channel is embanked or has raised defences.

The fluvial defences protecting this site consist of earth embankments which are in a good/fair condition and provide a protection. The crest level of this embankment is typically between 5.80m and 6.20m ODN. This provides a free board of at least 0.80m, which will accommodate the predicted increase due to climate change for the 100 year lifetime of the development. **Plan 4**

From the above figures it has been demonstrated that for flooding events up to 1in 100 year these can be contained within the existing river systems both now and for the 100year lifetime of the development.

Breach Analysis to the Crowland Washes

1 in 1000 year level with climate change in the Crowland washes is 5.00mODN

Lowest ground level rear of defences 2.80mODN **(Cross Section) Plan 5**

Length of Breach 40m (Earth Bank)

It is assumed that the defences will be similar to Broad Crested Weir.

Volume and velocity at the location of the breach is:-

$Q = 1.7 \times B \times H^{3/2} = 1.7 \times 40 \times (5.00 - 2.70)^{3/2}$

$Q = 221.89 m^3/sec$

Velocity at the breach V= Q/A

V= 2.21.89 / 40 x 2.30) = 2.52 m/sec

Taking the precautionary approach the Hazard Rating following a breach which in Flood Risk Assessment (FD 2320) Guidance for New Development Phase 2 R& D Technical Report these are classified as low <0.75, moderate 0.75 - 1.25, significant 1.25 - 2.50 and extreme >2.50 based upon an empirical measure of velocity and depth.

Flood Hazard value	Degree of flood hazard	Description	Indicative depth range
< 0.75	Low	Caution 'Flood zone with shallow flowing water or deep standing water'	Up to 0.25 m
0.75 – 1.25	Moderate	Danger for some (i.e. children) 'Danger: flood zone with deep or fast flowing water'	Up to 0.5 m
1.25 – 2.0	Severe	Danger for most 'Danger: flood zone with deep fast flowing water'	0.5 m to 3 m
> 2.0	Extreme	Danger for all 'Extreme danger: flood zone with deep fast flowing water'	0.5 m to over 3 m

HR = d x (v + 0.5) +DF

Where V = Flood flow velocity (m/sec)

D = Flood depth (m)

DF = A debris factor included to represent the greater damage, or risk of injury to people, that can occur if debris is swept along with the water. = 0.5 for depths <0.25 or 1.0 for depths

For the degree of Flood Hazard to be classified as low HR has to be <0.75

From calculations below the hazard rating at the site 860m from the breach HR = 0.74 therefore the site is within a Low Hazard Rating, Depth 0.19m. Velocity 0.75m/sec.

Hazard Rating

Site Name **James Road Crowland** Date **Mar-15**
Defence Type **Fluvial River - Earth Bank**

Ground Level at breach	2.7	mODN	Flood Level	5	mODN	Head at Breach	2.3	m
Breach Width	40	m						
Increments from breach	100	m						
Debris Factor Shallow	0.5		Deep	1	(note: shallow <0.26m)			

Hazard Ratings: Danger for some / Danger for most / Danger for all

DISTANCE FROM BREACH

DEPTH AT BREACH	0	100	200	300	400	500	600	700	800	900	1000	1100	1200
2.00	6.84	2.11	1.64	1.46	1.36	0.80	0.76	0.73	0.70	0.68	0.67	0.65	0.64
2.05	7.04	2.15	1.66	1.48	1.37	0.81	0.77	0.73	0.71	0.69	0.67	0.66	0.65
2.10	7.25	2.19	1.69	1.49	1.39	0.82	0.77	0.74	0.72	0.70	0.68	0.66	0.65
2.15	7.47	2.23	1.71	1.51	1.40	0.83	0.78	0.75	0.72	0.70	0.68	0.67	0.66
2.20	7.68	2.26	1.73	1.52	1.41	0.84	0.79	0.76	0.73	0.71	0.69	0.68	0.66
2.25	7.90	2.30	1.75	1.54	1.42	0.85	0.80	0.76	0.74	0.71	0.70	0.68	0.67
2.30	8.11	2.34	1.78	1.55	1.44	1.36	0.81	0.77	0.74	0.72	0.70	0.69	0.67
2.35	8.34	2.38	1.80	1.57	1.45	1.37	0.82	0.78	0.75	0.73	0.71	0.69	0.68
2.40	8.56	2.42	1.82	1.59	1.46	1.38	0.83	0.79	0.76	0.73	0.71	0.70	0.68
2.45	8.78	2.47	1.84	1.60	1.47	1.39	0.84	0.79	0.76	0.74	0.72	0.70	0.69

