



Democratic Services

Location: Phase II

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**To: COUNCILLOR JONATHAN BIANCO
CABINET MEMBER FOR PROPERTY, HIGHWAYS
AND TRANSPORT**

c.c. All Councillors

c.c. All Members of the Property, Highways and
Transport Select Committee

c.c. Pam Siva-Kumar, Highways

c.c. Perry Scott, Corporate Director of Place

Date: 21 July 2022

Non-Key Decision request

Form D

Ruislip Lido On-site Flood Plan

Dear Cabinet Member

Attached is a report requesting that a decision be made by you as an individual Cabinet Member. Democratic Services confirm that this is not a key decision, as such, the Local Authorities (Executive Arrangements) (Meetings and Access to Information) (England) Regulations 2012 notice period does not apply.

You should take a decision **on or after Friday 29 July 2022** in order to meet Constitutional requirements about publication of decisions that are to be made. You may wish to discuss the report with the Corporate Director before it is made. Please indicate your decision on the duplicate memo supplied, and return it to me when you have made your decision. I will then arrange for the formal notice of decision to be published.

Neil Fraser
Democratic Services Officer

Title of Report: Ruislip Lido On-site Flood Plan

Decision made:

Reasons for your decision: (e.g. as stated in report)

Alternatives considered and rejected: (e.g. as stated in report)

SignedDate.....
Cabinet Member for Property, Highways and Transport

Ruislip Lido On-site Flood Plan

Cabinet Member(s)	Councillor Jonathan Bianco
Cabinet Portfolio(s)	Cabinet Member for Property, Highways and Transport
Officer Contact(s)	Pam Siva-Kumar, Highways
Papers with report	Appendix – Ruislip Lido On-site Flood Plan 12AA(3) Certificate_Ruislip Lido Feb 22 12AA(4) Direction_Ruislip Lido Feb 22

HEADLINES

Summary	To present the Cabinet Member with the Ruislip Lido On-site Flood Plan as required under the sections 12A (1) and (2) of the Reservoir Act Countryside and in response to The Secretary of State's directive in 2021 to prepare a flood plan in relation to large, raised reservoirs for approval and adoption by the Council.
Putting our Residents First	This report supports the following Council objectives of: <i>Our People; Our Natural Environment; Our Built Environment</i>
Financial Cost	None at this stage.
Relevant Select Committee	Properties, Highways and Transport Select Committee.
Current Electoral Ward(s)	Ruislip

RECOMMENDATIONS

That the Cabinet Member for Property, Highways and Transport approves the Ruislip Lido On-site Flood Plan for adoption by the Council as required under sections 12A (1) and (2) of the Reservoir Act, in conjunction with the Corporate / Executive Director.

Reasons for recommendation

Under sections 12A (1) and (2) of the Reservoir Act, the London Borough of Hillingdon is required to prepare a flood plan for the Ruislip Lido in response to The Secretary of State's directive in 2021 to prepare a flood plan in relation to large, raised reservoirs. As there is no Cabinet meeting in late July or August 2022, the plan has been prepared for compliance and submitted for Cabinet Member approval.

Alternative options considered / risk management

It is a legal requirement for large, raised reservoirs, such as Ruislip Lido, to have an approved onsite flood plan. The Council would be at risk if this plan is not in place.

Democratic compliance / previous authority

The Secretary of State's directive in 2021 stated that a flood plan be prepared; this plan has been prepared in accordance with the guidance and therefore must be approved by the Cabinet.

Select Committee comments

None at this stage.

SUPPORTING INFORMATION

The Secretary of State directed the Council in 2021 to prepare a flood plan for the Ruislip Lido under the Reservoir Act 1975. The Council is required by law to prepare an on-site emergency flood plan outlining the action plan to respond to an incident, as well as test, review, and revise the plan.

The flood plan will assist in responding effectively to an emergency situation by deploying the necessary expertise at the right time to prevent, control, and mitigate a reservoir flood, minimise or prevent structural failure, divert uncontrolled release of water, and stabilise the structure.

The developed flood plan is an on-site flood plan and flooding outside will be covered in the London Borough of Hillingdon overall flood plan prepared by the Flood and Water Management Team.

Financial Implications

There are no direct financial implications arising as a consequence of this report. The plan is required by law for compliance purposes and its provisions are consistent with the existing level of budgetary resources (funding the highways emergency standby team and reservoir maintenance/testing costs) managed by the Highways Service.

RESIDENT BENEFIT & CONSULTATION

The benefit or impact upon Hillingdon residents, service users and communities?

The flood plan will assist in responding effectively to an emergency situation by deploying the necessary expertise at the appropriate time to prevent, control, and mitigate a reservoir flood, minimise or prevent structural failure, divert uncontrolled water release, and stabilise the structure.

Consultation carried out or required

The plan was developed in consultation with the Flood and Water Management Team and the London Borough of Hillingdon Emergency Planning Team.

CORPORATE CONSIDERATIONS

Corporate Finance

Corporate Finance has reviewed this report and confirms that there are no direct financial implications associated with the recommendations within this report.

Legal

Legal Services confirm that the legal implications are included in the body of the report.

BACKGROUND PAPERS

Appendix

Ruislip Lido Flood Plan (122604-BVL-ZO-RL-RP-00002)

Testing of Flood Plan 12 AA(4)

Confirmation of compliance 12AA(3)

Ruislip Lido On-site Plan



Ruislip Lido

On-site Plan

February 2022
Revision 2

Commissioned (and revised) by:

London Borough of Hillingdon
Civic Centre, Uxbridge
Middlesex UB8

Prepared by:

Binnies UK
60 High Street
Redhill
Surrey
RH1 1SH

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Change log for plan:

Rev	Date	Details of nature of change	By	Ckd	Approved		Accepted by EA
					Owner	Panel Eng	
1	24 August 2021	Draft	HR	JH			
2	Feb 2022	Updated for Certification	HR	JH	PS-K		

Management Information

Person responsible for preparing the plan	On behalf of Pam Siva-Kumar, LBH 01895 250441 psiva-kumar@hillington.gov.uk
Name of Engineer certifying the plan	John Hopkins, Binnies UK
Date of plan	TBC
Who to contact about the plan	Pam Siva-Kumar, LBH 01895 250441 psiva-kumar@hillington.gov.uk
Date for plan to be reviewed	February 2023
Date(s) for testing the plan	Before February 2027
How the plan will be tested	Seminar/incident simulation exercise

1. OBJECTIVES, SCOPE AND ADMINISTRATION OF THE PLAN**1.1 Objectives**

This plan forms part of the risk management of Ruislip Lido, comprising the measures that would be taken on site in the event of a serious problem with the structural stability of the dam. It also satisfies the requirements for Element II of a Flood Plan under Section 12A of the Reservoirs Act 1975 (added through Section 77 of the Water Act 2003).

1.2 Scope

This plan covers Ruislip Lido, owned by the London Borough of Hillingdon (LBH) who are also the Undertaker.

The principal characteristics of the reservoir are summarised in Table 1 and are shown in the figures in Appendix A.

Table 1: Details of Ruislip Lido

Capacity at spillway crest	400,000 m ³
Location & National Grid Reference	Reservoir Road, Ruislip. TQ 088 890
Consequence Class	A1
Frequency of surveillance visits	Weekly visits by LBH
Personnel with a knowledge of the dam's behaviour	
Undertaker's staff	See Table 2
Other	Supervising Engineer (John Hopkins)

1. Shown on Ordnance Survey Landranger (1:50,000 scale) sheet 176 and Explorer (1:25,000 scale) sheet 172

1.3 Administration of the plan

The status of this document is as shown in the document history record, and it is issued to those shown in Table 2. It has been prepared by Binnies UK and with input from the London Borough of Hillingdon.

