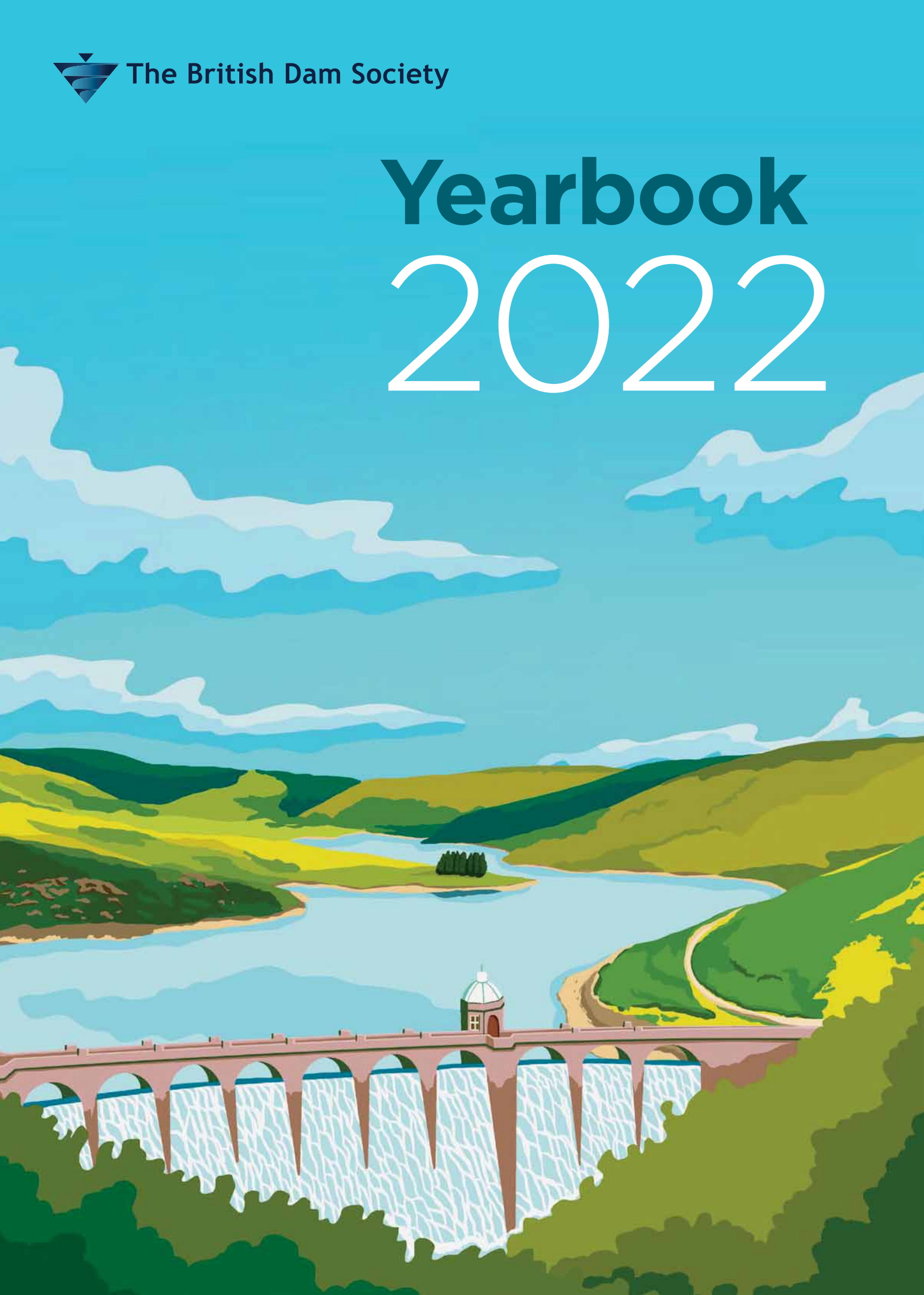
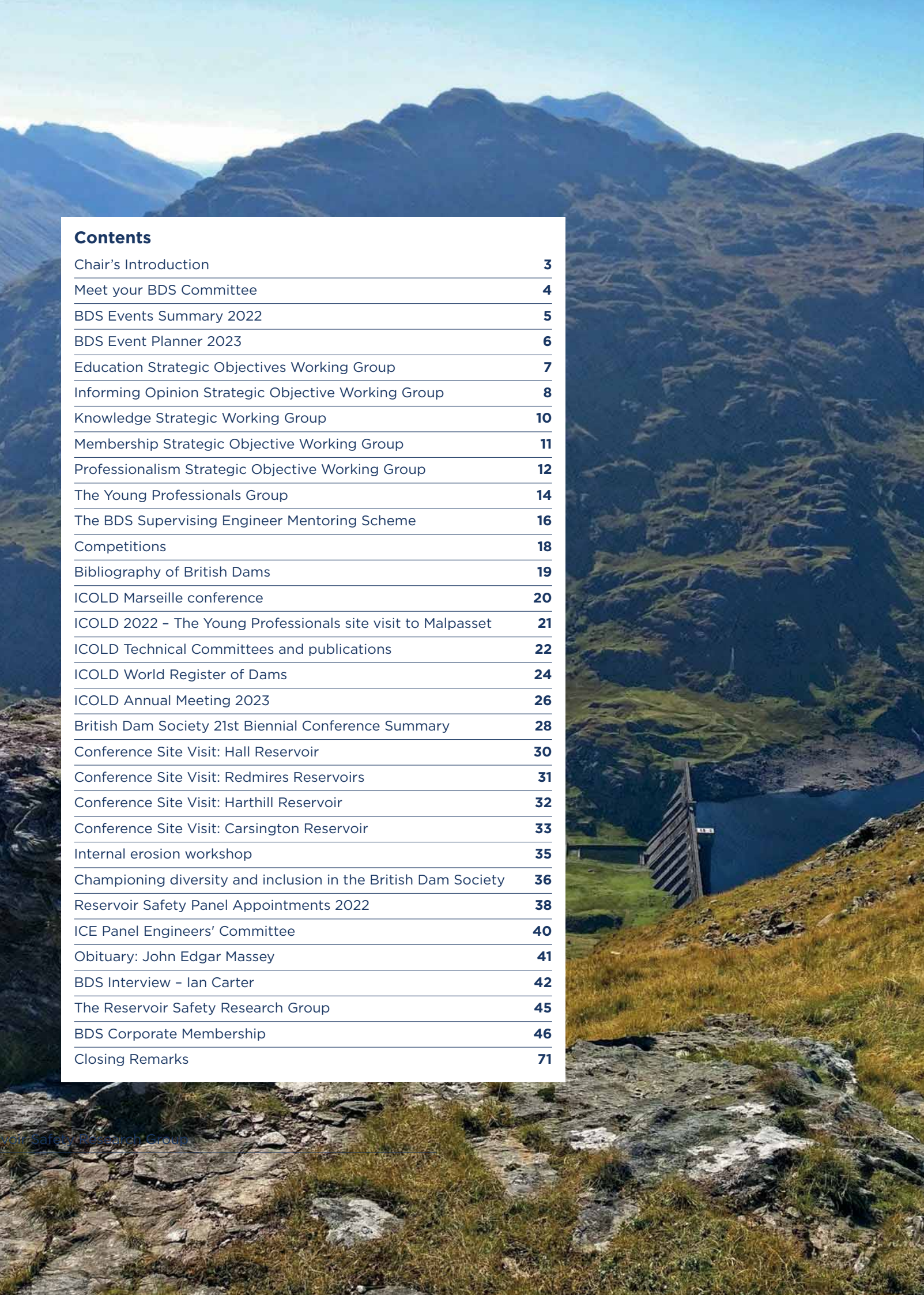
The British Dam Society

Yearbook 2022





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voir Safety Research Group

Chair's Introduction

Welcome to the 2022 British Dam Society Yearbook. 2022 has been a busy year for the BDS and we hope that this publication provides a showcase for some of the activities of the society and its individual and corporate members.

Like many organisations this year has been chance to return to some form of normality with regards how we operate and the events that we have been able to hold. The British Dam Society's 21st biennial conference was a very welcome return to our calendar, providing a fantastic opportunity for learning, collaboration, and fun. We were delighted to welcome 290 delegates to the University of Nottingham in September for a programme of technical presentations, workshops, site visits and social activities. Feedback from the event was overwhelmingly positive and delegates were certainly glad to attend an in-person event again. Personally, it was also really encouraging to see the noticeable change in the demographics of the delegates, with significantly more younger engineers attending the conference and participating in the presentations and workshops. This change is in no small part due to the considerable efforts of the Young Professionals Group within the last few years and I'm very grateful for how this group has been recently led by Kyle Mclean and for how the main committee has supported their initiatives.

> "Approximately 1400 delegates from around the world attended the ICOLD conference including 47 delegates from the UK."

The 27th Congress and 90th Annual Meeting of ICOLD took place in Marseille, France in May after a two-year break. Approximately 1400 delegates from around the world attended the conference including 47 delegates from the UK. Again, it was very pleasing to see a record number of young professionals from the UK attend this event and connect at such an early stage of their careers with other YPs from around the world. Many of the UK young professionals were able to attend the event as a result of the bursaries offered by the British Dam Society and I would encourage other YPs to take advantage of this funding and consider attending future ICOLD events, especially the forthcoming 91st Annual Meeting in Gothenburg. As we enter a new chapter in dam building in the UK it is especially important that we maintain our connections with the international community, to ensure that new technologies, new design methods and knowledge of past incidents are at the forefront of our thinking.

My time as BDS Chair comes to an end in April 2023 and therefore this will be my second and last BDS Yearbook. I would like to thank its editor, Andrew Pepper, for his incredible efforts in pulling this publication together. We have received lots of very positive feedback about the Yearbook and I think it's a very welcome addition to how we communicate with our membership.

Lastly, as you will know the UK reservoir safety industry is currently in a period of change and will be for several years to come. The success and the outcomes resulting from this change will very much depend on how people engage in the next few years. The British Dam Society is just one of the organisations that is helping to shape this change. Can I encourage you as individuals and organisations to consider ways in which you can contribute to this period and move our industry forward for the better.

David Littlemore
BDS Chair

Balgray Reservoir – Ryan McHugh

Meet your BDS Committee

The BDS is governed by a main committee that comprises elected and nominated members and consists of:

- Chair and Vice Chair (two-year term)
- Honorary Officers: Technical Secretary; Website Manager; Dams and Reservoirs Editor and YP Chair
- Up to 12 elected members (three-year term)
- Up to 3 members nominated by the BDS Chair (two-year term)
- The YP Chair is supported by 3 elected YP members who make up the YP Committee.

In 2023 a new Chair and Vice-Chair will be elected by the Committee from nominations made by the BDS membership. In addition, there will be an opportunity for BDS members to join the committee as an elected committee member. If you are interested in joining the BDS committee and contributing to the running of the BDS please contact the Chair or Vice Chair, or indeed any existing committee member to find out more.

David Littlemore
BDS Chair

Rachel Davies
BDS Vice Chair

Andrew Thompson
Hon. Technical Secretary / Membership WG Lead

Andrew Pepper
Dams & Reservoirs Editor

Chris Smith
Education WG Lead

David Neeve
Knowledge WG Lead

Matt Coombs
Professionalism WG Lead / Evening Meetings

Roger Lewis
Informing Opinion WG Lead

Martin Airey
Reservoir Committee

Xavier Bradley
YP Social Media

Michael Calder
YP Mentoring

Rhys Coombs
BDS Website Manager

Amy Carter
Equality, Diversity, and Inclusion

Stephen Cavanagh
Technical Site Visits / Regional Meetings

John Foster
SE Forum 2023 / Panel Engineer Committee

Rob King
Knowledge Database

Stephen Lockett
Professional institution & corporate member liaison

Paul Marsden
Schools and university liaison

Kyle McLean
YP Chair

Lucy Monkhouse
YP Events

Geraint Richards
Competitions

Darren Shaw
Communications Manager

Moira Doherty
BDS Secretary (ICE)

Summary of BDS Evening Events 2022

During 2022 the BDS hosted six evening technical meetings, summarised below. It was a pleasure to return to in-person meetings at One Great George Street in March and a restart of our regional hubs from April. All events were recorded and are available to Listen Again on the BDS website (https://britishdams.org/meetings-and-events/listen-again)

Monday 10th January 2022

Young Professionals Paper Competition

Five papers were presented by young members of the BDS followed by Q&A sessions. Amy Carter of Arcadis was declared the winner by the judges with India Hutchinson & Ciara Gill coming second and third respectively. See page 18 for more details.

Monday 7th March 2022

Guidance following the 2019 Toddbrook Reservoir Incident

Kieron Kenny (Turner and Townsend); Viktor Pavlov (Binnies); Tim Daly (Mott MacDonald); Eddie Robinson (Binnies)

The presentations provided an overview of the new guidance produced in response to recommendations of the independent review into the Toddbrook Reservoir incident, addressed how the guidance has been developed and noted challenges encountered.

- Supervising Engineer Guidance
- Inspecting Engineer Guidance
- Owners Guidance
- Spillway Design Guide
- Guidance to Spillway Failure Mechanisms
- Spillway Examination Guide
- Inspection Information Pack

Monday 25th April 2022

AGM followed by Dam safety management in Queensland, Australia

Tracey Williamson (GHD, Australia)

Tracey compared and contrasted the dam safety regimes in the UK and Queensland, whilst highlighting some of the dams she has inspected. She discussed how dam owners prepare for emergencies in Australia and gave examples of where UK dam owners may consider including some of these practices within their own emergency and incident planning.

Tracey also presented a project where she was the lead designer of a 25 m high concrete gravity weir, currently under construction, the first of its type in Queensland. It has followed the Infrastructure Sustainability Council (ISCA) Rating Scheme, which aims to optimise environmental, societal and economic project outcomes over the long term.

Monday 11th July 2022

ICOLD Technical Committee Updates

Viktor Pavlov (Costain); Jonathan Simm (HR Wallingford); Ian Hope (Severn Trent); Alan Warren (Mott MacDonald); Andrew Pepper (Independent); Kyle McLean (Mott MacDonald)

The UK representatives of the ICOLD technical committees below gave updates on recent developments in their respective committees with a brief overview of any new or emerging ICOLD bulletins.

- **Committee C:** Hydraulics for Dams
- **Committee LE:** Levees
- **Committee O:** World Register on Dams
- **Committee Q:** Dam Surveillance
- **Committee S:** Flood Evaluation & Dam Safety
- **Committee ZX2:** Young Engineers

Monday 3rd October 2022

Design, installation, operation, management and testing of siphons in dams

John Foster (Mott MacDonald), Jon Troke (Stantec), Ian Kirkpatrick (AWS)

A presentation on the up-and-coming CIRIA guidance (RP 1131) prior to issue, outlining key aspects associated with designing and installing retrofitted siphons to provide additional drawdown capacity. Whilst the guide is focussed on retro-fitted permanent siphon systems, the majority of the guidance could be applied to similar arrangements, including but not exclusively: temporary siphon arrangements; siphons for continuous supply; siphons for a new dam.

Monday 21st November 2022

PMP/PMF Determination

Duncan Faulkner (JBA Consulting), Daniel Hine, Clare Waller and Tim Hunt (Environment Agency)

The talk outlined the findings of the project, the type of methods recommended for development and some of the challenges, including the desire to reconcile the concept of the probable maximum with a risk-based approach to reservoir safety management. It has comprehensively reviewed methods for estimating the probable maximum precipitation (PMP) and probable maximum flood (PMF). It has also updated the catalogue of observed extreme floods and rainstorms in the UK, finding several exceedances of current estimates of the probable maxima. The project identified a recommended way ahead for development of new methods.

BDS Event Planner 2023

Throughout the year we host a number of evening talks, competitions, site visits and other networking activities for our members. For 2023 the main event is the BDS Supervising Engineers Forum in September and an opportunity for Young Professionals to submit their entries to the BDS Prize in November.

We also offer local hubs across the country to allow members to virtually join our evening talks and meet with fellow members from their region. Finally, our Young Professionals Group offer networking and CPD opportunities.

Ambergate Service Reservoir – Ian Hope

Dates for your diary

January	• London evening meeting (9th January) with regional hubs available. • 'Innovative underwater isolations for valve and pipework replacement' – P Edwards, S Richings, N Walding, T Brownrigg, D Brown, M Welsby. • Applications are open for Committee nominations – this year there are two positions available on the main BDS committee • Applications are open for Young Professionals Committee nominations
February	• Synopsis request opens for SE Forum
March	• London evening meeting (6th March) with regional hubs available. 'Grass cover – improving establishment and resilience to deal with increasing stresses' – M Hughes and D Holland
April	• DEADLINE for the Committee nominations (10th April) • DEADLINE for the YP Committee nominations (10th April) • Annual General Meeting followed by the BDS international lecture (24th April) with regional hubs available.
May	• Site Visits are to be held at various sites across the country throughout the year
June	• ICOLD Event – 2023 Annual Meeting in Gothenburg, Sweden (11-15th June) • ICOLD 2024 Abstract Submission Deadline (30th June)
July	• London evening meeting (10th July) with regional hubs available. • Registration for the BDS Supervising Engineers Forum opens – book early to avoid disappointment!
September	• ICOLD Event – 12th ICOLD European Club Symposium in Interlaken, Switzerland (5-8th September) • BDS Supervising Engineers' Forum at the Motorcycle Museum, Solihull (7 September)
October	• London evening meeting (2nd October) with regional hubs available • HYDRO 2023 event in Edinburgh, Scotland (16-18th October) • DEADLINE for the Young Professionals Paper submissions (BDS Prize) • DEADLINE for the BDS Photo Competition submissions
November	• IE Forum (20th November) – event for ARPEs • London evening meeting (20th November) with regional hubs available. This evening meeting is for the Young Professionals Paper competition and includes the results of the BDS Photo Competition.
December	• Submission of Synopses and Workshop Proposals open for 2024 Conference

For updated information go to **britishdams.org/meetings-and-events/events-calendar**

Education Strategic Objectives Working Group

The Education group comprises four members:

Chris Smith (Severn Trent Water) is the Education Lead

Paul Marsden (Keller) liaises with schools and universities

Gerallt Richards (Natural Resources Wales) manages competitions

Michael Calder (Binnies) manages the YP mentoring scheme

The goal of the Education SOWG is to enthuse the next generation of dam engineers and technicians, by means of the following activities:

BDS teaching resources in schools

Teaching materials to help schools, which were prepared several years ago, are available within the Education Zone on the BDS Website. This resource continues to be downloaded from the website at a steady pace.

Working with Arkwright Scholarship students & schools

BDS has regularly sponsored students through the Arkwright Scholarship, and will continue to consider applications from students with an interest in dam engineering.

Increase awareness of dam engineering in universities and colleges

Presentations by BDS members are made to universities who included aspects of dam engineering in their syllabus; we can also arrange site visits to reservoirs with university students.

Competitions for British Dam Society members

Full details of the three competitions successfully run in 2022 are given on page 18.

Witcombe Pool 1 – Bradley Baker

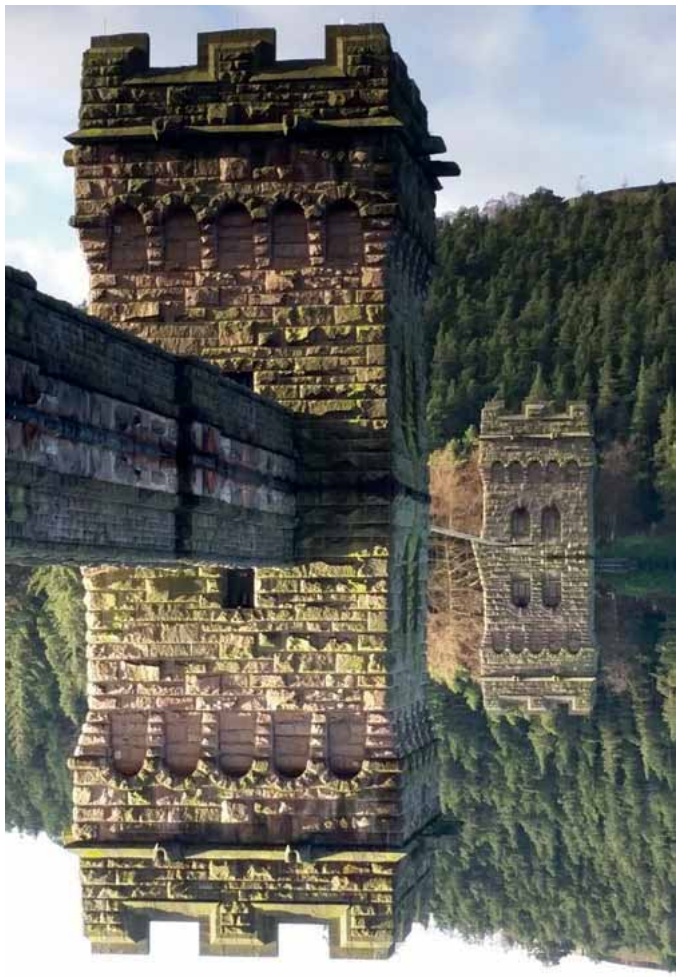
How you can help

We are always looking for new ideas with which we can inspire people into dam engineering, so if you have any please get in touch, and maybe help us to put your ideas into practice.

Our competitions rely on healthy numbers to make them worthwhile, so please do take part yourself or encourage friends and colleagues to be actively involved.

If you are in contact with any universities where there is an interest in dam engineering, please let us know so that we can explore further opportunities to inform and inspire engineers and technicians of the future.

If you have contacts with secondary school staff, please remind teachers of the resources that are freely available on the BDS website. Remember that we will also consider sponsoring students through the Arkwright Scholarship scheme.



Howden Dam – Paul Farnell

Informing Opinion Strategic Objective Working Group

The Informing Opinion group comprises three members:

Roger Lewis (Environment Agency) is the Informing Opinion lead

Stephen Lockett (AECOM) liaises with other Professional Institution groups and BDS corporate members

Xavier Bradley (Stantec) promotes the BDS on Social Media

Highlights of the Group's work in 2022

There has been good growth in social media activity on the BDS LinkedIn site throughout the year, doubling the number of followers from 381 in January to nearly 800 by mid-November. The LinkedIn website was particularly active during the ICOLD congress in Marseille. Social media activity was curtailed during the Nottingham conference, which coincided with the period of royal mourning, as a mark of respect. We reached our 2022 target of 3000 BDS Movie views on YouTube.

