



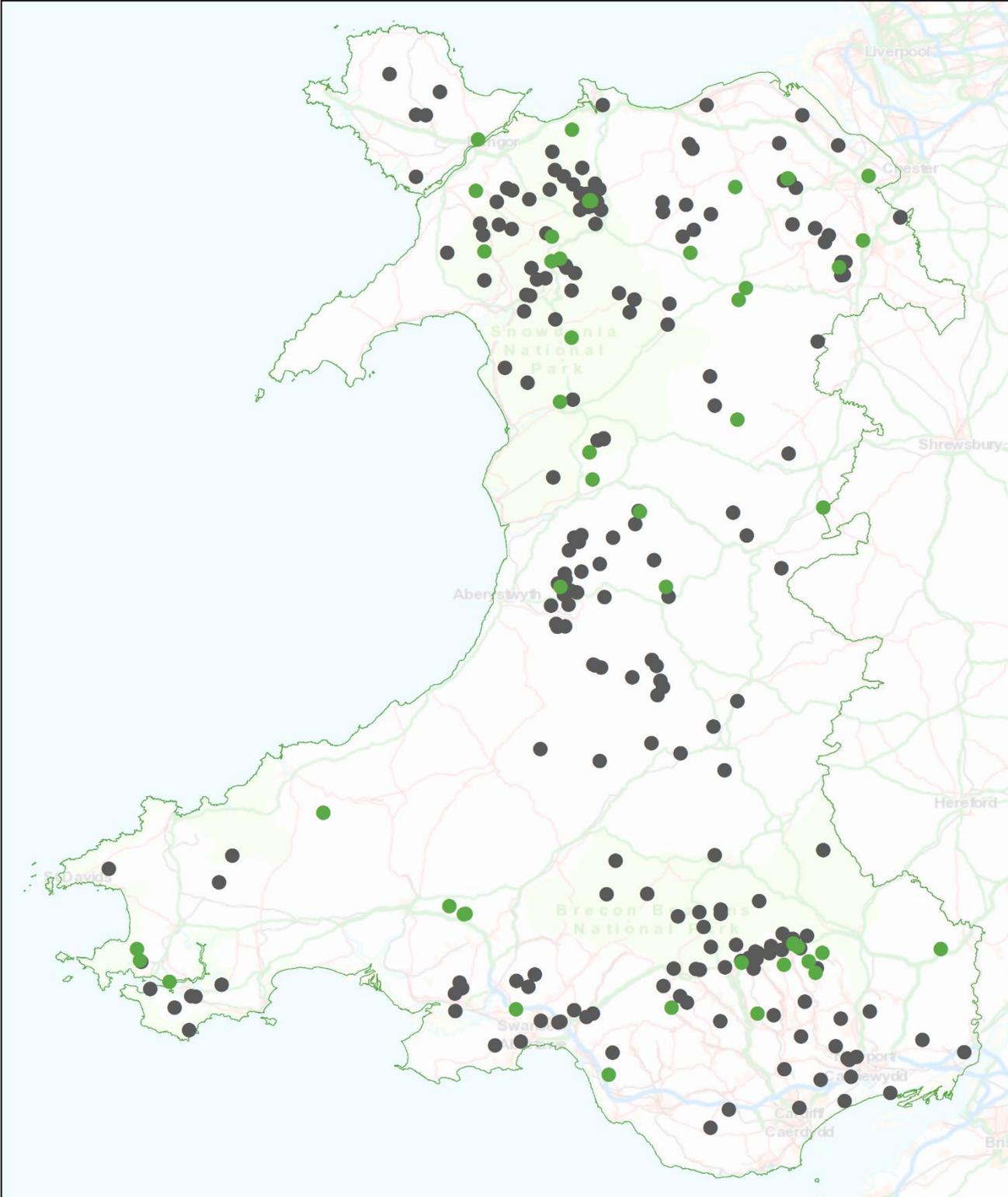
**Cyfoeth  
Naturiol  
Cymru**  
**Natural  
Resources  
Wales**

Biennial Report to the Cabinet Secretary for Environment  
& Rural Affairs

# Reservoir Safety in Wales

For the period 1 April 2015 to 31 March 2017

Natural Resources Wales



## Legend

- Reservoirs >10,000 m<sup>3</sup>
- Reservoirs >25,000 m<sup>3</sup>

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# 1. Natural Resources Wales

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Our goal is for Wales to be a place where our air, land and water are maintained, managed and enhanced sustainably, now and in the future. It is ambitious and broad-ranging, reflecting the scope of our responsibilities. We have divided our work into five cross-cutting programmes of work based on our vision for Wales.