Table 2: Distribution list for copies of this document and personnel who would be involved in managing any emergency on site

Position	Name	Postal Address	Phone		
			Office	Out of hours	Mobile
Internal – London Borough of Hillingdon					
Reservoir Safety Manager (Structures and Watercourses Manager)	Pam Siva-Kumar	London Borough of Hillingdon 2E/05 Civic Centre, High Street Uxbridge UB8 1UW	psiva-kumar@hillingdon.gov.uk Tel: 01895 250441		
Emergency Planning Officer	Pam Siva-Kumar	London Borough of Hillingdon 2E/05 Civic Centre, High Street Uxbridge UB8 1UW	psiva-kumar@hillingdon.gov.uk Tel: 01895 250441		
Interim Head of Highways	Poonam Pathak	London Borough of Hillingdon 2E/05 Civic Centre, High Street Uxbridge UB8 1UW	ppathak@hillingdon.gov.uk Tel: 01895 277557		
Network Operations Manager	Wayne Greenshields	London Borough of Hillingdon 2E/05 Civic Centre, High Street Uxbridge UB8 1UW	wgreenshield@hillingdon.gov.uk Tel: 01895 250564		
Reactive Maintenance Supervisor	Martin Kenealy	Harlington Road Depot 128 Harlington Rd, Uxbridge UB8 3EY	mkenealy@hillingdon.gov.uk Tel: 01895 277552		
Rapid Response Officer	Rapid Response/Standby Flood Officer (Rota basis)				

Borough Emergency Control Centre Manager		London Borough of Hillingdon			
Emergency Response Officer		London Borough of Hillingdon			
Borough Emergency Control Centre Manager		London Borough of Hillingdon			
Emergency Response Officer		London Borough of Hillingdon			
Supervising Engineer	John Hopkins	Binnies UK 60 High Street Redhill RH1 1SH			
Reservoir Inspecting Engineer (Last S10) (Now retired)	John Ackers				
Alternative AR Panel Engineer	Dominic Molyneux				
	Rachel Pether				
Enforcement Authority – Environment Agency					
a) Technical Manager - Reservoir Safety		Environment Agency Reservoir Safety Manley House Kestrel Way Sowton Industrial Estate Exeter EX2 7LQ			-
b) Regional Office - Operations Manager			(EA switchboard)		-

2. MANAGEMENT OF EMERGENCY BY UNDERTAKER

2.1 Undertaker's procedures and authorised personnel

London Borough of Hillingdon's Emergency Procedures apply. This includes:

- Standard company procedures for managing emergencies;
- Lists of staff positions authorised to take action and manage the emergency;
- Contact lists for individuals filling each position; and
- Escalation sequence for incident, related to severity.
- Strategic multi-agency Reservoir Plan

London Borough of Hillingdon employ a Supervising Engineer (John Hopkins) supplied by Binnies UK, who visits the reservoir twice a year. Binnies UK has other All Reservoir Panel Engineers whose contact details are given in Appendix F. An All Reservoirs Panel Engineer will be appointed by London Borough of Hillingdon in an emergency to come to site and supervise the situation.

Any incident would be escalated as shown in Table 3. The responsibility for implementing each stage and where appropriate escalating to the next stage lies with the London Borough of Hillingdon staff listed in Table 2. Initially responsibility would be with the first of these to visit the site; passing to the Reservoir Safety Manager when they arrive on site.

Table 3: Stages in escalation of incident management

Stage	Title	Activity
1	Preliminary assessment	London Borough of Hillingdon representative visits site, determines whether a serious incident
2	Situation assessment	a) A panel engineer (normally the Supervising Engineer) visits site b) Declare serious incident c) Set up incident control centre d) Panel AR Engineer appointed and comes to site.
3	On-site measures	Initiate on-site measures
4	External notification	Notify Local Authority Emergency Planning Officers of serious structural problem with dam
5	Off Site Plan	If at any moment there is a potential for a dam breach the immediate actions of the off site plan must be activated.

Table 4: On-Site Action and Trigger Levels

Stage	Status	Details of Trigger(s)	Undertaker's Actions	Local Responders Actions
STANDBY (dam breach possible)	ALERT	Earthquake/landslip affects local area. Movement in dam crest / slope / toe observed. Uncontrolled release of water, spillways blocked, downstream culvert blocked. Exceptional rainfall event, either forecast or occurring. Advice from Supervising / Inspecting Engineer.	LBH contact Supervising and/or Inspecting Engineer and arrange immediate visit, if required. LBH acting controller to be kept informed of the situation.	LBH acting controller may contact all relevant partners to place on standby. Increase frequency of readings and surveillance.
	ADVISORY	A structural problem in the dam has been detected or reported to the undertaker(s). A precautionary drawdown is to be carried out to reduce the likelihood of failure to an acceptable level.	Undertaker(s) to contact LBH Structures.	Organise emergency drawdown pumps. Arrange for road closure.

Table 5: Off-Site Action and Trigger Levels

Stage	Status	Details of Trigger(s)	Undertaker's Actions	Local Responders Actions
IMPLEMENTATION (dam breach imminent – dam has failed))	ALARM	An emergency drawdown is required to avert failure of dam structure.	LBH attends scene and provides updates to local responders and Supervising / Inspecting Engineer.	Acting Controller activates and implements Off-site Plan in conjunction with partners and undertakes all necessary mitigating actions. Acting Controller implements all relevant multi-agency command and control arrangements, in accordance with the ERF Multi Agency Reservoir Plan, with participation of Duty Officer and relevant engineers.
	IMMINENT FAILURE	Control of the reservoir has been lost and failure is inevitable.		
	FAILED	The dam has failed and large uncontrolled release of water has occurred.		
STAND-DOWN (flood waters subsided or return to properties permitted)	POST-STANDBY	Serious problem averted	None	'All clear given'. Review plan in light of response and any ensuing recommendations.
	POST IMPLEMENTATION	Water flows from the reservoir are minimal and efforts are focussed on consequences in zones of devastation.	None	Focus on on-going response and recovery operations affecting the needs of local populations, buildings, critical infrastructure etc.

Table 6: On-Site Roles and Responsibilities

Role	Typically Undertaken By	Responsibilities Include
Duty Officer	Structures and Watercourse Manager Highways Manager Delivery Manager Out of Hours Call Out Engineer	Will attend site in an emergency and implement emergency procedures as necessary, managing other Council emergency on site staff. Will liaise with Acting Controller as required
Acting Controller	Lead Emergency Planning and Resilience Consultant	No actual on-site role but will manage any emergency remotely, liaising between Council Duty Officer, Council on-site emergency staff, the Environment Agency and emergency services as necessary. Major problems and incidents will be reported to the Supervising Engineer who will liaise with the Inspecting Engineer if necessary.

The London Borough of Hillingdon Borough Emergency Control Room (BECC) would be managed by the Incident Controller. They will be responsible for

- a) Contacting the designated appropriate personnel to provide the frontline team;
- b) Facilitating implementation of on-site measures; and
- c) Any other actions requested.

London Borough of Hillingdon communications manager will be designated as the Press Officer at the start of the incident. All questions posed by the media shall be directed to this Press Officer. No-one else from London Borough of Hillingdon, or the Supervising / Inspecting Engineer, shall provide information direct to the media unless specifically requested to by the Press Officer.

2.2 External communications

External notification of an incident will be made once it has reached Advisory level, or greater, as defined in Table 4.4 of the draft *Engineering Guide to Emergency Planning for UK Reservoirs* (released by Defra in June 2006). This will be the Duty Manager, after Director level authorisation. Notification will be to the Local Resilience Forum and use the form in Element III of the Flood Plan. Where a Director is not available then the Duty Manager shall issue the external notification, to avoid any delay in off-site actions.

2.3 Checklist for those attending emergency

The individual in charge at the dam site should arrange to take, or to have delivered to site, the information listed in Table 7. Clearly the priority should be to get to the dam and arrange for any missing items to be delivered to site from elsewhere.

Table 7: Checklist of information and ancillary equipment required on site

		Available from
1	Mobile phone (and charger)	Use personal
2	Copy of this plan	Hard copy – files in London Borough of Hillingdon office control room, also copy held by supervising engineer
3	Copy of drawings/reservoir records	
4	Confined space equipment	Not required to operate control valves
5	Food & water	Emergency Management Command Structure to organise out of hours

3. DESCRIPTION OF THE RESERVOIR AND RETAINING DAM

3.1 Situation

Ruislip Lido was constructed in about 1810 as a feeder for the Grand Union Canal. It is now used primarily as an amenity and for recreation. It also functions as a flood control facility and, for this purpose, the water level has since the early 1990's been kept to about 0.65m to 1m below the sill level of the auxiliary spillway.