Depth

DISTANCE FROM BREACH

DEPTH AT BREACH	0	100	200	300	400	500	600	700	800	900	1000	1100	1200
2.00	2.00	0.61	0.41	0.32	0.26	0.23	0.20	0.18	0.17	0.16	0.15	0.14	0.13
2.05	2.05	0.62	0.42	0.32	0.27	0.23	0.21	0.19	0.17	0.16	0.15	0.14	0.13
2.10	2.10	0.64	0.43	0.33	0.28	0.24	0.21	0.19	0.18	0.16	0.15	0.14	0.14
2.15	2.15	0.65	0.44	0.34	0.28	0.25	0.22	0.20	0.18	0.17	0.16	0.15	0.14
2.20	2.20	0.67	0.45	0.35	0.29	0.25	0.22	0.20	0.19	0.17	0.16	0.15	0.14
2.25	2.25	0.68	0.46	0.36	0.30	0.26	0.23	0.21	0.19	0.18	0.16	0.15	0.15
2.30	2.30	0.70	0.47	0.36	0.30	0.26	0.23	0.21	0.19	0.18	0.17	0.16	0.15
2.35	2.35	0.71	0.48	0.37	0.31	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.15
2.40	2.40	0.73	0.49	0.38	0.32	0.27	0.24	0.22	0.20	0.19	0.18	0.16	0.16
2.45	2.45	0.74	0.50	0.39	0.32	0.28	0.25	0.23	0.21	0.19	0.18	0.17	0.16

Velocity

DISTANCE FROM BREACH

DEPTH AT BREACH	0	100	200	300	400	500	600	700	800	900	1000	1100	1200
2.00	2.42	1.33	1.08	0.96	0.87	0.81	0.77	0.73	0.70	0.67	0.65	0.63	0.61
2.05	2.45	1.34	1.10	0.97	0.88	0.82	0.78	0.74	0.71	0.68	0.66	0.64	0.62
2.10	2.48	1.36	1.11	0.98	0.89	0.83	0.79	0.75	0.72	0.69	0.67	0.65	0.63
2.15	2.51	1.37	1.12	0.99	0.91	0.84	0.80	0.76	0.72	0.70	0.67	0.65	0.63
2.20	2.54	1.39	1.14	1.00	0.92	0.85	0.80	0.77	0.73	0.71	0.68	0.66	0.64
2.25	2.57	1.41	1.15	1.01	0.93	0.86	0.81	0.77	0.74	0.71	0.69	0.67	0.65
2.30	2.59	1.42	1.16	1.03	0.94	0.87	0.82	0.78	0.75	0.72	0.70	0.68	0.66
2.35	2.62	1.44	1.17	1.04	0.95	0.88	0.83	0.79	0.76	0.73	0.70	0.68	0.66
2.40	2.65	1.45	1.19	1.05	0.96	0.89	0.84	0.80	0.77	0.74	0.71	0.69	0.67
2.45	2.68	1.47	1.20	1.06	0.97	0.90	0.85	0.81	0.77	0.74	0.72	0.70	0.68

The breach flood level at the site will be 2.70 + 0.19 =2.89mODN

South Holland District Council

In order to inform the process of risk assessment and site selection the District Council commissioned Haskoning UK Ltd Consultants to prepare a Strategic Flood Risk Assessment in December 2002.They have carried out an update of this report and this report was published in January 2010

This Flood Risk Assessment has taken the results of the updated South Holland Strategic Flood Risk Assessment (SHSFRA) into account in its findings.

It was found that the actual risk from primary sources of flooding (taken as being rivers and the sea) was assessed as being the product of:

- Medium probability (assigned because the standards of the primary defences are variable) and

• Low consequence (assigned because of the District's generally rural nature and because any urban flooding is likely to be shallow with minimal impact).

The findings reflect the considerable protection afforded to the area by coastal and tidal & fluvial flood defences and by the extensive well organised system of lowland IDB fluvial drainage.