Stephen Lockett has attended ICE Virtual Knowledge and Water & Sanitation Community Advisory Board (CAB) meetings on our behalf. He has been asked to help promote the Chris Binnie award for sustainable water management and to provide input to an ICE green paper on climate resilience. Involvement in this ICE CAB group also provides another opportunity for current dams and reservoir topics and issues to be discussed with the wider ICE community.

Stephen has recently taken on the role of 'Corporate Member Manager' with the aim of tidying up the current database to ensure the correct contacts are up to date and to gauge feedback with a view to seeing how the BDS may better serve our corporate members going forward.

We have made good progress with site visits and meetings with local residents and council officers, to discuss the possible location and form of a suitable memorial to the April 1925 dam disaster at Skelmorlie, in the runup to the centenary year in 2025. There is already a memorial at Dolgarrog (photo below), at the site of the November 1925 disaster, but currently nothing in Skelmorlie. Local residents have sent us a collection of historical information about the disaster, in which five people (a woman and four children) died. We have attended both virtual and face-to-face meetings with planners at North Ayrshire Council and members of Skelmorlie Community Council, to discuss the possibility of a memorial. The Community Council representatives were generally supportive. They would like it to be low-key (no names) and located on the pavement near the abandoned reservoir site, possibly on a boulder, set back from the road. One idea is to include a QR code on the memorial, linked to an information website. Discussions and meetings are continuing.

LABOUR PRAISE FOR TORIES Page 11

Daily Record and Mail

GLASGOW, MONDAY, APRIL 20, 1925. ONE PENNY.

MMUNISTS WHO CAUSED CATHEDRAL

IVE PERISH IN FLOOD.

ERVOIR BURSTS BANK AT SKELMORLIE.

COTTAGE WASHED AWAY.

AN AND CHILDREN DROWNED IN THE TORRENT.

MRS. ADAM LOST HER LIFE IN FLOOD.

ATTEMPT TO SAVE HER NIECE

RECOVERY OF BODIES.

HINDENBURG TALKS.

MONARCHY NOT IN DISCUSSION.

FRONTIER ISSUE.

BULGAR CRIMI AUTHORS.

TWO RINGLEADER ARRESTED.

Skelmorlie reservoir site – Stephen Lockett

Dolgarrog memorial site – Steven Morris

Fisher Tarn Dam – Natalie Bennett

Knowledge Strategic Working Group

Fynnon Dam – Ken Ottley

The Knowledge group comprises three members:

David Neeve (Arup) is the Knowledge SOWG lead, with responsibilities for ICOLD Technical representatives and ReSRAG, having taken over from Barry Dooley (Stantec) in July 2022.

Rob King (AECOM) is responsible for the BDS database.

Andrew Pepper (Independent) is the Editor of Dams and Reservoirs and the BDS Yearbook.

Highlights of the Group's work in 2022

Dams and Reservoirs
From the beginning of 2022 Dams and Reservoirs, the peer-reviewed journal of the British Dam Society, has been dedicated solely to technical papers, with BDS 'in-house' matters of interest now being covered by the BDS Yearbook. We have been able to fill all pages of each of the quarterly issues of the journal with a range of interesting papers from the UK and overseas, with each issue being mailed out to all our members on time. (There is the option to receive only the on-line copy if desired).

BDS Yearbook
Our first Yearbook, covering events in 2021, was a little late in being published, as it was a new venture and everyone was learning. (It was not helped by the Editor being in Australia at the time, so a number of MS Teams calls with the Chair late at night (for the Editor) and early morning (for the Chair) took place). Informal feedback suggests that the Yearbook was well received, hence this 2022 edition. Feedback is always welcome – the captioning of all infill photos is as a result of member feedback.

Bibliography
The Editor has been liaising with Paul Tedd to update the Bibliography of British Dams (see page 19). Paul now has all the papers that he needs and we anticipate the updated version of the bibliography will be on the BDS website early on 2023.

How you can help

Sharing knowledge is key to our industry, which has unique dams, but their problems may have been met elsewhere by others. The BDS has numerous ways in which technical knowledge is shared, one of which is by members writing technical papers for the benefit of their peers. The Dams and Reservoirs Journal is the medium by which this knowledge can be shared with all members, so you are urged to consider writing a paper – or even a short technical note. The Editor will be happy to give guidance and assist as necessary.

Similarly, it is important that the UK representatives of ICOLD Technical Committees keep the membership of BDS informed when new Bulletins are published, and the ReSRAG Theme Leads help to ensure that ReSRAG theme pages are current.

Finally, please feed back what you think of this Yearbook, and how it might be improved for next year.

Membership Strategic Objective Working Group

The Membership group comprises six members, and its main objectives are to increase and diversify membership of the BDS.

Andrew Thompson (United Utilities) is the Membership lead

David Littlemore (Stillwater Associates) is BDS Chair

Rhys Coombs (CC Hydrodynamics) is the BDS Webmaster

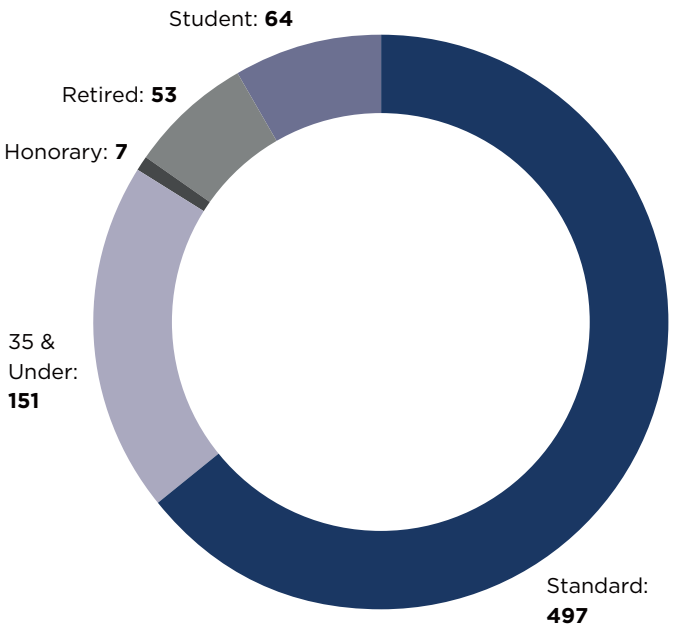
Martin Airey (Independent) is the BDS representative on the Reservoirs Committee

Kyle McLean (Mott MacDonald) is the YP Chair, responsible for YP membership

Amy Carter (Arcadis) is the BDS Equality, Diversity and Inclusion champion

2022 has seen significant growth in our society. Our membership numbers have increased by nearly 15% from 675 to 772 members and has included a significant rise in the number of Young Professional members (up from 98 to 151).

Current BDS membership by grade

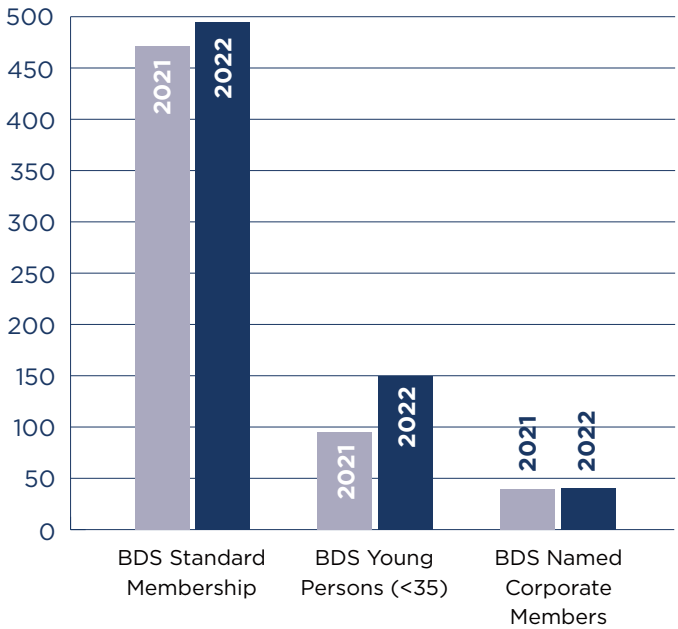


To achieve the objectives of the group, i.e. increase and diversify membership, we hope to provide more CPD and networking opportunities through our technical meetings in London (streamed to local BDS hubs across the country); lunchtime webinars led by the YP Group; technical site visits; competitions and finally our Supervising Engineers forum in September. These CPD events provide opportunities for the exchange of experience and information with other professionals, clients and industry suppliers.

The BDS Committee has taken the decision to increase our membership rates for 2023. This will be the first increase in subscription rates since 2005. The main reason behind the increase is to fund the initiatives that BDS now undertakes to attract and maintain young professionals to the profession, and to inform students and schoolchildren of the opportunities in dam engineering.

Category	New (2023) rate	Old (2022) rate
Member	£40	£35
Young Professional	£20	£15
Retired Member	£20	£16
Student	£0	£0
Corporate	£375	£375

Increase in BDS membership 2021 to 2022



Professionalism Strategic Objective Working Group

The Professionalism group currently has four members:

Matt Coombs (Binnies) the SOWG Lead and co-ordinates evening and technical events. This role was taken over half way through 2022 from Darren Shaw (Arup).

John Foster (Mott Macdonald) was a key member of the 2022 BDS Biennial Conference organising committee. Our first conference since Covid restrictions eased.

Stephen Cavanagh (Binnies) is responsible for the regional hubs and technical site visits.

Lucy Monkhouse (Canal and River Trust) was the Young Professionals (YP) representative in the group but her term on the committee finished in April. We would like to thank her for all her work during this time.

Over the course of 2022 the Professionalism SOWG has endeavoured to meet its five key objectives, which are outlined below:

1. Improve attendance at BDS technical meetings and improve the quality and diversity of presentations

The number of evening meeting events in 2022 was maintained, with most being online and in person with numbers attending One Great George Street steadily increasing. A summary of the 2022 events is given on page 5.

The regional hubs have now restarted, providing live streams of the BDS evening meetings in London, and are able be enjoyed as part of a group elsewhere in the UK. Refreshments are provided and anyone is welcome to attend. The current hub centres are: Warrington (UU), Leeds (Mott Macdonald), Birmingham (Binnies) and Glasgow (Fairhurst / Mott Macdonald).

Prior Park Site Visit – Matt Coombs

2. Increase the number of site visits

Site visits have been particularly challenging over the past couple of years with Covid restrictions, but a visit to Prior Park in Bath (National Trust site) was possible earlier this year.

3. Maintain attendance at SE/IE Forums and BDS Conferences

In 2022 the BDS 21st Biennial Conference was held at the University of Nottingham, and proved to be a very popular and well attended event. It was pleasing to see so many members in attendance and able to meet in person for the first time since the 20th Biennial Conference held in Swansea in 2018. It was an opportunity for friends and colleagues to meet and participate in lectures, site visits and workshops. We would particularly like to thank the sponsors and exhibitors who helped to make the event to successful. Recordings of the lectures will be made available on the BDS website shortly, and more details of the event can be found on pages 28 and 29.

4. Improve the 'events' area on the BDS Website

The events page now includes links to other related event of interest to BDS members such as ICOLD, ICE and other events (which may be hosted on other organisations' websites).

We would very much like to continue to expand this further and would welcome suggestions from members on related topics for other learned societies that they believe may be of benefit to the wider membership.

5. Newsletter

The SOWG continues to provide updates and details of forthcoming evening to the membership through the monthly newsletter.

How you can help

Within the Professionalism SOWG we are continuously looking for ways to improve events and membership facing activities. We would therefore welcome any suggestions you may have to increase engagement, interesting content (or meetings by other learned societies) and contributions with regard to content/presentations for evening meetings, site visits and the Supervising Engineers Forum. If you have a particular dam relative topic that you would like to present on please so not hesitate to contact Matt Coombs.

Llyn Llaeron – Steven Morris

The Young Professionals Group

Another year has passed! Over the past 12 months we have enjoyed sharing a number of in-person and online opportunities with our members. It has been an exciting year, with the success of the Inaugural International Young Professional Joint Webinar, ICOLD 2022 and the BDS Conference. The YP committee continues to work hard to provide events and opportunities for all members.

Who are we?

The Young Professionals group comprises members of the British Dam Society (BDS) under the age of 35. The group has been established to ensure the continuation of interest in the industry by the next generation and to help address the declining number of young members within the BDS.

What do we do?

The YP committee, while part of the wider BDS, exists to engage and support YP members and facilitate professional development and networking opportunities for those working in the industry.

The current YP committee has seven main objectives as follows:

1. Increase the BDS membership base of under 35s.
2. Increase networking opportunities for young professionals within the BDS.
3. Provide workshops for professional development.
4. Provide a mentoring scheme and professional development advice.
5. Assist BDS initiatives in schools, colleges, and universities.
6. Organise social evenings and events.
7. Liaise with other Young Engineers Forums in the ICOLD community to share ideas.

The committee is made up of four members, each of whom sits on the committee for a period of two years. The current committee, shown below, will serve until spring 2023.

Kyle McLean
YP Chair

Lucy Monkhouse
Events

Michael Calder
Mentoring

Xavier Bradley
Social Media

CPD Events

Throughout 2022 we have continued to provide our monthly CPD events on Thursday afternoons and have had some excellent presentations on topics including construction case studies; emergency onsite plans; reservoir engineering history and surveying techniques. With our events throughout the year averaging 60 attendees per session, it has been great to see so much engagement across the YP membership, and we would recommend anyone wanting to widen their knowledge of dams and reservoirs to take part too! All previous CPD events can now be viewed by going to the Members' Area of the BDS website, then clicking on 'Lunchtime Events.'

We would like to thank all presenters who have volunteered to share their knowledge and experience as part of these events and are always looking for new speakers – so please contact us if you would like to take part!

2022 CPD Activity	Presenter	Date
Clays Lake Flood Detention Reservoir	Steph Benn	January
Developments in the Construction of RCC Dams	Quentin Shaw	February
Reservoir Flood Maps: Theory and Practice	Jeremy Benn	March
Preparation of Emergency Onsite Plans	Matt Coombs	April
The reservoirs of Lord Armstrong – lessons that can be learned	Jeremy Benn	May
Flood Storage Reservoirs – lessons that can be learned	James Penman	June
BDS Evening Meeting – ICOLD Technical Committee update including YP initiatives	Kyle McLean	July
BDS Conference – Development of SupEs workshop	Kyle McLean	September
GTC leakage investigation on dams	Jürgen Dornstädter	October
Reservoir Surveying Techniques	Neil Harding	November
Geophysical characterisation of dams and leakages	Jo Hamlyn	November
Underwater surveying techniques	Neil Harding	December

Inaugural Canadian Dam Association and British Dam Society Young Professionals Joint Webinar

Inaugural Canadian Dam Association and British Dam Society Young Professionals Joint Webinar

In April, the BDS and CDA Young Professional groups hosted a joint webinar explaining the roles of each organisation, how dam safety is managed in the UK and Canada, and the process to becoming a licensed or professional engineer. Following the presentation, there was an opportunity for a live Q & A session, which saw engagement by attendees from all over the world. In total, over 150 people attended the event from over 15 countries. We would like to thank our speakers and the CDA for their participation and look forward to hosting additional international webinars with the ICOLD Young Engineers Forum community in the future.

BDS Conference

This year's BDS Conference was attended by a record number of YPs. Thank you to all those who took part in the YP networking event and the Quiz. The Supervising Engineer development workshop also was well received with lots of engagement during the hour-long open forum, exploring the common themes relating to the application and interview process.

Building the tallest tower at the YP Quiz

Upcoming Events

There is an exciting year ahead for 2023, as we develop our mentoring scheme and look towards holding more university talks to inspire more students into our industry. Moving forward, we look forward to hosting our second International Webinar with members from across the ICOLD Young Engineer's Forum.

We will continue with our very successful Lunchtime CPD events and hope to increase our engagement across our growing industry. The CPD events currently planned are:

- Risk Assessments for Reservoir Safety
- NEC Supervision at reservoirs
- Health and Safety – Public safety at UK reservoirs
- Waterproofing systems

We hope to host informal reservoir walks both in the south and the north, as an opportunity for members to come together. The visits will provide opportunity for networking, introduction to reservoir features and background to the unique sites. We are also planning on hosting a virtual training session on responding to an incident at a dam. Please get in touch if you are interested in either helping to organise the forum or a workshop for responding to an incident at a dam.

How you can help

Please feel free to contact us if you have any queries or would like to provide feedback to the YP committee. We are always open to new ideas and suggestions and intend to send out a survey in early 2023 to gauge a better idea on what opportunities would be useful. Please do take part to help us maximise the benefits of your membership.

General Queries:
youngprofessionals@britishdams.org
Mentoring: mentoring@britishdams.org
LinkedIn: British Dam Society
Instagram: BritishDams
Twitter: BritishDams

The BDS Supervising Engineer Mentoring Scheme

The British Dam Society Supervising Engineer Mentoring Scheme has been set up to support those training to be appointed onto the Supervising Engineer Panel. The scheme is focused on training Supervising Engineers, but it is open to any and all engineers looking to develop their skills and competencies within the dam industry. The scheme is coordinated by our Young Professionals (YP) committee.

The Mentoring Scheme is of key importance to our industry, and aims to help to address the steady decline in Reservoir Panel Engineers that has been observed in recent times and help achieve the British Dam Society's vision of being "a growing, inclusive and vibrant society; sharing knowledge and improving reservoir safety".

What does the scheme offer?

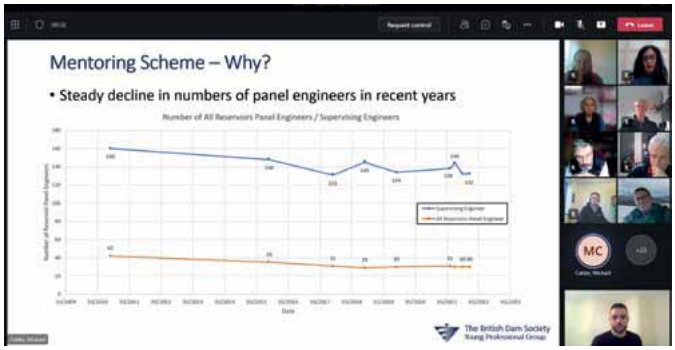
The Supervising Engineer Mentoring Scheme offers support to trainee Supervising Engineers via a series of initiatives, as follows:

- Networking Opportunities with engineering professionals outside your organisation, including All Reservoir Panel Engineers, Supervising Engineers and other trainees
- Opportunities to accompany Panel Engineers on Statutory Inspections including those outside your day-to-day discipline
- Continued Professional Development opportunities including design, operation and maintenance of dams
- Guidance and support during the Application Process and Interview Practice.
- Priority places for BDS Site Visits

Cruachan Reservoir – Matthew Craig

2022 Update

The Young Professionals Committee has continued its work throughout 2022 to re-establish and reinvigorate the mentoring scheme. Mentee applications were received and processed in late 2021, and our call for support in the form of mentoring was also positively received.



Regional mentoring hubs were established following applications review, with mentees and mentors grouped based on geographical location. Initial introductory workshops were held earlier in the year to kick-start the newly established scheme and introduce members.

The YP committee has been working closely with the ICE to develop MS Teams pages for the regional groups, which were successfully launched in April. These pages give scheme members a platform to help share, coordinate shadow inspection visits and group meetings, and allow the committee to share general knowledge and discussions about dam engineering.

The scheme is now a thriving group of professionals comprising a total of 31 mentees, and 21 Supervising and All Reservoir Panel Engineer 'mentors', located throughout the United Kingdom, and from a diverse and wide range of backgrounds.

The committee and scheme mentees meet once a quarter to discuss and share upcoming inspections events and activities, share general knowledge, and application tips. The YP committee has also received the wider support of the dam and reservoir community for these meetings too, having coordinated a presentation from a successful SE panel applicant who offered his support in presenting on his interview experiences to the mentee group.

Upper Lliw Dam – Jamie Lancaster

Scheme successes 2022

This year we have we have successfully coordinated mock interviews for advanced SE Panel candidates, and also facilitated over 30 No. S10 and S12 shadow inspection opportunities. We have also seen a handful of mentees recently submit their applications too.

One of the scheme's mentees has also been successful in their panel application this year. Congratulations to you on your success!

How you can help

We are always on the lookout for experienced dams and reservoir engineers, particularly panel engineers, to act as mentors for the scheme.

If you can offer aspiring SE panel engineers' guidance and support in their efforts toward application to the Supervising Engineers Panel, and would like to assist with the scheme, then please contact our YP Mentoring Champion:

Mentoring@BritishDams.org

How do I join the scheme?

A new application window will be opened in early 2023, and details will be sent to all BDS members in due course.

In the meantime, if you have any specific questions about the scheme, please email **Mentoring@BritishDams.org** and we would be happy to assist.

Final Message

We would like to thank all of those that have offered their time and efforts in the facilitation of the scheme, with particular thanks to the registered panel engineers acting as scheme mentors for their continued support.

Competitions

Young Persons Paper Competition

In January we held an evening meeting for the Young Persons Paper Competition. This competition is open to BDS members under 35 years of age, with a paper of 2,500 words and a presentation on a topic of dam engineering relating to the author's experience in reservoir research, design, construction, operation, maintenance, or supervision.

Following the presentations, the judges awarded the prize to **Amy Carter (Arcadis)** on her presentation on "Drivers for discontinuance: a multi-disciplinary approach to feasibility assessment."

The other finalists were:

Emma Bullen (Arcadis) – Managing the dam breach modelling and mapping of reservoirs in Wales.

Ciara Gill (Jacobs) – Forge Mill Flood Storage Area: Lessons Learnt.

Michael Jack (SSE) – Maintaining our dams and contributing towards Net Zero.

India Hutchinson (Stantec) – Grassholme Reservoir: Northern embankment stabilisation works.

You are able to listen again to these presentations via the BDS website, and papers of all five presentations have been published in Dams and Reservoirs (Volume 32, Issue 3, September 2022).

The Bateman Award

The Bateman Award is named after the illustrious Victorian dam engineer John Frederic La Trobe Bateman (1810 to 1889) who was involved in the construction of reservoirs and waterworks through much of the 19th century, and is awarded to the authors of a paper which has made a significant contribution to dam engineering or reservoir safety.

For this competition there were 70 eligible papers, covering a wide range of topics and is judged on technical content, originality and readability.

The award was presented to **Peter Mason** at the 21st Biennial Conference at Nottingham for his paper on 'Toddbrook: the independent government review – a forensic approach to causality.' This paper can be read via the BDS website – Dams and Reservoirs (Volume 30, Issue 4, December, 2020).