The reservoir is retained by an earth embankment dam. It is circa 6.7m high, 200m long with a surface area of 144,000 m² and a capacity of approx. 300,000m³. The reservoir has a maximum depth of about 6m and a top water area of 144,000m². The reservoir is operated to provide flood alleviation. Water level is normally managed to a target retention level of 49.5m OD. This is 1m below top water level. The reservoir is very rarely full or nearly full. The embankment has a crest length of 59m and a maximum height of 4.4m. The reservoir drawoff occurs through a valve controlled pipe discharging into a culvert through the downstream half of the dam, where flow is released downstream into the Cannon Brook and carried south toward the River Pinn.

The reservoir has been designated 'High Risk' and is considered Category A in accordance with *Floods and Reservoir Safety, 4th Ed, ICE, 2015*.

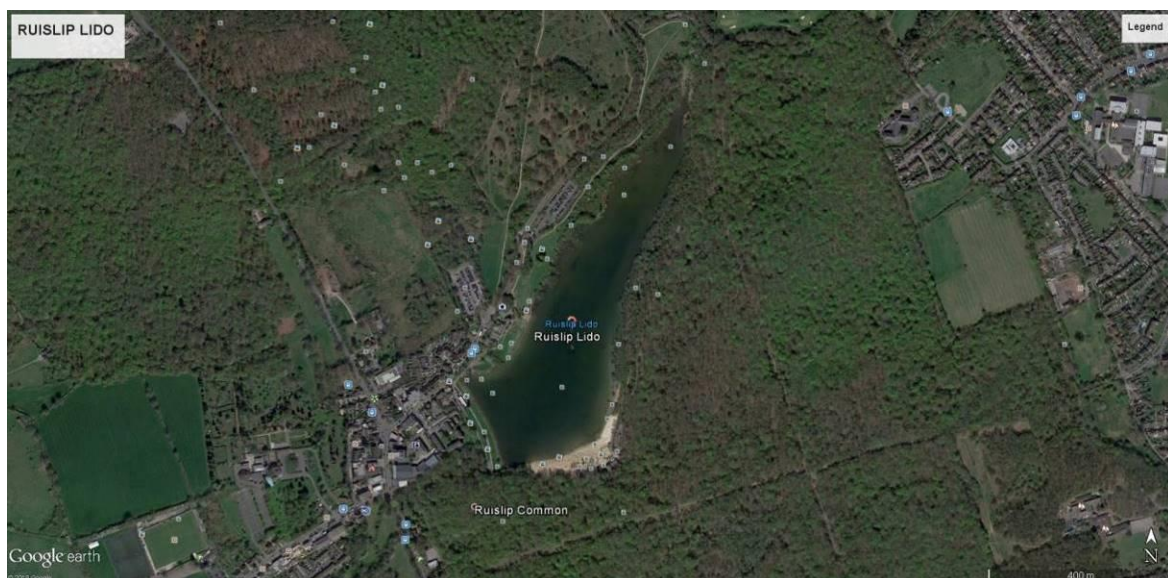


Figure 1 - Ruislip Lido – Location Plan

3.2 Detailed records

All data is held electronically on the company computer system, in addition to this there is a hard copy of this report held in the reservoir file in head office with the Operational Statistics section. The various databases are summarised in Table 8.

Copies of the information is also available on the Binnies computer system and hard copies in the files.

Table 8: Location of information on reservoir

Information	Electronic Database		Other
	LBH Network	Other	
Drawings	Highways Shared Drive	Hard copies in Highways cabinet	
Last Inspection report	Highways Shared Drive		
Supervising Engineers statements			
Monitoring data			
Prescribed form of record			
Drawdown Assessment Report			

3.3 Physical dimensions and features

This plan summarises the key dimensions and other information which would be of value to have to hand in an emergency, as follows

Table 6: Key dimensions of the dam

Date built (Original construction)	1810
Dam crest level	52.2 mAOD
Wave wall (main)	53.09 mAOD
Wave wall (central overtopping section)	52.49 mAOD
Height of dam crest above downstream toe	7 m
Dam crest length	200 m
Dam crest width	4 m
Main Spillway	1.85m dia. shaft to 1.2m dia, culvert
Auxiliary Spillway	0.6m pipe discharging into shaft of main spillway m
Main Spillway sill level	50.48 mAOD
Auxiliary Spillway sill level	49.76 mAOD
Freeboard (at TWL)	2.34m
Upstream slope	1 in 5.5 above 0.6m high wall and 1 in 6.5 below
Downstream slope	1 in 3.5 above and below berm
Type	Homogeneous earthfill embankment, assumed to have been built from sandy gravelly clay

3.4 Other features relevant to on-site operations

None

3.5 Access to reservoir

Access to the dam from the nearest public road is via the A4180 onto Reservoir Road. From there the dam crest can be accessed either by car or on foot although vehicle access is restricted by a locked barrier.

Table 7: Access to elements of dam

Issue	Access
Public access	The Lido is a public recreation area with a beach. Members of the public are able to access the dam crest and the water along the full length of the crest.
Undertaker's personnel	Good access from road across the berm. Through access along the crest road is restricted by bollards.
Access for works	
Upstream Face	The upper part of the upstream face is grassed with a well-maintained turf and a gentle enough slope for pedestrians
Downstream face	The downstream face is predominantly grassed with a tarmac road on a berm, and is easily accessed on foot (public access)
Crest	The crest has a concrete wave wall on the upstream side, which for much of its length acts as an emergency weir, with a tarmac road covering the majority of the crest. The road will have to be closed off if any works are to be undertaken.
Drawoff pipe	The outlet enters the shaft through a single 18" pipe from the reservoir and immediately bifurcates. There are then three valves in line on each branch of the pipe before they discharge into a culvert running downstream to the toe of the dam.
Overflow	There is a concrete approach to the drawoff pipe with its control being the upstream end of the concrete slab. These are easily accessed by staff
Auxiliary spillway	The auxiliary spillway including grille is easily accessed and inspected
Main spillway	The main spillway is covered by a concrete bridge deck. Access is via a personnel access gate in the grille (keys and access to be obtained from undertakers). Staff would need to be confined space trained to access the spillway shaft and culvert.
Drop shaft	A vertical drop shaft discharges the water from the main spillway into the downstream culvert. This can be visually inspected from the top but it not accessible without specialised abseiling equipment.
Downstream culvert	The culvert can be accessed by qualified personnel with confined space training. A removable grille, in good condition, normally covers the outlet.
Downstream toe	By foot from the road across the berm on the downstream face of the dam.
Access for operation of valves	The outlet enters the shaft through a single 18" pipe from the reservoir and immediately bifurcates. There are then three valves in line on each branch of the pipe before they discharge into a culvert running downstream to the toe of the dam. The valve shaft can be accessed via the valve house outlet structure which has a metal access ladder. Maintenance staff normally periodically operate (monthly) the downstream

	<p>butterfly control valves.</p> <p>The main control valves are either operated from the valve house at the crest of the dam or remotely. There is CCTV installed to check the status of the control valves.</p> <p>The guard valves are operated from the base of the shaft. They are normally kept open and only occasionally test operated.</p>
Main outlet culvert	<p>Access into the upstream end is from the valve shaft; ladder access. The downstream end of the culvert is more difficult to access, requiring removal of the grille. The culvert also bends so it is not possible to view much of it from the downstream end. A fixed grille covers the downstream end.</p>

3.6 Communications at reservoir

Mobile phone coverage at the dam site is considered good and reliable:

3.7 Welfare facilities

The nearest public toilets can be found adjacent to the Water's Edge Pub and Restaurant, and by Ruislip Lido beach. Out of hours access organised by BECC Manager.

3.8 Normal Operation

During normal operation, Ruislip Lido delivers protection against downstream flooding by functioning as flood storage. Outflow from the spillway channel is normally conveyed through a culvert underneath the dam crest road and the adjacent Park Wood, where it discharges into Cannon Brook and is conveyed further downstream to the River Pinn.

