

# Goldhill Mill Hydroelectric Power Scheme

## Environmental Report

### Document Control

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01	October 2022	Adrian Ezard

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## Renewables First – Company

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## 1 Introduction

This document accompanies the water resources abstraction licence application and hydroelectric power scheme application for the proposed hydroelectric power (HEP) scheme located at Goldhill Mill, 3 Elm Lane, Golden Green, Tonbridge, Kent.

An overshot waterwheel system is proposed for installation just downstream of the weir on the site.

The maximum abstraction proposed for the scheme is 1.3 times  $Q_{\text{mean}}$  in line with Table B of 'Guidance for run-of-river hydropower development'. Key parameters that allow higher levels of abstraction and departure from table A are listed below with supporting information included in the subsequent sections of this report.

1. Not prevent Water Framework Directive objectives from being achieved (see the 'Water Framework Directive' section of 'Guidance for run-of-river hydropower development').
2. Maintain or improve fisheries, fish passage and fish migration (see the 'Fish passage and screening' section of 'Guidance for run-of-river hydropower development').
3. Not have unacceptable impacts (effects) on protected sites or species (see the 'Nature conservation and heritage' section of 'Guidance for run-of-river hydropower development').
4. Not have unacceptable impacts on the rights of other water users, including anglers.

A completed WR325 Environmental Site Audit Checklist is also attached for reference.

## 2 Site details

### 2.1 Site description

Figure 1 to 5 shows the current layout around the installation location. The main flow of the river is directed through the mill building. There is an adjacent sluice and spillway to allow excess water to flow



*Figure 1: view looking upstream toward the mill, proposed turbine location to the right of the building.*



*Figure 2: Proposed turbine location .*



*Figure 3: Looking downstream toward bypass sluice on the left (proposed intake location) and redundant mill wheel channel to the right.*



*Figure 4: Outfall from bypass sluice channel.*



*Figure 5: Small tributary joining the bypass sluice outfall channel.*



## 2.2 Hydrological data

The difference in water levels from upstream of the fall to the level downstream has been measured as 1.9 metres.

The nearest EA gauging station is on the Bourne River at Hadlow approximately 1.6 km upstream. The flow rates have been checked against a catchment model to provide a more accurate flow model for the site.

The increase in values of the modelled flows was found to be small enough in relation to the EA gauged value, so the EA figures have been used for the purposes of this report.

The catchment area of the gauging station was 50.3 km<sup>2</sup>, whereas the catchment area including the site was 50.8 km<sup>2</sup>.

Flow Exceedance %	Gross Flowrate m <sup>3</sup> /s
Q <sub>10</sub>	0.621
Q <sub>20</sub>	0.408
Q <sub>30</sub>	0.315
Q <sub>40</sub>	0.266
Q <sub>50</sub>	0.232
Q <sub>60</sub>	0.202
Q <sub>70</sub>	0.173
Q <sub>80</sub>	0.131
Q <sub>90</sub>	0.092
Q <sub>95</sub>	0.072
Q <sub>mean</sub> (Q <sub>25.7</sub> )	0.347
<b>Q<sub>95</sub>/Q<sub>mean</sub></b>	0.21

Table 1: Flow exceedance for the site.