Other papers shortlisted for the Bateman Award were:

P J Mason – Implementing UK reservoir Safety – thoughts on future needs

J Benn – Lord Armstrong and the lakes of Cragside, Northumberland

A Brown, A Courtnadge & J Gosden – Detailing of flood detention reservoirs for resilience

N Bennett, J Foster & M Hewitt – RARS – A Client's perspective

D Chan, T Blower & J Green – Stabilisation of a service reservoir embankment suffering from seasonal downslope movements

Daer Reservoir – Ryan McHugh

Annual Photography Competition

We received 31 entries for the 2022 BDS Photography Competition.

The entries have been judged as follows:

1st – Ryan McHugh – 'Ogee, what a spill'

2nd – Craig Ramsay – Monar Dam

3rd – Joanna Parkinson – Llyn Cefni, Llangefni

The winning photographs are featured on the back page of the Yearbook.

Thanks to all who have entered the competition, your photographs may feature on the British Dam Society website and on the cover of the BDS Journal Dams and Reservoirs.

Upcoming events:

In 2023, there will be two competitions for BDS members. The November Evening Meeting is scheduled to be the presentations for the Young Persons Paper Competition. The annual BDS Photography Competition will again open in September 2023 – so remember to take some photographs while visiting reservoirs over the next few months.

Bibliography of British Dams

The origin of the "*Bibliography of British dams*" stems from Michael Kennard's 1994 Geoffrey Binnie lecture (Kennard, 1994) in which he states "*There is an extensive collection of papers on British Dams, in many different journals and conference proceedings, but there is no comprehensive bibliography.*" Using information on the Building Research Establishment (BRE) Dams database, the first version was compiled by Charles and Tedd (1996), and published in 1996 by BRE as part of its programme on reservoir safety research.

In 2010, Tedd and Charles (2010) provided an introduction to the bibliographies and publications available at that time on the British Dam Society website. Since then, there has been a large increase in the number of new guidance documents and revision of existing guidance available to engineers involved in reservoir safety.

The bibliography has been updated on several occasions. The current format as an Excel spreadsheet was first put on the BDS website in 2004. In 2021 it contained just over 1200 references, and is currently being updated to include papers from the BDS Conference 2022.

The bibliography was essentially concerned with dams within the ambit of the Reservoirs Act 1975 although it has now been extended to provided references to dams that have reservoirs within the ambit of current legislation with a smaller reservoir capacity. The main purpose has been to provide a list of papers that give a significant amount of information about specific dams; however, some more general documents such as engineering guides have been included. The vast majority of the publications included in the bibliography can be found in the library of the Institution of Civil Engineers (ICE). Many have been scanned by the ICE and are available electronically.

The bibliography only includes publications which have some relevance to dam construction, performance and safety. Publications which deal exclusively with environmental, recreation and social matters have not been included. The bibliography only includes papers that have been published in hard copy.

Each publication has a unique reference number, a full reference is provided, and the dams and subjects to which the paper is relevant are listed. The publications have been listed in two separate worksheets: numerically by reference number and alphabetically by first author. Publications relevant to specific dams or subjects can be rapidly located using the Excel search facilities.

The table below is an extract from the bibliography, showing the type of information that can be obtained:

No	Date	First author	Reference	Dams	Dams
115	1987	Tedd	TEDD P, CHARLES J A and BODEN J B (1987). Internal seepage erosion in old embankment dams. Groundwater Effects in Geotechnical Engineering, Proceedings of 9th European Conference on Soil Mechanics and Foundation Engineering, Dublin, vol 1, pp 507-510.	Challacombe, Cwmwernderi, Gorpley, Ramsden (Holmfirth), Walshaw Dean Lower	Internal erosion & filters
797	2002	Carter	CARTER I, CLAYDON J, WILSON G and SCUERO A (2002). Improving the watertightness of Winscar reservoir. Dams & Reservoirs, vol 12, July, no 2, pp 7-8.	Winscar	Asphaltic concrete, Geomembranes, Internal erosion & filters, Seepage & leakage

References

CHARLES J A and TEDD P (1996). *Bibliography of British dams: a companion report to the register of British dams (BR 310)* BRE Electronic Publications.

KENNARD M F (1994). Four decades of development of British embankment dams. 1994 Geoffrey Binnie lecture. *Supplementary issue of Dams and Reservoirs, pp 1-30*. Also Dams and Reservoirs, vol 5, no 2, June 1995, pp 3-14. British Dam Society, London, 1995.

TEDD P and CHARLES J A (2010). Publications and bibliographies of the British Dam Society. *Dams & Reservoirs*, vol 20, no 4, December, pp 151-161.

ICOLD Marseille conference

ICOLD's 27th Congress and 90th Annual Meeting was held in Marseille from 27th May to 3rd June 2022, which saw the welcome return to an in-person annual ICOLD event. There were over 1,400 delegates from around the globe who came together for eight days of knowledge-sharing, discussion and networking.

The event started with three short courses, the Technical Committee meetings and workshops. The Symposium was held on 30th May with presentations on four key topics of: Territorial and Water Multi-Purpose Issues; Governance and Funding; Innovative Solutions in Reservoir Uses; and Operating Multi-Purpose Facilities.

On 31st May there was the 90th ICOLD General Assembly as well as Technical Visits to local dams including the Malpasset dam ruins. The General Assembly saw the election of the new ICOLD President, when Michael Rogers of the USA, having completed four years in the role, handed over to Michael Lino of France.

The Annual Meeting ran from 1st to 3rd June with a variety of presentations covering:

Question 104 – Concrete Dams Design – Innovation and Performance

Question 105 – Incidents and Accidents concerning Dams

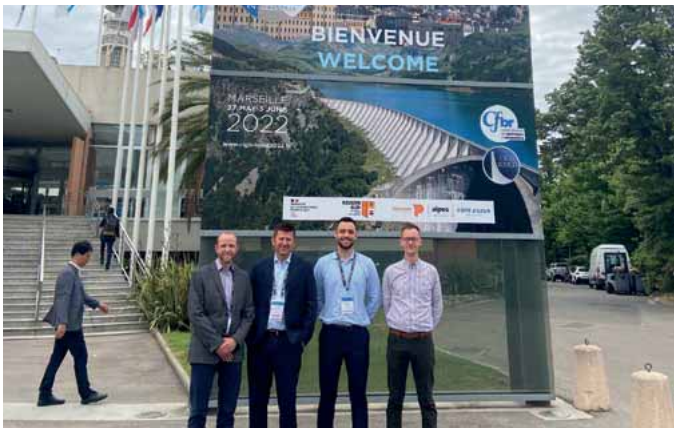
Question 106 – Surveillance, Instrumentation, Monitoring, and Data Acquisition and Processing

Question 107 – Impacts of Climatic Change on Existing Dams and Reservoirs and Remedies.

There were 47 attendees from the UK at the event with six presentations made in the Annual Meeting by UK representatives Rodney Bridle, Malcolm Dunstan, John Foster, Debbie Gray, Quentin Shaw, and Jonathan Simm.

The social events were varied and well attended. These included city tours around Marseille, a Baobab Cultural Evening, a UK Attendees dinner, and the Conference Dinner at the Palais du Pharo overlooking Marseille harbour. In addition, the Young Professionals had a packed programme of dedicated sessions and social events.

John Foster addresses the meeting



BDS Committee Members

Palais de Pharo, venue for the conference dinner

ICOLD 2022 – The Young Professionals site visit to Malpasset

Niall Allen, of Mott MacDonald, attended the **Malpasset Dam Failure YP (Young Professionals) site visit** on Tuesday 31st May 2022 during the ICOLD 2022 conference in Marseille.

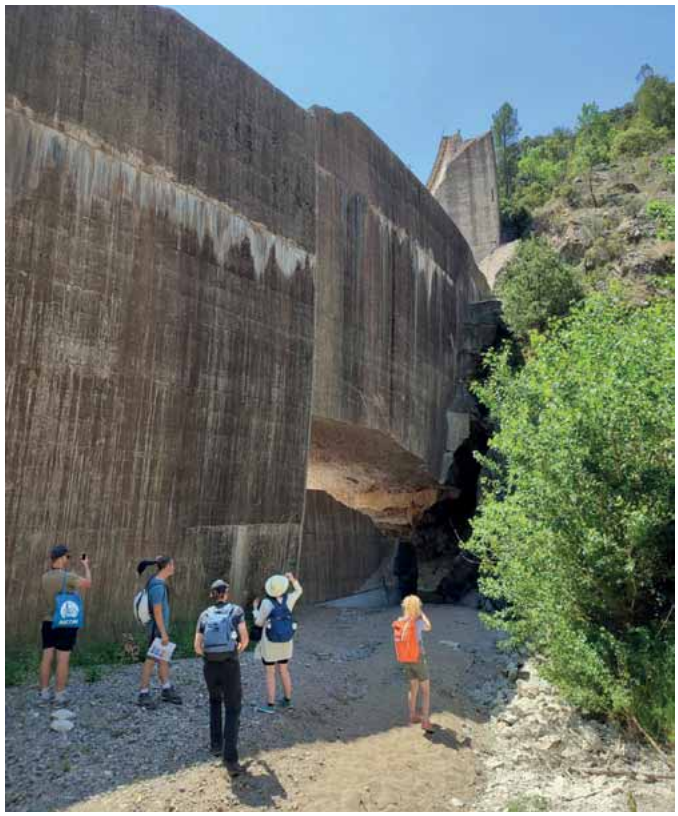
After a pleasant bus journey through the French Provence region, young engineers from around the world arrived at the Malpasset Dam Failure site near to Fréjus. The weather was typical of the region in May, bright sunshine with temperatures creeping up to the high 20s. The hosts from CFBR (Comité Français des Barrages et Réservoirs) were responsible for the organisation and smooth running of the day.

The Malpasset dam suffered an infamous failure in December 1959. Constructed in 1954, the dam was a 66.5m high double curvature arch dam which failed after an explosive failure of a large wedge of rock on the left bank foundation. This triggered the release of 50Mm3 of water downstream, severely impacting the city of Fréjus, leaving 800 damaged properties, and killing over 420 people.

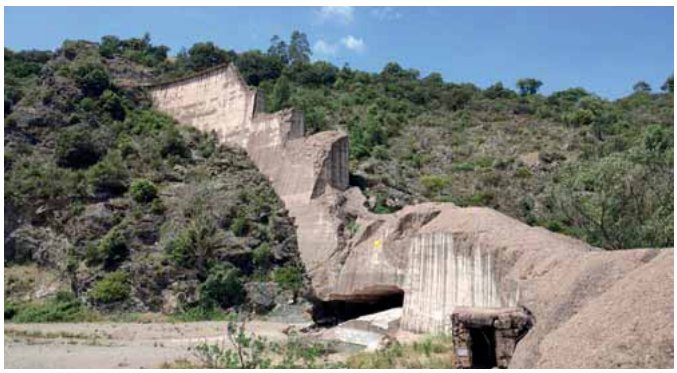
We were first taken to an exhibition at the Villa Aurélienne in Fréjus which reminded us of the human and economic catastrophe of the event. This also gave us the first opportunity to connect with other young engineers and speak about the dam failure and what it meant for the region and the industry as a whole.

We were then shuttled off to the car park just downstream of the Malpasset dam ruins. Split into three groups, ably assisted by a CFBR member at the helm of each group, we set off to tour the dam ruins. We walked upstream towards the dam where we were greeted by members of CFBR at different 'checkpoints' where they would explain the different components of the dam failure and gave us an opportunity to ask questions and discuss. The CFBR had also set out balloons on the downstream side of the dam to indicate the height of the 40m wave post-breach – this really put into perspective the size of the failure and subsequent impacts.

We were then given an opportunity to be up close and personal with the failed dam. It was interesting to see the scale of the failure and it was a true reminder to the next generation of dam engineers of the consequences of a dam failure. After a long day of learning and discussion, with new connections made, we jumped back onto the coach and made it in good time ready for the cultural evening at Vieux-Port de Marseille!



YP members examining upstream face of failed Malpasset Dam



Remains of Malpasset Dam from downstream side

The Benefits of being a BDS YP member

- Opportunity to join the BDS Mentoring Scheme, to support professional development in the industry.
- Access to a range of interesting CPD talks from senior experts in the industry across the year.
- Access to 'Dams and Reservoirs' journal.
- Opportunity to network with other young engineers through the ICOLD forum.

ICOLD Technical Committees and publications

ICOLD (International Commission on Large Dams) is a worldwide non-governmental organisation which provides a forum for the exchange of knowledge and experience in dam engineering. ICOLD was founded in 1928 and currently has 104 member states, with approximately 10,000 individual members. The British Dam Society forms the UK National Committee of ICOLD.

TECHNICAL COMMITTEES

A key means of exchanging information is by Technical Bulletins on a wide range of topics. These bulletins are the heart of ICOLD activity, and are produced by Technical Committees comprising members from a number of National Committees having expertise in a particular topic. Each Technical Committee will meet for 3 to 5 years to produce a 'state of the art' Technical Bulletin with recommendations for engineers using knowledge and examples from all over the world.

UK representatives on Technical Committees should therefore ensure that published guidance draws on UK experience, and where possible ensure that the outputs are relevant to the UK reservoir industry. Representatives are expected to attend most or all ICOLD Annual Meetings and other meetings of the Technical Committee as necessary, and to provide updates to the BDS membership on the activities of their committees, typically through relevant BDS evening meetings and / or contributing to BDS publications.

Technical Committee (TC) representative vacancies

Appointment of TC representatives and co-opted members is for a term of up to six years (with the possibility of a further three-year extension), and is co-ordinated by the BDS with vacancies advertised in August each year. The BDS is currently seeking interest from those who would like to serve on:

Committee G: "Environment"

Committee I: "Public Safety Around Dams"

The UK does not currently have representation on the following additional committees and is not actively seeking representation. However, if anyone has a keen interest in any of these committees then please speak with the BDS chair directly in the first instance before applying.

Committee Reference	Committee Name
F	Engineering activities with the planning process for water resources projects
J	Sedimentation of Reservoirs
K	Integrated Operation of Hydropower Stations and Reservoirs
N	Public Awareness and Education
R	Multipurpose Water Storage
U	Dams and River Basin Management
X	Financial and Advisory
Z	Capacity Building and Dams

In addition, the BDS is keen to appoint co-opted member to any committee, even if there is already a UK representative for that committee. The full list of ICOLD Technical Committees can be found here: **https://www.icold-cigb.org/GB/icold/technical_committees.asp**

There is a procedure to be followed to apply for a TC position, and ultimately to be approved by ICOLD, details of which are available from the BDS Honorary Technical Secretary, Andrew Thompson, on **HonTechSec@britishdams.org**.

Lubreoch Dam – Alan McGowan

Cilcain Reservoir No 1 – Hermann Stehle

PUBLICATIONS

Technical Bulletins

On completion by the relevant Technical Committee and sign-off at an annual ICOLD meeting, all Technical Bulletins become available free of charge to the ICOLD membership. There are currently over 170 bulletins that have been published since 1960, and these are all available to members via the ICOLD website.

Congresses Proceedings

ICOLD Congresses are held every three years, when three or four technical questions are selected and debated. The most recent Congress was held in Marseille in June 2022, and a summary of this event can be found on page 20. The questions debated at the congress were:

- **Q 104:** Concrete Dams Design Innovation and Performance
- **Q 105**: Incidents and Accidents concerning dams
- **Q 106**: Surveillance, Instrumentation, Monitoring and Data Acquisition and Processing
- **Q 107:** Dams and Climate Change

BDS Young Professionals attended all these events and a summary of the debate of each question will be published in a future issue of Dams and Reservoirs.

ICOLD publishes full proceedings of the Congress, including the academic communications and the ensuing discussions, which are free to attendees, but chargeable to non-attendees. However, congress proceedings over six years old are free to any ICOLD member, so free to all BDS members. (As these are provided on a USB memory stick you may have to pay a small shipping charge).

Symposium Proceedings

In each of the two years between ICOLD Congresses an annual meeting by an ICOLD member country, when the inviting country organises a symposium on a theme of its choice. The proceedings of those symposia include the academic communications presented during the symposium.

The next annual meeting is in June 2023 in Gothenburg, Sweden – see page 25 for more details. The symposium held during that meeting will have the theme ‘Management for Safe Dams’. The purpose of this symposium is to share information from case studies, technologies, and innovations to increase the safety of dams and levees along with their associated benefits.

Access to ICOLD Publications

BDS members firstly need to register with ICOLD to gain access to any publications, so please obtain the necessary details for UK members from the BDS Honorary Technical Secretary, Andrew Thompson, on **HonTechSec@britishdams.org**.

There is then an ICOLD Publications Portal to be negotiated with another login, again available from the BDS Honorary Technical Secretary, which will give you access to all the free publications (for download) and member-only discounted rates for chargeable publications, such as recent Congress proceedings or hard copies of bulletins.

ICOLD World Register of Dams

The Register

The International Commission on Large Dams (ICOLD) set up Technical Committee O to prepare and maintain a register of all the large dams throughout the world.

The definition of as "Large Dam", as adopted for the register, is:

A dam with a height of 15 metres or greater from lowest foundation to crest.

Or

A dam between 5 metres and 15 metres in height impounding more than 3 million cubic metres of water.

To compile the register information has been obtained from about 165 countries to date, not all of whom are members of ICOLD, and data is now held on more than 61,000 dams, of which the UK currently accounts for 569 dams.

The register is large database with very many fields, but for many dams only the basic information is held.

Examples of the more common data fields, most of which are generally completed for each dam, include:

Reservoir (name; owner; purpose)

Location (country; latitude & longitude; nearest town)

History (date constructed; design consultant; contractor)

Type (construction material; sealing; foundations)

Dimensions (height; crest length; crest altitude; dam volume; reservoir capacity; reservoir area; reservoir length)

Hydrology (reservoir catchment area; spillway capacity; spillway type)

The Committee

Technical Committee O comprises about 20 members, as representatives of their respective national committees, such as the British Dam Society.

Each member is responsible for the keeping the data of their own country up to date, but is also allocated other countries to liaise with, in order to ensure that their entries in the register are also correct and as complete as possible.

As an example, the French representative, who happens to be the Committee chairman, has 45 countries to liaise with. However, seven countries of those countries have no large dams at all, and another half dozen have just a single large dam.

In contrast, the UK representative is responsible for the data on the UK's 569 large dams and those of only three other countries, namely Australia (710 large dams), New Zealand (142 large dams) and Nigeria (150 large dams).

Access to the Register

To obtain full access to the register for three years the fee is €230 for members of the public and €173 for ICOLD members (all BDS members are ICOLD members). Anyone wishing have access to the register should contact the BDS representative on the committee, Andrew Pepper on **atpec@peppernet.org** or 07774 217 174.

The data search starts by completing a web page as shown in Figure 1

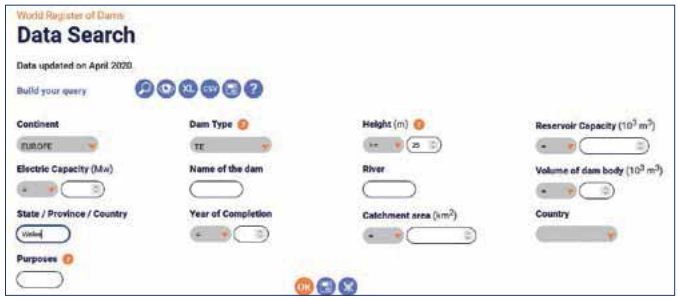


Figure 1: Date search entry page – here the search is for all earth embankment dams in Wales that are at least 25m high

Fifteen dams result from that search, see Figure 2. There are many more fields to these entries, which are not shown in this screenshot.

Name of the dam	Owner	Dam Type	Height (m)	Area of Reservoir (10^3 m²)	Reservoir Capacity (10^3 m³)	PDF
BLAEN-Y-CWM	Dwr Cymru / Welsh Water	TE	27	110	1,200	
CANTREF	Dwr Cymru / Welsh Water	TE	26	173	1,491	
CARNO LOWER	Dwr Cymru / Welsh Water	TE	27	88	800	
CELYN	Dwr Cymru / Welsh Water	TE	46	3,300	80,931	
CLAERWEN	Dwr Cymru / Welsh Water	TE	50	1,560	27,850	
LLANDEGFEDD	Dwr Cymru / Welsh Water	TE	39	1,732	24,408	
LLIW LOWER	Dwr Cymru / Welsh Water	TE	30	250	1,220	
LLYN CELYN	Dwr Cymru / Welsh Water	TE	58	3,500	73,965	
LLYN COWLYD	National Power	TE		1,035	9,430	
PANT-Y-REOS	Dwr Cymru / Welsh Water	TE	27	63	658	
PONTSTICILL	Dwr Cymru / Welsh Water	TE	34	1,412	15,640	
TALYBONT	Dwr Cymru / Welsh Water	TE	30	1,272	11,668	
USK	Dwr Cymru / Welsh Water	TE	33	1,160	12,253	
WENTWOOD	Dwr Cymru / Welsh Water	TE	26	164	1,863	
YSTRADFELLTE	Dwr Cymru / Welsh Water	TE	30	239	3,200	

Figure 2: Extract showing the fifteen results from the data search criteria in Figure 1

Clicking the right-hand column of the results page for any dam downloads a pdf datasheet page for that dam, which lists all the data held on that dam.

INVITATION TO GOTHENBURG, SWEDEN
ICOLD ANNUAL MEETING

11-15 JUNE, 2023

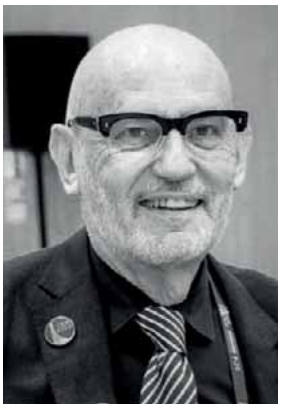
Swed COLD

CIGB ICOLD

ICOLD•CIGB 2023 GOTHENBURG

fortum LKAB BOLIDEN VATTENFALL

ICOLD Annual Meeting 2023



A Message of Invitation for ICOLD 2023 from President Michel Lino

Dear colleagues and friends of ICOLD,

On behalf of the International Commission of Large Dams/ Commission Internationale des Grands Barrages (ICOLD/ CIGB), I am pleased to invite our 104 National Committees to send delegates and their accompanying persons to 91st Annual Meeting of ICOLD. The meeting will be held 11 – 15 June 2023, in Gothenburg, Sweden.

Gothenburg is a friendly city located on the west coast of Sweden. She is called the second Swedish capital and known for its culture and long history of international trade and influences. As the second-largest city in Sweden, Gothenburg boasts a vibrant cultural scene, world-class restaurants, sustainable living, and a fascinating history – all within walking distance from our ICOLD hotels and conference center. In June we should enjoy very pleasant weather conditions.