- Good for People - People are safe, and enjoy and benefit from our natural resources and understand their relevance in our day to day lives.
- Good Environment - Ecosystems are resilient and secured for the future, wildlife and landscapes are enhanced, and the use of our natural resources is carefully managed.
- Good for Business - A 'location of choice' for business and enterprise and a place where best practice environmental management is adopted and encouraged.
- Good knowledge - Gaining wisdom and understanding of our natural resources and how we affect them – using evidence and applying learning from experience, so that we make good decisions.
- Good Organisation - Well led and well managed, with suitably skilled and experienced staff and effective underpinning systems and processes; transparent in our decision-making and continuously improving our service to customers and partners, benchmarking ourselves against the very best

**92**

**additional reservoirs registered under the new 2016 regulations, creating...**

**316**

**Large Raised Reservoirs in Wales**

**65**

**reservoir inspections carried out by independent specialist engineers**

**4**

**reservoirs late in completing safety measures**

**33%**

**reduction, since 2015, in the number of reservoirs in breach of the law**

**188**

**of 224 reservoirs registered prior to the amendments have their risk designations completed.**

**100%**

**NRW & Welsh Government reservoirs compliant with the law**

Fig. 2-1: Proportion of undertakers by type

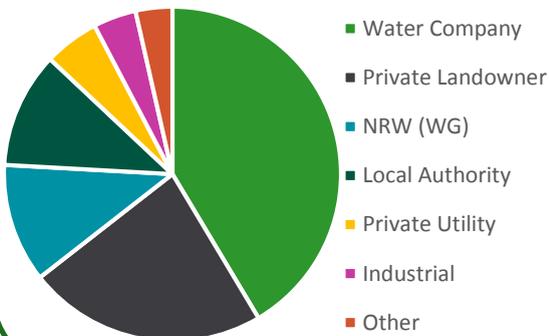
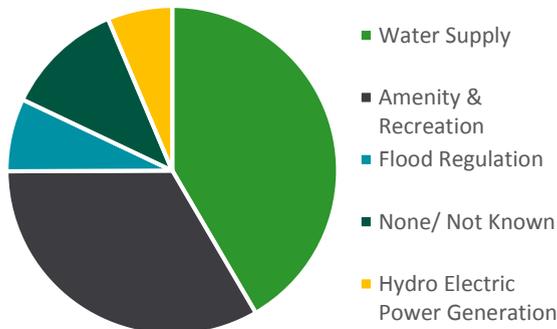


Fig. 2-2: Principal uses of large raised reservoirs in Wales



### 3. Introduction

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The role of the enforcement authority for the Reservoirs Act 1975 (the Act) in Wales transferred from the Environment Agency to Natural Resources Wales (NRW) on 1 April 2013. In our first biennial report for the period ending 31 March 2015, we described the transfer of duties from the Environment Agency to NRW and reported that a Wales-wide focus had brought benefits to public safety through closer examination of reservoirs. This report builds on the transition years and provides an overview of further improvements to reservoir safety management in Wales.

The main purpose of the Reservoirs Act 1975 is to protect people and property from the uncontrolled release of water from large, raised reservoirs<sup>1</sup> and the potentially catastrophic consequences that can arise. The Act requires that these reservoirs are constructed, supervised, inspected, maintained, altered and removed under the guidance of qualified civil engineers.

Section 3 of the Act requires that the relevant authorities report on the steps taken to ensure reservoir undertakers<sup>2</sup> observe and comply with the law. Regulation 7 of the Reservoirs Act 1975 (Capacity, Registration, Prescribed Forms, etc.) (Wales) Regulations 2016, then requires:

#### **Reports by the Natural Resources Body for Wales<sup>3</sup> (NRBW) to the Welsh Ministers**

- (1) For the purposes of section 3(1) of the 1975 Act, the NRBW is to report to the Welsh Ministers—
  - (a) in relation to the period 1 April 2016 to 31 March 2017 no later than 30 September 2017; and
  - (b) at two yearly intervals thereafter.
- (2) The NRBW must submit the report to the Welsh Ministers no later than 6 months after the end of the period to which the report relates.
- (3) The report must confirm—
  - (a) the number of large raised reservoirs that have been registered;
  - (b) the steps (if any) that the NRBW has taken to ensure the undertakers of a large raised reservoir have complied with the requirements of the 1975 Act; and
  - (c) if the NRBW is itself the undertaker for any large raised reservoir, a statement as to—
    - (i) the number of large raised reservoirs for which it is the undertaker; and
    - (ii) any steps it has taken to observe and comply with the requirements of the 1975 Act.

This report is produced in compliance with the above requirement, and submitted to the Cabinet Secretary for Environment & Rural Affairs for information.