The computer modelling used in the SFRA to produce the Hazard, depth and velocity maps simulated the spread of flood waters over the land and allowed for the presence of locally raised features such as road embankments etc. The maps produced by the Environment Agency took a more precautionary approach.

The potential flooding consequences shown on this map relate to flooding from the sea, main rivers and Internal Drainage Board systems taking into account the presence of current flood risk management measures such as flood defences.

The consequences designated as being an Actual Risk arise from direct overtopping of defences, where this would occur, together with assumed breach failure of some defences. Breach failure has been assumed to occur in places where the freeboard between Peak Sea or river water level and the defence crest level is less than the minimum desirable for structural security of the defence.

From the Actual Risk Extent District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability, the Actual Peak Depth District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability and Actual Flood Hazard District - Year 2115 1% Fluvial / 0.5% Tidal Event Probability maps from the update of strategic flood risk assessment for South Holland District Council, the site is not affected from any tidal breach to the flood defences.

North Level Internal Drainage Board

The proposed development site is located within the catchment area of The North Level Internal Drainage Board. The Board is therefore responsible to operate and maintain the arterial fluvial system.

The Board has confirmed that the site is within the Postland Catchment No 7 and that their Abby Drain (911) lies to the north of the cemetery site. These drain outfalls to Postland Pumping Station which discharges into the River Welland.

It will be necessary to obtain the Boards consent for any works within the 9.0m byelaw distance from the brink of the channel.

FLOODING FROM OTHER SOURCES

Flooding is a natural process and can happen at any time from sources other than watercourses and the sea.

- Flooding from land can occur from intense rainfall, often over short duration of time that is unable to soak into the ground or enter the drainage system. However with the natural topographic nature of the ground being flat and no high ground around the development this will not cause any rapid inundation of the site and is likely only lead to local ponding of shallow depth and low velocity which will drain away into the riparian watercourses alongside James Road. Also the properties are raised at least 300mm above the existing ground level.

- The area is not known to suffer from any groundwater problems.

- Flooding from sewers can occur from over loading from heavy rainfall caused by blockages or having inadequate capacity. Again with the flat nature of the land around the site this is not expected to cause any problems to the site in connection with depth of flow or velocity and drain away into the riparian watercourses.

- Non natural or artificial sources of flooding such as reservoirs, lakes or canals where water is stored above natural ground level could cause flooding if the structure fails or is over topped. There are no other known facilities close by which would affect the site.

HISTORIC FLOODING

The site was affected by flooding from the March 1947 River Welland flood event. **Map 6**

SEQUENTIAL APPROACH

When applying the sequential approach for flood risk in accordance NPPF he site would fall into Zone 3a (High Probability) as the site is shown to be within the fluvial flood plain as shown on the Environment Agency's Flood Map without defences in place.

Applying the Flood Risk Vulnerability Classification in Table 2 of NPPF, the proposed residential development is classified as "More Vulnerable", with Table 1 of NPPF stating that such uses are appropriate in this zone subject to the exception test (as summarised in Table 3 NPPF).

TABLE 3: Flood risk vulnerability and flood zones 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Sequential Test

The aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding.

The NPPF states that development should not be permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower probability of flooding. It is important to note that the Sequential Test does not specifically mean that sites such as this cannot be developed, rather that sites at less risk should be developed first.

In this context, it is necessary to examine the housing needs within the District. There is a lack of a five year housing land supply in the south east Lincolnshire area and Crowland is classified as a sustainable settlement. The development of the site will, therefore, go towards much needed residential development in the Town and District.

Given that this application is on a windfall site, and that there is a significant proportion of land around Crowland which is deemed to be at risk of flooding, to rigidly apply the Sequential Test would undermine the ability of the District Council to meet its strategic housing need by further restricting available, developable land within the settlement of Crowland. There are not significant numbers of other sites available in the Crowland for this type of development in a lower flood risk area. This approach would therefore undermine the wider strategic objectives of the NPPF in ensuring there are enough deliverable sites to meet wider housing needs.

This windfall site is available for development now, is sustainable and would contribute to the housing stock within South Holland at a time when the number of deliverable sites falls well short of what is required.

Accordingly, the Sequential Test is passed.

