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3 February 2022

Mr Andrew Hall  
Deputy Chief Inspector of Rail Accidents  
Cullen House  
Berkshire Copse Rd  
Aldershot  
Hampshire GU11 2HP

Dear Andrew,

**RAIB Report: Derailment due to a landslip, and subsequent collision, Watford on 16 September 2016**

I write to provide an update<sup>1</sup> on the action taken in respect of recommendations 2, 3 & 6 addressed to ORR in the above report, published on 10 August 2017.

The annex to this letter provides details of actions taken in response to the recommendations and the status decided by ORR. The status of recommendations 2, 3 & 6 is '**Implemented**'.

We do not propose to take any further action in respect of the recommendations, unless we become aware that any of the information provided has become inaccurate, in which case I will write to you again.

We will publish this response on the ORR website on 4 February 2022.

Yours sincerely,

A handwritten signature in blue ink, appearing to read 'Oliver Stewart', written in a cursive style.

Oliver Stewart

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<sup>1</sup> In accordance with Regulation 12(2)(b) of the Railways (Accident Investigation and Reporting) Regulations 2005

## Proposed update to RAIB

### Recommendation 2

*The intent of this recommendation is to determine whether other Network Rail locations have an unrecognised washout risk for reasons found at the accident site. Implementation is expected to comprise verification that the current processes identify risk at locations similar to the accident site and a check to find any other sites omitted from washout studies for reasons similar to those at Watford.*

Network Rail should review, and if necessary, improve its process for identification of localised water concentration features which can channel significant amounts of water onto the railway with the consequent risk of slope failure. This review should include:

- a. using current Network Rail processes to analyse the washout and earthflow risk for the slow lines cuttings at Watford to determine whether this correctly identifies the landslip site as a high risk location; and
- b. verifying that the process has been applied to all relevant track alignments including those such as at Watford where there are closely spaced multiple alignments

### ORR decision

1. Network Rail has reviewed its existing processes for identifying locations vulnerable to localised water concentration and has developed a revised suite of tools, taking account of the learning from incidents such as the landslip at Watford tunnel.
2. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:
  - taken the recommendation into consideration; and
  - has taking action to implement it.
  - **Note** – ORR judges that Network Rail has done all that was required of it by this recommendation in that the development of the WERM3 tool has overcome the weaknesses identified in RAIB's investigation. We are aware that, following the fatal derailment at Carmont, Network Rail is researching and developing potential further improvements. We would characterise this as part of normal, expected continuous improvement – and not a reason to defer judging that the recommendation has been implemented. Aspects of this next stage of work will be reported in relation to some of RAIB's anticipated Carmont recommendations.

**Status: Implemented.**

**Previously reported to RAIB**

3. On 9 August 2018 ORR reported that we were content with the approach Network Rail were taking to address this recommendation and the aim of completing work before the start of the examination season.

## Update

4. On 8 October 2018 Network Rail provided the following closures details:

*Network Rail has reviewed and improved its process for identification of localised water concentration features which can channel significant amounts of water onto the railway. Network Rail's review has centered on the second generation Washout and Earthflow Risk Mapping (WERM2), which was implemented in 2014 within the Soil Cutting Hazard Index (SCHl) algorithm, one of three tools used to determine an Earthwork Hazard Category (EHC). The WERM2 outputs were generated by a modelling process and attributed to Soil Cuttings in the asset inventory at that time. The review has considered, inter alia:*

- *The Earthwork assets known to have failed by washout and earthflow mechanisms, including the cuttings at Watford;*
- *The performance of WERM2 in terms of whether or not this specific tool is a good predictor of such failures;*
- *Whether WERM2 should remain a component of SCHl or form a standalone metric/control;*
- *The appropriateness of the update process for WERM, including frequency as well as linkage of outputs to Soil Cuttings; and*
- *Any potential improvements that can be made to the source data or the algorithm.*

*The main outcomes of the review are a third generation Washout & Earthflow Risk Mapping (WERM3) and a parametric Washout & Earthflow Hazard Index (WEHI). The following conclusions result from the analyses undertaken as part of the review:*

1. *The WERM3 predictions of the locations of water concentration features at the top of cutting crests for various rainfall return periods are more robust than the WERM2 outputs because:*
  - a. *They provide greater coverage of the network through updating of the underlying network model*
  - b. *They provide improved identification of the intersections between the modelled flooding and the top of cuttings through the use of two methods for defining cutting crests*
  - c. *They provide improved identification of the complex slope geometry around tunnel portals*
  - d. *The outputs are more reliable through:*
    - i. *The removal of a greater number of false positives*
    - ii. *Changes/additions to the crest drainage data*
    - iii. *Updating of the underlying flooding model*
    - iv. *Inclusion of rock cuttings with soil upper slopes*
    - v. *Higher precision model outputs*

Therefore, Network Rail has concluded that the WERM3 outputs should replace the WERM2 outputs in the JBA GISMO field tool and in the next iteration of the Powerpack.