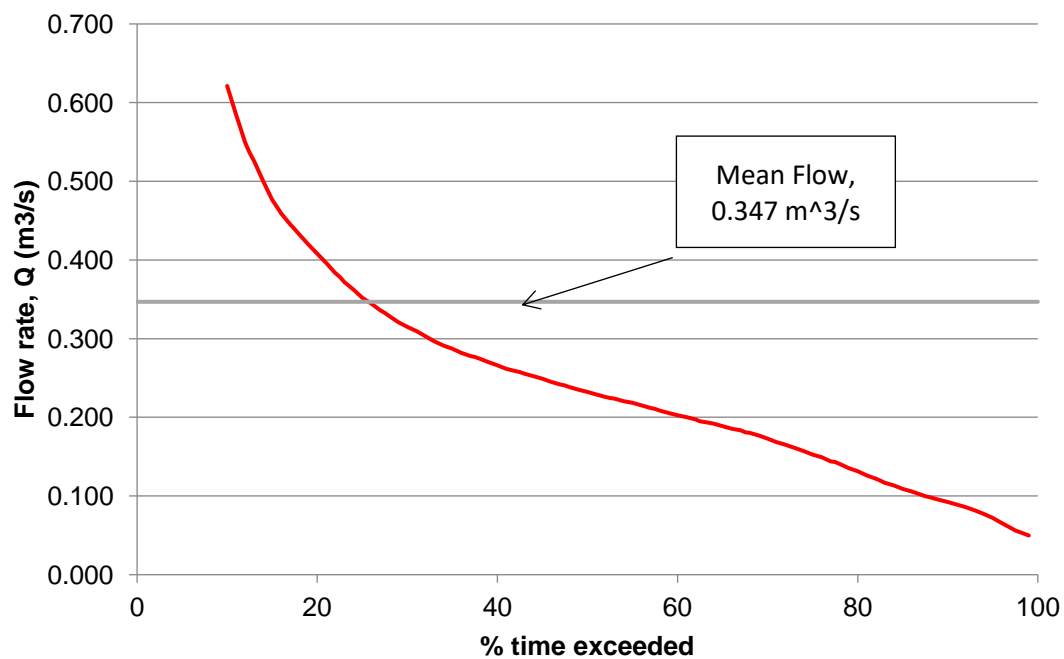


Figure 6: flow duration curve for the site.

### 3 Proposal

#### 3.1 Proposal summary

The HEP system consists of a single overshot waterwheel turbine installed adjacent to the mill building. The intake will be located at the existing bypass sluice. The outfall will be in the area immediately adjacent to the existing outfall through the mill. The scheme is expected to generate a peak electrical power output of 4.0 kW.

#### 3.2 Summary of hydrology information

It is proposed that the HEP scheme flow is 1.3 times  $Q_{\text{mean}}$  – 450 l/s. The hands-off-flow down the bypass channel is proposed to be  $Q_{95}$  - 72 l/s.