This 91st Annual Meeting of ICOLD will be hosted by the National Committee of Sweden, SwedCOLD, who have been preparing for several years now. Several excellent Study Tours will be offered before and after the meeting along with our usual ICOLD exclusive Cultural Evening and Technical Excursion. SwedCOLD is also hosting a special symposium as part of ICOLD 2023 themed Management for Safe Dams. The purpose of this symposium is to share information from case studies, technologies, and innovations to increase the safety of dams and levees along with their associated benefits, perfectly fitting with the essential commitment of ICOLD to Dam Safety.

I am convinced that the ICOLD 2023 Organizing Committee, led by Maria Bartsch, President of SwedCOLD and former Vice- President of ICOLD, and Anders Isander, Chairman of the Organizing Committee will arrange a wonderful event and a friendly and inclusive reunion of the ICOLD family.

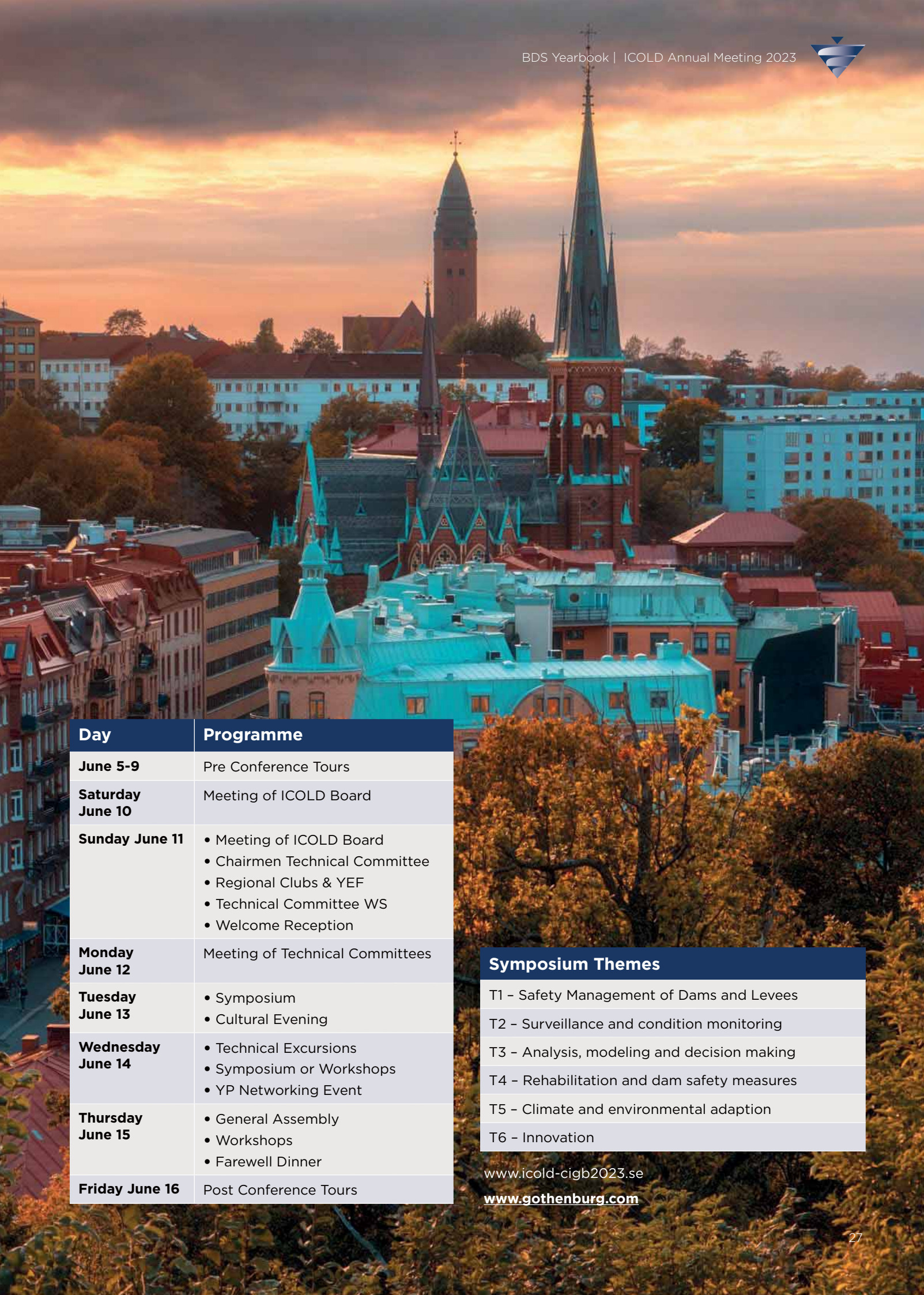
The year 2022 saw dramatic droughts across the northern hemisphere, devastating floods in South Africa and Pakistan, and a global energy crisis compounded by the war in Ukraine. In our changing world, ICOLD must be a key player in offering solutions to climate change adaptation and energy transition. We, dam and reservoir professionals, must pledge to play our full part in the process. Our annual meetings and congresses are milestones in our efforts to achieve these goals.

So, I warmly encourage our ICOLD family and friends to gather for ICOLD 2023 in Gothenburg as we continue the work to meet our mission in setting standards and guidelines to ensure that dams and levees are built and operated safely, efficiently, economically, and are environmentally sustainable and socially equitable. I invite representatives from all 104 ICOLD National Committees to participate in this meeting as we endeavour to meet the challenges of the 21st century in the development and management of the world's water and hydropower resources and to be part of the solution to the crisis that the planet is going through.

I will be glad to welcome you in Gothenburg in June 2023 in person and in good health.

Yours sincerely,

Michel Lino
President of ICOLD



Day	Programme
June 5-9	Pre Conference Tours
Saturday June 10	Meeting of ICOLD Board
Sunday June 11	• Meeting of ICOLD Board • Chairmen Technical Committee • Regional Clubs & YEF • Technical Committee WS • Welcome Reception
Monday June 12	Meeting of Technical Committees
Tuesday June 13	• Symposium • Cultural Evening
Wednesday June 14	• Technical Excursions • Symposium or Workshops • YP Networking Event
Thursday June 15	• General Assembly • Workshops • Farewell Dinner
Friday June 16	Post Conference Tours

Symposium Themes
T1 – Safety Management of Dams and Levees
T2 – Surveillance and condition monitoring
T3 – Analysis, modeling and decision making
T4 – Rehabilitation and dam safety measures
T5 – Climate and environmental adaption
T6 – Innovation

www.icold-cigb2023.se

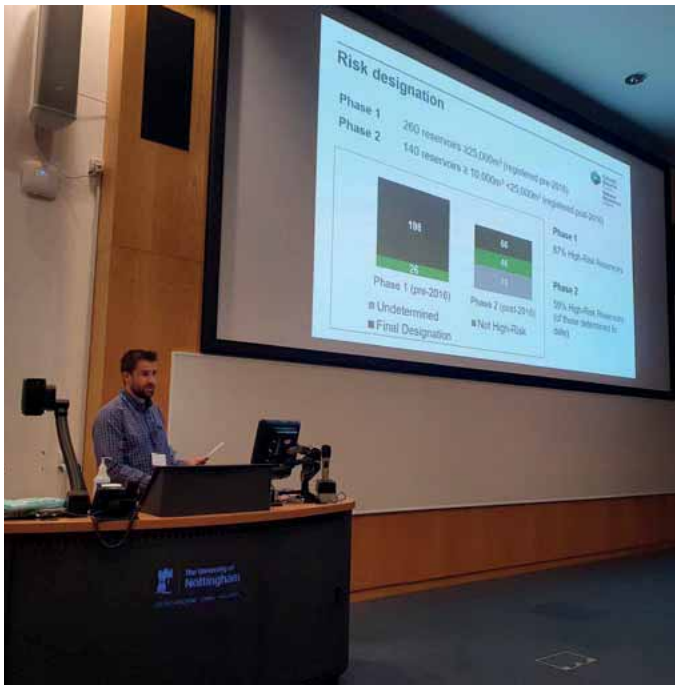
www.gothenburg.com

British Dam Society 21st Biennial Conference Summary

The British Dam Society 21st Biennial Conference was held at the University of Nottingham from 14th to 17th September 2022. This year's conference was titled '*Dams and Reservoirs in a Climate of Change*' to focus on the forthcoming changes to the reservoir safety industry as well as our changing physical climate. A record 290 delegates and 12 exhibitors attended the event, which followed the same conference format as our Swansea Conference in 2018, with technical presentations in the morning sessions followed by either workshops or site visits in the afternoon. Over the three and a half days of the conference there were 24 technical presentations, 4 site visits and 16 workshops together with social events each evening.

The conference also included an opening welcome from Dr Bob Steer (Severn Trent Water) and Keynote Speech from Caroline Douglass (Executive Director of Flood and Coastal Risk Management, Environment Agency).

Tim Hill from Mott Macdonald was this year's Geoffrey Binnie lecturer. His presentation was very well received and formed part of our last evening's events, which ended with an excellent dinner. A technical paper of this year's Binnie Lecture will be published in Dams & Reservoirs in due course.



Geralllt Richards updating the conference on the work of NRW

The conference's **technical sessions** were as follows:

- **Session 1:** Legislation, research and guidance
- **Session 2:** Reservoir societal and environmental impacts
- **Session 3:** Flood Storage
- **Session 4:** Reservoir Operation and Investigation
- **Session 5:** Extending the lifespan of assets
- **Session 6**: Reactive response/remedial works

Recordings of each of the sessions will be added to the BDS website.

The sixteen **workshops** were as follows:

- Panel Engineer Development (SE) – S12 site visit
- Concrete dams' lessons
- Retrofitting of aging dams – drawdown capacity
- Managing conflict between reservoir safety and other legislation – Part A & B (Two Sessions)
- ICE review into the supply of Panel Engineers
- Toddbrook virtual site visit
- Geotechnical investigation of dams
- Emergency planning/Onsite Plans – Emergency planning for small owners
- Emergency planning/Onsite Plans – Testing of plans
- Service reservoirs
- Reservoir surveying techniques
- Panel Engineer Development (SE) – experience and application for panel
- Design of flood storage reservoirs
- Gated structures on dams – design, actuation, testing and maintenance
- Sustainable reservoir management
- Discontinuance of reservoirs

Outputs from each of the workshops will be added to the BDS website.

The **technical site visits** were to the following reservoirs:

- Hall Reservoir – Anglian Water
- Redmires Reservoir – Yorkshire Water
- Carsington Reservoir – Severn Trent Water
- Harthill Reservoir – Canal & Rivers Trust

A write up from each of these site visits is included within this yearbook.

SE Training Workshop at Newstead Abbey Upper Lake

Tim Hill delivering the Binnie Lecture

The British Dam Society is extremely grateful to the **conference organising committee** for all their hard work in pulling the conference together in such an amazing way

- Rachel Davies – Organising Committee Chair & Finance
- David Littlemore – Delegate registration
- Andrew Thompson – Proceedings & technical sessions
- Andrew Pepper – Proceedings
- John Foster and Darren Shaw – Workshops
- Matt Coombs – Exhibitors / Sponsors
- Chris Smith and Emma Hawkes – Site Visits
- Rhys Coombs – Website / Conference App
- Kyle Mclean – YP / Quiz Night

Feedback

Since the end of the conference, we have had lots of very positive feedback and some suggestions for improvements via the questionnaire that was sent to all delegates. Overall, the conference scored a very impressive 8.7 out of 10 with excellent scores for the teaching facilities (8.6); the conference format – Presentations & workshops (8.8); site tours (8.5); workshops (8.1) and the new app (8.8).

The BDS has always used university facilities to keep the cost of our conferences to a minimum and therefore we appreciate that the student accommodation and dining facilities may not be to the highest standard; however, even these elements of the conference received credible scores – Accommodation (7.1) and Food (7.5). A full breakdown of the conference feedback will be available on the BDS website.

Conference Site Visit: Hall Reservoir

Ian Kirkpatrick, of Anglian Water, led the **Hall Reservoir and WTS site visit** on Thursday 15th September 2022 during the BDS Conference.

Hall Reservoir is the raw water storage reservoir for Hall Water Treatment Works (WTW) which supplies 57,000 properties in the Lincoln area. The reservoir and WTW were designed and constructed by Anglian Water's Special Projects Alliance comprising Anglian Water, Mott MacDonald and Galliford Try; the Construction Engineer was Tim Hill of Mott MacDonald.

The visit took place on a dry but cloudy afternoon with participants from water companies and consultants. The visit was led by Ian Kirkpatrick and Will Ravencroft from Anglian Water with technical input provided by Tim Hill and Tim Blower of Mott MacDonald. The tour was conducted in a relaxed and informal manner which meant that there were some meaningful discussions and exchanges of information between the participants.

After a journey from Nottingham University, during which lunch was consumed, a brief stop to use facilities at the WTW was followed by an introductory talk describing the works at the WTW office. The participants learned that Hall reservoir is a non-impounding reservoir constructed in 2013. 316,00 m3 of raw water, pumped from the near-by River Trent, is retained behind the oval shaped reservoir's 870 m long and 7.5m high perimeter embankment. This embankment comprises Mercia Mudstone and wind-blown sand with a re-worked Mercia Mudstone upstream waterproofing element. These construction materials were won from an excavation approximately 6m deep in the centre of the reservoir. The top 1m of the 'cut' surface was also re-worked to improve its water-tightness. Using the site won materials provided a cost-effective design agreed by the members of the Special Projects Alliance.

The participants were then taken the short distance to the reservoir, where they were able to see the compressor building (to operate the bladder outlet valve and Johnson screen on the upstream face), the inspection point for the outlet pipe (which comprises a 630mm diameter PE pipe within a 750mm diameter PCC pipe) and the 800mm diameter inlet main and inlet structure.

Figure 1 – 800mm diamater inlet main and inlet structure (used with permission from Mott MacDonald)

Figure 2 – Hall Reservoir embankment crest (used with permission from Mott MacDonald)

Figure 3 – Will Ravencroft of Anglian Water describing the Hall WTW UV plant (used with permission from Mott MacDonald)

The upstream wave protection and the protection to the overflow spillway comprises 'Enkamat' bitumen impregnated matting which the participants were able to see has been effectively anchored by encouraging vegetation growth.

The participants were able to see two surface drainage and weir chambers installed on the downstream slopes to monitor the two seeps which were observed in 2016 on the northeast section of the embankment. The eastern seep dried up shortly thereafter while the western seep dried up once the reservoir water level dropped to 1m below TWL. In 2017 site investigations were carried out and in 2018 the Alliance contractor returned to excavate a 4 m deep cut-off trench and backfill it with imported puddle clay over a short length of the crest, after which most of the seepage ceased. The remaining seepage point is monitored regularly.

Will Ravencroft then led the participants on a tour of the Hall WTW, where they leaned that the works draws water either from the raw water storage reservoir, which holds approx. 10 days' worth of storage, or direct from the Trent; abstraction rates can be up to 64Ml/d.

The works water blends with that of Newton WTW to ensure water quality is maintained, due to the higher nitrate levels and potential trihalomethane (THM) levels. Hall WTW currently runs on a fixed flow output of 8.0-10.0 MLD and the treatment incorporates UV streams which are used for pesticide removal in conjunction with hydrogen peroxide.

Conference Site Visit: Redmires Reservoirs

Jonathan Simm, of HR Wallingford, attended the **Redmires Reservoirs site visit** on Thursday 15th September 2022 during the BDS Conference

As a recent member of BDS, up to now previously focussed on levees, it was interesting to join some site tours to dams projects to see how the "other half" lives. On this particular day the objective was to view a cascade of three water supply reservoirs and their dams at Redmires, constructed in the mid-1800s to serve Sheffield. After a coach drive, with packed lunch on board, and some strong encouragement from Andrew Pepper to persuade the coach driver to take his vehicle up some narrow and steep roads, we arrived at the site and duly donned our PPE to visit the dams and reservoirs.

The focus of the visit to the upper reservoir was on works recently completed. A seepage problem through the dam had been solved by 18m long steel sheet piles driven through the dam core. To supply the pile driver a 350-tonne crane had been used, situated on a temporary rockfill causeway (still visible – see photo) constructed into the drained reservoir. Another development had been the installation of new siphon arrangements with a sufficient capacity to meet the new guidance that reservoirs should be able to be lowered at a (capped) rate of 1m per day. The siphon had been designed to be self-priming if the water level in the reservoir was at full supply level, with suction pumping being available to prime the siphon when the reservoir was partially drawn down. We were also shown the air admittance valve used to break the siphon.

For the inspection of the middle reservoir, we were fortunate enough to see the construction works in progress (see photo). In this case the works were aimed at addressing slope instability problems on the downstream face of the dam, problems that were evident on sections of the dam where works had not yet commenced. The overall approach to solving the problems had been introduction of a toe weight berm with incorporated filter, together with toe drainage to reduce pore pressures on actual or potential slip surfaces. The downstream slope had also been re-profiled.

Thanks to Newman Booth of Yorkshire Water and the construction team, Neil Shepherd and Chad Lockhart for providing excellent support and information on the visit.

Redmires Middle Reservoir showing works to stabilise the downstream face – Jonathan Simm

Redmires Upper Reservoir drawn down with temporary rockfill causeway still visible – Jonathan Simm

Conference Site Visit: Harthill Reservoir

Harthill Reservoir – Canal and River Trust

Jenny Clifford, of United Utilities, was on the visit to **Harthill Reservoir** on Friday 16th September 2022 during the BDS Conference.

Harthill Reservoir, located between Sheffield and Worksop, is a Category A Pennine Type dam, constructed in 1796. The dam has undergone many phases of upgrade work and repairs over the years, as was evident on site. The visit was led by members of the Canal & Rivers Trust design team, the Reservoir Supervising Engineer and Kier site team. The delegates were split into three groups to cover the main elements of work proposed on site.

The site and proposed work provided a good insight into the problems faced by the reservoir industry. The proposed siphon drawdown scheme encouraged conversations on different drawdown techniques and optioneering for the site, linking in to the drawdown workshop the previous day. It was interesting to hear about the suitability of different options considered and the views of the group members – from AR Panel Engineers, consultants and client companies.

Viewing the central spillway, which was to be decommissioned as part of the works, led to discussions on the incident at Toddbrook Reservoir and also the risks associated with these structure types. The outline of the proposed new overflow scheme on the western abutment provided an insight into the constructability of the scheme, the proposed programme and sequencing of works, along with the third-party challenges such as the footpath closure, land acquisition and the ongoing public consultation. The reservoir was being drawn down at the time of the visit in preparation for the works (during which it is proposed to keep it empty). However, the site was still very busy with the public, including fishing club members and walkers, who all appeared to be positive about the work.

It was interesting to see so many different phases of work, both completed historically and proposed for one site; from evidence of discontinuance of the upstream reservoir with a notch through the embankment to the proposed decommissioning of the existing draw-off arrangement.

Highlights of the visit for me were hearing about the archaeological surveys which were required prior to the new spillway structure, as well as the need to retain existing structures, such as the very small primary overflow channel, for heritage purposes. It was nice to hear from a member of the Keir team that this was his first reservoir project and was already a dream project.

We were lucky to have sunshine throughout the visit, even if we were a bit windswept for the conference dinner!

Conference Site Visit: Carsington Reservoir

Emma Hawkes, of Severn Trent Water, led the **Carsington site visit** on Friday 16th September 2022 during the BDS Conference.

After a pleasant bus journey with our packed lunches through the Derbyshire countryside, and with Martin Airey pointing out some particularly exciting tourist attractions, (Apparently the tramway museum is a must see!), 39 BDS conference delegates arrived at Carsington Water. The weather could not have been better, thankfully it was dry and sunny, as Carsington can be brutal with gale force winds and sideways rain even on the nicest of summers day.

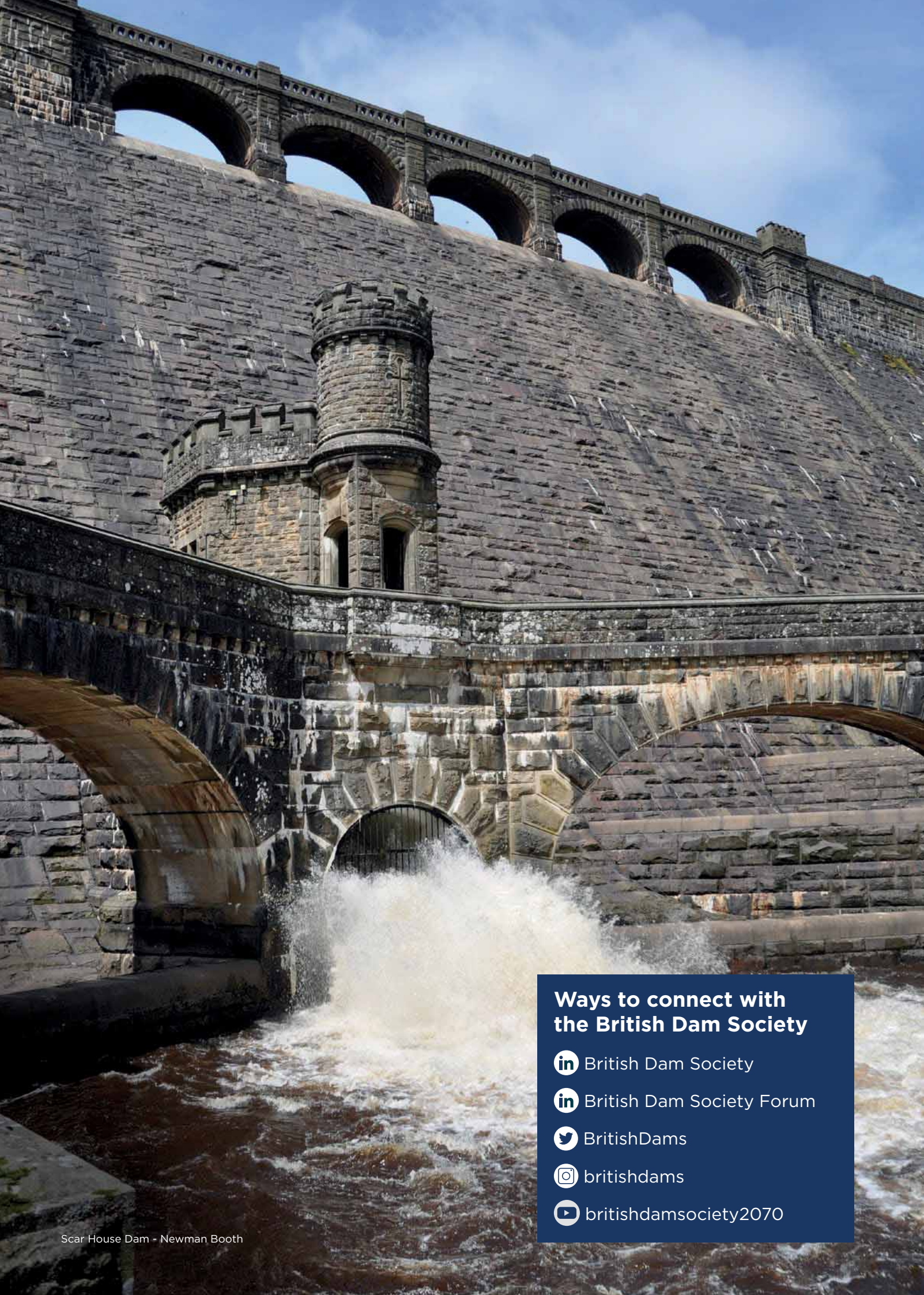
Split into three groups, ably assisted by a Severn Trent Water Reservoir team member at the helm of each group, off we set to explore. The site is an embankment dam, 1200m long and although we did not walk the entire length, the delegates got a good overview of the site layout, how it works, including the instrumentation that we monitor and some information on the visitor centre. (Unfortunately, there wasn't enough time to visit the ice-cream shop, but I thoroughly recommend if you are ever in the area). There was also plenty of opportunities to discuss the history of the site, the building of the dam and the infamous failure during construction. It was good to point out some of the features that changed following its rebuild; such as only two draw offs on the tower, rather than the original three due to the change in profile of the upstream face and where on site the failed material was re-used.