The various functions relevant to operation of the reservoir in an emergency are listed in the distribution list for this document, shown in Table 2. London Borough of Hillingdon regularly schedule surveillance visits (minimum of weekly) to Ruislip Lido.

4. ACTIONS BY UNDERTAKER ON SITE

4.1 Situation assessment

In the event of a problem, London Borough of Hillingdon would contact the Supervising Engineer for advice, which if a serious incident was in progress would lead to the appointment of an All Reservoirs Panel Engineer.

The first step on arrival of an engineer at the dam is assessment of the situation, to assess:

- Likely mode of failure and estimated time to failure if no action were taken;
- Candidate options for actions that could be taken to delay or avert failure;
- Availability of resources, both on site and at short notice from off-site; and
- Risk assessment of candidate options, in terms of likely effectiveness in averting failure, health and safety issues for personnel on site and environmental impacts.

The checklist in Table 4.8 of the *Engineering Guide for Emergency Planning for UK Reservoirs* may be used to assist this process. The action(s) to be taken will be determined by the Site Lead.

4.2 Undertaker's Resources relevant to on-site activities

4.2.1 Equipment at dam site

N/A

4.2.2 Resources which could be brought to site

It has been identified that the Environment Agency and the Fire and Rescue Service have equipment that could assist in breach mitigation actions, i.e. High Volume pump and other pumping equipment.

London Borough of Hillingdon have the following equipment available or approved suppliers for pump hire (available at short notice):

Contractor/Supplier	Skills/Equipment	Contact Name	Contact Number
O'Hara Bros (Term Contractor)	Pumps		
O'Hara Bros (Term Contractor)	Pumps		

4.3 Reservoir drawdown

4.3.1 Capacity of permanent installations

Drawdown is via a single 460mm (18 inch) pipe from the reservoir which bifurcates into two 230mm (9 inch) pipes. There are three inline valves on each branch; two gate valves and one butterfly valve.

The theoretical installed drawdown capacity at TWL is circa 0.5 m³/s. This gives an installed drawdown rate of 6.52% H/day, equivalent to 287mm/day. It would take approximately 4.2 days to empty the top third of the reservoir. The present actual drawdown capacity, based on a flow test carried out in 2018 after the upstream grille was

replaced, is circa 0.3 m³/s. At 0.3 m³/s this gives a drawdown rate of 3.24% H/day equivalent to 144mm/day. The basic recommended drawdown for a Category A dam is 5% H/day equivalent to 220mm. The theoretical installed capacity meets this standard. However, the present actual capacity does not.

Attachment C includes data on the reservoir volume.

4.3.2 Operation of permanent installation

The two main control valves are either operated from the valve house at the crest of the dam or remotely.

The guard valves are normally kept open.

4.3.3 Provision for installing and operating pumps

The reservoir drawdown could be supplemented with pumps brought to the site. It would be practical to install up to about 0.5m³/s of temporary pumping capacity but it is unclear how long it would take for this to be installed. There is good access across the dam and suitable locations for pump installations. (See Attachment A, Map 3) The discharge would either be into the overflow channel on the downstream left flank or the outlet channel downstream of the centre of the dam. However, there is currently no special provision for the installation of additional pumps.

Pump Location	Estimated suction hose length	Estimated delivery hose length
Crest of dam by spillway	30m	40m
Crest of dam near valve house	40m	40m

Note: The pump hoses are likely to pass across the access road on the berm which will need special provision for traffic to pass over.

The Environment Agency and the Fire and Rescue Service have equipment which can assist in breach mitigation actions, i.e High Volume Pump and other pumping equipment. Further investigation should be undertaken and contacts established in the Fire and Rescue service. There is good access across the dam and suitable locations for pump installations. The discharge would either be into the overflow channel on the downstream left flank or the outlet channel downstream of the centre of the dam. Advice should be sought on how long it would take to source and install this additional capacity. See Attachment A, Map 3 for loading and unloading area.

These data are used to provide illustrations of required pumping capacity to reduce the load on the dam by half (lower to 66% water depth), as follows:

		Theoretical	Present	With temporary pumps
Rate of lowering	mm/day	287	144	
Reservoir capacity in top 33%	m ³	150,000 – 200,000		
Days to lower to T33% (50% of volume)	days	4.2	7.3	2.5
Inflow volume in winter	m ³ /s	0.02		
Total volume to be evacuated by pumps	m ³	-	-	
Pumping rate	m ³ /s	-	-	0.5

4.4 Other measures

The checklists in Appendix C of the *Engineering Guide to Emergency Planning for UK Reservoirs* would be used in the event of an emergency.

4.5 Off-site impacts of site activities

During normal operation, Ruislip Lido delivers protection against downstream flooding by functioning as flood storage. However, according to the 2016 emergency plan, up to 5,200 members of the public would be at risk in the event of overtopping during a storm event, or in the event of a breach during site activities.

Outflow from the spillway channel is normally conveyed through a culvert underneath the dam crest road and the adjacent Park Wood, where it discharges into Cannon Brook and is conveyed further downstream to the River Pinn.

Figure 2 shows the Environment Agency's Flood Map. This indicates that areas of flooding (I in 100 year flood), that risk flooding properties, could occur on Cannon Brook in the vicinity of the A4180 and Ladygate Road, however the Halcrow Flood Risk Assessment Report, dated September 2011, found that the flooding risk at the A4180 is overstated.

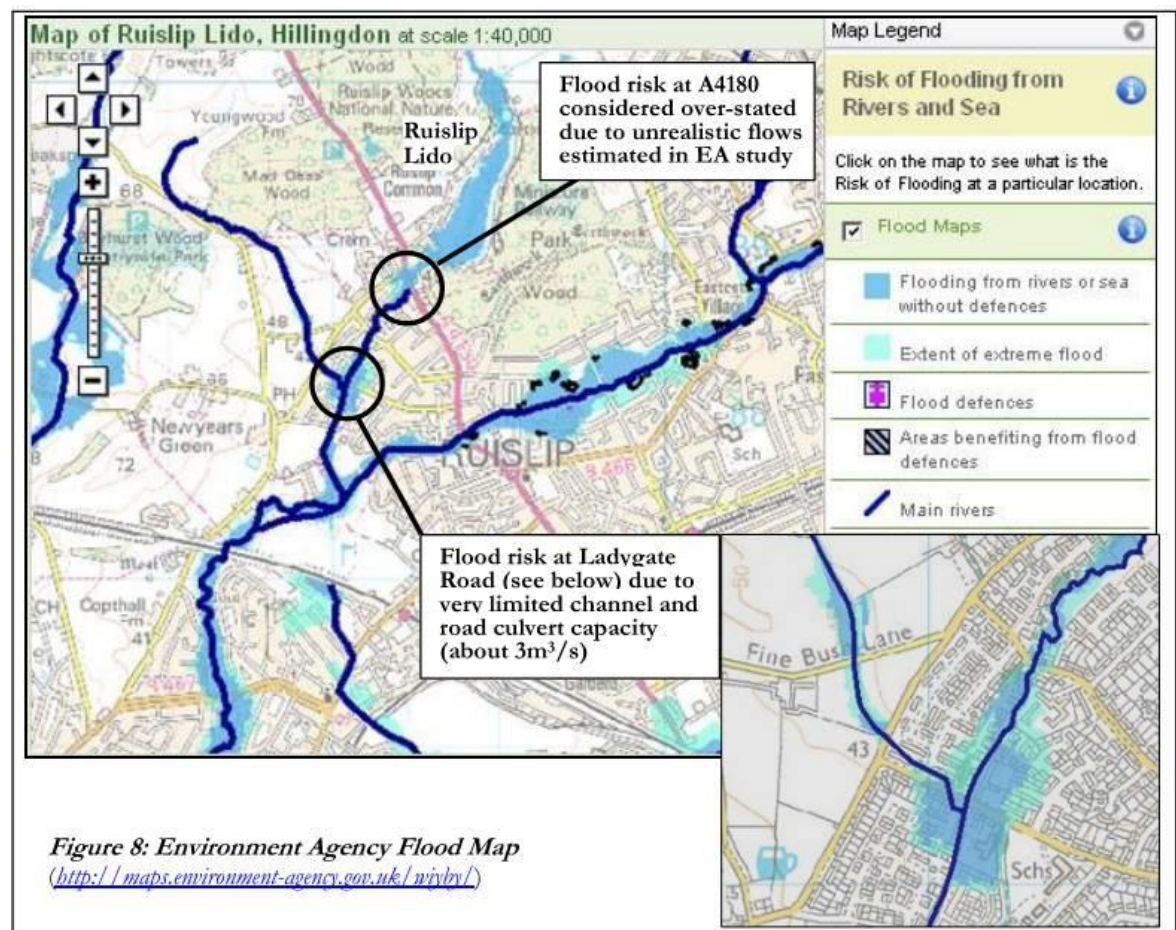


Figure 2 – Environment Agency Flood Map

(Extract from Halcrow, Flood Risk Assessment Report, dated September 2011)