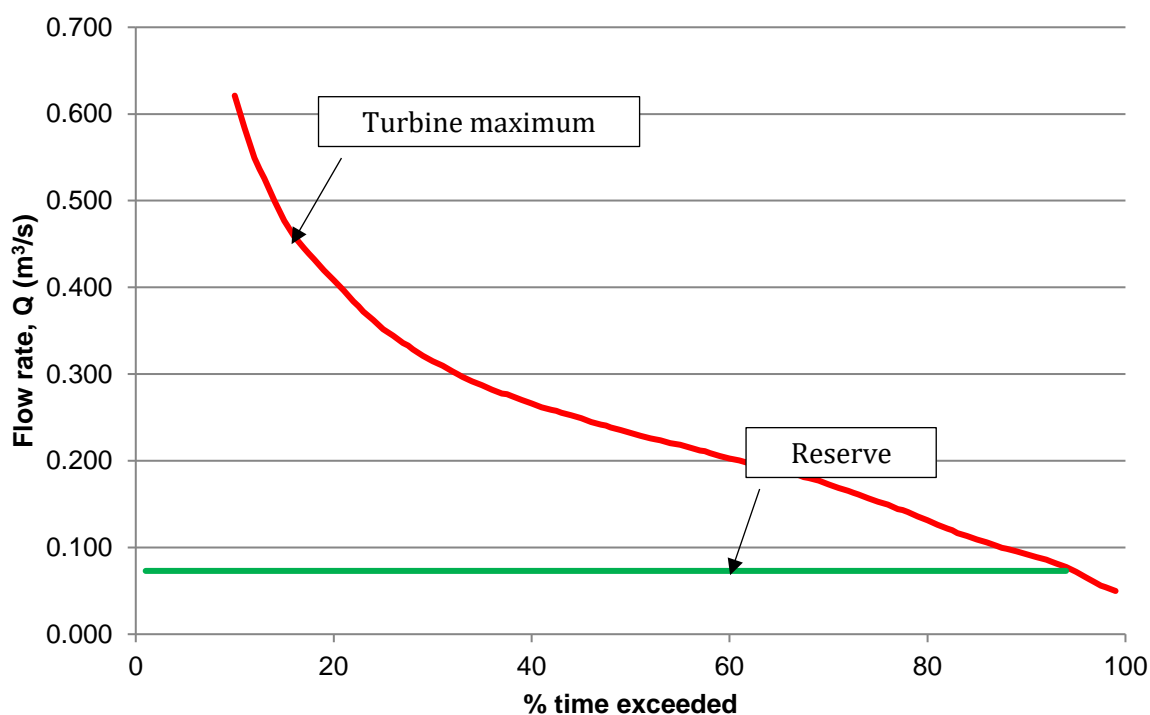


Figure 7: flow duration curve with turbine flow.

Table 2 outlines the key hydrological information for the proposed HEP system.

Turbine intake location	TQ 63632 48478
Outfall location	TQ 63639 48476
Depleted reach	0 m
Turbine type	1 no. overshot waterwheel
Waterwheel diameter	1.90 m
Waterwheel rated flow	0.450 m <sup>3</sup> /s
Hands-off-flow	0.072 m <sup>3</sup> /s
Rated system head	1.95 m
Maximum hourly abstraction	1,620 m <sup>3</sup>
Maximum daily abstraction	38,880 m <sup>3</sup>
Maximum annual abstraction	8,553,600 m <sup>3</sup>

*Table 2: key hydrological information for the HEP system.*

### 3.3 Layout

Refer to site plan drawing (GOLDH\_P01) and general arrangement (GOLDH\_P02).

### 3.4 Operation

Flow will enter the headrace near the side sluice via a trash screen and travel along a channel to the waterwheel. At the end of headrace there is a sluice which controls the flow of water into the waterwheel. The flow is controlled to achieve an upstream water level in the head race. The flow is also limited by the maximum power generated by the waterwheel. Water is discharged at the bottom of the waterwheel back into the downstream millpond alongside the current discharge location through the mill.

Although the headrace will be notched into the existing bank, this will not raise the upstream water levels, as any excess flow will be able to spill over the upstream spillway as it does at the moment, during periods of excessively high flow. When the wheel is not in operation the water will flow through the existing channel through the mill.

## 4 Ecology

### 4.1 Designations

A desktop review of ecology designations was undertaken using the MAGiC online database to an area extending to 150m from the site.

The site is not within a SSSI, SAC, RAMSAR, SPA, NNR, LNR, NP or AONB designation.

The mill is a listed building.

The site is approximately 22km (along water courses) from the tidal limit on the River Medway, so would fall under EU eel regulations. These will require the installation of an eel pass as part of the scheme.

### 4.2 Fish and aquatic habitats

An overshot waterwheel is to be used. This technology poses little risk to fish, so only a 100mm trash screen on the intake will be used.

The Environment Agency Ecology & Fish Data Explorer has been used to carry out a desk study of the fish species that could be impacted by the scheme. The Middle Medway catchment was checked for the area covering the River Bourne. The only data found related to Golden Green site ID 17191 on the River Medway approx. 1km to the south. As there appear to be no downstream obstructions on the River Bourne to its confluence with the River Medway approx. 3km to the east, it has been assumed the species found would be similar at both locations.