The final part of the tour was the tunnel and tower, which as far as reservoirs go, is quite a good one to see, until you get to the end of the tunnel and realise that 214 steps stand in the way of you and the views from the top of the tower. Getting the short straw, I took each of the three groups up the tower to admire the views across the reservoir and be able to see the overflow weir, which was very visible thanks to the reservoir level.

On the day of the visit, the reservoir was 7.2m below the top water level, like many reservoirs around the UK the water levels have been particularly low this summer due to the hot sunny weather and lack of rain. Carsington is used to supplement the River Derwent. The water gravitates down the aqueduct to the river outfall 10km away, allowing us to abstract from the river further downstream in Derby at two of our Water Treatment works supplying the Nottingham and Derby areas. We also pump the water up to another of our statutory reservoirs across the valley to support the water treatment works there that feeds the northern Derbyshire area.

Getting 39 people up the tower AND back down again, will forever be a career achievement for me. Thankfully we made it back to the campus with time to spare for everyone to do their hair and get their glad rags on, ready for the conference dinner that evening!

Carsington Reservoir drawoff tower – Emma Hawkes



Ways to connect with the British Dam Society

- British Dam Society
- British Dam Society Forum
- BritishDams
- britishdams
- britishdamsociety2070

Scar House Dam - Newman Booth

Internal erosion workshop

In July 2022 Andrew Thompson, the BDS Honorary Technical Secretary, was invited to Sheffield University to open the 28th European Working Group on Internal Erosion on behalf of the British Dam Society.

The European Working Group on Internal Erosion was first set up in 1993 under the chairmanship of Andrew Charles to focus on the vulnerability of dams to internal erosion. In 1984 Andrew Charles stated at a BDS conference in Cardiff that Internal Erosion is "the least understood and may be the most important mechanism for dam failure". The advancements in research, understanding and best practise on this "most important mechanism" were discussed over three days of presentations by predominantly international and UK based academics but also a number of industry-based professionals.

European Working Group on Internal Erosion site visit to Toddbrook Reservoir – View of the auxiliary spillway from the embankment crest with Whaley Bridge village in the background (Andrew Thompson)

> "The least understood and may be the most important mechanism for dam failure"

The topics covered in the technical presentations included modelling and investigations in the processes of suffusion and backward erosion on gap graded soil; application of Hole Erosion Testing; use of instrumentation and potential monitoring techniques for erosion processes; and techniques applied for risk assessments and determining the likelihood of internal erosion.

European Working Group on Internal Erosion site visit to Dale Dyke – Memorial to the 1864 event overlooking the embankment (Andrew Thompson)

European Working Group on Internal Erosion site visit to Dale Dyke – Original memorial plaque to the 1864 event funded by public donations (Andrew Thompson)

The event included technical site visits to Toddbrook and Dale Dyke reservoirs hosted by the Canal and River Trust and Yorkshire Water respectively and a tour of Sheffield University's geotechnical testing laboratories.

Championing diversity and inclusion in the British Dam Society

By Amy Carter

Amy is a senior engineer at Arcadis and was elected to the BDS committee at the 2022 Annual General Meeting for a three-year term. She was subsequently appointed to the newly created role of Diversity & Inclusion Champion, with the remit of initiating and developing a strategy for improving diversity and inclusion within the BDS membership.

Introduction

Those of you who attended the Young Professionals' quiz night at the biennial conference in Nottingham in September 2022 may recall a round of questions designed to get you thinking about your fellow colleagues and BDS members. What hidden barriers might they have overcome to reach this point? What situations may they be dealing with outside of work? What additional support could be provided to ensure they can fully engage with their role, and benefit from the opportunities that delivers? These are the kinds of questions we must ask ourselves if we are to create an inclusive working environment, and benefit from the breadth of knowledge and experience held by people from a diverse range of backgrounds and circumstances.

The current situation

The BDS has not previously collected data on the characteristics of its members, so we cannot provide a quantitative analysis of the diversity of the current membership or how this has changed since the Society's inception in 1965. The closest comparison we can draw is the following statistics, which are taken from the ICE's Membership Diversity Report 2020-2021 (available for download from the ICE website).

Of those ICE members who chose to declare:

The average age was 32. This is attributed to a response rate for under 40s of 80.7%, compared to 22.7% for over 40s.

63% are White British, with ethnic diversity decreasing dramatically at higher grades.

77% are men.

92% are heterosexual/straight.

93.33% described themselves as having no disability.

Of the latter two, the ICE notes that these are higher than the predicted national figures and suggests a hesitation to declare this type of personal information.

As a Society, we are acutely aware of the wider skills shortage in UK construction and the issue of the future supply of Panel Engineers as we enter a period of increasing demand for dams and reservoirs expertise. We need to change in order to attract and retain an engaged workforce, who collaborate more effectively and who develop more innovative solutions to the challenges of tomorrow. It is broadly acknowledged that increasing diversity in the industry is a solution to this problem.

Adopting a framework for change

As a Specialist Knowledge Society of the Institution of Civil Engineers (ICE), the BDS is committed to operating in accordance with the ICE's diversity and inclusion policy, and in particular with the Fairness, Inclusion and Respect (FIR) Committee's Diversity and Inclusion Action Plan 2021-2025. As part of this action plan, the ICE makes the following commitment.[1]

> "All our members and staff should feel able to challenge prejudice, whether racism, sexism, homophobia, transphobia, ageism, ableism, faith-based or social class-based discrimination and approach their work with open and critical minds."

Ladybower Reservoir – Ian Hope

[1] Diversity and Inclusion Action Plan 2021-2025. Fairness Inclusion and Respect Committee, March 2021.

Where are we now?

The FIR's Action Plan identifies a generic four-stage framework (Figure 1) to describe progression toward a more diverse and inclusive organisation. We believe that the BDS is currently operating at Level 1 and are seeking to implement our own action plan to reach Level 2 – with the creation of this new committee role being the first of these actions. Other actions we are looking to take in the short term include:

- Updating the BDS constitution to reflect our commitment to building a more diverse and inclusive Society.
- Developing a new section of the website to share our progress and signpost members to resources.
- Setting up a dedicated @bds.org.uk email address to gather member feedback and build connections with other initiatives within the industry.

LEVEL 1 INITIATING	Case for change is emerging, data and insights just being gathered; action tends to be informal, isolated, bottom-up, one-offs
LEVEL 2 DEVELOPING	Case for change is clear; quantitative data gathered; responsibility and accountability being formalised; guidelines being developed; activity being launched; connections being made
LEVEL 3 ENGAGING	Case for change is well established; qualitative data being gathered and shared; sustained senior level support in place; skills and capabilities being built; activity catching on; high levels of collaboration; clear signs of change
LEVEL 4 TRANSFORMING	The approach to change is focused on transforming the culture and systems of the organisation; complex qualitative and quantitative data is being routinely gathered and shared; high levels of dialogue, collaboration and learning; clear evidence of change

Figure 1. Diversity and Inclusion Progression Framework (Fairness Inclusion and Respect Committee, 2021)

Ben Lawers Dam – Jack Bradshaw

Where are we going?

It goes without saying that the ultimate goal is to reach Level 4, but this will be a complex journey with many viewpoints to consider. The committee recognises that none of us are experts in this field, and as a first port of call will be reviewing industry standards and taking advice from the ICE on how best to meet our commitment. Ideas currently being considered include:

- Commissioning a survey of BDS members to gather both quantitative and qualitative data on the current membership and culture of inclusion within the Society.
- Setting up a BDS 'allies' network to share thoughts and ideas on diversity and inclusion issues and create a sense of belonging for members from under-represented communities.
- Undertaking a review of the diversity of representation within BDS publications and events to facilitate benchmarking and drive improvement.

We will keep any action plan under regular review and be responsive to membership feedback and changes in best practice.

Final thoughts

As a newcomer to the BDS and this brand-new role, I have been encouraged by the support from members I have met so far, and particularly by the numerous observations of greater representation at this year's conference. It would appear that we are already on the right path, but it is up to all of us to accelerate the cultural shift which will ensure the continued relevance and success of our Society. I look forward to working with and on behalf of all of you to drive this initiative forward in 2023.

If you are interested in getting involved, please reach out to **amy.carter@arcadis.com**

The British Dam Society would like to congratulate the following members on their appointments to a Reservoir Safety Panel

Appointed as an All Reservoir Panel Engineer:

Anthea Peters
Associate, Arup

Appointed as Supervising Engineers:

Debbe Cook
Principal Engineer, Arup

Chris Dale
Associate Director,
JBA Consulting

Jeremy Fletcher
Engineer, Arup

James Howard
Technical Director,
JBA Consulting

Rob King
Associate Director,
Dam Engineering, Aecom

Stephen Maxwell
Senior Reservoirs Engineer,
Canal & River Trust

Jayne Norman
Reservoir Supervising
Engineer, Yorkshire Water

Clement Okundonor
Reservoir Engineer,
Affinity Water

Nick Prytherch
Senior Reservoir Technician,
Severn Trent Water

Christopher Restorick-Vyse
Associate Engineer, Atkins

Richard Terrell
Design Manager for Reservoir
Development, Binnies

Alasdair Walker
Principal Civil Engineer,
Mott MacDonald

The British Dam Society would also like to congratulate the following members on their reappointments to Reservoir Safety Panels

All Reservoirs Panel:

Tim Hill, Mott MacDonald
Jonathan Hinks, HR Wallingford
Dominic Molyneux, Binnies UK

Service Reservoir Panel:

Robin Hawley, Independent

Supervising Panel:

David Bell, AECOM
Stephanie Benn, Jacobs
Matthew Curtis, United Utilities
Alun Davies, Natural Resources Wales
Alan Dickerson, Forestry Commission
Barry Dooley, Stantec
Murray Drummond, Scottish Water
Christopher Fisher, Jacobs
Jonathan Forester-Green, Yorkshire Water
Moray Gaskin, SSE Renewables
Steven Gledhill, United Utilities
Jonathan Highfield, Stillwater Associates
Ian Hope, Severn Trent Water
Matthew Jenkins, Arup
Anthony Judge, Scottish Water
Ralph Kelly, Scottish Canals
Michael Miller, Northumbrian Water
Ross Morrin, Scottish Water
Steven Morris, Natural Resources Wales
Clare Pailing, United Utilities
Bryn Philpott, Thames Water
Douglas Scott, SSE Generation

The members below have now retired from their respective reservoir panels, and the BDS would like to acknowledge the contribution to dam safety that they made while serving on their panels

All Reservoirs Panel:

Martin Airey
Keith Gardiner
Richard Robson

Supervising Panel:

Graham Cleverley
Andrew Robertshaw
Andrew Ross

Castlehill Reservoir – Mark Mackenzie

ICE Panel Engineers' Committee

The following summarises the creation, operation and initial activities of this newly-formed ICE Panel Engineers' Committee, or PEC. The committee's aims are to represent all panels of reservoir engineers and provide a link for communication between reservoir engineers and the government departments and their regulators across the United Kingdom.

The purpose of the committee is to exchange ideas and information with government and the enforcing agencies of the four nations and the ICE to help with the early involvement of ideas in the delivery of David Balmforth's second report recommendations. The committee will provide a voice for reservoir engineers working within the current reservoir safety regulatory framework, but also to provide guidance and direction for planned future amendments and potentially even completely new reservoir safety legislation.

Invitations for applications to this new committee were sent to all reservoir panel engineers at the beginning of the year from the Reservoirs Committee chair. Eighteen responses were received. The committee of panel engineers comprises the Chair, initially the Reservoirs Committee chair, and seven members, with representation from the BDS committee, the Reservoirs Committee, Scotland and large undertakers has been formed. Members of the committee are:

- **Alan Brown** (ARPE and Consultancy and independent Undertakers)
- **Siobhan Butler** (SE and large Undertaker)
- **Paul Farnell** (SE and large Undertaker)
- **John Foster** (ARPE, BDS, Consultancy and independent Undertakers)
- **Mark Hayward** (SE, Consultancy and independent Undertakers)
- **Tony Judge** (SE, Scotland committee and large Undertaker)
- **Chris Scott** (APRE, ICE Reservoir Committee and Consultancy)

Rosebery Reservoir – Stewart Roberts

The committee had its inaugural meeting on 23rd June 2022, chaired by the then chair of the Reservoirs Committee, Mr Richard Coackley. The new chair of the committee will be Mr Ed McCann. Since this first meeting the Secretary of State has formally accepted all the Balmforth recommendations.

It is anticipated that the committee will meet twice a year, with additional ad hoc meetings when required. The ICE has agreed to initially provide a secretariat role for the creation of the committee.

The intention is that the ICE will create a web forum/portal on the ICE Reservoirs site to receive and share views and comment from Panel Engineers, and where Panel Engineers can view updates on progress and invitations for feedback on the DEFRA/PEC agenda. It is expected that this portal will also be accessible from the BDS website. The committee membership has also been set up not only to represent specific areas of the reservoir safety community, but so that they are also accessible to different parts of the reservoir safety community.

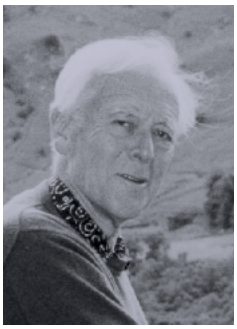
The committee will in addition provide updates to reservoir panel engineers through:

- Briefing notes from their meetings will be made available online.
- Presentation briefings at the BDS Supervising Engineers' Forum, All Reservoir Panel Engineer Forum and at the biannual BDS conference.
- Updates will be provided to the ICE's Reservoirs Committee and the BDS Committee.

The committee and DEFRA will now arrange a first meeting to confirm the process and protocols to be followed regarding future liaison and correspondence, with the aim to make it as effective as possible.

To date, beyond the setting up of the committee, it has already been consulted on and involved with the early findings of the DEFRA/ICE research and consultation project regarding the future supply of panel engineers chaired by Lord Robert Mair. This has included an exercise in modelling required panel engineer numbers against potential future legislation changes which was presented at a workshop at the 2022 BDS conference.

Obituary: John Edgar Massey



John Edgar Massey
BSc CEng FICE FIWEM

July 1924 – April 2022

John Massey was a water and dams engineer for most of his 50-year career. He was a husband, a father, a mentor and a friend to many. He was a man always interested in what was happening, always enquiring and asking questions. He was a long-standing member of the British Dam Society and within the sector he was a well-respected elder statesman.

Born in Sankey, Cheshire, he attended Wade Deacon Grammar School in Farnworth before moving to Chorlton to complete his High School Certificate in 1941. Too young to be called up, John found work as a junior site engineer with F Mitchell and Sons Ltd and after a quick lesson with the 'dumpy level' from his Dad, found himself at the wise age of 17 setting out oil storage tanks and pipelines for defence contracts. During this time, he learnt to drive (on a 5 ton Bedford lorry) and to quote John, "whenever I could, I would have a go at driving some of the machines, such as bulldozers, scrapers, dragline excavators, and of course lorries..... and for a while I had the ambition to become a full time lorry driver – until my father discouraged me". One can only wonder on what might have been.

In January 1943 he was called up to the Fleet Air Arm, but peace broke out just after he completed his Cadetship in Mechanical and Electrical Engineering and he did not see active service. Demobbed in 1946 John enrolled at Manchester University and graduated in Civil Engineering in 1949.

John's early working experience was on a variety of civil engineering projects, including re-building war damaged warehouses and sidings at Birkenhead Docks, sewerage works in Yorkshire and hangars at Heathrow. In 1956 he joined G H Hill and Sons in Manchester and started his 30-year involvement with the firm, where he was engaged on numerous water treatment and reservoir projects.

Through his career he became Senior Partner of G H Hills and when the firm was taken over by Mott MacDonald in 1989, he was appointed as a Technical Consultant with particular emphasis on dam and reservoir engineering. He was also Secretary, then President of the Institution of Water Engineers, Northern Division, and a member of Panel 1 under the Reservoirs (Safety Provisions) Act 1930, and latterly a member of the All Reservoirs Panel under the Reservoirs Act 1975. There are many reservoirs between the Midlands and Inverness that have had the benefit of his input, be it design, construction, or inspection.

John retired at the age of 74 but maintained a keen interest in the industry to the end. He encouraged pub lunches with former colleagues to catch up on the latest news and even in his late 90s wouldn't think twice about driving across the moors no matter the weather to meet up with a good friend.

Away from work he was pro-active in his local Methodist church, a driver of the community enterprise ambulance and took on various roles as a Rotarian, including Vice President and President, and on cold winter nights on the Father Christmas float. He was a keen promoter of the charity WaterAid acting as their adviser to Zambia and in recognition of this the Rotary Foundation of Rotary International awarded John the Paul Harris Fellowship "in appreciation of tangible and significant assistance given for the furtherance of better understanding and friendly relations among peoples of the world".

He never forgot his family and friends, as the cards and 200+ attendees at his funeral bear witness to this.

Some project examples

Typical of the profession, John was involved with many projects over his career. The following are but a small sample of the reservoir projects:

- **Dovestone;** 5Mm^3 capacity, 38m high earth and rock fill dam near Manchester.
- **Whiteadder;** 7.4Mm^3 capacity, 30m high earth and rock fill dam in East Lothian.
- **Turriff Raw Water Reservoir, Aberdeenshire;** a 195m diameter circular open pumped storage reservoir comprising mass concrete gravity walls and cut-off
- B**arnby Raw water reservoir, East Yorkshire;** 900,000m^3 open pumped storage reservoir with 9m high, reinforced concrete cantilever walls.
- **Raywell covered treated water reservoir, Humberside;** 100,000m^3 capacity, 7m high mass concrete gravity walls.
- **Ho Man Tin covered treated water reservoir, Kowloon, Hong Kong;** 80,000m^3 capacity 6m high reinforced concrete cantilever walls.
- **Wharford Farm flood balancing reservoir, Runcorn**; Bankside storage with earth fill embankments.

Of the numerous statutory inspections that John made, he always held the reservoirs at Walshaw Dean in the remote wind-blown Pennines as one of his favourite locations.

BDS Interview – Ian Carter

In June 2016 I nervously walked into a basement meeting room in One Great George Street to face my SupE interview panel which included ARPE Ian Carter. In November 2022 I had the opportunity to turn the tables and ask some (not so) tough questions! I joined Ian (via Teams) to talk about his career, time as BDS Chair and his views on the future of the industry.

Ian Carter is an ARPE and Technical Director (Dams) at Stantec

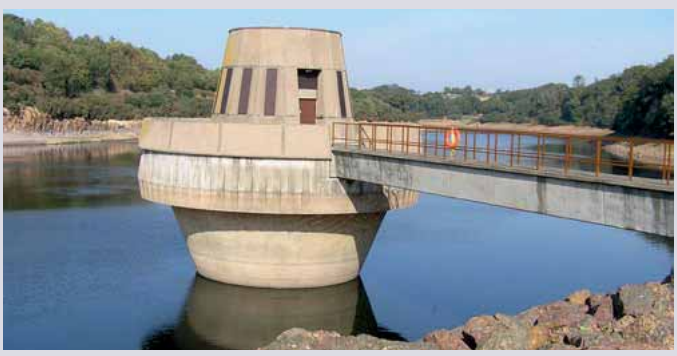
Interview by Andrew Thompson, BDS Honorary Technical Secretary

AT – So, Ian, where did it all start for you and what made you choose a career in the dam industry?

IC – Where did it all start? As an undergraduate I'd always had a hankering for a tunnelling career and my best friend, he was the person aspiring towards dams. As it turned out we went completely the other way and I went into dams, he went into tunnels. At the onset of my career, I wanted to work at Kielder Dam but was disappointed. However I wanted to travel; I wanted a bit of adventure. Back then, there was no such thing as a gap year, and if you wanted to travel you would look for jobs overseas. An opportunity opened to work on Kotmale Dam in Sri Lanka and I went for it.

I was mainly involved in ground investigation during the construction of the dam. It was a concrete-faced rock-filled dam built on a karst foundation with natural caverns, major faults and shear zones. We did all sorts of esoteric tests and some very deep drilling, 200 metre deep holes into the tunnels and powerhouse. You could see things changing in front of your very eyes. It was so very inspiring and I was hooked from that point.

You find that once you've got a little bit of experience then other opportunities tend to come along. Other dam construction work followed; I went on to Kenyir Dam in Malaysia, to Benutan Dam in Brunei, and later to Queen's Valley in Jersey. That set me up to turn my hand to dam design and later still to reservoir safety. I rather feel that dam engineering chose me rather than the other way around.



Queen's Valley Dam, Jersey – Ian Carter

AT – Did you have a mentor or someone who guided you in your early part of development?

IC – I don't think you stop having mentors, really. I think they might not be formal or official but, as you go through your career, different people help you and give you pointers as to what you need, where you might go. In Sri Lanka I came into contact with the expert panel and had several opportunities to talk to these international experts. Later on, I had the good fortune to came under the influence of the Hawksley team who engineered Empingham Dam. There were numerable luminaries amongst that team: Rod Bridle, Bob Schofield, Peter Horswill and Ron Cole, but others on the periphery too, such as Prof Peter Vaughan and Dr John McKenna. They all provided insight and their words of wisdom helped me to develop my career. I feel very lucky that I came into their orbit and I'm massively grateful to each one.