2. The development of the WERM3 model has addressed the specific requirements of the RAIB report into the Watford failure, namely:

a. The revised WERM2 and the new WERM3 analysis methods now correctly identify the area adjacent to the slow line tunnel portal at Watford as a potential water concentration feature. However, the analyses indicate that an extreme rainfall event would be required for the water concentration to develop.

b. The track alignment model has been improved (not just at Watford, but nationally) to pick up multiple lines.

c. The modelling of cutting crests and tunnel portals has been improved nationally to provide more comprehensive coverage.

3. However, in comparing the WERM2 and WERM3 water concentration feature locations with the known failure sites (the calibrating data set):

a. There is a weaker correlation between the modelled water concentration features and the calibrating data in WERM3 compared to WERM2.

b. Whilst the WERM3 model consists of more robust inputs, it is statistically a poorer predictor of failure, and particularly of washout failure, than the WERM2 outputs.

c. It is considered that the WERM2 outputs were fortuitously producing a better correlation with the calibrating dataset.

4. The WEHI algorithm is a weak predictor of washout and earthflow failure. Possible reasons for this include:

a. An extensive and reliable calibration data set specifically relating to washout and earthflow failures is not available.

b. There is a poor correlation between the available calibration data sets and some of the component parameters investigated for WEHI.

c. There may be limitations in the resolution in the WERM3 water concentration feature analysis due to limitations in the underlying digital terrain model (DTM).

Therefore, the WEHI algorithm does not currently warrant adoption as a standalone hazard index for the identification of earthworks susceptible to washout and earthflow failure. However, in developing WEHI a number of new parameters have been defined and data sets developed. These parameters, as well as the improved WERM3 and the derived composite WEHI, should be considered for inclusion as input parameters in the future re-assessment of the SCHI algorithm.

### **Recommendation 3**

*The intent of this recommendation is to identify and assess the effectiveness of design features that provide guidance to trains when derailed, so limiting the*

*deviation of trains from the track and reducing the risk of collision with trains approaching on other lines. This could be achieved by the retention or strengthening of features already forming part of the bogie structure, or infrastructure measures such as guard rails. It is also intended that the learning from research in this area is used to derive meaningful design requirements.*

*The Rail Delivery Group (RDG), in conjunction with RSSB, should:*

a. commission research into the ways in which guidance can be provided to derailed trains. This should include consideration of:

- how the design of bogies and bogie mounted equipment can assist in limiting the lateral deviation of passenger trains during a derailment;
- practice in other countries (e.g. Japan);
- how specially installed infrastructure features can achieve the same effect at high risk locations;
- potential design requirements for the retention or enhancement of such features on new trains or infrastructure; and
- the potential benefits and drawbacks of such measures. If such features, whether existing or additional, are shown to have a net beneficial effect in reducing risk by limiting lateral deviation, RDG/RSSB should:

b. share this information with the relevant Standards Committees; and

c. record and disseminate the design requirements with a view to their incorporation into future standards.

## **ORR decision**

5. RDG commissioned RSSB to carry out research into devices to guide derailed trains. Devices to Guide Derailed Trains (T1143) has now been published.

6. The report has concluded there may be a case for fitting existing vehicles with a device comprising two bogie-mounted stoppers offset laterally, subject to addressing issues when a vehicles encounters S&C when derailed. However, the report also concluded that fitting a derailment device to new vehicles at an incremental cost offers the best value for money.

7. In terms of derailment containment devices fitted to the infrastructure, the report recommended using the prototype infrastructure risk tool to identify suitable locations.

8. The report also recommended that research is carried out into the complete derailment event to improve understanding of the effectiveness of different infrastructure mitigation solutions.

9. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, RDG has:

- taken the recommendation into consideration; and
- has taken action to implement it

**Status: Implemented.**

### Previously reported to RAIB

10. On 9 August 2018 ORR reported the following:

Following an RDG proposal, RSSB have undertaken a research project into technical devices to guide derailed trains. The project is considering both vehicle-mounted and infrastructure-mounted devices and will consider measures in place on other railways with similar characteristics to the UK mainline.

### Update

11. On 10 June 2021, RSSB reported that research project T1143 had been published on SPARK. T1143 included an annex identifying how each part of the recommendation had been addressed:

Requirement (see part a of the rec)	Ref in T1143	Information in T1143
<p>The Rail Delivery Group (RDG), in conjunction with RSSB, should:</p> <p>a. commission research into the ways in which guidance can be provided to derailed trains. This should include consideration of:</p>	<p>This project (T1143) for which this document represents the summary report</p>	
<p>how the design of bogies and bogie mounted equipment can assist in limiting the lateral deviation of passenger trains during a derailment;</p>	<p>Section 3.1 and 3.4.2</p>	<p>Section 3.1 - a device would need to be designed capable of resisting a lateral point load of the order of 120 – 140kN to provide guidance and restraint to further lateral excursion following a flange climb derailment.</p> <p>Section 3.4.2 - These features were generally laterally offset/asymmetrical in their nature so could only offer such control in one direction and all of the examples above, whilst providing some degree of control, may not be sufficient to prevent secondary collision with a train on an adjacent line.</p>

		Section 3.4.2 – Concern ...a rolling stock fitted device could engage with a turnout rail with the potential to increase the consequences of a derailment.... The desktop study did not close out this issue and to consider this issue further would have exceeded the scope of this project.
practice in other countries (e.g. Japan);	Section 3.4	Section 3.4 - Two rolling stock mounted solutions were identified, both of which were developed in Japan
how specially installed infrastructure features can achieve the same effect at high risk locations;	Section 3.5	3.5.1. Guard Rail 3.5.2. Robust Kerb 3.5.3. Check Rail
potential design requirements for the retention or enhancement of such features on new trains or infrastructure; and	Section 3.2	Section 3.2 - provision of control/guidance to a derailed vehicle such that no element of the structure exceeds a lateral excursion greater than 500mm // be able to resist a lateral point load of the order of 120-140kN // would need to be compliant with the Lower Sector Vehicle Gauge (LSVG) as defined in GE/RT8073 // Switch & Crossings it is important that as a minimum a device should not become a detrimental factor  Section 3.1 - a device would need to be designed capable of resisting a lateral point load of the order of 120 – 140kN to provide guidance and restraint to further lateral excursion following a flange climb derailment.
the potential benefits and drawbacks of such measures. If such features, whether existing or additional, are shown to have a net beneficial effect in reducing risk by limiting lateral deviation, RDG/RSSB should:	Section 3.6, table 3	Section 3.6, Table 3 <ul style="list-style-type: none"> <li>• Axle-box mounted L-Shaped bracket (leading wheelset)</li> <li>• Bogie-mounted Central Stopper (leading bogie) with specially positioned Guard Rails</li> <li>• Two laterally offset bogie mounted Stoppers (leading bogie) without Guard Rails</li> <li>• Guard Rails</li> <li>• Robust Kerb</li> </ul>

## Recommendation 6

*The intent of this recommendation is to support the completion of a full survey of drainage assets required to mitigate safety risk on Network Rail infrastructure.*

Network Rail should develop and commit to a time bound plan to complete its planned survey of drainage assets to provide sufficient asset knowledge to adequately manage risk. This should include a desk study of archive records and current records, together with inspections on site.

## ORR decision

12. Network Rail drainage asset survey now complete and ORR has been provided with time-bound commitments from all regions to complete drainage asset inventories.

13. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- taken the recommendation into consideration; and
- has taken action to implement it

**Status: Implemented.**

## Previously reported to RAIB

14. On 9 August 2018 ORR reported the following:

Network Rail have not formally responded to this recommendation. However, this is an area that we have been actively pursuing for some time, and we are aware of plans that are already in place in some Routes for completion of drainage surveys. We are also aware Network Rail have set an internal timescale of October 2018 for all Routes to complete a timebound plan to complete these surveys, which should implement this recommendation (although we would need to continue to monitor the delivery of those plans.)