The Exception Test

The next step is to assess the proposal in relation to the Exception Test, and this requires the development to:

- provide wider sustainability benefits to the community that outweigh the flood risk,

- a site specific FRA should demonstrate the proposal would be safe and not increase the risk of flooding elsewhere.

In relation to the first element, it has been demonstrated that this development provides a contribution to additional housing in a sustainable location within the development curtilage of Crowland and will also provide some affordable housing and as such has a wider benefit to the community as a whole. As part of the residential development, the Parish Council will retain ownership of 10 single storey dwellings, and it is the intention that these will be rented out to residents of Crowland who wish to move from, and free-up, existing family accommodation, but still live within the town.

In relation to the second part this Flood Risk Assessment demonstrates that the proposal is safe in terms of flood risk and would not increase the risk of flooding elsewhere. The lowest floor level for the single storey properties has been set at 3.30mODN, which is 300mm above the predicted fluvial breach level and have been located of the highest point of the site. With the remaining properties being two storeys there is a safe haven for residents to await the flood level to recede or to be rescued.

Accordingly, the Exception Test is passed.

Both the Sequential and Exception Test have been passed and it has also been demonstrated that the development would be safe for its lifetime, would not increase the risk of flooding elsewhere and would incorporate measures to ensure its flood resilience and resistance.

With the Hazard rating being low, the dwellings would be safe for their 100 year lifespan; there is a safe access and egress to and from the properties along Thorney Road into the village of Crowland.

CLIMATE CHANGE

Global warming is now recognised that it is likely to affect the frequency and severity of extreme events as both tidal and fluvial flooding.

The annual sea rise due to climate change is given in the NPPF and the recommended contingency allowances are stated in Table 4.

TABLE 4: Recommended contingency allowances for net sea level rises

	Net sea level rise (mm per year) relative to 1990			
	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

The site is unaffected by tidal flooding.

The effect of global warming on fluvial flood peaks is given in Table 5. It is expected that the overall effect up to 2025 will result in an increase of rainfall of 5%, 2025-2055 10%, 2055-2085 20% and2085-2115 of 30% with Peak River flows increasing by 20%.

Table 5: Recommended National Precautionary Sensitivity Ranges for Peak Rainfall Intensities. Peak River Flows, Offshore Wind Speeds and Wave Heights.

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	*+5%*	*+10%*	*+20%*	*+30%*
Peak river flow	*+10%*	*+20%*		
Offshore wind speed	*+5%*		*+10%*	
Extreme wave height	*+5%*		*+10%*	

The increased fluvial flood flows due to global warming, over the lifetime of the development (100 years), will be contained within the adequate freeboard to the defences of the Washes and will not affect the development site.

INFRASTRUCTURE

Foul Water Drainage

Foul drains will be provided and connected into a new foul sewer laid under a Section 106 Agreement to be adopted by Anglian Water and be connected into the adjacent foul sewer network.

Surface Water Drainage

The drainage strategy for the site is the preliminary overview and will be subject to the detailed design being undertaken when planning permission and final layout has been determined. It is proposed to utilise infiltration techniques to reduce the storm water discharge from the proposed development in order to minimise the impact of the development on the surrounding area and to comply with EA guidelines, which require at least one workable solution for managing surface water.

The proposal being submitted is for outline planning permission is for the construction of an adoptable access road with domestic curtilage driveways, grass areas and soft landscaping. The total proposed impermeable area equates to around 40%.

Existing green field runoff values and volumes, calculated in accordance with the HR Wallingford Greenfield run-off estimation for sites in accordance with DEFRA/Environment Agency Report SC030219 rev. E and Interim National Procedure principle 17 confirm that the site generates a 1 year run-off of 5.0litres/sec, 30year of 5.0 litres/sec and 100 year of 5.0 litres/sec. These are all minimum default values as the actual values are all less than 5.0 litres/sec.