AT – Have there been particular projects or moments that were career highlights along your journey?

IC – I think a highlight would be the Queen's Valley scheme in Jersey. My role was Resident Engineer and I was there from beginning to end. The scheme had three dams. The main dam was made watertight by an asphaltic concrete core and was 30 metres high. ACC dams are relatively unusual, which is strange given their absolutely superb track record and performance. A highly underrated dam-type in my opinion. The other two structures were a concrete-faced rockfill dam and a concrete core dam. So the job had great variety. Big dams, like Kenyir, a 155 metre high clay core rockfill dam, are awe inspiring, but they do take a long time to build. I spent eighteen months or so on that project but it took around seven or eight years to complete, so typically you only get to see parts of those jobs.

As well as the "Tech-fest", there was quite a bit of public-facing work to be done in Jersey, which wasn't easy, as there was a lot of opposition to dam construction on the island. We had an uphill struggle persuading many local residents of its need and value, not to mention convincing them of its safety. One particular family was very difficult throughout the entire construction period. I was dispatched on numerous occasions to speak with them. A lot of listening, patience and empathy was needed, although it never seemed to be quite enough. However, when I returned to Jersey a couple of years later and bumped into them again, it was as if the prodigal son had returned! Their attitudes had been transformed. They were delighted with the outcome and so pleased to see me again. People tend to fear the unknown and even though you try to persuade otherwise, they still find it hard to believe. Knowing that we had not only done a really good job, but had also changed the hearts and minds of some of our strongest detractors, was very satisfying for me and most certainly a career highlight for me.

Draw off towers at Mengkubau Dam, Brunei – Ian Carter

Mengkubau Draw-off Towers in Brunei also gave me a lot of personal pleasure, as it gave me the chance to dabble in architecture. These happened to be conceived one Boxing Day afternoon after contemplating the remains of a Christmas pud.

AT – I guess it's rewarding to see the end product in the construction process. Are there other dams you have returned to see them as complete?

IC – Yes, I have on many occasions, with varying outcomes. Sometimes you like what you see when you go back, as was the case in Jersey. Abberton Dam in Essex was much the same. The latter was already a Special Protection Area (SPA), SSSI, RAMSAR, etc., when we started but the scheme delivered further ecological and environmental benefits and enhanced the landscape.

But there have been other projects, especially overseas where owners and clients have sometimes failed to maintain them as well as they might (and should) have done. I've had people tell me, 'We can't locate the instrumentation house,' and then found that part of the dam had been completely reclaimed by secondary jungle, like some of lost city in the Khmer rainforest. Those 'returns' can be really demoralising, especially when you recall the effort that went into building them in the first place.

Derwent Dam – Ian Carter

AT – Over the years you would have inspected, supervised, visited many reservoirs, do you have a favourite?

IC – That's a tough question, and I hesitate to answer, I don't want to choose one and then, on reflection, realise that that it's not my favourite at all! A bit like children, dams and reservoirs all have their endearing and redeeming points, a vista here, a detail there. Like many things in life, you tend to remember recent experiences. I was down in Berkshire a couple of days ago at a beautiful place in "Downton Country", where there is a beautiful house built on the dam that looks out over the water. The reeds, the trees in all their Autumnal splendour. Idyllic! I'd die for a place like that! Well, that's my favourite for the next 48 hours anyway!

That said, I do have a soft spot for the North Pennines and Derwent Dam in Durham in particular. It was built in the 1960s, arguably the halcyon days for the UK dam building era. Few dams in recent times can lay claim to the dam being completely redesigned after contract award and with the team already on site. It must have been one of the last dams to have been built before projects moved into the 'modern' era and beset by commercialism, contractual claims and confrontation. From my research into Derwent's history, and having spoken to some of the key 'players' involved, it's quite clear that client, designers and contractor all worked together closely using cutting edge technology and thinking. Together they achieved an outcome, which was not only completed in a timely fashion but with elan, craftmanship, and an attention to detail and aesthetics that was remarkable. I always enjoy going to visit that one.

AT – What is your view on the main challenges that face the industry in the future?

IC – Resources. That's the fundamental challenge. The need for dam engineering professionals is increasing. How we attract new blood into our sector will be challenging. How we keep those people and stop them draining away to other more lucrative parts of the profession will be even harder. The Balmforth Review has broached the subject but seems quite naïve in its approach to the matter. There are so many different factors pulling the sector in opposite directions. It won't be a simple nut to crack. I've seen an awful lot of young graduate engineers who have a promising start but are then lost into project management or some other field. Providing not just training, but also learning opportunities that give employees the chance to broaden their experience, will be a huge challenge. The problem is easy to see but the solutions are going to be really hard to find.

Abberton Main Dam – Ian Carter

AT – In 2021 and earlier this year, in England, the industry was busy preparing on site plans following The Flood Plan (Reservoirs Emergency Planning) Direction 2021. Have you ever been unfortunate to be involved in any incidents?

IC – Yes, a few come to mind, although those were at a time before mandatory reporting was introduced and incidents became capitalized with an "I", so to speak. In each case, the outcome was a precautionary drawdown, as this is the Dam Engineer's main go-to tool at times of doubt or concern. Fortunately, none of these events escalated into full-blown incidents requiring 'heroic' action. Thankfully, all were resolved in a relatively straightforward manner.

I've also been involved with several planned tests in recent years, which generally turn out to be insightful. It is surprisingly easy for the plan to fall flat on its face even before it has really got going. During one such test, with the cast 'prepared for action', the initiating phone call from the "member of the public" into the customer call centre, was met with 'Thank you for your call, we'll have a technician come out and look at it within the next 48 hours'.

AT – What advice could you give to engineers in the future who will be testing their plans?

IC – My general advice would be much the same whether it is for a flood plan test or a real-life crisis. The desire to panic needs to be avoided; but, if you must do so, then 'panic slowly'. Take time to consider the situation and don't jump to a diagnosis, as there may be alternative explanations for the symptoms that present themselves to you. You need to stay calm, look at the evidence and think matters through before leaping into action.

I have no doubts that the testing of flood plans will create huge logistical issues. Not only are dam safety professionals in very short supply, but I also wonder how invested other stakeholders will be.

I dare say that we will all learn a great deal from testing flood plans but I confess to being a little concerned about 2027, the 5-year anniversary of the Ministerial deadline, which could turn out to be chaotic, if not paralysing, when hundreds of flood plans need to be tested and reported upon. In this matter, I suggest that Supervising Engineers critically review their flood plans sooner rather than later.

AT – You were BDS Chair between 2005 and 2007 – how much do you think the Society and industry has changed?

IC – I'll answer the second part of the question first. The biggest change in the industry over the last couple of decades has been the ever-increasing need to consider environmental matters. These issues were around when I started out on my career. Contrary to received wisdom, they weren't ignored, I mean, why would you ignore them? Engineers must also live on this planet and, in my experience, we always have been concerned about the state and welfare of our surroundings. That said, the need to manage ecological, archaeological, and other constraints has become ever more rigorous in recent years.

The raising of Abberton Dam came shortly after my stint as BDS Chair. It was quite a challenge to raise a previously failed dam while keeping it fully operational throughout. The engineering design and analysis was complex, but even so, it only accounted for about 15% of fees for professional services. In one sense, it turned out to be the easy part; some five times as much capital was spent on environmental and ecological aspects of the planning and design.

I don't think that our industry has yet come to terms with this sea change. The ever-increasing constraints have become major hoops that need to be jumped through. It was good to see this matter being addressed in a Workshop session at the conference this year. Sadly, dam engineers often tend to think about delivering engineering solutions in isolation, rather than as part of a wider process. As a result, the time required to deliver a successful project is often wholly underestimated. I know that the enforcement authorities often take the view that Undertakers lack the will, organisation, and the requisite sense of urgency to implement safety measures, but I believe this to be the exception rather than the rule. However, inspecting engineers also need to play their part. Speaking as an ARPE, we need to be mindful of the complete process and make sure that delivery deadlines take peripheral matters into account. If we fail to so, then we are only setting up our clients to fail.

Coming back to the first part of your question, the Society is in rude health, if the numbers attending and participating at the last Conference are anything to go by. I think the BDS is moving in the right direction and I am glad that I was able to do my bit all those years ago to push it forward.

The Reservoir Safety Research Group

The Reservoir Safety Research Advisory Group (ReSRAG) is supported by the ICE and has a home under the Joint Flood and Coastal Erosion Risk Management R&D Programme (Defra, Environment Agency, Natural Resources Wales, Welsh Government). ReSRAG is made up of representatives across academia, industry, government, and other organisations, who advise on research and identify future priorities. The group is always keen to hear from members for their views and ideas on future research needs.

The group is also connected to a wide range of international developments across many partnerships such as ICOLD and The Centre for Energy Advancement through Technological Innovation (CEATI) & The Dam Safety Interest Group (DSIG).

Ongoing and recently published research

All outputs are published at **www.gov.uk/government/organisations/flood-and-coastal-erosion-risk-management-research-and-development-programme**, where there is an option to sign up to future updates.

Spillways – As a result of the independent review of Toddbrook reservoir there are a number of improvements underway including R&D for a Spillway examination guide and Spillway design guide. This was published in June 2022 and is available at **https://www.gov.uk/flood-and-coastal-erosion-risk-management-research-reports/spillway-design-examination-and-failure-mechanisms**.

Extreme Flood Hydrograph Estimation and Extreme Flood Estimation – Assess the suitability of existing methods for estimating Probable Mean Precipitation (PMP) and Probable Mean Flood (PMF) and develop new methods and guidelines to ensure that we understand the risk posed to our highest risk reservoirs from extreme flood events. It has created a catalogue of extreme historical rainfall events, benchmarked current methods, reviewed international practice and considered potential alternative methods for estimating PMP and PMF. This project has also examined snow melt calculations and provides a worked example to ensure these are applied consistently. A first look at the results was presented at the November 2022 BDS evening meeting and the full report is expected to be published Summer 2023.

Breach – A review of all matters flood levee or soil dam breach related (representing over 80% of regulated dams). Providing an overview of breach processes and a prioritised list of proposed future research. Led by HR Wallingford and Stillwater Associates. This is expected to be published in spring 2023 and will provide a framework for future work in this area.

Benefits in removing or adapting redundant reservoirs – Commissioned by the Environment Agency to HR Wallingford this R&D considers not only discontinuance, but adaptation. It draws on a wide number of existing case studies to provide a good practice overview. Expected to be published in spring 2023.

Transitions – Those interested in potential failure occurring between soft and hard structures (i.e. soil dam and wall) may be interested in this R&D, publishing Spring 2023. An international consortium led by HR Wallingford consisting of representatives from Netherlands (Deltares) USA (USACE) and the UK. New inspection guidance and piloting of the transition zones has been undertaken whilst considering the risks and effects looking at the prioritisation, inspection and engineering of them.

Earthwork stabilisation using bacteria – Working with Network Rail and Queen Mary University of London to understand if there is potential to naturally feed already existing bacteria in soils and strengthen the soil structure.

Real-time monitoring of MEICA performance – Although predominantly focused on other flood assets, the Mechanical, Electrical, Instrumentation, Control and Automation (MEICA) research may support dam engineering. It will optimise operation and maintenance costs over the whole-life of the asset and move toward the pro-active management of MEICA assets. This is due to publish later in 2023.

What's next?

The following projects have previously been prioritised and are likely to be the next projects to start.

- **Reservoir leakage and seepage** – What methods are available and applicable to monitoring reservoir leakage and seepage, including real time monitoring and modern SMART sensing technology. Improving best practice from existing developments in this area.
- **A Standard Methodology for estimating loads on and the behaviour of reservoir wave walls of various types and shapes** – To assess existing methods across a number of disciplines (wave overtopping, wave forces on structures and soil mechanics) and considers the key inputs/measures for this type of analysis.

Further information from Dr Daniel Hine, Environment Agency, **daniel.hine@environment-agency.gov.uk**

BDS Corporate Membership

The Benefits of BDS Corporate Membership

The British Dam Society is the key UK organisation for exchange of information and networking regarding all engineering and safety matters concerning dams and reservoirs.

While the BDS has many hundreds of individual members, it also has a number of corporate members, who support the society's activities in many ways, and in return are able to inform the general membership of their capabilities and project examples.

The BDS membership includes many senior staff and managers in top consultancies, dam owner organisations, government agencies and major contractors, who are involved in dams and reservoirs both in the UK and overseas.

The BDS biennial conferences and Supervising Engineers' forums, as well as a programme of technical meetings in London and the regions throughout the year, provide an opportunity for the exchange of experience and information with other professionals, clients, competitors and suppliers. These events are also valuable for the opportunities they offer for continuing professional development (CPD) to our individual members and to the staff of our corporate members.

The BDS has involvement in national and international technical committees and steering groups, influencing guidance and research projects.

The BDS informs and supports their members on national and international issues and best practice in planning, development, maintenance and operation of dams and reservoirs.

In addition to the benefits of individual membership, Corporate Membership includes the following:

- **Three named representatives, each of whom has all the privileges of individual members, including hard copies of the Society's "Dams and Reservoirs" journal and access to the BDS Members' Area on the BDS website as well as the ICOLD Members' Section on the ICOLD website, where Technical Bulletins can be downloaded free of charge.**
- **Each corporate member may take a full page in the Society's Yearbook, to publicise a project, outline the company's capabilities and provide contact details.**
- **The company's logo and link to their website can be published on the BDS website.**
- **If the corporate member provides a PowerPoint slide to advertise the company, this will be shown before each of the BDS evening talks.**
- **The corporate member's three named representatives will have voting rights at the society's AGM or Special Meetings and at all elections for new committee members.**

The subscription fee for a Corporate Member of the British Dam Society for 2023 remains at £375 per year.

To apply for Corporate Membership, please download the form via the link below:

BDS Corporate Membership Application Form and return completed forms to the BDS Secretary at **bds@ice.org.uk**

Where a full page of a corporate member's activities has not been included in this yearbook, page 70 gives brief details of the capabilities of other corporate members and provides contact details for each one.

Clywedog Reservoir – Jonathan Highfield

ENR2021 TOP 500 DAMS & RESERVOIRS

AECOM

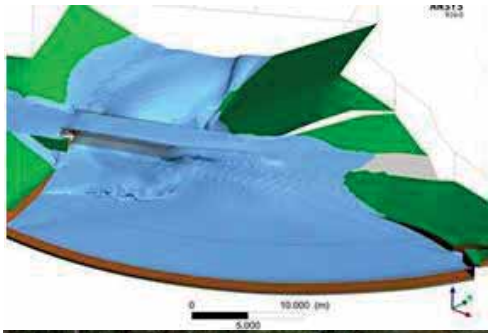
Gladhouse Reservoir Spillway Repair Works

Introduction: AECOM has been helping Scottish Water every step of the way with Gladhouse Reservoir since 2015

Project summary

Gladhouse reservoir is an impounding reservoir formed in 1879 by an earth embankment with a puddle clay core 300m long and 23.6m high and falls within Category A as defined by the '*Floods and Reservoir Safety 4th Edition*' (FRS4). Following the last Section 47 Inspection the following was one of the stated items to be completed in the interest of reservoir safety:

a) *Repair and upgrade the spillway channel to ensure that it can withstand and accommodate the design flood and ensure the safety of the dam under the PMF Safety check flood. A time for completion will need to be determined by the appointed Qualified Engineer.*



To discharge the MIoS item above requires the stepped spillway walls to be repaired and concrete lined (including raising). Once complete this project will allow the reservoir water level to operate naturally and not kept down to prevent spilling and further damage. Other elements of the project will improve drawdown capacity and reduce the time for strategic valve operation with the installation of electrically operated actuators.

AECOM were engaged by Scottish Water to provide detailed design services for all aspects of the project including the spillway repair works and bridge replacement.

The primary focus of the AECOM Dams & Reservoirs team is to ensure that the completed works at the dam is resilient, complies with all current best practice, and provides safe cost-effective repairs that satisfy the requirements of the Inspection Report and the Construction Engineer to allow certification under the Reservoirs (Scotland) Act 2011.

Services

- Ground Investigation specification, supervision, and reporting.
- CFD modelling (inc. verification and options review),
- Detailed design of spillway improvement works,
- Detailed design of drawdown augmentation,
- Stakeholder engagement

Achievements

AECOM has now been supporting Scottish Water in the management of their dam's portfolio for more than ***20*** years. Our continued involvement, including on this project is a testament to the relationship we have nurtured over the years and continue to do so. We are committed to offering this level of commitment to all our clients, and also offer the following services:

Inspection and Supervision, Dam Safety, Design and Rehabilitation of concrete & embankment Dams, Risk Assessment, DamSmart, Reservoir Drawdown Assessments, Construction, Dam Decommissioning, Fish Passage, and Monitoring & Instrumentation.

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THE INTERNATIONAL JOURNAL ON HYDROPOWER & DAMS

At this crucial time of global energy transition, with nations racing to meet their targets or commitments for renewable energy generation, the roles of hydropower, pumped storage and the associated water infrastructure have never been so important. The synergy between hydropower and intermittent renewable energy sources enhances recognition of the role hydro can play in the operation of grid systems, and in recent years has opened opportunities for hybrid systems.

But it should not be overlooked that hydropower in its own right is the only source of renewable energy that can offer so many additional benefits, in terms of multiple use of storage reservoirs, or improved river regulation, navigation, and flood control in the case of run-of-river schemes.

In many of the less developed countries, where the remaining potential is vast, hydropower can be a relatively low-cost option for much needed installed capacity, as well as the ancillary benefits.

These three factors underpin the mission and activities of Aqua-Media International, now approaching its 30th year.

The *International Journal on Hydropower & Dams* and Aqua-Media's associated international conferences and exhibitions have sought, over nearly three decades, to highlight development potential worldwide, encourage best practice, and crucially, keep the industry up to date with technological developments, particularly those that are improving the safety, efficiency and economics of future projects. Coverage of new technologies, for example, based on digitalization, artificial intelligence, cloud-based monitoring, and so on, clearly demonstrates that an industry already well established in the 19th century remains absolutely dynamic today.

During the pandemic, when it was not possible to hold in-person conferences, we worked with one of the Technical Committees of ICOLD to host about online event on floating solar panels on hydro reservoirs, and this was the first time an event had specifically brought together experts from the solar PV industry with reservoir owners and operators, and crucially, experts on safety, who had the opportunity to debate safety and environmental aspects of FPV, and thus to enhance confidence in this relatively new technology.

Through ancillary publications, such as the *World Atlas of Hydropower & Dams*, we concentrate statistics, trends, current activities and future plans into one source of reference. Nearly 200 country reports, which are freshly researched each year, give an accurate insight into international developments, which seems to be unique.

During next year, because of numerous postponements during the pandemic, we will be hosting international conferences for both ASIA and AFRICA, as well as HYDRO 2023 in Edinburgh; the latter will be a chance to showcase Scotland's hydropower heritage and expertise, and its future plans for pumped storage. More details are on our website, where we regularly also post news, tender announcements, special reports and an events calendar.

For both our publications and conferences, we are privileged to be working in close collaboration with ICOLD, and with leading experts around the world on the various engineering disciplines that we cover, which of course includes a number of BDS members.

Aqua-Media International
(Publisher of *Hydropower & Dams*)
Tel: +44 (0)20 8772 7240 ~ Email: edit@hydropower-dams.com
www.hydropower-dams.com

ASIA 2023 — **14-16 March**

HYDRO 2023 — **16-18 October**

AFRICA 2023 — **10-12 July**

ARUP

Toddbrook Reservoir, Whaley Bridge

Designing for dam safety in the public realm

After the evacuation of the town of Whaley Bridge in 2019 following damage to the spillway on Toddbrook dam, we have developed detailed designs for owner Canal & River Trust. When constructed, these will allow Toddbrook reservoir to be refilled and continue to provide water for the local canals as well as serving as a well-used amenity for the local community.

The scheme has been designed to address safety recommendations made in the Section 10 inspection carried out after the incident, the main focus being to provide a new spillway which will allow the decommissioning of the damaged auxiliary spillway. The reservoir area is used by the public and designated as a SSSI, so environmental and ecological studies and public consultation informed our optioneering to select a preferred location for the new spillway. Our design team has worked to integrate the design of the concrete structure into the parkland landscape, successfully incorporating the overflow and the channel downstream into Memorial Park, taking account of the safety of the public who may interact with the spillway. By working collaboratively with the Trust and their contractor we have been able to make carbon and cost savings in the design of the overflow structure.

The scheme will ultimately improve the safety of the dam, providing benefit for both people living downstream and people using the reservoir and surrounding parkland for enjoyment.

About Arup

Arup was formed in 1946 and is a global firm of consulting engineers, planners and scientists with a specialist water consultancy providing excellence in water and environmental engineering. Arup has expertise in investigation, feasibility, design, and construction supervision of new dams, as well as the design of remedial and improvement works to existing dams. We have delivered projects for central and local government, international funding agencies, privatised water utility companies, banks, and design and build contractors. We have also worked for research organisations including CIRIA, the DETR and others producing guides on many aspects of dam and reservoir design and maintenance.

Search 'Toddbrook' on Arup.com to find out more about the project and our team.