## Update

15. On 13 December 2018 Network Rail provided the following initial response:

*All routes have produced time bound plans to complete planned surveys of drainage assets. These surveys will provide sufficient asset knowledge to adequately manage risk and will include a desk survey of archive records and current records, together with inspections on site. The DRAM for each route has been allocated to lead the recommendation on their route. All routes acknowledged the recommendation and have produced individual action plans.*



*Each route is responsible for delivering their own plan, and they will be measured and monitored through the STE Lineside Infrastructure team.*

16. Network Rail has provided quarterly updates at liaison meetings on progress with the drainage asset survey and the development by individual regions of plans to deliver drainage asset inventories. We have been provided the following dates for completion of asset inventories:

Scotland – CP6 Yr. 4 (2023)

Wales and Western – CP6 Yr. 5 (2024)

North West and Central – CP6 Yr. 4 (2023)

LNE and EM – East Coast - CP6 Yr. 4 (2023), Anglia - CP6 Yr. 5 (2024)

Southern – CP6 Yr. 5 (2024)

## Previously reported to RAIB

### Recommendation 2

*The intent of this recommendation is to determine whether other Network Rail locations have an unrecognised washout risk for reasons found at the accident site. Implementation is expected to comprise verification that the current processes identify risk at locations similar to the accident site and a check to find any other sites omitted from washout studies for reasons similar to those at Watford.*

Network Rail should review, and if necessary, improve its process for identification of localised water concentration features which can channel significant amounts of water onto the railway with the consequent risk of slope failure. This review should include:

- a. using current Network Rail processes to analyse the washout and earthflow risk for the slow lines cuttings at Watford to determine whether this correctly identifies the landslip site as a high risk location; and
- b. verifying that the process has been applied to all relevant track alignments including those such as at Watford where there are closely spaced multiple alignments

### ORR decision

1. We are content with the approach Network Rail are taking to address this recommendation and the aim of completing work before the start of the examination season.
2. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:
  - taken the recommendation into consideration; and
  - is taking action to implement it by 30 September 2018.

**Status: Implementation ongoing. ORR will advise RAIB when actions to address this recommendation have been completed.**

### Information in support of ORR decision

3. On 19 July 2018, Network Rail provided the following initial response:  
*Network Rail will:*

*Undertake a review of the second generation Washout and Earthflow Risk Model (WERM2), which was implemented in 2014 as part of the Soil Cutting Hazard Index (SCHI) and therefore Earthwork Hazard Category (EHC). The WERM2 outputs were generated by an offline modelling process and attributed to Soil Cuttings in the asset inventory at that time. The review will consider, inter alia:*

- *the Earthwork assets known to have failed by washout and earthflow mechanisms, including the tunnel approach cuttings at Watford;*

- *the performance of WERM2 in terms of whether or not this specific tool is a good predictor of such failures;*
- *whether WERM2 should remain a component of SCHI or form a standalone metric/control;*
- *the appropriateness of the update process for WERM, including frequency as well as linkage of outputs to Soil Cuttings; and*
- *any potential improvements that can be made to the source data or the algorithm.*

*The outcome of the review may or not include recommendations for potential modifications that could be made to WERM2 in order to assist in better predicting washout and earthflow failures. This may lead to an improved calibration to failures, and potentially a national re-appraisal. In any case, WERM outputs will be re-calculated for each individual earthwork asset within the inventory, such that all relevant track alignments are captured. The intention is to complete this activity by the start of the 2018/19 Examination Season. That corresponds to 1 October 2018 so the proposed completion date is 30 September 2018*

### **Recommendation 3**

*The intent of this recommendation is to identify and assess the effectiveness of design features that provide guidance to trains when derailed, so limiting the deviation of trains from the track and reducing the risk of collision with trains approaching on other lines. This could be achieved by the retention or strengthening of features already forming part of the bogie structure, or infrastructure measures such as guard rails. It is also intended that the learning from research in this area is used to derive meaningful design requirements.*

*The Rail Delivery Group (RDG), in conjunction with RSSB, should:*

a. commission research into the ways in which guidance can be provided to derailed trains. This should include consideration of:

- how the design of bogies and bogie mounted equipment can assist in limiting the lateral deviation of passenger trains during a derailment;
- practice in other countries (e.g. Japan);
- how specially installed infrastructure features can achieve the same effect at high risk locations;
- potential design requirements for the retention or enhancement of such features on new trains or infrastructure; and
- the potential benefits and drawbacks of such measures. If such features, whether existing or additional, are shown to have a net beneficial effect in reducing risk by limiting lateral deviation, RDG/RSSB should:

b. share this information with the relevant Standards Committees; and

c. record and disseminate the design requirements with a view to their incorporation into future standards.