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1 A large raised reservoir is one which is designed or capable of holding 10,000m<sup>3</sup> of water above the natural level of the adjoining land.

2 The undertaker is the legal term for the person, people, company or organisation who operates or manages the reservoir. If no activity is undertaken at the reservoir, the owner is the undertaker.

3 The Natural Resources Body for Wales is the legal name of Natural Resources Wales, or NRW. The Natural Resources Body for Wales (Functions) Order 2013 transferred the statutory functions of Environment Agency Wales, Forestry Commission Wales and the Countryside Council for Wales, along with some functions of Welsh Government, to NRW.

## 4. The Amendments to the Reservoirs Act 1975

On 1 April 2016 amendments made to the Reservoirs Act came into force as enabled by Schedule 4 to the Flood and Water Management Act 2010. The most significant of the amendments were:

- A lowering of the threshold for the registration of reservoirs – from a capacity of water stored above natural ground level of 25,000 down to 10,000 cubic metres (m<sup>3</sup>);
- The power for us to designate large raised reservoirs as high-risk reservoirs if we think an uncontrolled release of water could endanger human life. (*High-risk reservoirs* must be formally inspected and supervised by qualified civil engineers, whereas others do not have this requirement);
- Incidents which may affect the safety of the reservoir must be reported to us.

At the close of the reporting period, there were 316 large raised reservoirs registered in Wales. These reservoirs include those which are in operation, formally abandoned or currently under construction or alteration.

This biennial report spans the introduction of amendments, and like-for-like comparison should consider the substantial increase in the number of regulated reservoirs.

Figure 4-1. shows the number of reservoirs registered with NRW before and after the implementation of the amendments on 1 April 2016.

Reservoirs registered as a large raised reservoir before the amendments coming into force on 1 April 2016 are referred to as pre-commencement reservoirs.

Post-commencement reservoirs registered since 1 April 2016 are capable of holding 10,000 - 24,999m<sup>3</sup> of water under the new regulations.

This report sets out what we have done to ensure undertakers observe and comply with the Reservoirs Act, and reports on the work undertaken by us in the management of reservoirs for which we are responsible.

Our purpose as the enforcement authority is to provide Welsh Government, and the people of Wales, with reassurance that the large raised reservoirs in Wales are kept in safe condition to protect the people who live and work downstream from potentially catastrophic flooding.

This report covers the period 1<sup>st</sup> April 2015 to 31<sup>st</sup> March 2017, during which we have:

- Progressed a 33% decrease, since April 2015, in the number of reservoirs in breach of the law; from 9 reservoirs to 6;

Figure 4-1: The total number of registered large raised reservoirs in Wales.



- overseen the introduction of 2016 amendments to the Reservoirs Act 1975;
- identified and brought into regulation previously unregistered reservoirs;
- maintained checks on the appointment of qualified civil engineers for reservoir engineering purposes;
- received and collated incident reports to share with other regulatory bodies and the engineering community to improve our understanding of why dams fail; and
- sought to ensure safety measures are carried into effect.

The Reservoirs Act 1975 directs undertakers as to how they are required to manage their reservoirs. Not all requirements have an equal bearing on safety. Our approach to enforcing the law has focussed on the activities most likely to impair the safety of reservoirs and have a direct bearing on people and property downstream. Our principal priorities are:

1. The appointment of qualified civil engineers:
  - 1.1. Construction Engineer – to design and supervise the construction or alteration of any large raised reservoir;
  - 1.2. Supervising Engineer – to provide feedback and provide an Annual Statement on the behaviour of the reservoir; and to call for inspection if they consider this necessary;
  - 1.3. Inspecting Engineer – to carry out periodic inspections and make recommendations as to safety and maintenance works;
2. The completion of mandatory safety measures;
3. Reservoir monitoring and record keeping by the undertakers.

We have verified that every engineer belongs to an appropriate engineering panel as appointed by Defra on behalf of England and Wales. This appointment process is administered by the Reservoirs Committee of the Institution of Civil Engineers for the whole of the UK.

## 5. Pre-commencement Reservoirs

Pre-commencement reservoirs are capable of storing 25,000m<sup>3</sup> of water above the natural level of the land adjoining the reservoir – the previous capacity threshold.

### 5.1. Designation of pre-commencement Reservoir

Prior to the amendments, undertakers for pre-commencement reservoirs were required to comply with the Reservoirs Act 1975 in its entirety regardless of the hazard posed by the reservoir. The amendments provided us with a new power to designate reservoirs as high-risk reservoirs<sup>4</sup> and draw a distinction between reservoirs where we think an uncontrolled release of water could endanger human life, and those which present less serious consequences.