	SITE_ID	SITE_NAME	SURVEY_ID	EVENT_DATE	EVENT_DATE_YEAR	SURVEY_RANKED_NGR	FISHED_AREA	SURVEY_STRATEGY	SPECIES_NAME	LATIN_NAME	RUN1
1	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Bleak	Alburnus alburnus	11
2	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Chub	Leuciscus cephalus	4
3	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Common bream	Abramis brama	1
4	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Perch	Perca fluviatilis	1
5	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Pike	Esox lucius	2
6	17191	Golden Green	161425	2022-09-06	2022	TQ6428847336	2640	SINGLE CATCH SAMPLE	Roach	Rutilus rutilus	24

No upstream fish data was found. No other species data were identified within the catchment upstream of Goldhill Mill. Downstream species and comments from the pre-app lodged for the scheme are below:

NOTE: the proposed scheme no longer has any depleted reach. Original response comments in relation to this have been omitted.

## 2.2 Fisheries and fish passage

Protected Species	European Eel	1.1km d/s of abstraction
	European Eel migratory route	1.1km d/s of abstraction 15km from tidal limit of the River Medway

Our records indicate that the site is not a Salmonid migratory route, therefore the scheme will not require a formal fish pass to fulfil requirements under the Salmon and Freshwater Fisheries Act 1975.

## 2.3 Protected sites and species

### SAC/SSSI site

The proposal lies 7km downstream of the Bourne Alder Carr Site of Special Scientific Interest (SSSI). This proposal should not have any pathway to directly or indirectly impact the designated features for this SSSI. Therefore, it is unlikely that Natural England will need to be consulted.

### Biodiversity

The following protected species and habitats are in the vicinity of the proposal.

Protected Species	Tubular Water-dropwort	1.1km d/s of abstraction
	Water vole	Possibly at site
Protected Habitats	Deciduous woodland	At site

We believe that there is no pathway for impacts on the Tubular Water-dropwort and Deciduous woodlands therefore no further investigations will be required for these features.

The location could be suitable for water vole shelter and foraging. If there is found to be a risk to water vole habitat due to an increase in exposure of habitats in the depleted reach or increase in flooding in the northern channel, then a water vole habitat survey would be advisable. The potential impact is where the water levels may fluctuate, which will depend on the control structures and any water level management regime. A survey should be carried out at suitable time of the year, by a competent person – the local Wildlife Trust might be able to offer assistance or service. This survey could also be submitted as part of your Planning and/or Flood Risk Activity Permit (FRAP) applications.

*Table 3: data supplied by the EA.*

## 5 Geomorphology

When the HEP scheme is operating, it will take the flow around the mill building, rather than through it. The outfall from the HEP will empty into the same location as the current flow through the building. There will be no change to the current flow distribution or regime.

The flows and sediment transfers within the River Bourne will be unchanged.

## 6 Water Framework Directive

The WFD objectives for the River Bourne (shown in Table 4 have been assessed)

<https://environment.data.gov.uk/catchment-planning/WaterBody/GB106040018210>

The proposed installation will have no or effect on these objectives.

### Objectives

Classification Item	Status	Year	Reasons
<b>Ecological</b>	<b>Good</b>	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
<b>Biological quality elements</b>	<b>Good</b>	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Fish	<b>Good</b>	2021	Disproportionately expensive: Disproportionate burdens
Invertebrates	<b>Good</b>	2015	
Macrophytes and Phytobenthos Combined	<b>Good</b>	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
<b>Physico-chemical quality elements</b>	<b>Good</b>	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Ammonia (Phys-Chem)	<b>Good</b>	2015	
Dissolved oxygen	<b>Good</b>	2015	
Phosphate	<b>Good</b>	2027 - Low confidence	Disproportionately expensive: Disproportionate burdens
Temperature	<b>Good</b>	2015	
pH	<b>Good</b>	2015	
<b>Hydromorphological Supporting Elements</b>	<b>Supports good</b>	2015	
Hydrological Regime	<b>Supports good</b>	2015	
<b>Supporting elements (Surface Water)</b>	<b>Not assessed</b>	2015	
<b>Specific pollutants</b>	<b>High</b>	2015	
Copper	<b>High</b>	2015	
Iron	<b>High</b>	2015	
Manganese	<b>High</b>	2015	
Triclosan	<b>High</b>	2015	
Zinc	<b>High</b>	2015	