In accordance with recognised guidance, National Planning Policy Framework 2012, there is a hierarchy of where surface water should discharge. This hierarchy should be followed where practicable, and is as follows:

1) Infiltration
2) Watercourse
3) Public sewer

Infiltration

It is expected that Infiltration can be used as the method of disposal of surface water from all areas of the development, as detailed below, subject to the relevant approvals. For robustness and, to ensure no overland exceedence flows, all infiltration structures will be designed to the 100 year plus 30% climate change standard:

Domestic Curtilage Roof areas can, for example, discharge to individual shallow cellular soakaways. The base of the soakaway structure would be set so as to be at least 1m above the water table and soakaways would need to be sited 5m away from buildings. These can be finalised at detailed design stage. A typical soakaway needs to comply with paragraph 9 of the Technical Guide to the NPPF 2012, which needs to be monitored and maintained to ensure it will continue to function correctly for the lifetime of the development and prevent any increase in flood risk on or off site. It is however possible to incorporate source control (water quality) SuDS into the scheme design, for example, fit water butts to domestic curtilage rainwater downpipes on all rear elevations

Domestic Curtilage Driveways can be constructed in permeable materials such as gravel, porous tarmac or porous block paving.

Adoptable Access Roads can, for example, be drained either, in part and detailed site layout permitting, by roadside swales or by a traditional piped highway drain system with below ground oversized pipe attenuation and a restricted discharge to the watercourse alongside James Road.

Watercourse

There are no proposals for any surface water to discharge to watercourse unless the ground investigation proves that swales should not be used.

Public Sewer

There are no proposals for any surface water to discharge to public sewer.

As there is a positive drainage system capable of receiving flows from the development and the remoteness of the site there is no likely impact on neighbouring property.

MORPHOLOGY

There are no environmentally sensitive aquatic features within the site boundaries therefore the development will have no effect upon either fluvial or coastal morphology.

FLOOD PROTECTION

Any impact of damage to the properties can be foreseen and mitigated against by relatively simple design and construction techniques. There are two forms of flood protection works:-

- **Flood-resistance or proofing works**: - these try to reduce the amount of water actually entering a building.
- **Flood-resilient works: -** these reduce the amount of damage caused by water entering the building.

The proposed property will have the following resilient measures incorporated in the construction in accordance with “Improving the flood performance of new buildings” CLG (2007).

- The ground floor living accommodation for the single storey dwellings is to be raised above the 1 in 100 year breach level for scenario year 2115 at 3.30mODN, and will be provided with a boarded loft area and escape window. The two storey properties will have a ground floor of 3.00mODN.

- Avoid the use of absorbent cavity insulation to the ground floor level.

- External doors to be of construction not susceptible to moisture.

- Treated and sealed timber skirting and architraves.

- Arrange for all service circuits to be routed at first floor level where practical socket outlets, boilers etc. to be a minimum of 0.5m above the raised ground floor level.

- The property Owners will contact the Environment Agency’s Floodline on 0845 988 1188 to register the site to receive advance warning of flooding by telephone, mobile, fax, SMS text, email or pager.

CONCLUSION

- The site does have the benefit of protection from fluvial flooding by the existing defences which are properly maintained to a 1 in 100 year standard of protection from fluvial flooding both now and for the lifetime of the development.

- Whilst the site lies within the High Probability Zone 3a without defences as shown on the flood maps. The proposed Residential Use falls within the More Vulnerable uses of land as defined in Table 2 NPPF, this development use is appropriate in this zone subject to passing the Sequential Test.

- With the Hazard rating being low there is a safe access and egress to and from the properties along Thorney Road into the village of Crowland.

- Flooding from other sources is unlikely to affect the site.

- Any impact of damage to the property can be foreseen and mitigated against by relatively simple design and construction techniques as suggested in the report.