Undertakers of pre-commencement reservoirs must continue to arrange for supervision and inspection by qualified civil engineer, as was previously required by the Act, unless notified by us that they are not considered to be high-risk reservoirs.

The benefits of our designations have been felt by undertakers for reservoirs which are not designated high-risk. Following our review of the possible flood consequence posed by a reservoir, if we have not considered it to be a high-risk reservoir, we have written to the undertakers to inform them that they no longer need to appoint supervising or inspecting engineers. This results in substantial financial savings for them by removing the requirement to appoint engineers for supervision and inspection purposes.

Designation has taken the 3-step process shown below:

1. Review of information held by NRW, resulting in a provisional designation sent to the undertakers;
2. A period for representations during which undertakers may dispute our provisional designation and provide further evidence to inform our decision;
3. Review of any additional information provided resulting in our final designation.

Completion of the designation of pre-commencement reservoirs will be completed during the remainder of 2017.

The results of the designation process as at 31 March 2017 are shown in Table 5-1.

	“High-risk”	Not “High-risk”
Provisional Designation	204	16
Final Designation	171	23
Awaiting Final Designation (no representations)		22
Awaiting Final Designation (representations made)		4
Awaiting Provisional Designation		11

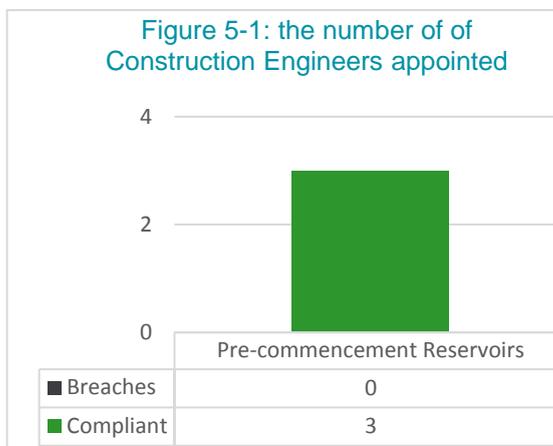
<sup>4</sup> A high-risk reservoir is defined by the Reservoirs Act 1975 as one where we think an uncontrolled release of water could endanger human life. The designation does not confer any likelihood on an escape of water occurring.

## 5.2. Regulation of pre-commencement reservoirs

Pre-commencement reservoirs, whether as a designated high-risk reservoir or awaiting designation, must comply with all requirements of the Reservoirs Act 1975. The implementation of our principles set out in section 3 of this report are shown below.

### Appointment of Construction Engineers

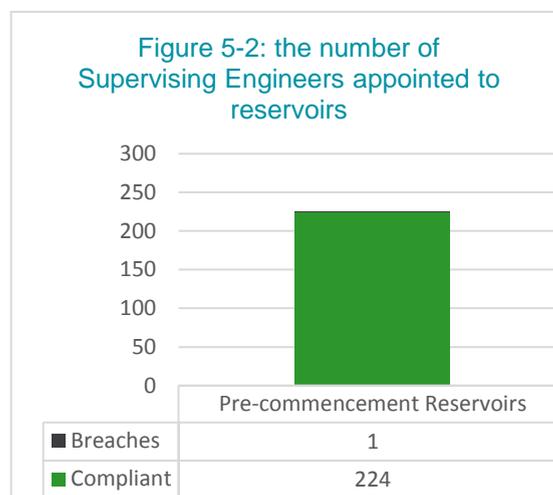
We recorded three pre-commencement reservoirs as being under construction. At the close of the reporting period all construction and alteration works on registered large raised reservoirs were under the supervision of a Construction Engineer. We monitor the issue of Preliminary Certificates permitting first filling, and Final Certificates confirming completion of the construction and scheduling of the reservoirs' first periodic inspection.



### Appointment of Supervising Engineers

Supervising Engineers are only required to be appointed to high-risk reservoirs, or pre-commencement reservoirs which have not yet received a designation.

Throughout the reporting period we have ensured that all large raised reservoirs have had a Supervising Engineer appointed to them. One breach of this requirement occurred and is subject to an enforcement notice.



There is a new requirement for Supervising Engineers to provide a copy of their Annual Statement to us, and to provide specific reports on any matters in the interests of maintenance. We intend to monitor the content of these to establish how the information may provide a wider view of reservoir maintenance.

### Appointment of Inspecting Engineers

Inspecting Engineers are only required to be appointed to high-risk reservoirs, or pre-commencement reservoirs which have not yet received a designation.

The periodic inspection of reservoirs must be carried out by a qualified civil engineer from one of the appropriate panels of engineers, and the inspecting engineer must be independent of the undertakers. An inspection must take place every 10 years, or sooner if required by the Supervising Engineer to address a particular concern.