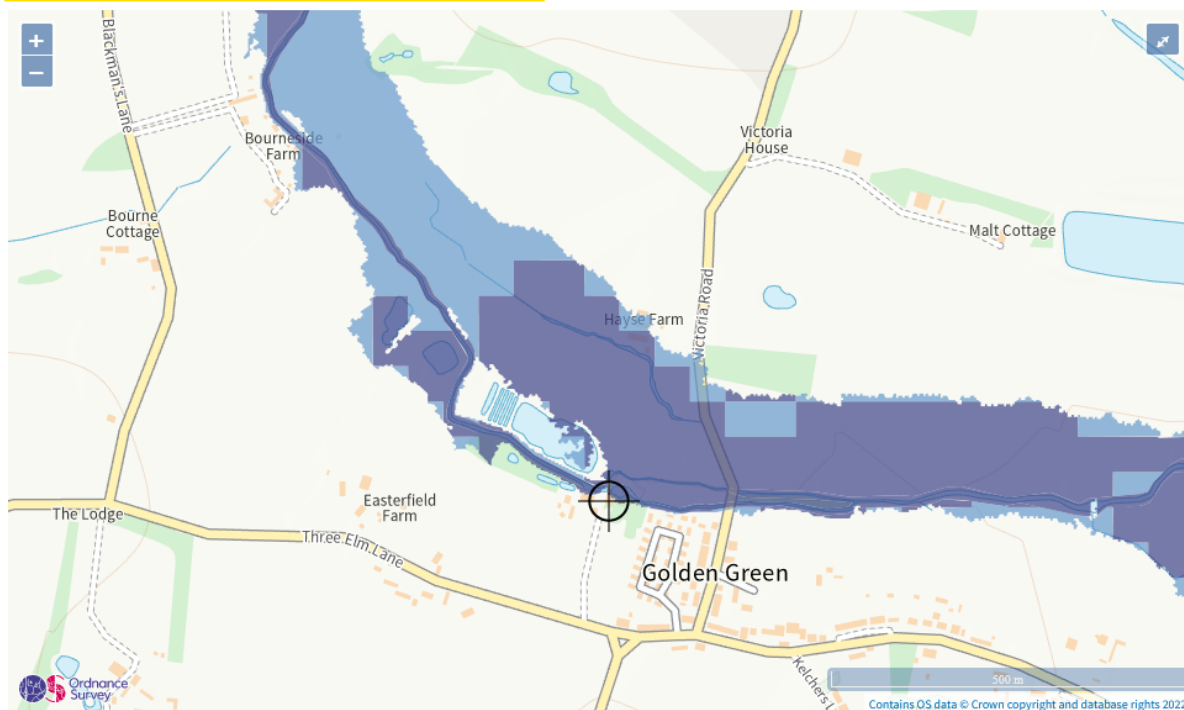
<b>Chemical</b>	<b>Good</b>	2063	Natural conditions: Chemical status recovery time; Technically infeasible: No known technical solution is available
<b>Priority hazardous substances</b>	<b>Good</b>	2063	Natural conditions: Chemical status recovery time; Technically infeasible: No known technical solution is available
Benzo(a)pyrene	<b>Good</b>	2015	
Benzo(b)fluoranthene	<b>Good</b>	2015	
Benzo(g-h-i)perylene	<b>Good</b>	2033	Technically infeasible: No known technical solution is available
Benzo(k)fluoranthene	<b>Good</b>	2015	
Cadmium and Its Compounds	<b>Good</b>	2015	
Di(2-ethylhexyl)phthalate (Priority hazardous)	<b>Good</b>	2015	
Dioxins and dioxin-like compounds	<b>Good</b>	2015	
Heptachlor and cis-Heptachlor epoxide	<b>Good</b>	2015	
Hexabromocyclododecane (HBCDD)	<b>Good</b>	2015	
Hexachlorobenzene	<b>Good</b>	2015	
Hexachlorobutadiene	<b>Good</b>	2015	
Mercury and Its Compounds	<b>Good</b>	2040	Natural conditions: Chemical status recovery time
Nonylphenol	<b>Good</b>	2015	
Perfluorooctane sulphonate (PFOS)	<b>Good</b>	2015	
Polybrominated diphenyl ethers (PBDE)	<b>Good</b>	2063	Natural conditions: Chemical status recovery time
<b>Priority substances</b>	<b>Good</b>	2015	
Cypermethrin (Priority)	<b>Good</b>	2015	
Fluoranthene	<b>Good</b>	2015	
Lead and Its Compounds	<b>Good</b>	2015	
Nickel and Its Compounds	<b>Good</b>	2015	
<b>Other Pollutants</b>	<b>Does not require assessment</b>	2015	