Find us on social media:

LinkedIn: linkedin.com/company/arup/
Twitter: @ArupUK
Instagram: @arupgroup
Facebook: @ArupGroup

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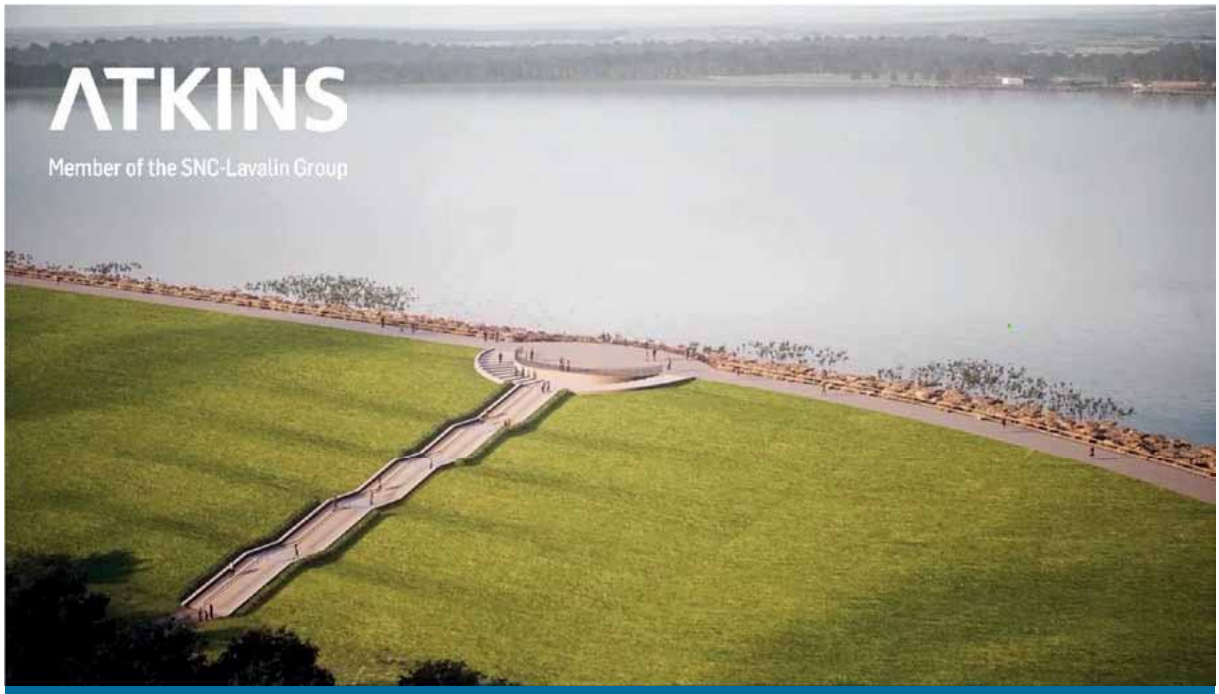

Atkins, member of SNC-Lavalin group, delivers dams, reservoirs and hydropower projects around the globe.

Atkins' experienced team is actively engaged in the full range of services associated with reservoir engineering including water supply, flood alleviation, irrigation and hydropower, statutory inspections, dam breach analysis and flood inundation mapping together with the design and supervision of both new build, measures in the interests of safety and remedial works in the UK and internationally.

Our current work includes significant projects such as Havant Thicket Reservoir for Portsmouth Water. Here we have provided integrated design and planning services for the first large water resources reservoir to be built in the UK in 30 years and the major pipeline needed to fill and connect it to the water supply network operated by two water companies. In our role as Design Guardian, we are actively involved in ensuring that the detail design of the reservoir embankment, structures and pipelines will meet the client's requirements and planning conditions. At the same time we are providing further support to the client, including by acting as Principal Designer for one of the two main new pipelines and for off-site habitat creation works.

Our work provides significant opportunities for career development across a wide range of skills, including development to panel engineer status. Our growing UK team is part of a 250-strong international practice with pedigree that comes from designing, constructing, and refurbishing 200,000 MW of hydropower, with over 100 such projects completed in the last 10 years.

Contact Chris Restorick-Vyse

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Llyn Tegid Reservoir Safety Project

Enhancing lives, communities and the environment

© Image courtesy of NRW

Project Overview

Llyn Tegid is the largest natural lake in Wales, located south of the town of Bala in the county of Gwynedd and Snowdonia National Park. It is raised by 2,950m of embankments at its north end along sections of the River Dee and Afon Tryweryn, which protect the town of Bala from extreme weather events. The reservoir also plays a vital role in managing floods in the Dee Valley by storing flood water and then allowing controlled release to the River Dee.

Works are underway to replace rip rap protecting the embankment against wave erosion and reinforcement of the embankment turf, using a plastic and coir composite matting to protect against overtopping erosion. The design enhances the site for local residents by including new parking and seating areas, improvements to footpaths, tree planting and landscaping.

Binnies developed the outline and detailed design for the scheme and continue to support as construction approaches completion.

© Image courtesy of NRW

Our Reservoir Team

Our reservoir team has played a pivotal role in the design and construction of many of the world's most iconic dams for over 100 years. This includes innovative projects such as the world's first piano key bellmouth overflow at Black Esk for Scottish Water, the 300m wide Marina Barrage in Singapore for PUB, and the fresh water from the sea reservoir at Plover Cove for the Water Supplies Department of the Hong Kong Government. Our team provides technical expertise in dam engineering and reservoir safety across the world, enhancing lives, communities and the environment. Looking forward, our intelligent dam monitoring system, iDMS, is digitally transforming the reservoir industry.

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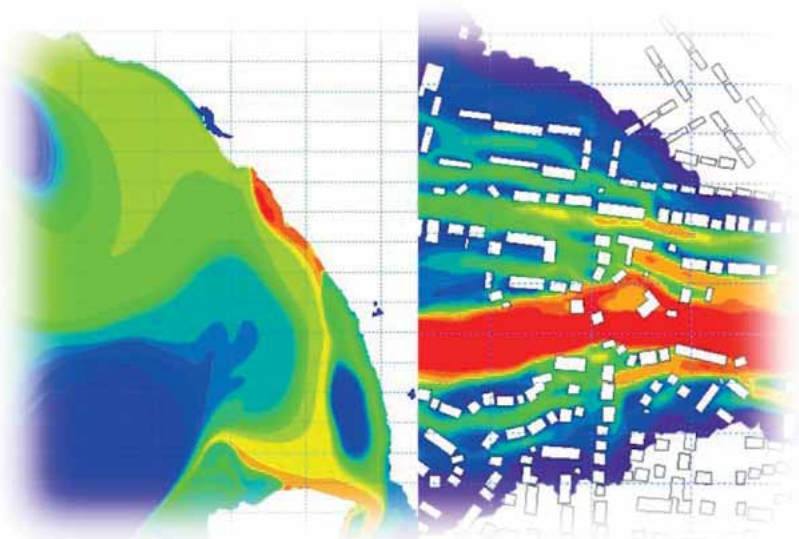


Detailed Inundation Modelling
Large Domain Modelling
Variable Roughness Domains
Flexible Mesh Models
Reservoir Flood Studies
CFD Assessments for Large Structures
Flood and Yield Assessments
Fluvial Assessments
Pluvial Assessments
Tailings Dam Inundation Assessments
Flood Risk Assessments
Compensation Flood Storage
Coastal Surge Modelling
Geospatial Analysis

CC Hydrodynamics is a specialist numerical modelling house focussed on wet infrastructure and flooding. We predominantly help other businesses with their numerical modelling needs by using our in-house automation and computational cluster to undertake studies such as dam failure inundation assessments, flood risk assessments, hydraulic modelling including CFD, geospatial analysis, hydrological studies, and big data manipulation and interrogation. We work both within the UK and globally. CCH also provides Supervising Engineer services in England and Wales.

CC Informatics is a specialist informatics company focussing on drone surveys, remote vehicle inspections, and machine vision/artificial intelligence to aid with post processing. CCI has specialist in house tools which can be used for defect identification and defect tracking for large structures. In 2021 CCI demonstrated a working AI with masonry defects. In 2022 CCI has developed a working AI with concrete defects, which can output tables and mapped drawings. Additionally CCI has developed a means of cataloguing change at structures. In 2022 and 2023 CCI will be working on an embankment version of the technology. CCI also can collect photographic data via UAV or other bespoke data collection platforms which allow access to difficult or dangerous environments.

In Development:

AssetScan EMBANKMENT

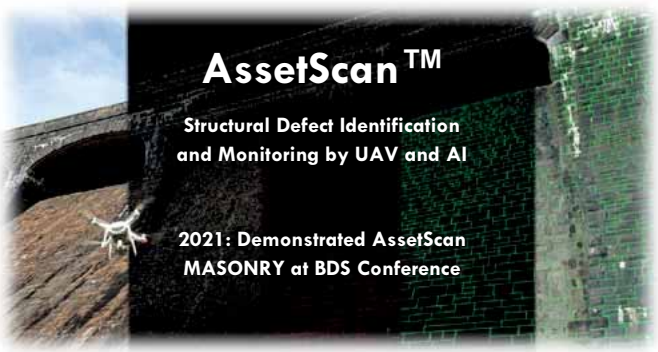
Slips/failures

Animal Burrows

Invasive Species

Erosion

Cracks



New to 2022:

AssetScan CONCRETE

Cracks

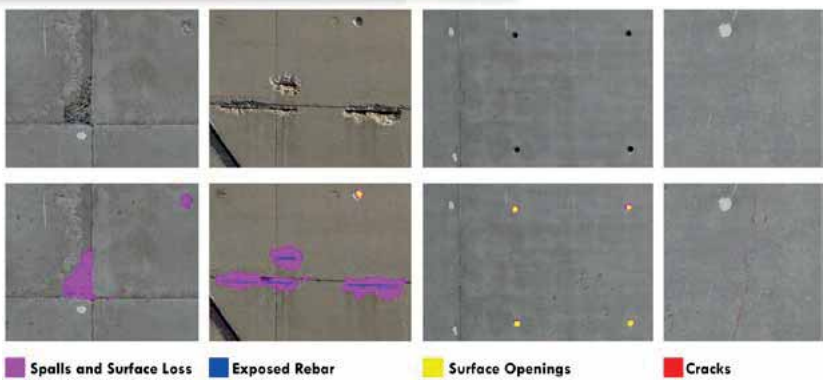
Spalls

Holes

Exposed Rebar

Other Defects

COMING IN 2023



CC Informatics
www.cc-info.co.uk

CCI

Dŵr Cymru Welsh Water has a portfolio of 138 reservoirs, which includes 85 impounding reservoirs, 8 non-impounding reservoirs and 45 service reservoirs. Below are three projects completed during 2022 to improve reservoir safety across Welsh Water's operating area.

Usk Tunnel and Pipework

Usk reservoir is a critical impounding reservoir providing raw water to two water resource zones. The need to safeguard this asset has led to significant investment, previously with the spillway refurbishment and now with the replacement and upsizing of the valves and pipework within the tunnel. The latest project has increased emergency drawdown provision, improved river regulation for downstream abstraction, and provided enhanced environmental releases into the River Usk which is a Special Area of Conservation (SAC). The work included the decommissioning of the original 1950s isolation valves, provision of double isolation on each of the twin 450mm legs of pipework to allow for safe construction and future maintenance. The downstream twin 450mm pipes have been combined and upsized into a single 800mm pipe which has maximised flow capacity and improved access through the tunnel.

Lluest Wen reservoir is contained by a single earth embankment dam that impounds the Afon Rhondda Fach river system. The reservoir, which is believed to date from 1898, currently impounds 1.07 million cubic metres of water and is the first in a cascade of two which supply raw water to the Maerdy WTW, which in turn supplies around 36,000 customers. The spillway replacement scheme has seen significant investment and consists of a structure formed on the left abutment of the dam, approximately 220 metres in length with 60 degree and 90 degree bends along its flow path. The key driver for the spillway replacement was concern over the deterioration of the chute over time and the capacity of the chute to safely pass the Probable Maximum Flood (PMF).

Lluest Wen Spillway

Aled Isaf Grouting

Aled Isaf dam was constructed in 1939 and consists of a high central concrete overflow section flanked on both banks by lower earth embankments, constructed across the headwaters of the Afon Aled. A Willowstick survey in 2019 identified two main areas of leakage on both the left and right earth embankments. Specialist contractor Bachy Soletanche were selected to install 15 secant piled wall at chainage 140ft on the right embankment and 33 secant piled wall at chainage 500ft [plus two tube a manchette injections for contact and compaction grouting to the dam/clay core interface] on the left embankment. A new Willowstick survey is being commissioned to test the results of the grouting works against the original survey.

Dŵr Cymru
Welsh Water

Andrew Bowen
Head of Dam Safety
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Edwards Diving Services Ltd. (EDS) successfully completed reservoir safety works at Caerphilly Castle to assure the long-term stabilisation of the outer moat embankment.

Caerphilly Castle is one of the great castles of medieval Western Europe. The second largest castle in the UK is a busy tourist destination and is frequented by the local community who use the grounds of the castle for recreation and fishing purposes. The outer moat has suffered erosion along the upstream face toe from local wildlife (geese) and also as a result of the outlet to the auxiliary overflow discharge. EDS were engaged by Cadw to complete the works to stabilise the upstream embankment toe and provide long-term erosion protection by installing rock mattresses, rock rolls and coir rolls.

The construction challenges of the site in terms of the impact of construction plant on the steep upstream embankment face and crest path (used by tourists for access) were considered at an early stage and overcome by adopting a water-based construction methodology.

An excavator mounted on a pontoon within the reservoir was used to excavate a trench along the upstream embankment toe (under an archaeological watching brief) before placing the rock rolls and coir rolls and then backfilling.

Stability calculations were provided to support the desired pontoon arrangement, considering the many permutations of plant positioning and materials storage. The works required careful planning and navigation of the pontoons within the moat to permit passage beneath the visitor entrance access bridge and to accommodate the fluctuation in moat water levels working in summer and winter conditions.

Despite poor weather conditions which would have resulted in working methods from the embankment having to be suspended, EDS' innovative approach enabled the works to be carried out successfully with minimal disruption and impact on the historic site, reservoir embankment and public access routes.

EDS has a track record of working with reservoir owners and operators to develop and deliver engineering solutions in challenging locations for a safer environment.

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USK RESERVOIR:

THE IMPORTANCE OF VALVE SELECTION

The USK Reservoir was built in 1955 and is currently owned and managed by Dwr Cymru Welsh Water (DCWW). The reservoir comprises an earth dam some 30m high and 480m wide. It is the first UK example of an earth dam with horizontal drainage blankets.

DCWW required enhanced control of water releases to the Rivers Usk and Wye both from a habitat and draw down safety perspective.

Delivering Project Solutions
Glenfield Invicta's first contribution to the design of the Usk Reservoir works came in 2016. The engineering consultancy Arup was reviewing design options. Their engineers were particularly concerned that works to enhance water releases could lead to surge pressure damaging legacy pipework within the reservoir. Understanding the operational characteristics of different valve specifications was, therefore, paramount.

The Importance of Valve Selection
Greg Morris (Business Development Manager – Dams, Reservoirs & Hydro) engaged with Arup engineers to discuss the optimal choice

of control valve. Greg explained that the risk of surge pressure was mitigated through the design of the valve. In particular, both under electrical and manual operation, the valve was designed to ensure it closed slowly and smoothly to ensure flow was regulated gradually, without any pulsing effects taking place.

Several valves were specified across the system. An Orbinox Model CH fixed cone discharge valve (DN450) was recommended by Glenfield Invicta as the principal control valve due to the relatively slow operating speed and the need for a smooth and regulated flow regulation performance.

An important objective of the Usk Reservoir project was to achieve accurate compensation flows. The required range and accuracy of compensation flows led to the specification of a Series 872 needle control valve (DN300).

Isolation gate valves were required on the upstream tunnel (DN450) and embankment toe (DN800). In both cases Series 54 reservoir-specification gate valves were specified to meet the required 100-year design life and accommodate the high flow velocities. Consideration was also given to the orientation of the electrical actuator and gearbox to avoid any fouling with the tunnel walls. Glenfield Invicta engineers also installed the actuators and extension spindle arrangements on site.

Greg emphasised the fundamental importance of technical support in the award of the supply contract to Glenfield Invicta:

'As with all dam and reservoir projects, technical support is paramount in securing the business. Lots of time, effort and resource was spent reviewing system drawings and specifications, selecting the correct valve type, calculating the optimal size and confirming the exact specification of valve for each application.

'The really rewarding aspect of this project for me was that we (Glenfield Invicta) worked with several of our sister companies from across the AVK Group, including Orbinox, ACMO and Anhui, to deliver a valve package that comprehensively met the quite onerous requirements of the Usk project.
'I am very fortunate as an engineer to have the luxury of access to the product ranges of so many AVK Group valve manufacturers which means I am able to offer the ideal product for virtually every application'.

For more information on this project or Glenfield Invicta's Solutions please contact:

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Greenfisher Contracting

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www.gfcontracting.co.uk

Cropredy Marina – 100 berth marina extension, turnkey project.

Greenfisher Contracting (GFC) are an Earthworks, stabilisation and marina civil engineering company based in Northamptonshire.

We have completed projects for repeat clients across the Midlands and the south, from earthworks, water management, soil stabilisation, reservoir and marina construction. We offer design and build services on offer we can deliver turn key projects for our range of private and commercial clients.

GFC have over 25 years of experience in the industry and use our specialist skills to deliver those technically challenging projects, whilst keeping our environmental impact to a minimum.

GFC carried out the design and build of Cropredy Marina extension, including earthworks, provision of all services, piling, jetty installation, culvert and ditch diversion, and resoling of landscaping areas.

HESSELBERG HYDRO

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Hesselberg Hydro specialises in the use of asphalt in hydraulic engineering for erosion and scour protection. The company supplies and installs reinforced geomats for river training, Open Stone Asphalt for flood protection structures, estuarine revetments & dams, and grouted rock for the most exposed coastlines. Our services also include feasibility studies, inspections, design, & maintenance of asphaltic structures for dams, rivers, coastlines and ports.

We have been strengthening upstream faces and spillways using Open Stone Asphalt (OSA) on UK reservoirs since 1991 and have worked with most of the UK's major water companies to provide solutions to strengthen deteriorating upstream faces. Upstream faces comprising stone pitching, rip-rap, concrete blocks, Grasscrete® and concrete slabs have all been strengthened using OSA.

In 2022 we installed erosion protection to the downstream slope on two existing flood storage dams, in Kent and in the West Midlands, to improve the resilience against an increased threat of overtopping. After proving its suitability for the hydraulic loading, the OSA was selected over other products on the basis it saves time, money and carbon.

Jacobs Challenging today. Reinventing tomorrow.

PROJECT SHOWCASE

Trawsfynnydd Reservoir

Jacobs has provided panel engineering services to Magnox at Trawsfynnydd reservoir, continuously for over 30 years. The 33Mm^3 reservoir was originally built for hydroelectricity generation in 1928, with a 40m high arch dam and three saddle dams up to 11m high. Between 1965 and 1991 the reservoir also provided cooling water to the nuclear power station of the same name. The original arch dam suffered from alali-silica reaction (ASR), and was replaced in 1991 with a gravity dam designed by Jacobs, referred to as the new Maentwrog dam. Jacobs engineers have provided dam engineering support on the reservoir ever since, including:

- Ongoing supervision and section 10 inspections
- Annual deformation monitoring
- Assessment of drawdown capacity
- Investigation of vibration and noise associated with operating the 1.2m diameter scour valve. Jacobs developed a test specification and analysed the test results to determine the extent the valve could be safely operated for a continuous period.
- Structural investigation into ASR of the saddle dams, including desk study, specification and interpretation. The investigation included visual and delamination surveys, crack monitoring instrumentation, extraction of 100mm diameter cores for petrographic examination, strength testing and expansion testing.
- Deformation monitoring, including laser scanning of the main dam and saddle dams as well a monitoring of the pipeline
- Twice-yearly review of instrumentation data

Flood studies, spillway assessments and upgrades at Environment Agency Flood storage reservoirs (FSRs)

As delivery partner on two of the Environment Agency's regional delivery hubs for the North West and the Thames & Anglian regions, Jacobs is carrying out flood studies and evaluating the adequacy of spillway capacity at eight FSRs across the Hertfordshire and North London area. The studies are in response to safety recommendations in recent Section 10 inspections. Jacobs has identified the need for upgrade works at some of these reservoirs and has developed the scope, designs and business cases. Where the existing spillway capacity does not meet full engineering standards, we have used a risk assessment approach to determine the scale of works proportionate to the risk. This ranges from minor localised earthworks to spillway upgrades.

RESERVOIR ENGINEERING AT JACOBS

Jacobs provides a full range of dam and reservoir engineering solutions covering the full life cycle of dams from prefeasibility through to detailed design, inspections, studies and repurposing/discontinuance. Globally, Jacobs' Dams Community of Practice includes 350 staff with centres of excellence in the UK, Australia and USA, with decades of experience in delivering solutions to complex problems for a variety of clients.

Within the UK, we have specialist reservoir engineers across five offices, with key hubs in Reading and Glasgow. This includes three All Reservoir Panel Engineers and ten Supervising Panel Engineers under the Reservoirs Act 1975. Our team works alongside specialists covering all relevant disciplines including hydrology, geotechnics, hydraulics, structural analysis and environment. Our projects range from statutory inspections and remedial works to design and construction of new dams. Reservoirs range from small amenity lakes and service reservoirs to the largest reservoirs in the UK.

Our purpose is to create a more connected, sustainable world.
Our values are:
We do things right.
We challenge the accepted.
We aim higher.
We live inclusion.

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KELLER

Earlswood Lakes Birmingham

Earlswood Lakes are situated near Solihull, Birmingham.

In early 2021, the Canal & River Trust embarked upon a £1.6 million programme of improvements to the reservoirs there.

Keller were contracted by Kier to build and install a Slurry Cut Off wall to alleviate future flooding on Valley Road.

The works were situated close to the reservoir along the towpath of Valley Road and close to other amenities, making a successful project very difficult to achieve.

The slurry wall was located on the narrow dam crest with a working weight limit of eight tonnes.

To carry out the works, the water levels in the Engine and Windmill Pools at the reservoir were temporarily lowered to maintain the safety of the dam.

Keller then installed a Slurry Cut Off barrier using a self-hardening cementitious slurry, in accordance with the ICE Specification. The Keller design mix targets a permeability of 1 x 10 -9 m/s.

The works were carried out with extreme care, with the crest of the dig protected with mats and sandbags to contain any spillages. The washout was controlled by sending all the slurry back via lines to the batching area.

After the installation, normal water levels were then restored.

Raising the core level will help improve the dam's resilience during any future flood events.

You can view a video of the completed works by scanning the QR code

Picture: Canal & River Trust

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KGAL
consulting engineers

Your Partners in Engineering Excellence

Xayaburi HEP, Lao PDR

Design of all hydraulic steel structures for the main spillway, powerhouse, multiple fish passes, low level outlets for sediment flushing and navigation locks for shipping, each complete with hydraulic operating equipment and electrical control systems, in addition to tunnel linings, cranes and ship arrestors, and a small boat transfer system.

- **Spillway** - 7 radial gates amongst the largest of their type in the world - 25m high, 19m span, 465 tonnes each
- **Navigation Lock** (450m long) - 3 pairs of mitre gates, each pair circa 30m deep, 12m wide, 320 tonnes
- **Total weight of hydraulic steel structures** designed in excess of 30,000 tonnes

All gates designed by **KGAL** in the UK, with full seismic assessment to the latest ICOLD requirements, and manufactured on site in a purpose-built facility by the client, Whessoe Sdn Bhd.