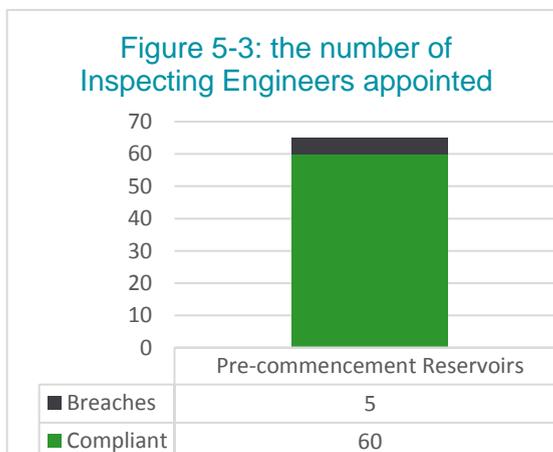


Fig 5-3 shows that five inspections were carried out later than the date due. The longest overdue period was 65 days; this delay is considered minimal when compared to the ten-year periodic inspection cycle.

There are 30 inspecting engineers in the UK, and many have a full schedule of appointments in the UK and around the world. Undertakers occasionally find that an engineer is unavailable to carry out an inspection before its due date. With a diminishing number of inspecting engineers, we are increasing the period in which we provide reminders from 6 months to 12 months to help undertakers begin the process of appointment sooner.

**Measures in the Interests of Safety<sup>5</sup>**

An Inspecting Engineer may include in their report a recommendation as to any measures to be taken in the interests of safety. The measures include a range of activities as shown in Figure 5-4 and may include straightforward tasks or involve substantial works. Measures may take weeks or years to complete depending on the nature of the requirement. We provide reminders and seek progress updates for these measures to help undertakers complete them within the timescales provided by the engineer.

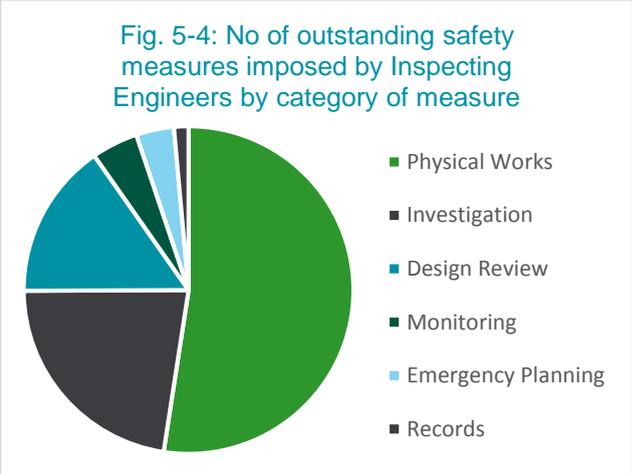
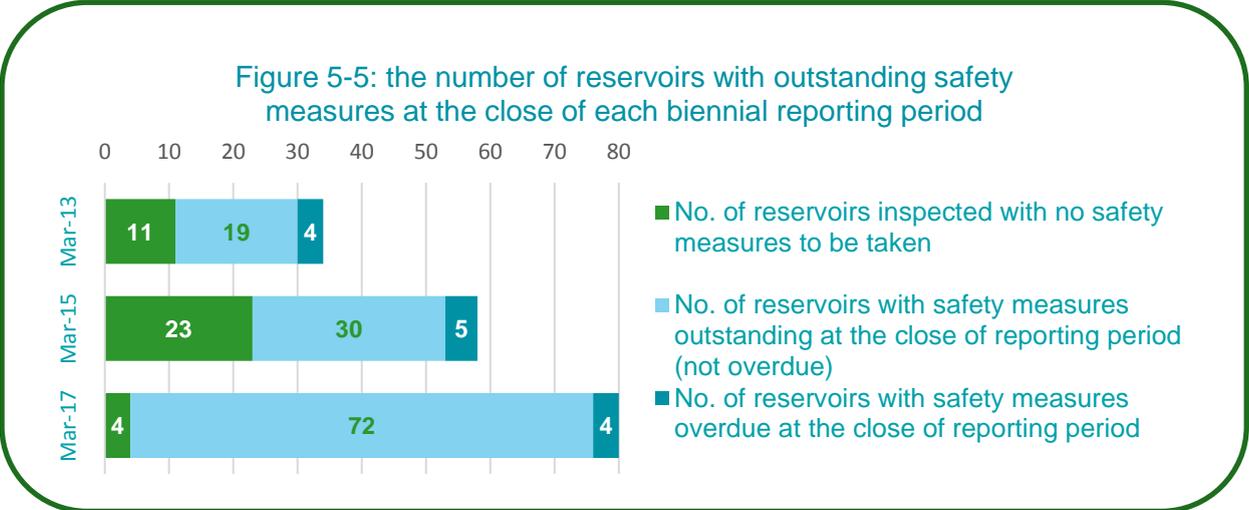


Figure 5-5 below shows a significant rise in the number of measures over the last two years. This mirrors a spike in the number of reservoirs that underwent recent inspection, arising from our earlier work to identify pre-commencement reservoirs that had not previously been registered. The undertakers are required to complete all safety measures within the timescales prescribed and this will likely place a substantial financial burden on them.