5. MAINTENANCE OF THE PLAN

5.1 Training of staff

The members of London Borough of Hillingdon staff listed in Table 2 each hold and have read a copy of the *Engineering Guide to Emergency Planning for UK Reservoirs*. The panel engineers at Binnies UK are kept up to date in respect of confined spaces and CDM Regulations training courses.

A seminar/incident simulation exercise should be held at the frequency shown in Table 8, to test and discuss the arrangements, confirm their practicality and identify improvements that could be made to increase the value of the plan and/or reduce costs. It should be attended by the London Borough of Hillingdon staff listed in Table 2 and the Supervising Engineer.

In addition, at least one of the staff listed in Table 2 should attend a site visit with the Supervising Engineer to check the practicality of implementation of the on-site arrangements set out in this Plan.

5.2 Periodic testing of equipment

- a) The gate valves should be test operated at least once per year. (Test operations should be included in the Prescribed Form of Record.)
- b) The actuated draw-off valves are normally tested monthly. The actuated valves are operated regularly to control the reservoir water level. These have been modified and now allow on and off-site operation. A CCTV system allows visual monitoring of valve positions. The gate valves are not routinely operated, but should be test operated at least once per year, as per a). [In the event of a power cut it is unlikely to be possible to operate the control valves.]

5.3 Exercising of On-site Plan

Exercising shall be carried out as shown in Table 8.

Table 8: Frequency of exercising of on-site plan for Ruislip Lido

Item in plan to be checked	Method of testing	Frequency of testing	Responsibility for testing (sign off on test sheet)
24 hour contact number for pump supplier	Phone numbers at 2300hrs	Annually	Reservoir safety manager
Undertaker's 24 hour emergency response	Phone designated number at 2300hrs	Annually	Reservoir safety manager
Contact of London Borough of Hillingdon staff listed in Table 2 and Attachment F	Check details correct	Annually	Reservoir safety manager
In-house seminar / incident simulation exercise	See Section 5.1	One every 5 years	Reservoir safety manager
Contact equipment and material suppliers to confirm their availability during an emergency	Included in seminar. Phone numbers	Once every 5 years	
Site attendance including operation of valves.	Check practicality of on-site arrangements	Once every 5 years	Reservoir safety manager

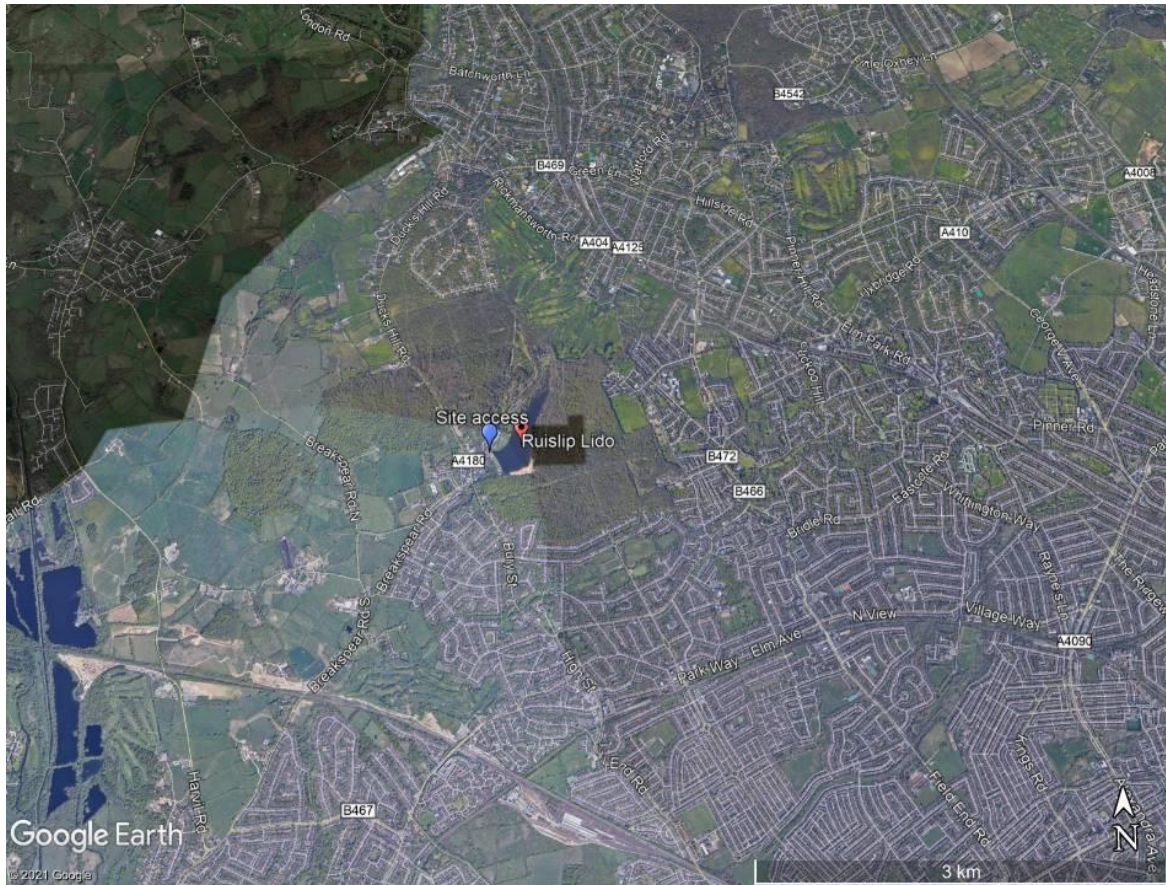
5.4 Review and updating plan

The list of contacts in Attachment F should be checked annually, with a checklist of dates and times phone numbers were checked given in the format in Attachment F.3 and included in the Supervising Engineer's annual statements.

This plan should be reviewed (and updated or modified as appropriate) at the frequency shown in Table 8:

ATTACHMENT A: MAPS SHOWING ACCESS TO DAM SITE**Map 1: Regional access to Ruislip Lido**