APPENDIX

Photo 1 Proposed Development Site

Photo 2 River Welland & Washlands

Map 1 Extract from Environment Agency Flood Zone Map

Map 2 Extract from NFRA Flood Map

Map 3 Plan of Location of the Welland Washes

Map 4 Crowland Wash Crest Heights

Map 5 Node Map

Map 6 Historic Flood Map

Section Crowland Washes Levels Node 28279

Plan 1 Location Plan

Plan 2 OS. Site Levels



Photo1 Proposed Development Site



Photo 2 River Welland & the Wash lands

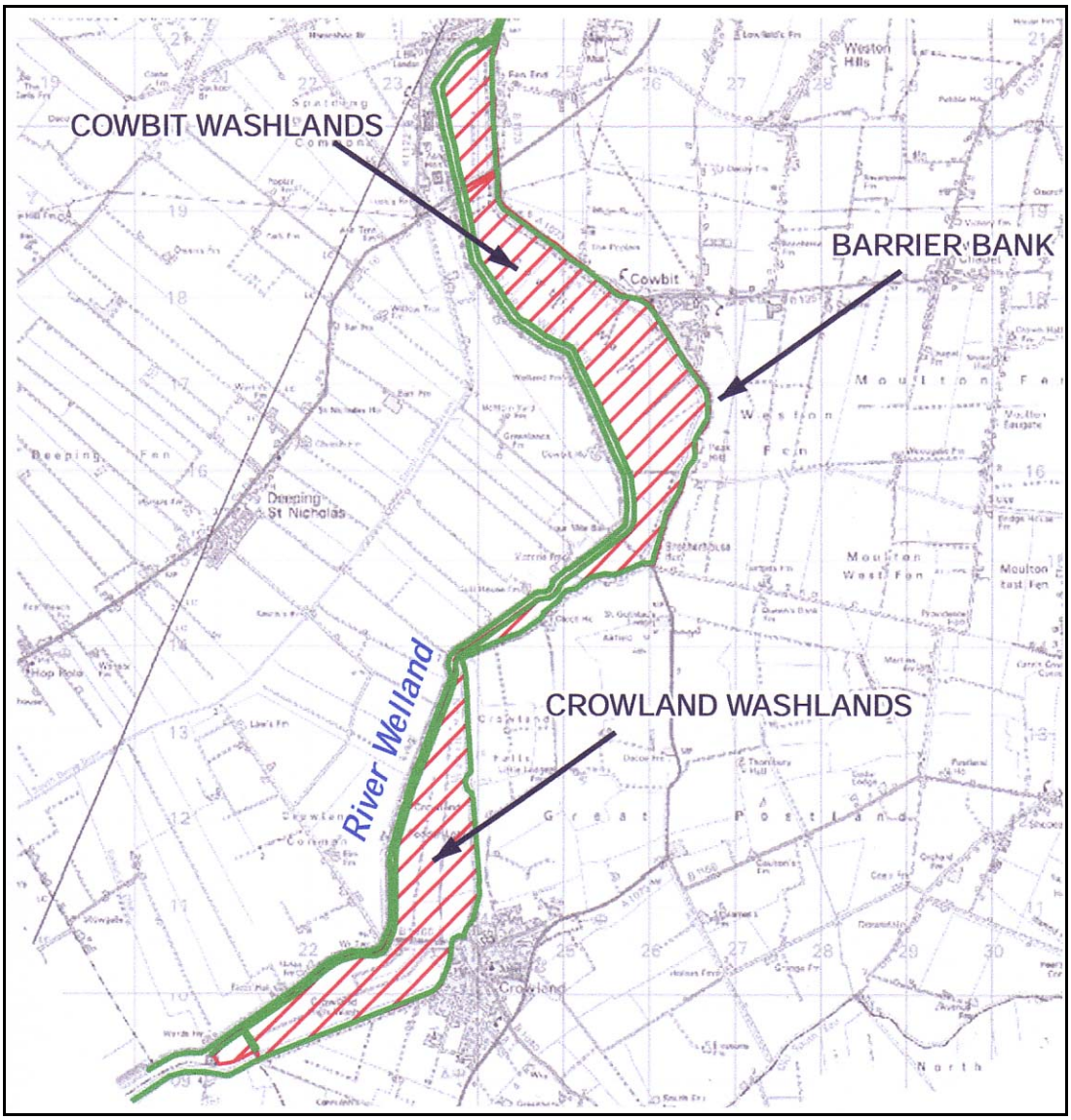
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MAP 1