5 Measures in the Interests of Safety are recommended by the Inspecting Engineer and are statutory obligations which are enforceable by us.

The number of reservoirs where safety measures were overdue at the close of each reporting period has remained steady, and at a low level. However, the rise in safety measures which are currently pending prompts concern for the future. There is an increased chance of compliance timescales being exceeded and we will monitor progress against these carefully.

Where measures are overdue we have sought the root cause for failing to implement them, and balanced this with the potential flood risk and opinion of the engineer as to the safety of the reservoir, to establish the overall breach of the undertakers' duty and inform our enforcement response.

### Abandonment

We received no notifications of the appointment for an engineer to report on a reservoir prior to its abandonment. One abandoned reservoir is recorded as under supervision by an engineer for its re-use as an operational reservoir. We are monitoring the completion of statutory safety works for this.

### Discontinuation

We received no notifications of the appointment for an engineer to supervise and report on the discontinuation of a reservoir.

## 5.3. Orphans

There are currently two reservoirs which are considered to be 'orphans' because either we have confirmed there is no undertaker, or we have not been able to identify the undertaker despite extensive searching. The Reservoirs Act 1975 is silent on how orphan reservoirs are to be treated but provides us with step-in powers to ensure safety is maintained. For these two reservoirs we have stepped in, in the interests of public safety, to:

- Maintain the appointment of Supervising Engineers;
- Provide staff to visit and report back to the Supervising Engineer;
- Arrange for periodic inspections as prescribed by the last Inspecting Engineer, or as required by the Supervising Engineer;
- Implement safety measures.

These reservoirs require significant resource to manage.

## 5.4. Incidents

We were notified and received reports of three incidents that may affect the safety of reservoirs. The details of these have been shared with other enforcement authorities for collation and summary in the UK-wide annual report.

## 6. Post-Commencement Reservoirs

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The 2016 amendments to the Reservoirs Act 1975 changed the definition of a large raised reservoir and lowered the capacity threshold, above which registration is required. Between 1 April 2016 and 31 March 2017, we received registrations for 92 reservoirs with a capacity of 10,000m<sup>3</sup> or more. This section reports on these post-commencement reservoirs.

### 6.1. Designation of post-commencement reservoirs

We anticipate this activity will begin following completion of the designation of pre-commencement reservoirs.

### 6.2. Regulation of post-commencement reservoirs

Whilst these reservoirs are without a risk designation, there are circumstances where the undertakers are required to take action and notify us of this.

#### Appointment of Construction Engineers

A Construction Engineer is required to design and supervise the construction or alteration of any large raised reservoir, regardless of its designation. We received one notification of the appointment of a Construction Engineer for a post-commencement reservoir.

#### Appointment of Supervising Engineers

Post-commencement reservoirs are not required to have a Supervising Engineer unless designated high-risk, however, some undertakers have chosen to appoint Supervising Engineers in the absence of a designation, and notified us of this. We consider this to be good practice.

#### Appointment of Inspecting Engineers

Post-commencement reservoirs are not required to be inspected unless designated high-risk, however, some undertakers have chosen to appoint Inspecting Engineers in the absence of a designation, and notified us of this. Undertakers are also implementing their engineers' recommendations. We consider this to be good practice.

#### Abandonment

We received no notifications of the appointment for an engineer to report on a reservoir prior to its abandonment.

#### Discontinuation

We received no notifications of the appointment for an engineer to supervise and report on the discontinuation of a reservoir.

### 6.3. Orphans

We have not confirmed any post-commencement reservoirs as orphans. We consider it plausible that orphans may come to light as we investigate smaller reservoirs to assess their liability for registration. Depending on the number of orphans which become

apparent, we will engage with Welsh Government to establish sensible steps to manage the risk they pose.

#### **6.4. Incidents**

We received no reports of incidents that may affect the safety of post-commencement reservoirs.

## 7. Reservoirs managed by NRW

We own or manage 38 large raised reservoirs, including those within the Welsh Government Woodland Estate. These reservoirs fulfil different purposes, for example: flood storage and habitat conservation; others are historic structures which lie within the land we manage. Since the creation of NRW, we have continued to identify and assess these reservoirs, carry out inspections where needed and maintain an extensive programme of safety works.