Commercial operation reached on 29 October 2019, providing renewable power for 1 million people in Lao PDR and 3 million people in Thailand.

Contact

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Regional Managing Director

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Overview & Services - Mott MacDonald has over 100 years' experience in dam engineering, with our dedicated teams having delivered works in over 30 countries worldwide, from small scale works to large hydropower dams. Priding ourselves on our technical excellence and drive, we provide clients with a wide range of services, including:

- Panel engineer services
- Hydrology, hydraulic modelling, and computational fluid dynamics
- Geotechnical assessment and advice, including construction supervision support
- Feasibility studies and detailed design services
- Environmental and ecological scoping and assessments
- Mechanical, Electrical, Interface, Control and Automation services

One of our latest projects includes the design and construction of an online flood storage reservoir near Leeds in Yorkshire.

Calverley Flood Storage Reservoir - The 2015 Boxing Day floods damaged more than 3,000 properties in the area of Leeds, Yorkshire, costing greater than an estimated £500million. A number of the businesses affected have since failed or had to relocate.

Mott MacDonald are working in joint venture with BAM Nuttall on behalf of Leeds City Council to deliver the Leeds Flood Alleviation Scheme, which includes the construction of a flood storage reservoir at Calverley. The scheme aims to promote sustainable economic growth and support communities by reducing flooding risk to the area and people of Leeds, with our collective goal:

> "*Deliver safely and sustainably, a flood alleviation scheme to a 1 in 200-year standard that protects the public, businesses, infrastructure and the environment, promoting growth*"

The Mott MacDonald team used their expertise to design and support construction of the reservoir, including sequencing of the flow control structure, providing 3D and 4D modelling and providing site presence to support the technical delivery of the reservoir, and to support collaboration with key stakeholders.

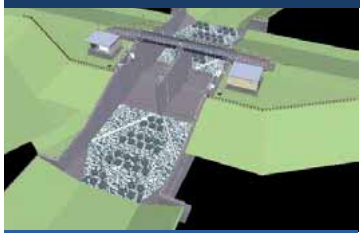
Innovation

Construction Sequencing

Technical Delivery

Cofferdam & Wingwall

Digital Approach



3D and 4D Modelling

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Project Contact Details
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Multiconsult

Kinlochleven & Lochaber, Scotland

Multiconsult has provided specialist Technical Advisory services for Blackwater dam of the Kinlochleven hydro scheme and three dams of the Lochaber hydro scheme, Treig, Laggan and Spey dams (Lochaber). The dams owned by SIMEC range from 80 to 113 years of age. Multiconsult has provided specific technical advice regarding the dams, ranging from condition assessment, dam monitoring and design/specification/ supervision dam of repairs.

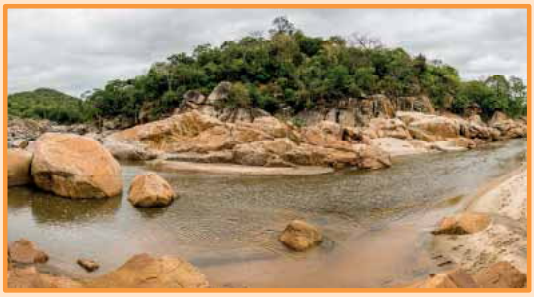
Khobi-II, Georgia

Located at the foot of the Caucasus Mountains in Georgia, Khobi-II is a 47 MW run-of-the-river power plant currently under construction. The headworks of the project includes two 8 m high radial gates, spanning from the riverbed elevation up to the normal high-water level, and located next to the powerplant's intake. Next to the gates, an uncontrolled stepped weir is found on top of an 8 m high concrete gravity dam.

From there, a 6.6 km headrace tunnel takes the power flow to a 640 m long steel penstock and onto a surface powerhouse.
Multiconsult is supporting and adding value to the Owner by supervising, foreseeing any potential challenges and providing advice on every stage of the construction process.

Mpatamanga, Malawi

Soon to become the single largest powerplant in Malawi, Mpatamanga is a 309 MW hydropower peaking plant located in the Shire River downstream of Tedzani. Mpatamanga reservoir is formed by a 45 m high Concrete Face Rockfill Dam (CFRD) with an adjacent gated spillway at the right abutment. Multiconsult undertook a Due Diligence of the Feasibility Study. We added value to the Client by highlighting the potential negative social and environmental impact on the downstream fauna and communities from peaking operation of the powerhouse leading to pre-designed of a 22 m high concrete gravity dam, including a second powerhouse to provide an additional 40 MW to the country's power grid.



Contact: hydro-uk@multiconsultgroup.com | Tel: 01233 754485 | www.multiconsultgroup.com

Cyfoeth Naturiol Cymru
Natural Resources Wales

We are the enforcement authority for the Reservoirs Act 1975 in Wales, regulating around 400 large raised reservoirs with a capacity of 10,000+ cubic metres. Our principal duty is to ensure reservoir undertakers observe and comply with the law.

We are moving our focus from traditional compliance to one which promotes reservoir safety more widely. Our goals are to provide the following:

1.
A clear vision and objectives for reservoir safety in Wales

2.
A regulatory process which focuses on positive outcomes beyond compliance

3.
Improving access to advice, guidance, training and development for everyone involved

We also manage and operate a substantial portfolio of reservoirs for flood risk management and conservation benefits, including reservoirs within the Welsh Government Woodland Estate to provide popular public amenity.

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Severn Trent is a FTSE 100 water company, serving more than 8 million customers. Our region stretches from: mid-Wales to Rutland in the East and the Bristol Channel to the Humber in the North.

We manage a captivating collection of 82 statutory reservoirs in England and Wales, regulated by the EA and NRW respectively.

You can see a part of our estate of reservoirs in the STW & HD Reservoir Surveillance training manual, which was developed as a go-to guide for our operational teams carrying out frequent visits to our statutory reservoirs :- 2019_03_04_Maintaining Reservoirs_Redesign.pdf (britishdams.org)

Our goal is ***"to be recognised as the best in the country at reservoir safety".*** The ST/HD Dams and Reservoirs team comprises; 5 Supervising Engineers, 4 Reservoir Technicians and a team of 3 Surveyors dedicated to reservoir safety. A further 3 engineers and 2 of our technicians are training to become SEs on an industry-leading programme which includes an in-house, tailored WIRE1 Reservoir Supervising course. Recently, one of our experienced technicians qualified as an SE through this programme, further demonstrating our dedication to development and progression.

Our capital programme includes an ambitious, proactive programme of remote monitoring. We also fully support the Defra/EA R&D programme and are actively involved in the current CIRIA Siphons Guide.

A great example of one of our fascinating projects is at **Cae Llwyd Reservoir** where we are investing £ 3.5m on MIoS construction works. The works comprise a new weir, tumblebay and spillway. Tasks included the careful placement and compaction of clay to key into the existing dam core using a robotic sheep's foot roller compactor (see below), construction of a comprehensive drainage system and preparations for construction of an extensive spillway chute. A trainee SE has been site-based as part of his development programme whilst providing necessary oversight of key construction works.

Our team are active participants of BDS with representation on the BDS committee. We have also promoted papers and presentations which included the "*Clywedog 50-year Review*" and "*Ladybower Reservoir Emergency Exercise*". The most recent emergency exercise of our On-site plan at Lake Vyrnwy was attended by nearly 100 observers including representatives from regulators and government. We have also recently hosted site visits as part of the 2022 BDS biennial conference.

Stillwater Associates

Reservoir Safety & Water Consultancy

2022 has been another busy year for Stillwater Associates with the company working on several interesting design and construction projects in the UK and overseas. A selection of these projects is detailed below.

Buckshole Reservoir

Following on from our BDS evening meeting presentation in early 2021 on **Buckshole Reservoir** *(pictured above)* in Hastings, we completed the detailed design of the new spillway channel and stilling basin. The new 4m-wide, 90m-long reinforced concrete channel was designed to replace the under-capacity existing spillway channel running immediately adjacent to the right mitre of the embankment. The new channel includes 2m-high sidewalls and flow deflectors positioned at various locations along the length of the channel to safely contain extreme flood flows in the order of 48m^3/s. The various components of the channel, including the bespoke stilling basin at the downstream end, were optimised during a physical model that was developed to inform the detailed design. The construction of the new channel, which was completed in November 2022, will significantly reduce the risk of out of channel flow and any resulting damage or breach of this Category A reservoir.

This project also included the design and installation of a new 300mm diameter siphon draw-off pipeline cored through the existing overflow weir to allow the reservoir to be drawn down for maintenance purposes or during an emergency. The siphon, which was installed in parallel with the new spillway channel, has been designed to provide sufficient capacity for this category A reservoir in accordance with the 2017 EA drawdown guidance.

Reservoir Discontinuance Projects

Our other main design and construction projects include several reservoir discontinuance projects including schemes for Welsh Water in North Wales and Llandarcy North Site Reservoir in South Wales. Welsh Water's **Llyn Bran Reservoir** *(pictured below)* in North Wales, retained by a mass concrete gravity dam, was successfully discontinued in late summer 2022. This project, which posed unique environmental and planning challenges, was designed and managed by Stillwater Associates from inception through to the end of construction. We now move onto the discontinuance of another two Welsh Water earthfill embankment dams in Flintshire where we have previously provided similar design and management services and are now preparing for construction works to start on site during spring 2023.

We have also been developing several options for either discontinuing, or retaining and upgrading, **Kionslieu Reservoir** for the Isle of Man Government (DEFA). Again this project has a number of interesting and significant ecological, reservoir safety and planning constraints which have shaped the design.

As a UK-owned specialist reservoir safety consultancy we are able to engage with a full range of clients from water companies to small private estates together with assisting larger consultancies meeting their reservoir safety requirements. Stillwater Associates now provides reservoir safety services to over 350 reservoirs with support from an extensive network of panel engineers across the UK. This, and our varied client base, enables us to continue to provide excellent training opportunities for our staff looking to achieve membership of a reservoir panel.

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Company Profile

TerraDat provides non-invasive geophysical investigation of dams and spillways to identify and characterise subsurface defects not observable from the surface. TerraDat has 30 years experience in providing critical information to engineers for the design of efficient and effective intrusive investigation and remediation. We often find that an integrated combination of geophysical techniques can provide the level of information required.

The recent demand to both identify and monitor water flow through the subsurface has led us to develop a system called SPiVolt. This utilises the Self-Potential (SP) method to map hydrogeological regimes within embankments in near real-time. Data can be accessed 24/7 via an interactive data portal which displays the data in various formats and includes automated processing. Installation of the system is rapid, environmentally sensitive and cost-effective.

Spillway Condition Case Study

A geophysical survey was commissioned by Hafren Dyfrdwy at Pen-y-Gwely reservoir to investigate the condition of the spillway with respect to voiding and seepages.

Ground Penetrating Radar (GPR) was used to provide detailed cross-sectional images and depth plans to identify anomalous areas of response that may be related to voiding, the presence of engineered structures and/or sub-surface boundaries. Electrical Resistivity Tomography (ERT) was used to investigate the existence of seepages on either side of the spillway.

The combination of GPR and ERT proved to be an effective way of non-intrusively investigating the spillway and surrounding material at a high resolution. Accurate locations of possible voids, structural defects and areas of seepage not visible from the surface were provided to the Client.

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SPiVolt
leak monitoring technology

Every day, we serve 15 million customers across London and the Thames Valley, operating 59 statutory reservoirs, and 450 smaller service reservoirs and flood storage reservoirs.

Jon C Green – Reservoir Safety and Asset Condition Manager
Email: Jon.C.Green@thameswater.co.uk

William Girling Reservoir – Embankment Leakage Remedial Works

William Girling Reservoir is a non-impounding reservoir owned and operated by Thames Water which feeds Coppermills Water Treatment Works. The construction of the reservoir began in 1937, with the reservoir completed in 1951. The reservoir has a capacity of 15,911,322m^3 and surface area of 1.5km^2. The reservoir is retained by a continuous earthfill embankment comprising a clay core with gravel shoulders, having a maximum height of about 17m and a perimeter length of 5.6km.

Figure 1: Plan showing location of leakage area and initial Willowstick® survey results

Thames Water has carried out a Portfolio Risk Assessment which identified leakage through the embankment as a priority remedial work activity for this reservoir. A subsequent Willowstick® geophysical leakage detection survey confirmed one likely area of seepage through the embankment and foundation at Chainage 1410m, covering a length of c. 30m. The Thames Water appointed All Reservoirs Panel Engineer (ARPE) advised remedial works should be undertaken to arrest further seepage flow as soon as practical, in accordance with the Reservoirs Act 1975.

Figure 2: Installation of sheet pile through embankment.

Atkins, as part of Costain Atkins Black & Veatch Joint Venture (CABV JV) (Eight2O), subsequently developed a solution that comprised the installation of a single sheet pile wall to act as a cut-off for the leakage. The site works were managed by Costain, with Sheet Piling UK Ltd. (SPUK) appointed as subcontractor to install the sheet piles. Installation took place using the silent and vibrationless Giken pile press method and a 600 tonne Liebherr crawler crane was used to slew the full and cut sheet pile sections from the laydown yard onto the embankment crest.

Site constraints included the overhead (O/H) powerlines traversing above the line of the sheet pile wall, which necessitated that some of the pile sections be reduced in length to maintain an exclusion zone from the O/H lines during installation, and which were then welded together to reach the required depth of approximately 19m. In addition, the slew radius of the crawler crane was restricted to avoid collision with the electricity pylons, which ultimately defined the location of the reaction platform and first pile on the embankment crest. A slope stability assessment was undertaken to ensure the surcharge imposed by the plant required on the embankment crest did not cause slope instability.

Following the pile installation, the dam crest was reinstated to its original condition including the reinstatement of a short section of the wave wall and the clay core at the location of the reaction stand. A post-construction Willowstick® leakage survey confirmed that the sheet pile remedial works was successful in cutting off the leakage identified in the earlier survey.

This project was completed with the reservoir in full operation and demonstrates how remedial works can be carried out without affecting the integrity and stability of embankments whilst achieving sound results.

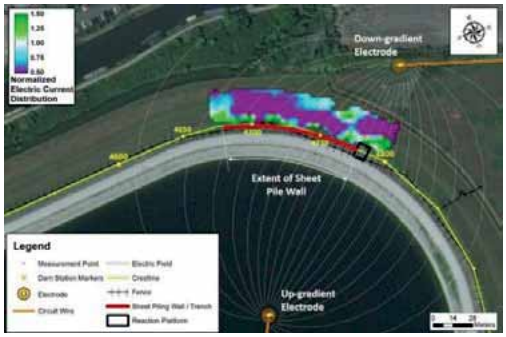

Figure 3: Post-remedial works Willowstick® survey results

Project Reviews 2022

Central Spillways

Ogden Upper Remedial Work

Ogden Upper IR near Barley, constructed in 1906, forms a cascade with Ogden Lower. Recent movement of the central spillway concrete ramp, constructed in 1991, combined with increased flows in the right hand side drainage prompted investigation. These concluded that there was high level leak, close to crest level, with the joint between the concrete nib and spillway wall having opened. Granular backfill, used behind the nib as part of the permanent works, extended below TWL creating a flow path into the central spillway drain. Remedial works were undertaken requiring extensive excavation down to the original clay core with new puddle clay placed up to crest level behind the concrete nib and sealing of the open joint. As part of UU ongoing review of central spillways although no reported issues had been recorded on the left hand side of the central spillway, it was agreed to carry out the same remedial measures to mitigate any potential future issues.

Swinden IR Geophysical Surveys

Following an ongoing PRA and central spillways assessment across the UU stock of dams, a Willowstick survey was conducted at Swinden No.1 IR to support the Seepage Toolbox review and the recently identified embankment leak. This identified 2 potential seepage paths; confirming the known locally overtopping the core on the crest and an additional one adjacent to the auxiliary spillway. Core raising works have been completed on the crest and a programme of GPR surveys and targeted BHs located an isolated granular zone at the upstream side of the spillway. Localised grouting works are planned in the new year allowing the reservoir to be raised back to TWL.

SupE Training

Graduate Development

In the year since our new graduates Nathan Freeman and Tom Rigby joined us, they have been busy building their experience in reservoir safety and ground engineering. Their programme has seen them attend a number of S10 inspections including Errwood and Entwistle, as well as numerous S12s learning from our team of experienced SupEs. They have also attended targeted courses including the Supervising Engineer Development workshops at the BDS conference 2022.

Team Developments

UU continues to offer opportunities for prospective engineers from within our Catchment, Ground Engineering, and Reservoirs Teams and as a result has seen further growth. The team welcomed new SupEs Natalie Bennett, Dave Hughes and Jenny Clifford, taking us to 7 full time, 6 part time, and 6 trainee SupEs, with the newest additions being graduates Will Meredith and Liz Smith.

Upcoming Projects

Harlock and Belmont IRs

In the next year works will be starting on Harlock reservoir following directions from the ITIOS to raise the dam crest and improve the spillway to safely pass the Probable Maximum Flood (PMF). Drawdown improvements are planned for Belmont with the construction of a new twin pipe siphon.

2023 CPD and BDS Site Visits

Where possible United Utilities are supportive in offering opportunities to prospective SupEs of external employers (for example S12 and S10 attendance) and working with the BDS mentoring scheme. Please contact ian.scholefield@uuplc.co.uk for more information.

Bristol Water plc

Bristol Water plc, founded in 1846, supplies water to over one million people and businesses in an area of almost 2400 km2 centred on Bristol. It is a subsidiary of Sociedad General de Aguas de Barcelona S.A. (Agbar). The Agbar Group has subsidiaries in 19 countries, and provides services to more than 37 million people around the world.

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CDMS

CDMS Sub-Surface Engineering Ltd has a long, robust history, which began initially with the formation of Commercial Diving and Marine Services in early 1971. Since then, the company's name has changed, but the retention of the founding spirit has remained, resulting in innovation dedication and reliability. Now after 47 years in the diving industry, the company can call on a wealth of experience gained over literally thousands of projects that have been successfully completed with a 100% safety track record. Over the years professional association with new clients and other organisations have further strengthened the company's versatility, exposure, and commitment to deliver the best services available.

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Duglas Alliance Ltd

Duglas Alliance Ltd is a British company specialising in hydropower and industrial projects construction. The Company is able to join the project at any stage of construction and further operation – as an external project management office or providing services as a subcontractor.

Duglas Alliance Ltd employees participated in construction of major industrial and power facilities all over the world – in Africa, Iran, India, Ukraine, Russia and other countries. The largest project of the company is the construction of Sendje Hydropower Plant in the Republic of Equatorial Guinea.

The network of Duglas Alliance Ltd's partners and suppliers comprises more than a hundred companies around the world – ranging from small, but reliable suppliers of consumables for the life support of the construction site to large energy companies, such as General Electrics. Equipment fleet of the Company has 270 units of construction and elevation machinery and specialised construction equipment from leading manufacturers.

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Stonbury

Stonbury are specialist contractors to the Water Industry, maintaining framework agreements with over 14 of the UK's leading Water Companies for the repair, refurbishment and maintenance of water retaining assets, including service reservoir, water towers and associated structures. Our specialist services are applied to a range of assets, from raw to treated water storage points.

Utilising extensive and practical knowledge in both civil engineering and high-performance repair, waterproofing and coating systems, Stonbury are proud to have completed the build of their first service reservoir in 2017. Stonbury's in-house expertise and directly employed teams offer cost-effective and reliable solutions for a range of civils and new build scheme.

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Yorkshire Water

Yorkshire Water is responsible for providing clean and waste water services to over five million customers and businesses within Yorkshire, and the efficient management of the local water supply network from source to tap. We are responsible for 134 large raised reservoirs under the ambit of the Reservoirs Act 1975, ensuring their continued safety and availability for water supply and amenity within local communities.

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Burdekin Falls – Tracey Williamson

Closing Remarks

Following the challenging last few years, in 2022 the BDS has provided members with some much-needed face-to-face opportunities to meet, share experiences and learn from each other. As can be seen from the pages of this Yearbook, in-person evening lectures at the ICE have been reinstated, a wonderful conference at Nottingham University was held, the BDS hubs are allowing networking to occur on a more regular and local basis and Young Professional lunchtime events are being well-received with great attendance.

Internationally, the first post-Covid ICOLD meeting was held in Marseille, where several BDS members were delegates. Alongside this, a variety of other international conferences took place all over the world covering a range of topics attended either on-line or in person by our members. Throughout all these occasions, it is clear to see the passion that our BDS members have for our industry, the desire to share knowledge and learn from each other. It is great to see the increasing number of Young Professionals attending these events and enabling networking and knowledge dissemination to happen through the generations. We all know that our industry is going through a period of change and transformation; however, together we can ensure that we face it with a positive attitude and a willingness to ensure that the changes work for all involved.

As we look forward to 2023, it will be once again full of opportunities to network, with several evening lectures planned, multiple Young Professional organised 'Lunch and Learns', the Supervising Engineers' Forum in September and internationally the 91st ICOLD Annual Meeting is being held in June in Gothenburg Sweden. I hope to see you, and encourage all our members to join us at one or more of the planned events in 2023.

Rachel Davies
BDS Vice Chair

Stwlan Reservoir – Louise Shaw

Cruachan Dam – David Steven

Chew Valley Lake – Craig Goff

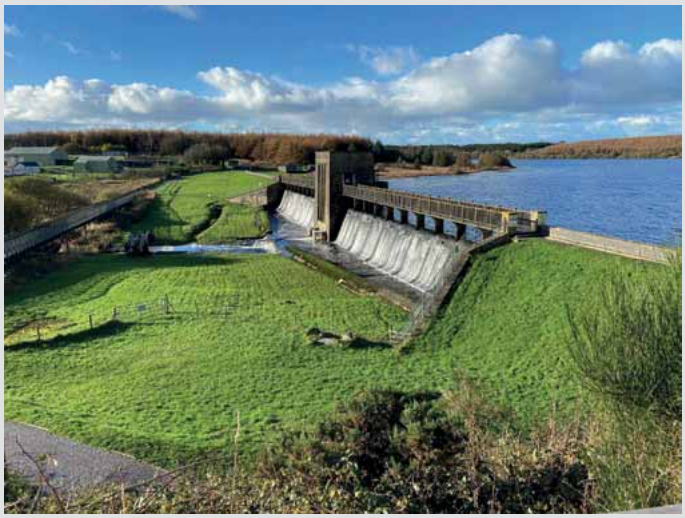
BDS Photography Competition

Ryan McHugh
“Ogee, what a spill”

1st

Craig Ramsay
Monar Dam

2nd



Joanna Parkinson
Llyn Cefni, Llangefni

3rd

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