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MAP 2

Plan of River Welland Washes



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MAP 3

November 2007 Crowland Wash Crest Heights

Environment Agency

Scale 1:15,000

(Crowland Crest Heights - 11/07

— Main River

Created by the Flood Risk Mapping & Data Management Team, Lincoln

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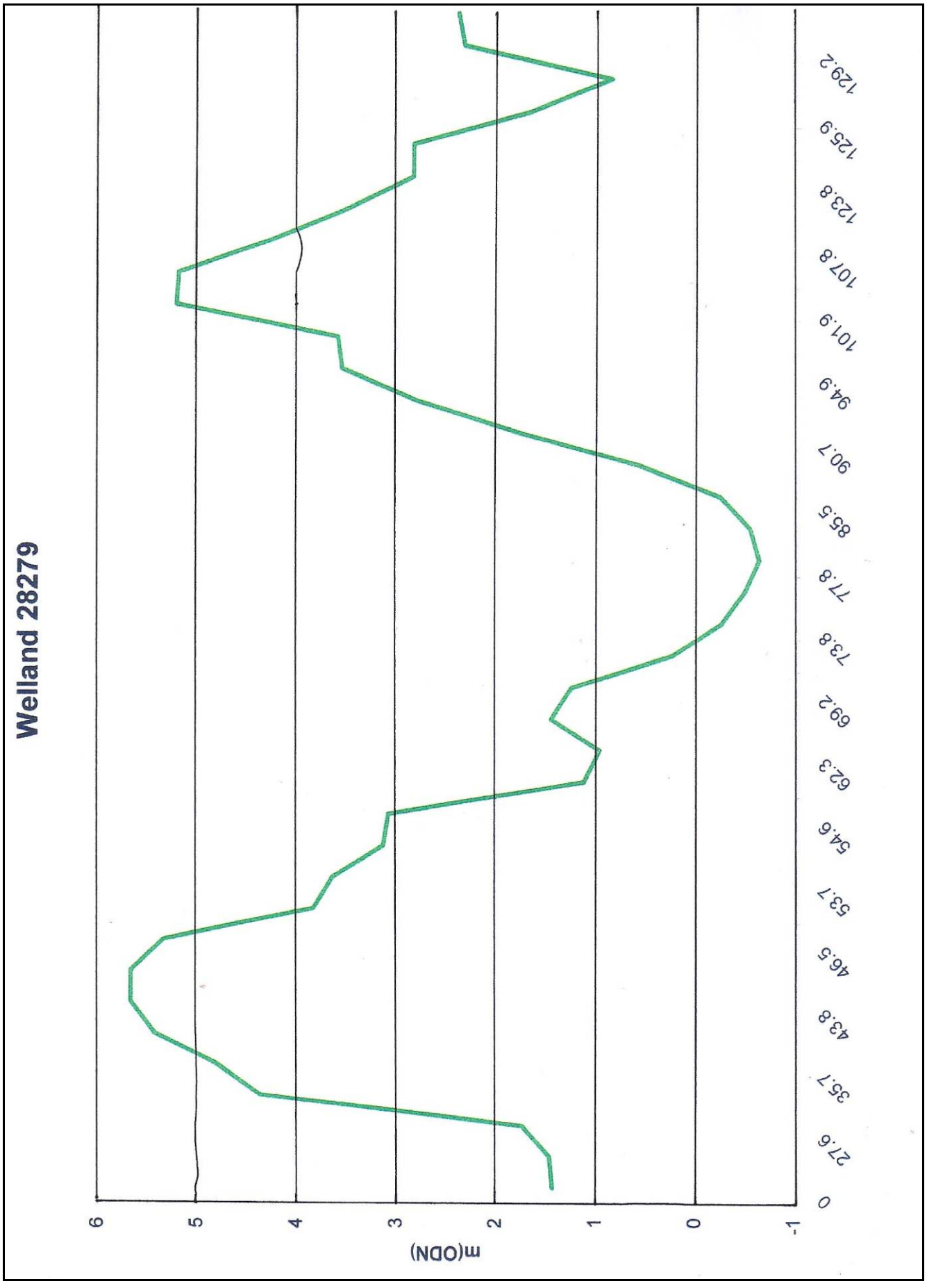
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

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MAP 4

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MAP 5


Welland 28279
m(ODN)
6
5
4
3
2
1
0
-1
0
27.6
35.7
43.8
46.5
53.7
54.6
62.3
69.2
73.8
77.8
85.5
90.7
94.9
101.9
107.8
123.8
125.9
129.2

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MAP 6

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N

0 10 20 30 40 50m

KEY

Roads

Footpaths

Housing

Woodland Burial Site

Woodland Burial Site

Cemetery

Allotments

Drain

Drain

Drain

Drain

Drain

Drain

Drain

Drain

Drain

SNOWDEN CLOSE

THORNEY ROAD

B1040

Rev.	By	Notes	Date
-	-	-	-

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Client: Crowland Parish Council