At the close of the reporting period all our large raised reservoirs had been inspected and supervising engineers appointed.

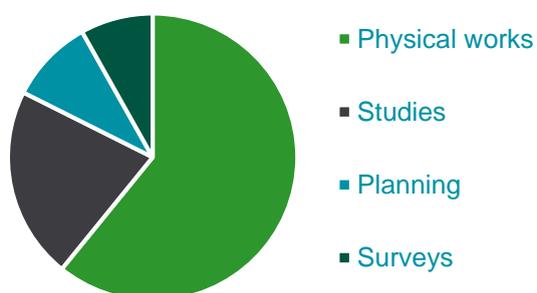
Where these inspections identified measures to be taken in the interests of safety, a programme of works is in place to ensure these are carried into effect. These measures vary in their scale from administrative exercises to extensive physical engineering works. The common categories of the safety measures are shown in figure 7-2 below.

In addition to safety measures, our staff maintain a schedule of regular visits to monitor and report on the reservoirs. In doing so, any weaknesses are identified and monitored, with further advice sought from engineers as required.



*Fig. 7-1: Construction of a new reservoir to store flood water; protecting people from flooding.*

**Fig. 7-2: The range and proportion of safety works being undertaken at reservoirs managed by NRW**



Our work also considers the overall purpose of reservoir structures. Where the primary use has become redundant, we consider whether its removal is appropriate to remove ongoing liabilities, or whether it may be managed for some other purpose. For example, a redundant water supply reservoir may provide flood storage or conservation benefits that we do not wish to lose by removal of the reservoir. The principles of sustainable management of natural resources fits well with our approach.

At the close of the reporting period we are pleased to report that all pre-commencement reservoirs for which we are responsible have been inspected and supervised appropriately. Registration of post-commencement reservoirs is substantially complete with preliminary investigations and inspections underway.

## 8. Information & data

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In addition to our regulatory activities we have also performed the following functions:

- Maintained the register of large raised reservoirs;
- Responded to internal and external enquiries for information on reservoir safety;
- Responded to consultations on applications for planning consent, development consent orders, water abstraction and hydropower permit applications;
- Created and maintained a register of reservoirs with enhanced information to help us, and other Category 1 responder, to prepare for reservoir flooding emergencies;
- Maintained our working relationship with Government departments and regulators in England, Scotland and Northern Ireland on matters of mutual reservoir safety interest;
- Collated and shared reports of incidents which may affect reservoir safety, to help engineers, regulators and governments ensure lessons can be learned;
- Participated in Local Resilience Fora information sessions and exercises; and provided advice to the organisations involved;
- Participated as a member of the Reservoirs Committee<sup>6</sup>;
- Participated in reservoir safety Research & Development activities.

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<sup>6</sup> The Reservoirs Committee sets standards for the different panels of engineers, and the appointments to these panels. It makes recommendations to Defra on the appointment of engineers to the different panels.

## 9. Summary and the next 2 years

Wales is a land famous for its reservoirs, the safety of which ultimately falls to the undertakers who own, manage or operate them. It is our duty to make sure these undertakers observe and comply with the Reservoirs Act 1975. We have continued to seek positive working relationships with undertakers and the engineers which inspect and supervise them to maintain a high level of compliance. We seek to continue to maintain this high level of compliance with our priorities set out in section 3 of this report, and to review the impact and success of the amendments.

### 9.1. Business As Usual

In the next two years, we anticipate that we will receive in the region of 60 Inspecting Engineers' reports and over 200 Supervising Engineers' Annual Statements. Many of these documents will contain engineers' recommendations to keep reservoirs safe and in good order. We will be providing reminders to undertakers to appoint engineers in good time and monitoring satisfactory completion of inspections; enforcing this where necessary.



*Figure 9-1: Old dams, newly registered will require substantial investment and work by undertakers to bring them up to a safe standard.*

Additional advice will be required for newly registered reservoirs for their first-time inspection following designation as high-risk reservoirs. It is likely that these will contain substantial safety measures for aging structures that have not previously been maintained to an adequate standard.

Since the amendments to the Act, some undertakers have benefitted from reduced regulatory and financial burdens of inspection and supervision. Whilst these reservoirs present a lower risk, they are not outside of regulation and we will monitor changes which may alter their designation.

Public safety is being enhanced through better knowledge of reservoirs that have previously lain outside of regulation, posing dormant with unknown risks. The registration of these reservoirs will enable us to scrutinise the risk they pose and the need for formal inspection. We

are continuing to receive registrations as a result of our work to identify waterbodies potentially capable of holding or storing 10,000m<sup>3</sup>.

