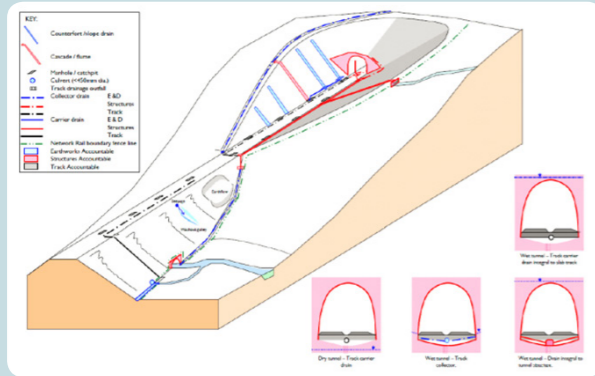# Improving Drainage System Performance

**NetworkRail**

## What is the situation?



The effective control of water is essential to the safe and economic management of railway infrastructure.

Drainage has an important role in reducing the degradation mechanisms caused by water; such as the long-term softening of materials that form the track support system and earthworks.

Neglect of the drainage system can have significant cost and safety implications for the parent asset; such as delay minutes, poor track geometry, line closures and the likelihood of earthwork failures.

## Analysis of causes



Fishbone diagram — Improving Drainage System Performance

**Current & Future Demand**
- Inadequate models
- Unknown catchment allocations to system
- Missing / changing topography
- Historical seasonal trends
- Effects of weather resilience
- Forecast / weather prediction tool
- Effects of climate change
- Relationship of data to system
- Effect of 3rd party changes
- Lack of understanding of past performance

**Understanding Whole Life Cycle**
- No Tier 1 (Whole life) model
- Proactive risk based interventions
- Lack of market / benchmarking knowledge
- Weak understanding of leading indicators
- No drainage specific risk model
- Material / asset knowledge
- Unknown components
- No adaption of existing practices, processes or materials

**Past & Present Performance**
- Data not accessible
- Data not analysed
- No CRI measure
- Poor reliability
- Flooding performance trends
- Data not accessible
- No specific drainage fault management system
- Silos in learning from past incidents
- No knowledge transfer
- No degradation modelling
- No system approach

**Reduced Whole Life Cost**
- No developments in construction productivity
- Lack of drainage construction expertise in NR
- Lack of risk based proactive maintenance
- Lack of recognition of the WLC of the railway system
- No consistent unit cost
- Reacting to symptoms of poor drainage instead of addressing root cause
- Lack of research in 'no Maintenance' components

## Priority problems

### Specific priority problems

- Now-casting and fore-casting demand on drainage system.
- Understanding whole life cost of drainage system.
- Understanding whole life cycle of drainage system – concept to demolition.
- Measuring system performance - including impact on parent asset and social/environmental/ reputation factors.

### Related goals

- To measure and monitor performance of system by CP6.
- Understanding whole life cost and cycle to support modelling, prioritisation and business planning for CP7.
- Demand analysis in order to support business planning, risk identification and long-term investment strategies.

### Benefits

- Improvements to drainage system performance are facilitated through an understanding of demand, whole life and investment strategy.
- Setting key parameters to monitor which equate to performance allows for continual improvement through targeted and measurable activities.
- Improving performance will naturally lead to improving safety and resilience.

## Scope

Improving drainage system performance doesn't simply focus on effective maintenance or intervention techniques, but considers a holistic view of the effects of the system. A plan-do-review cycle is required to support continual improvement. The review phase of the cycle is via measuring and monitoring performance. At a basic level, the enablers which support a better understanding of performance and allow for improvements are:

- Current and Future Demand (now-casting and forecasting).
- Understanding Whole Life Cycle.
- Reducing Whole Life Cost.
- Past and Present Performance.

Providing a solution to the issues highlighted will allow for improvements to the drainage system performance by providing the 'review' phase of the plan-do-review cycle, supporting NR's commitment to continuous improvement.



Continuous Development — Plan / Do / Review / Improve

**To address these challenges it is expected that R&D actions will need to address the following aspects:**

### Qualitative & quantitative demand analysis tools

- (now-casting) How can current demand on a drainage system be captured and quantified?
- (forecasting) How can future demand, based on extreme/adverse weather and climate change be improved to provide enough time for a response?
- Demand analysis is vital in determining the capability of the drainage system as well as contingency planning.

### Drainage system whole life models

- How can the drainage system's whole life cycle, including costs, be modelled?
- Whole life modelling supports better decision making as well as improvements to performance.
- Continual improvement to business processes and standards would be underpinned by a greater understanding of whole life cycle.

### Holistic system performance measure

- How can the drainage system be measured so that the performance covers not only operations disruptions, but also social, reputation, environmental impact?
- How can measures be monitored at the correct frequency and with quality data in order to be responsive and trusted?
- Performance measures allow for a business to review asset management and interventions and provide confidence that best practice/continual improvement practices are in place.



Whole life costing hierarchy diagram:

- Non construction costs → Whole life costing ← Income and benefits
- Other project development related costs: Safety Costs, Land Costs, Finance Costs, Disruption Costs, Taxes & Grants
- Economic + related social and environmental costs: Income /Charges, Monetise Benefits, Social Costs, Environmental Costs, Other Costs
- Construction Costs (Design → Standards; Construction Works → Capital Works, Service Life (Reliability))
- Renewals Costs
- Operation Costs (Staff → Service Pattern; Utilities → Energy/ Carbon etc)
- Maintenance Costs (Preventative → Standards/ Inspection; Corrective → Response Times/Fix)
- End of Life Costs (Disposal → Salvage/ Demolition)
- Rail Method of Measurement Volume 1 and 2 — Unit Rates MUCs — Rail Method of Measurement Volume 3 and 4
- Labour, materials, spares, consumables, plant & equipment, etc.