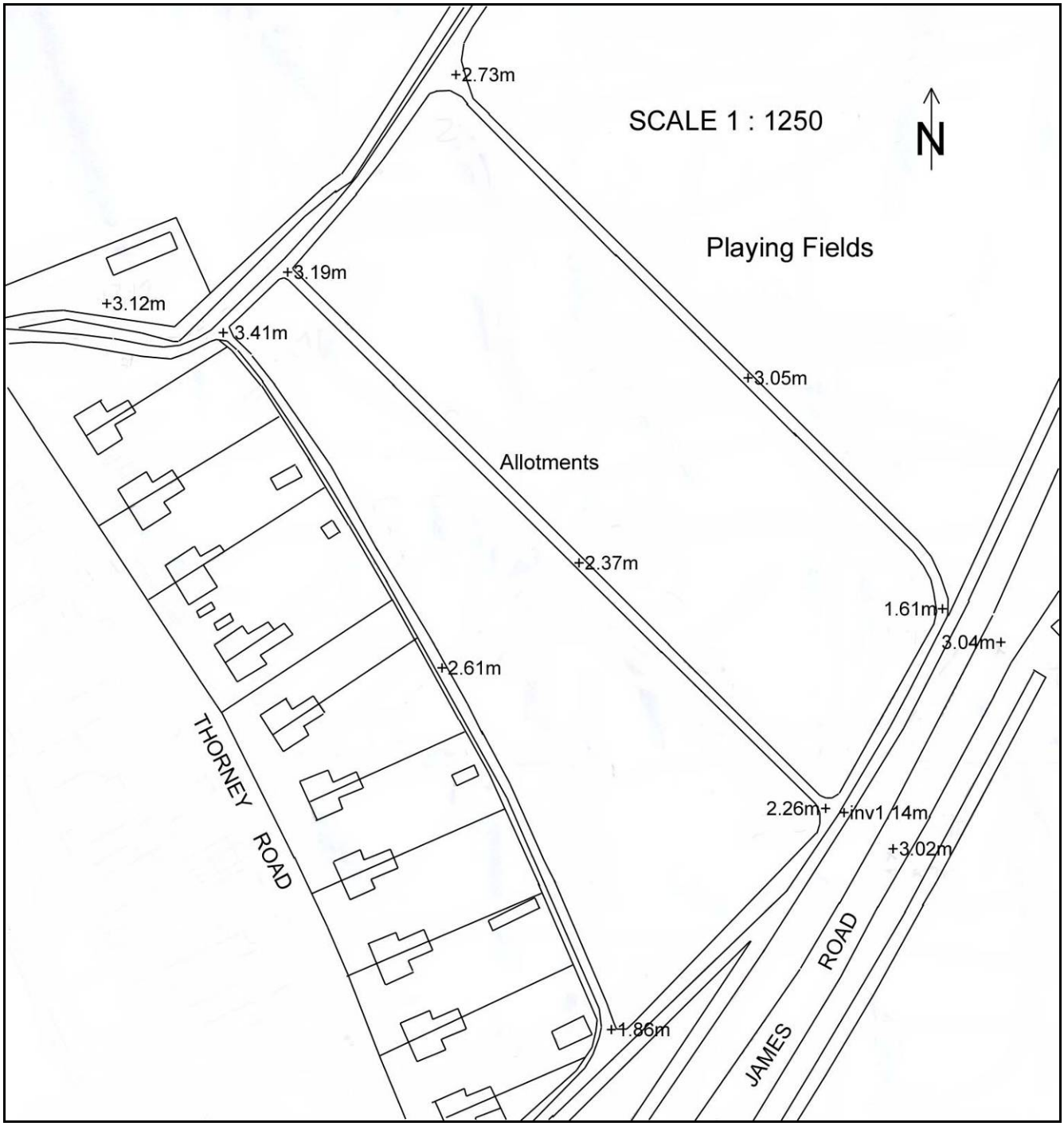
Project: Land off James Road, Crowland

Drawing title: Proposed housing, relocated allotments & new burial ground - Option 2

Drawing No.	Rev.	Drawn
1144-01-SP02		AB/JRB

Scale	Date	Checked
1:1000 @ A1	04-02-15	

All measurements should be checked against on site conditions and any discrepancies should be brought to the attention of the Robert Doughty Consultancy.



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PLAN 2