0



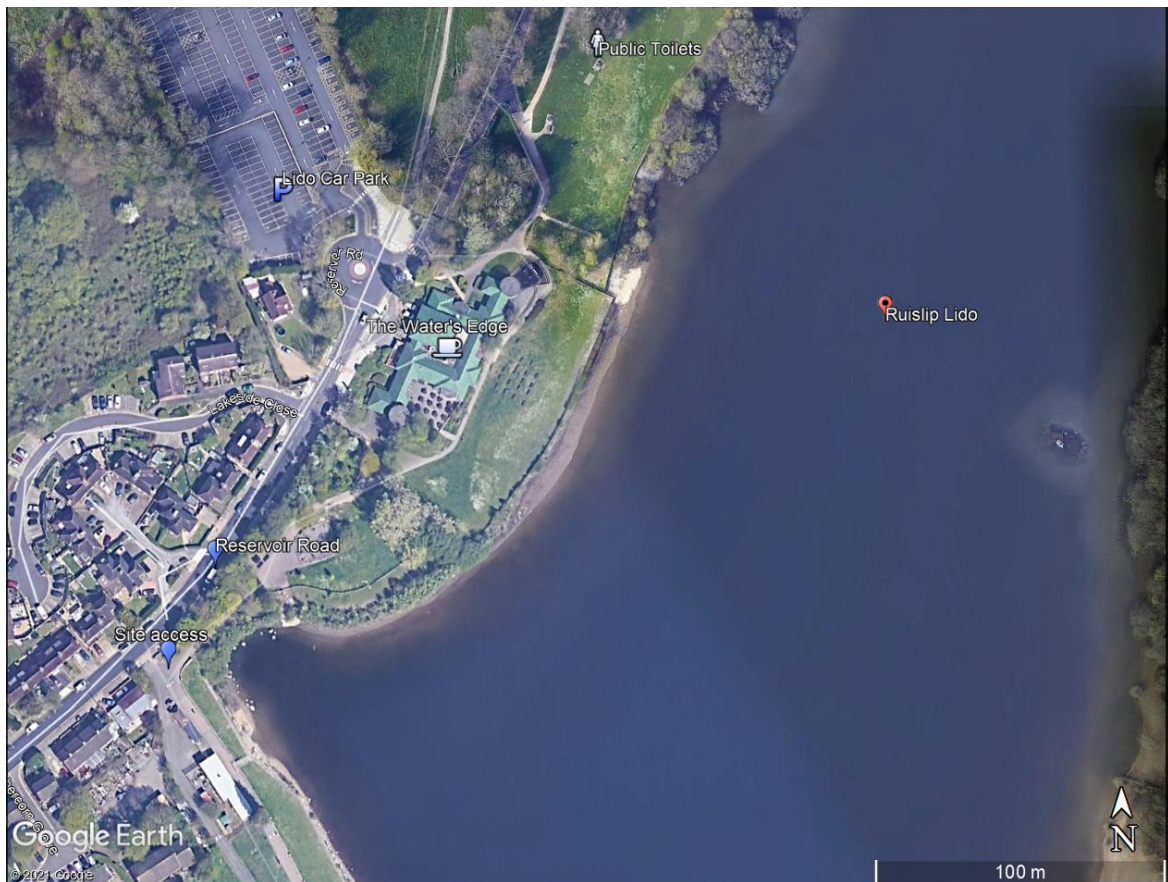
This map shows the local access routes and roads. The site is directly accessible via the A4180/Duck's Hill Road onto Reservoir Road.

Regional access from the major motorways is as follows:

- From the A40 by exiting onto the B467/Breakspear Rd S heading North towards Ruislip; Alternatively you can take the B466.
- From the A25 by taking any exit towards Rickmansworth, followed by the A404/London Road and onto the A4180 /Duck's Hill Road.

The nearest train stations to Ruislip Lido are:

West Ruislip (1.7 mi)
 Ruislip Manor (1.5 mi)
 Ruislip (1.5 mi)
 Northwood Hills (1.7 mi)
 Eastcote (2.2 mi)

Map 2: Local access routes and constraints

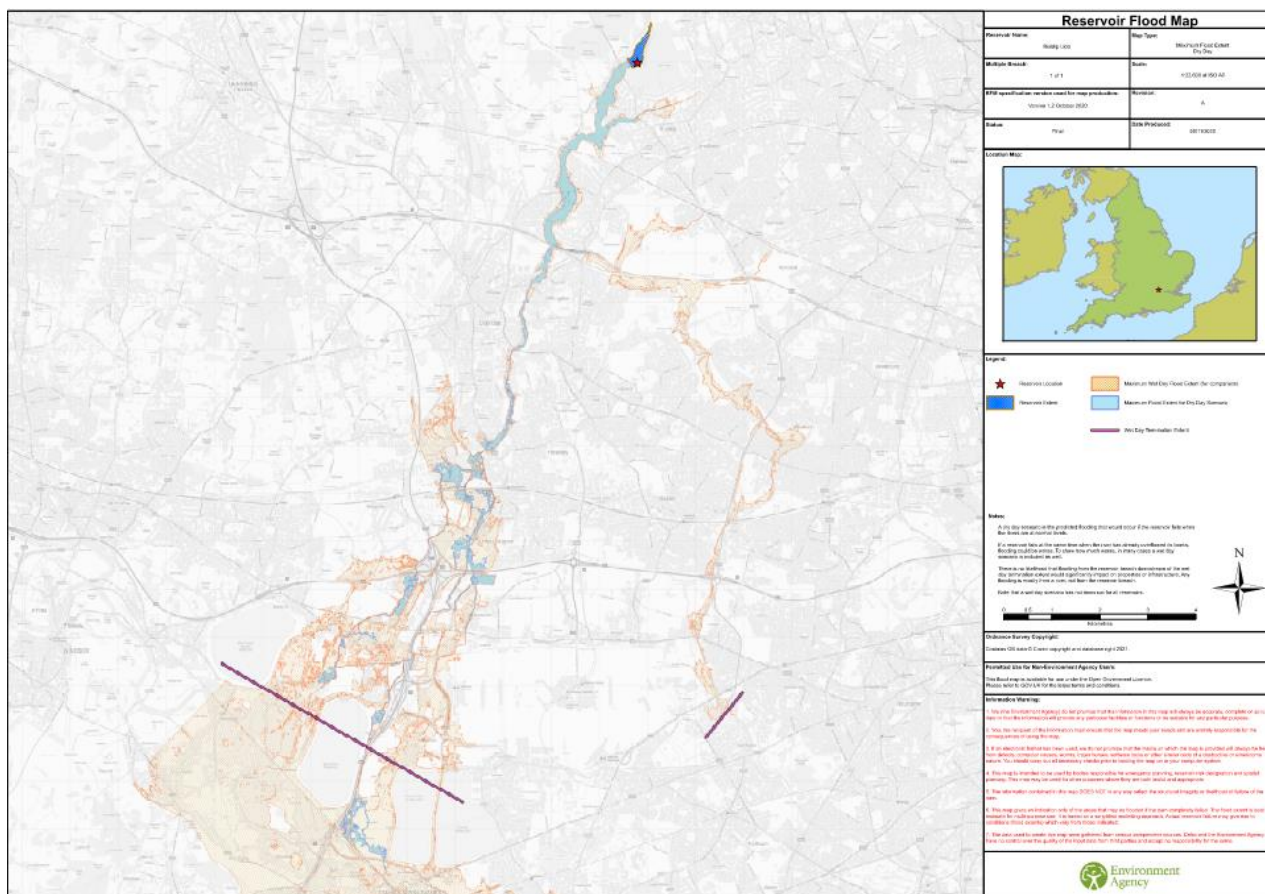
Access to the dam from the nearest public road is via the A4180 onto Reservoir Road. From there the dam crest can be accessed either by car or on foot although vehicle access is restricted by a locked barrier.

The nearest public toilets can be found adjacent to the Water's Edge Pub and Restaurant, and by Ruislip Lido beach.

Map 3: Temporary Pump Locations



Map 4: Extent of Maximum Flood Outline (Reservoir Inundation)



ATTACHMENT B: HYDROMETRIC DATA AND ESTIMATED INFLOWS**B.1 Gauged flows**

As there is no gauging station on the River Pinn two methods have been used to produce a flow duration curve (daily flows).

- 1) Using Institute of Hydrology reports 108 & 126.
- 2) Using gauging station @ Yeading Brook West (39055).

Calculated flows are summarised in Table B.1.