### 9.2. Reservoir Designations

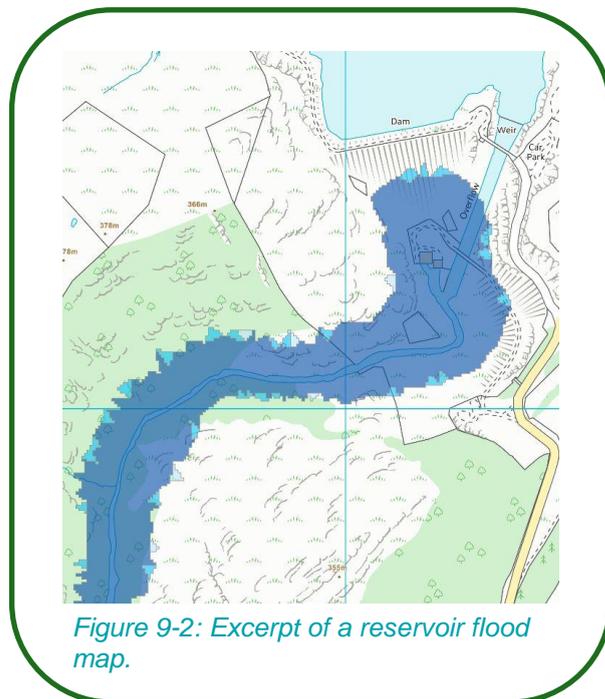
We will complete the designation of pre-commencement reservoirs and begin to assess post-commencement reservoirs by collecting data and producing flood maps.

### 9.3. Reservoir Flood Maps

*We will start work on a flood mapping project to illustrate the possible flood impact following a dam failure. The maps will guide our designation of reservoirs and better inform Local Resilience Fora for improved emergency preparedness.*

Currently there is no flood mapping for newly registered reservoirs under 25,000m<sup>3</sup>. A flood mapping exercise is planned to be carried out to ensure that we are able to complete the designation of all registered reservoirs between 2017-2019. As a result, we will have an enhanced knowledge of the flood consequence in the event of a dam breach for all large raised reservoirs in Wales. This mapping will also enable us to seek opportunities for further reductions in regulation, where appropriate, without increasing the risk to people living and working downstream.

We will keep Local Resilience Fora informed of changes in their area and provide updated information as to the nature and location of reservoirs to ensure preparedness and response plans for incidents are robust.



*Figure 9-2: Excerpt of a reservoir flood map.*

### 9.4. Improving Guidance

*We will develop guidance to help undertakers understand good practice principles of looking after their dams and reservoirs.*



*Figure 9-3: Sharing advice and guidance between engineers and undertakers.*

We seek to engage with newly identified undertakers who may have little or no knowledge of the Reservoirs Act 1975 or its requirements. This brings new challenges in the regulation of people and businesses that have never before been regulated. Our guidance will be developed to help these people keep their reservoirs in safe condition and fulfil their duties to comply with the law in line with our other wellbeing goals.

A new charging scheme will be implemented during 2017-18 to recover our costs incurred through registration and annual compliance monitoring.

## 9.5. Good For People – keeping the people of Wales safe.

*Our corporate wellbeing goals will develop through the reservoirs theme “Good for People”.*

The village of Dolgarrog, whose community lost 16 lives in 1925 as a result of dam failure, provides a constant reminder of the roots and purpose of the legislation we regulate – to protect people and property against the escape of water from reservoirs and the catastrophic consequences which may follow.



*Figure 9-4: A breach in Llyn Eigiau’s dam, above Dolgarrog*



*Figure 9-5: 1925 photo showing the size of boulders washed into Dolgarrog. Note the two people standing atop. (image courtesy Gwasnaeth Archifau Conwy Archive Service)*

We are working with the British Dam Society, water companies, reservoir engineers and undertakers to help the Dolgarrog community maintain and enhance their memorial to the people whose lives were lost during the disaster. A memorial at the site of the disaster explains the tragic story to visitors, and work by the community is ongoing to maintain this prior to the anniversary in November 2017. This commemoration is likely to attract interest from local people, civic leaders, politicians and the media, focussing attention on the inherent flood risk from reservoirs and the steps we must take to protect against a repeat experience.



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Published by:  
Natural Resources Wales  
Cambria House  
29 Newport Road  
Cardiff  
CF24 0TP

0300 065 3000 (Mon-Fri, 9am - 5pm)

[enquiries@naturalresourceswales.gov.uk](mailto:enquiries@naturalresourceswales.gov.uk)  
[www.naturalresourceswales.gov.uk](http://www.naturalresourceswales.gov.uk)

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