## ORR decision

4. Following an RDG proposal, RSSB have undertaken a research project into technical devices to guide derailed trains. The project is considering both vehicle-mounted and infrastructure-mounted devices and will consider measures in place on other railways with similar characteristics to the UK mainline.

5. After reviewing the information provided ORR has concluded that, in accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, RDG in conjunction with RSSB has:

- taken the recommendation into consideration; and
- is taking action to implement it, but ORR has yet to be provided with a time-bound plan.

**Status: Progressing. ORR will advise RAIB when further information is available regarding actions being taken to address this recommendation.**

## Information in support of ORR decision

6. On 20 December 2017 the Rail Delivery Group provided the following initial response:

*In your letter you state that this action has been placed on the Rail Delivery Group, but I feel the need to point out that Recommendation 3 of the RAIB report is a joint action on both RDG and the Rail Safety and Standards Board (RSSB).*

*I have therefore been working with the RSSB to address this recommendation and can advise the following progress:*

- i) Once the RAIB report was published I submitted a 'Research idea' form to RSSB to request an industry research project be undertaken - that will attempt to address the issues identified by this recommendation.*
- ii) I attended the RSSB Rolling Stock Standards Committee (RSSC) on 8th December 2017 and sought support from industry to progress an RSSB research project. I am pleased to report that RSSC supported progressing my proposal.*
- iii) RSSB have arranged an 'Idea Development Meeting' on the afternoon of 29/01/18.*

*In addition, I also plan to invite a representative from RAIB to attend the Idea Development meeting- since I think it would be helpful to understand more about their thinking in relation to the generation of this recommendation.*

*I hope that you also appreciate that this recommendation will take a considerable amount of time in order for the industry to implement any findings emerging from the research project.*

7. On 13 July 2018, RDG provided an update on the actions they we're taking:

*The Research Idea has progressed to the stage where a formal RSSB Project has been generated. It will be known as T1143: Devices to guide derailed trains.*

*We are planning to seek the endorsement of the cross-industry Vehicle / Track System Interface Committee at their meeting of the 26<sup>th</sup> July.*

*In support of this, I have reviewed and provided comments to RSSB on the draft 'Specification for research project' and 'Assessment of the case to undertake' for this project.*

8. The research project defined the following objectives and work packages:

*Devices to guide derailed trains can be split into two categories, rolling stock mounted solutions and infrastructure mounted solutions. It is proposed that the project is split into three work packages; the first two to address the two categories separately and the third to bring the findings together.*

***Work Package 1: Assessing the use of Rolling Stock Mounted Equipment for the Reduction in Risk of a Derailment.***

***Assessment of technical strategies and devices.***

*Identify, categorise and assess the rolling stock mounted systems, including those under development and those used outside GB intended to limit lateral excursion in the event of derailment. Define the mechanism of restraint and assess the potential effectiveness and limitations of each system. The study shall include descriptions of devices deployed in service and any others that have been described in academic research.*

***The behaviour of a derailed vehicle during and immediately after leaving the rails.***

*Through dynamic modelling, understand the geometry and forces relating to secondary engagement of bogie mounted structures on the rail following derailment. The modelling should estimate the direction and magnitude of potential restraining forces to be imposed by track features, and the resultant lateral deviation from normal running position. Modelling should be carried out for plain line track only, but the impact of Switches and Crossings (S&C) should be considered qualitatively. Variation from speeds up to 125mph should be considered.*

***Potential for bogie or axle mounted equipment in GB railways***

*Based on the constraints of GB Lower Sector Vehicle Gauge (LSVG) evaluate the options available to provide rolling stock mounted devices for limiting lateral deviation following derailment. This should consider the structures that came into play in previous derailments (see Appendix A) and the systems identified in 2.1.1. This evaluation should consider interactions based on the modelling carried out in 2.1.2, and interactions with S&C. From this evaluation, define and*

*summarise viable options, and document options ruled out and reasons for doing so.*

*Note: There might be circumstances where there is a case for devices that exceed of LSVG, and where this is necessary the considerations should be presented.*