Table B.1: Inflows to the reservoir

Station number	39055		Reservoir	
River	Yeading Brook West		-	
Station name	-		-	
Grid ref	TQ083846		TQ 088 890	
Catchment area	17.6	km ²	6.33	
Years of record	-			Runoff expressed as mm/day/km ²
Bankfull discharge	1.485	m	0.53	
Mean rainfall	657	mm	236.30	Annual
Mean annual runoff	11.56	m ³ /s	4.16	
Mean flow	0.13	m ³ /s	0.05	
Median annual flood (QMED)	4.24	m ³ /s	1.52	
10 percentile (high flow)	0.314	m ³ /s	0.11	
50 percentile (median)	0.059	m ³ /s	0.02	
95 percentile (low flow)	0.008	m ³ /s	0.00	

B.2 Flood estimates

A flood study for the reservoir (1992) showed the following results:

Parameter	10 000-year flood	Summer PMF
Storm duration (hours)	12.5	8.5
Total rainfall depth (mm)	188	225
Peak inflow (m ³ /s)	37.9	100.1
Peak outflow (m ³ /s)	8.2	46.0
Peak flood level in reservoir (m OD)	52.20	52.82
Peak flood surcharge relative to auxiliary overflow (49.86m OD) (m)	2.34	2.96
Head over dam crest overflow section (52.49m OD) (m)	—	0.33

B.3 Nearest Environment Agency gauging station data

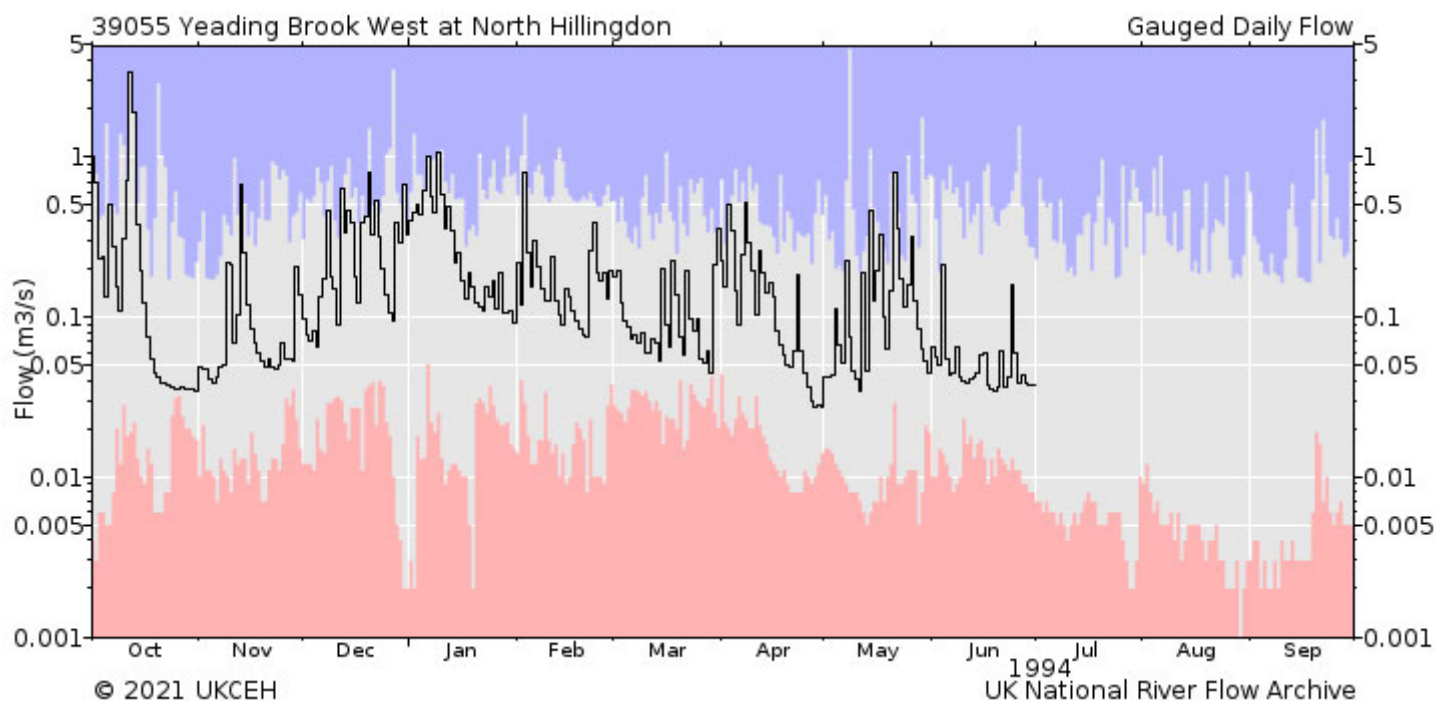
(downloaded from National River Flow Archive at <https://nrfa.ceh.ac.uk/data/station/info/39055>)

39055 – Yeading Brook West at North Hillingdon

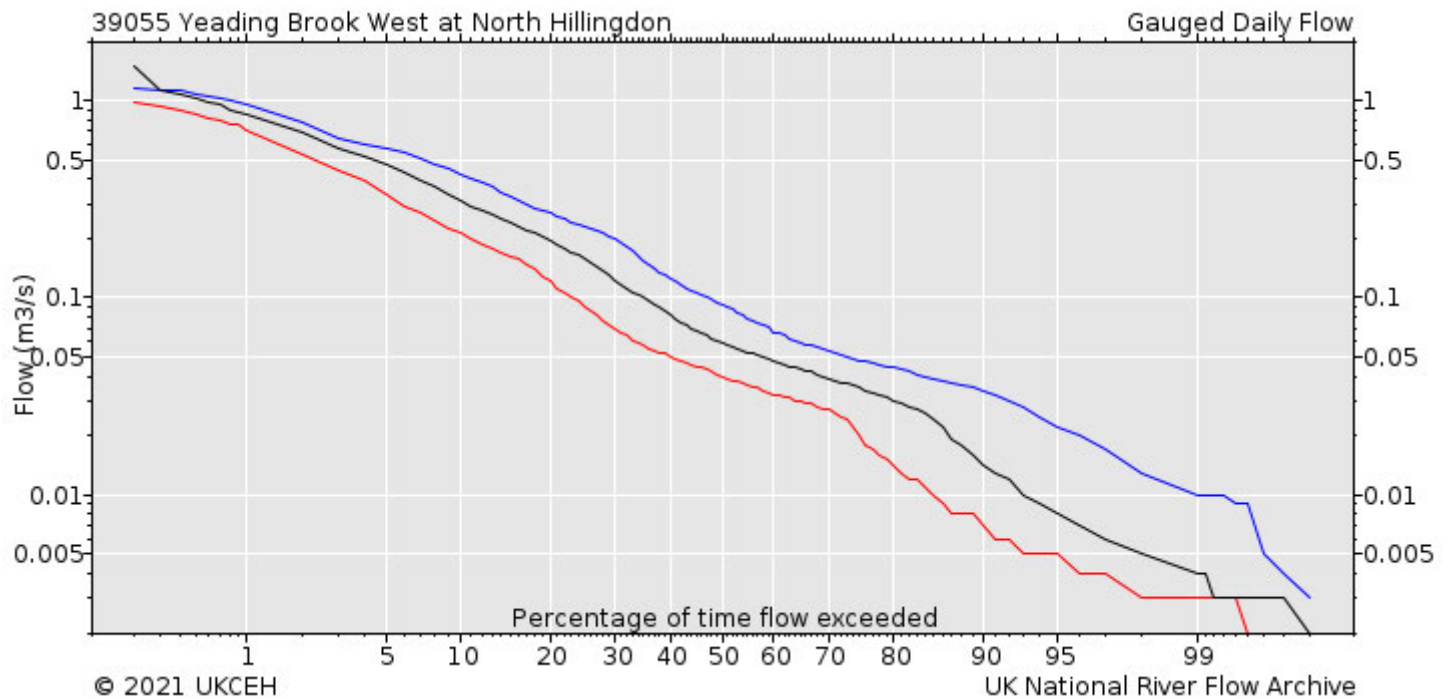
Grid Reference: TQ083846
 Operator: EA
 Local number: 3620TH
 Catchment Area: 17.6km²
 Level of Station: 32mOD
 Max. Altitude: 113.40mOD
 Mean flow: 0.13m³s⁻¹
 95% exceedance (Q95): 0.008m³s⁻¹
 10% exceedance (Q10): 0.314m³s⁻¹
 61-90 Av. Ann. Rainfall: 657mm



Sample Hydrograph of Gauged Daily Flows



Flow Duration Curve for Gauged Daily Flows



Station Description

Gauging station located on Yeading Brook West, a small tributary of the River Crane. The station was closed in 1995.

Catchment Description

Impervious, suburban catchment in NW London, including some of the runoff from Northolt Airport. Some agricultural land immediately u/s of the station..