Table 4: WFD objectives for the River Bourne



## 7 Flood Risk

Flood risk from surface water runoff is medium. The EA flood map shows the main surface water risk to the north of the site.



Extent of flooding from rivers or the sea

● High ● Medium ● Low ● Very low ⊕ Location you selected



Extent of flooding from surface water

● High ● Medium ● Low ○ Very low ⊕ Location you selected

Flood risk from the River Bourne is high but there would not be any change to this from the proposed scheme.

All control equipment will be located in an existing building on site above relevant flood levels.

All of the equipment located within the river will be flood resilient with the exception of the generator. It is not practical to locate the generator above the 1% AEP with climate change allowance level of 85%. However, it is possible to locate it above the 1% AEP. If the flood level were to exceed this, the generator would be replaced as it is a low cost item.

**Flood flow based on  $Q_{med,CDS}$  region #7 in the Flood Studies Report (FSSR 14).**

<b>Flood Return Period</b>	<b>Growth Factor</b>	<b>Flow (<math>m^3/s</math>)</b>
$Q_{med}$ (average bi-annual)	1.00	5.4
1 year flood	0.85	4.6
30-year flood	2.30	12.5
100-year flood	3.19	17.3
200-year flood	3.74	20.3

1.1.1 The flows noted above lead to flooding on the site. However, the majority of the flood plain is in the fields to the north of the watercourse with little additional depth experienced to the Mill footprint. The significant Kent flood of December 2013 led to water levels up to the edge of the courtyard but not in the house (note from owner). We have not been informed of levels experienced at the Mill during the floods of 2000. However, the environment Agency Historic Flood Outline maps shows that the courtyard is thought to have been above flood levels during the period of their records (1946 to present), see image below.

**Figure: EA historic flood outline map.**



Recorded Flood Outline

1.1.2 Flows seen on the Medway in 2013 were amongst the highest on record in some cases larger than the previous record in 1968. Very wet antecedent conditions combined with

the intense storm of 23 December produced flows on the middle Medway with return period of 68-80 years<sup>1</sup>. (JBA Consulting).

- 1.1.3 The design will preserve the status quo by ensuring there is no reduction to carrying capacity past the Mill. The cross-sectional area and head differential will be preserved on the two sluice gates near the proposed water wheel that provide some degree of flood level relief. The ground levels will not be altered in areas that act as flood plains. Hydroelectric equipment will be designed to be resilient to expected flood level.

## 8 Human impacts

### 8.1 Navigation

The watercourse is not used for navigation, so the scheme will have no impact.

### 8.2 Recreational use

The site is privately owned and any flows or water levels downstream or upstream will be unchanged. Angling will therefore be unaffected by the proposal. There is no public right of way immediately through the site.

### 8.3 Heritage

There are no scheduled monuments, world heritage sites or listed buildings that will be affected by the proposed scheme. Goldhill Mill is listed, but the scheme is location outside of the curtilage.