## ***Work package 2: Assessing the use of Infrastructure Mounted Equipment for the Reduction in Risk of a Derailment.***

### ***Understanding of Current Worldwide Solutions and approaches***

*The current use of guard rail systems in the UK is associated with the prevention of catastrophic disasters following a derailment. These are generally associated with structures over water, and high-level structures in urban areas.*

*Beyond this reasoning, the logic behind the positioning of these sites is perhaps not consistently applied and well understood, and it is unlikely, in the event of a track renewal, that an alternative solution would be implemented and therefore a like for like replacement would be implemented.*

*Network Rail is known to have analysed what means of containment have been applied by rail authorities in other parts of the world, and the starting point for this study would be to collate all work carried out by rail authorities in the UK.*

*Once the extent of those studies has been collated, then the scope of any additional research can be established. The study should seek to have discussions with selected rail authorities with comparable operating characteristics as the UK.*

*The study should also address any research that has been carried out to understand the mechanism of a derailed train and any associated linkage to speed. It is understood that some European rail authorities have found that any form of guard rail or derailment guidance is not effective above a certain speed and could then in fact increase the risk of harm.*

*The outputs from this research study will inform the next stage of this proposal.*

### ***Understanding of the Magnitude of the Risk within the UK and Development of a Risk Analysis Tool***

*It is clear that the accidents cited by RAIB have identified that there is a level of risk associated with the derailments that have occurred on the GB rail system. This risk needs to be evaluated to assess the appropriate investment for the industry to mitigate the risk.*

*For the Infrastructure system, it is clear that the wholesale installation of guard rails, or an equivalent system, has a high capital cost, and it will also increase the operational cost of the rail system. Therefore, it is suggested that this work*

*focuses on the development of a risk analysis approach which gives the infrastructure manager the ability to target investment. Considerations should be given to both likelihood of an event and impact, and will likely include an assessment of the following:*

- 1. Properties of the track including curvature, ballast depth, presence of parallel line and distance of the six-foot interval.*
- 2. Line speed*
- 3. Type, frequency and crashworthiness of traffic*
- 4. Presence of local structures, and height and condition of the structures*
- 5. Presence of cuttings and embankments, their geometry and risk of landslides*
- 6. Consequential risk in immediate area*
- 7. Dead load on the structure*
- 8. Clearances to structural members*
- 9. The existence of derailment-containment kerbs*

### **Work package 3: Review use of devices to guide derailed train**

*This work package will take a railway system view to establish the scenarios where a rolling stock solution, an infrastructure solution or some combination of the two would be appropriate. Considerations would include:*

- The relative merits of Rolling Stock or Infrastructure solutions*
- Potential effects on other systems, inspection and maintenance regimes*
- Review of difference in risk profile between plain line and S&C*
- Review of contribution of other factors that affect outcome of derailed train trajectory*
- Implementation approaches*
- Identify situations where derailment guidance is not likely to be justified*
- Recommendations on which, if any, solutions would be appropriate for introduction to the GB network, and appropriate mechanisms for achieving deployment.*
- Costs?*

9. On 31 July 2018 RDG confirmed that the research proposal was supported by the Vehicle/Track System Interface Committee.

## Recommendation 6

*The intent of this recommendation is to support the completion of a full survey of drainage assets required to mitigate safety risk on Network Rail infrastructure.*

Network Rail should develop and commit to a time bound plan to complete its planned survey of drainage assets to provide sufficient asset knowledge to adequately manage risk. This should include a desk study of archive records and current records, together with inspections on site.

### ORR decision

Following the addition of this issue to the Regulatory Escalator, Network Rail have now provided ORR with formal, time-bound commitments for the completion of drainage asset surveys by the end of the control period. We have also gathered more detailed plans – indicating how the work will be delivered – from individual Regions. Given that this recommendation only requires the commitment to a time-bound plan (rather than its implementation), then on that basis it can be considered implemented. We will of course continue to monitor delivery until the work has been completed.

10. In accordance with the Railways (Accident Investigation and Reporting) Regulations 2005, Network Rail has:

- Implemented the recommendation

***Status: Implemented***

### Information in support of ORR decision

11. Network Rail have not provided a response to the recommendation. However, we are aware that some Network Rail routes have time-bound plans in place for the completion of drainage surveys and those that haven't have been asked to provide them by October 2018.