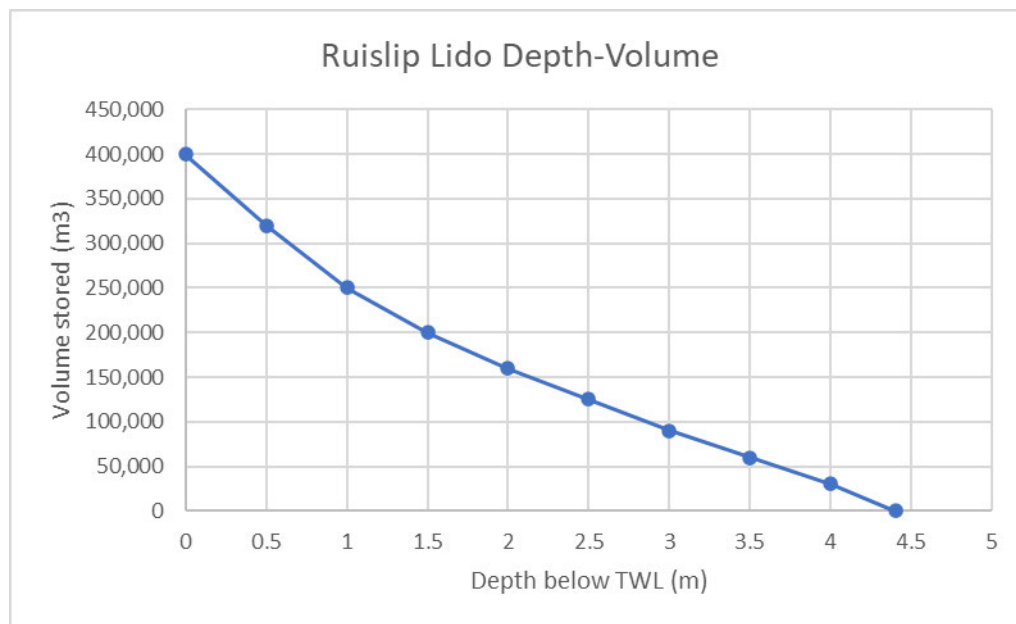
Factors Affecting Runoff

N/A

River Flow and Catchment Rainfall on the National River Flow Archive

Gauged Daily Flows (gdf): 1979 to 1994

Catchment Daily Rainfall (cdr): 1961 to 2017

ATTACHMENT C: RESERVOIR LEVEL AGAINST ELEVATION AND DRAWDOWN CAPACITY**Figure C.1: Reservoir volume****RUISIP LIDO CAPACITY VS DEPTH**

Water Level (mAOD)	Amount of drawdown (m)	Volume of water in storage (m³)	Remarks
50.5	0	400,000	Main Overflow Level
50.0	0.5	320,000	
49.5	1.0	250,000	Normal retention level/Target Level
49.0	1.5	200,000	
48.5	2.0	160,000	
48.0	2.5	125,000	
47.5	3.0	90,000	
47.0	3.5	60,000	
46.5	4.0	30,000	
46.1	4.4	0.00	
45.67	-	-	Drawoff pipe IL

Note: Storage on this chart is calculated from the main overflow level (50.48mAOD). The official Top Water Level is considered the weir sill in front of the auxiliary spillway pipe (49.76mAOD)

ATTACHMENT D: VALVE ARRANGEMENT



Photograph showing arrangement of valves. Remotely controlled butterfly control valves are those furthest downstream (top of photo)

ATTACHMENT E: INFORMATION SUPPLEMENTARY TO RESERVOIR RECORD

None

ATTACHMENT F: INFORMATION TO BE UPDATED FREQUENTLY**Details of checks/updates since last major revision of plan**

Date	Updated by	Comments

F.1 Pump suppliers

Pump suppliers	Phone		Distance from site
	Working hours	Out of hours	
Environment Agency			

F.2 Panel AR Engineers

Name	Office address	Phone		
		(working hours)	Out of hours (24 hour contact)	Mobile
	Binnies UK			
Dominic Molyneux	60 High Street			
Rachel Pether	Redhill, RH1 1SH			

F.3 London Borough of Hillingdon staff who would be called upon first in an emergency

Name	Office address	Skills, equipment	Phone and email		
			Work	Out of hours	Mobile
Pam Siva-Kumar	London Borough of Hillingdon Civic Centre, Uxbridge, Middlesex UB8 1UW	Engineering Structures Manager	psiva-kumar@hillington.gov.uk 01895 250441		
Poonam Pathak	London Borough of Hillingdon Civic Centre, Uxbridge, Middlesex UB8 1UW	Interim Head of Highways	ppathak@hillington.gov.uk 01895277557		
Wayne Greenshields	London Borough of Hillingdon Civic Centre, Uxbridge, Middlesex UB8 1UW	Network Operations	wgreenshield@hillington.gov.uk 01895250564		
Martin Kenealy	Harlington Road Depot, 128 Harlington Road, Uxbridge UB8 3EY	Reactive Maintenance Supervisor	mkenealy@hinningdon.gov.uk 01895277552		-
		Rapid Response/ Standby Flood Officer (Rota)			
	London Borough of Hillingdon	Borough Emergency Control Centre Manager			
	London Borough of Hillingdon	Emergency Response Manager			

F.4 Schedule of associated documents to be read with this plan

Type	Title	Plan		Latest Revision			Remarks
		Originator	Owned by	Rev No	Date	Custodian/contact	
Emergency response	Ruislip Lido Reservoir Emergency Plan	London Borough of Hillingdon	London Borough of Hillingdon	Draft	May 2016		
Emergency Drawdown	Ruislip Lido - Drawdown Assessment	Black & Veatch	London Borough of Hillingdon	1	May 2018		

ATTACHMENT G: MAINTENANCE LOG**G.1 Exercising since On-site Plan issued**

Details of entry		Details of exercise			Details of debriefing/lessons learnt			Actions taken/ remarks
Date	Name	Date	Level	Lead Individual	Date	Lead individual	Location of report	

G.2 Contact verification and callout simulation

Details of entry		Details of verification				Result of call	Any Actions taken/ remarks
Date	Name	Date	Time	Type	Lead individual		

RUISLIP LIDO

Reservoirs Act 1975

Certificate under section 12AA(3), as to the requirements of a direction under section 12A(2)(a) and (b) being satisfied

I *John Hopkins of Binnies UK Ltd, 60 High Street, Redhill, Surrey. RH1 1SH*, being a member of the *Supervising Panel*, appointed by *London Borough of Hillingdon* to consult on the preparation of a flood plan under section 12A for the reservoir known as *Ruislip Lido* situated at *Reservoir Road, Ruislip, Middlesex NGR: TQ 088 890*, am satisfied that the requirements of a direction under section 12A(2)(a) and (b) are satisfied.

3 February 2022

RUISLIP LIDO

Reservoirs Act 1975

Direction under section 12AA(4) by Appointed Engineer, as to the testing of a flood plan

I *John Hopkins of Binnies UK Ltd., 60 High Street, Redhill, Surrey. RH1 1SH*, being a member of the *Supervising Panel* appointed by *London Borough of Hillingdon* to consult on the preparation of a flood plan under section 12A for the reservoir known as *Ruislip Lido* situated at *Reservoir Road, Ruislip, Middlesex NGR: Reservoir Road, Ruislip. TQ 088 890*, direct that the flood plan be tested as specified below, the interval commencing on *3 February 2022*. A report of the test shall be provided to assess the need for revision of the plan.

Element of flood plan	Manner of testing	Interval between tests
24 hour contact number for pump supplier	Phone numbers at 2300hrs	Annually
Undertaker's 24 hour emergency response	Phone designated number at 2300hrs	Annually
Contact of London Borough of Hillingdon staff listed in Table 2 and Attachment F of Plan	Check details correct	Annually
In-house seminar / incident simulation exercise	See Section 5.1 of Plan	One every 5 years
Contact equipment and material suppliers to confirm their availability during an emergency	Included in seminar. Phone numbers	Once every 5 years
Site attendance including operation of valves.	Check practicality of on-site arrangements	Once every 5 years

3 February 2022