### 8.4 Landscape and visual

There is no proposal to landscape the area around the proposed installation as the majority of the installed equipment is within the river below the bank level.

## 9 Conclusions

This proposed HEP scheme meets the necessary requirements for an abstraction licence.

An assessment has been completed to show that there will be no significant adverse impact on ecology, geomorphology and human uses of the watercourse and any impacts can be mitigated effectively.

The scheme is not considered to impact on any Water Framework Directive objectives for the impacted water body.

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<sup>1</sup> MCR5376 Leigh Flood Storage Area Review. HR Wallingford (JBA Consulting), 2015.



## Title register for:

**Goldhill Mill, Three Elm Lane, Golden Green, Tonbridge, TN11 0BA  
(Freehold)**

**Title number: K587257**

Accessed on 21 October 2022 at 11:17:37

This information can change if we receive an application. This service can not tell you if HM Land Registry are dealing with an application.



**This is not an official copy. It does not take into account if there's a pending application with HM Land Registry. If you need to prove property ownership, for example, for a court case, you'll need to order an official copy of the register.**

## Register summary

<b>Title number</b>	K587257
<b>Registered owners</b>	Timothy Bahram Neville Farazmand  Goldhill Mill, Three Elm Lane, Golden Green, Tonbridge TN11 0BA  Jacqueline Edwards  Goldhill Mill, Three Elm Lane, Golden Green, Tonbridge TN11 0BA
<b>Last sold for</b>	£3,000,000 on 28 July 2011

## A: Property Register

This register describes the land and estates comprised in this title.

Entry number	Entry date
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1	1985-04-24	KENT : TONBRIDGE AND MALLING  The Freehold land shown edged with red on the plan of the above Title filed at the Registry and being Goldhill Mill, Three Elm Lane, Golden Green, Tonbridge (TN11 0BA).
2	1993-06-11	The land edged and numbered in green on the title plan has been removed from this title and registered under the title number or numbers shown in green on the said plan.

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## B: Proprietorship Register

This register specifies the class of title and identifies the owner. It contains any entries that affect the right of disposal.

**Class of Title:** Title absolute

Entry number	Entry date
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1	2011-08-26	PROPRIETOR: TIMOTHY BAHRAM NEVILLE FARAZMAND and JACQUELINE EDWARDS of Goldhill Mill, Three Elm Lane, Golden Green, Tonbridge TN11 0BA.
2	2011-08-26	The price stated to have been paid on 28 July 2011 was £3,000,000.

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## C: Charges Register

This register contains any charges and other matters that affect the land.

**Class of Title:** Title absolute

Entry number	Entry date
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1	1993-06-11	<p>The land is subject to the following rights granted by a Transfer of the land edged and numbered K727601 in green on the filed plan dated 19 May 1993 made between (1) John Vernon Cole and Shirley Margaret Cole (Transferors) and (2) Jonathan Paul Kellett and Jane Louise Kellett (Transferees):-</p> <p>"The Transferors hereby grant to the Transferees and their successors in title owners and occupiers of the land hereby transferred the right and liberty in fee simple of access onto the remaining land in title number K587257 at all reasonable times for the purpose of inspection, maintenance, repair and renewal (as the case may be) of the fence and hedge along the boundaries marked A-B and B-C on the plan annexed hereto."</p> <p>NOTE: The points marked A-B and B-C referred to affect the Eastern and Northern boundaries of the land transferred.</p>
2	2015-08-13	REGISTERED CHARGE dated 10 August 2015.
3	2015-08-13	Proprietor: NATIONWIDE BUILDING SOCIETY of Nationwide House, Pipers Way, Swindon L SN38 1NW.
4	2015-08-13	The proprietor of the Charge dated 10 August 2015 referred to above is under an obligation to make further advances. These advances will have priority to the extent afforded by section 49(3) Land Registration Act 2002.