WALES&WEST UTILITIES

Climate Change -
What it might mean to Pipeline Operators…..

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Climate Change

Forecasts

Climate Change Forecasts

- Increased winter precipitation: (2020 = 30%) (2050 = 40%)
- Reduced summer precipitation: (2020 = -30%) (2050 = -60%)
- Increased winter and summer : wettest days (intensity of rainfall) (2020 = 40%) (2050 = -50%)
- Increase sea level rise: (2020 = 9.7cm) (2050 = 21.8 cm)

Climate Change

What it might mean to Pipeline Operators…….

What this means….

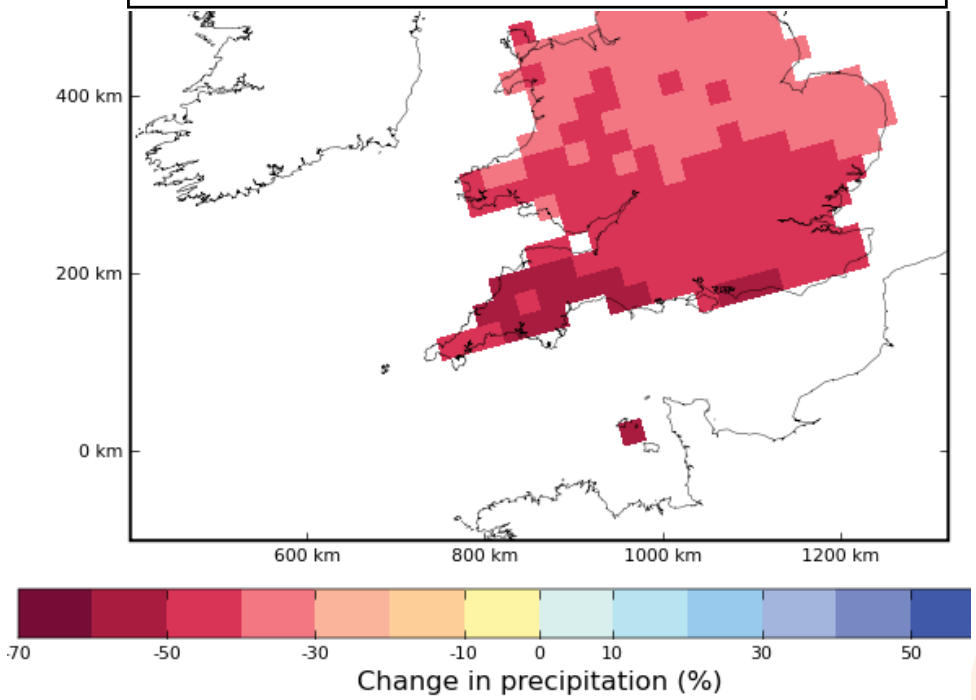
- Sea level rise - Increased water volumes at river mouths;
- Increased winter precipitation - Prolonged periods of rivers carrying high volumes of water and increased potential for river flooding;
- Reduced summer precipitation - Hardened river banks become more prone to erosion from intense summer storms;
- Increased precipitation intensity - Flash flooding causing increased water velocities and the ability for rivers to carry more, and heavier debris.

Climate Change

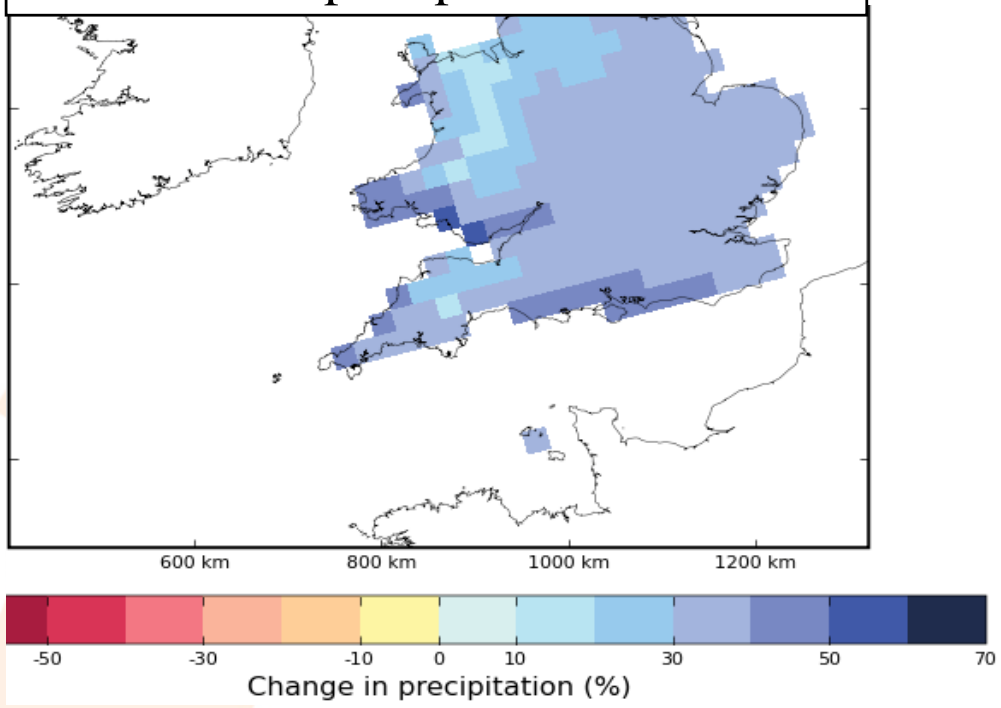
Summer and Winter mean precipitation

Wales & the South West region

Summer mean precipitation 2050



Winter mean precipitation 2050



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What it might mean to Pipeline Operators……

- More severe weather events, more flooding, increase in average rainfall
- Increase in depth and speed of water courses leading to increased rates of erosion and increased river meandering
- Streams, gullies, rhynes, channels and ditches previously assumed stable may need to be reassessed
- Pipelines in areas subject to routine flooding could suffer complications due to buoyancy
- Environment Agency approach inconsistent with respect to protection of existing infrastructure

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WWU experience in recent years

- Sporadic identification of locations where crossings or parallel pipeline sections at risk, or in some cases exposed following severe weather events - reactive investment

- Previous approach required detailed survey of all river crossing points, navigable water courses, estuaries, large expanses of water on a risk based frequency (1 – 5 yearly)

- Procedures less stringent for very minor water courses, usually assessed during condition monitoring or CIPS (5 yearly), but not always accessible

- Review of pipeline maintenance plans and graphical records identified over 200 locations, not previously subject to detailed assessment, for re-evaluation

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WWU experience

- Preliminary survey undertaken in 2010 to identify any exposed crossings
- 5 locations identified and remedial actions planned
- All 200 locations programmed for full survey over a 5 year programme
- Full survey to include mapping of the depth and profiling within the limits of the crossing as well as the profile and condition of the bed and banks
- Future frequency to be risk based, determined from the detailed finding of the initial survey

River Trothy Tributary

As found 2010

- 100mm 24.1bar pipeline
- Below ground water crossing- a lot can happen in five years !
- Steep sided ravine, inaccessible without specialist equipment
- Substantial scour of river bed immediately downstream of bridge
- Old concrete apron eroded and undercut
- Subsiding masonry threatening pipeline

River Trothy Tributary

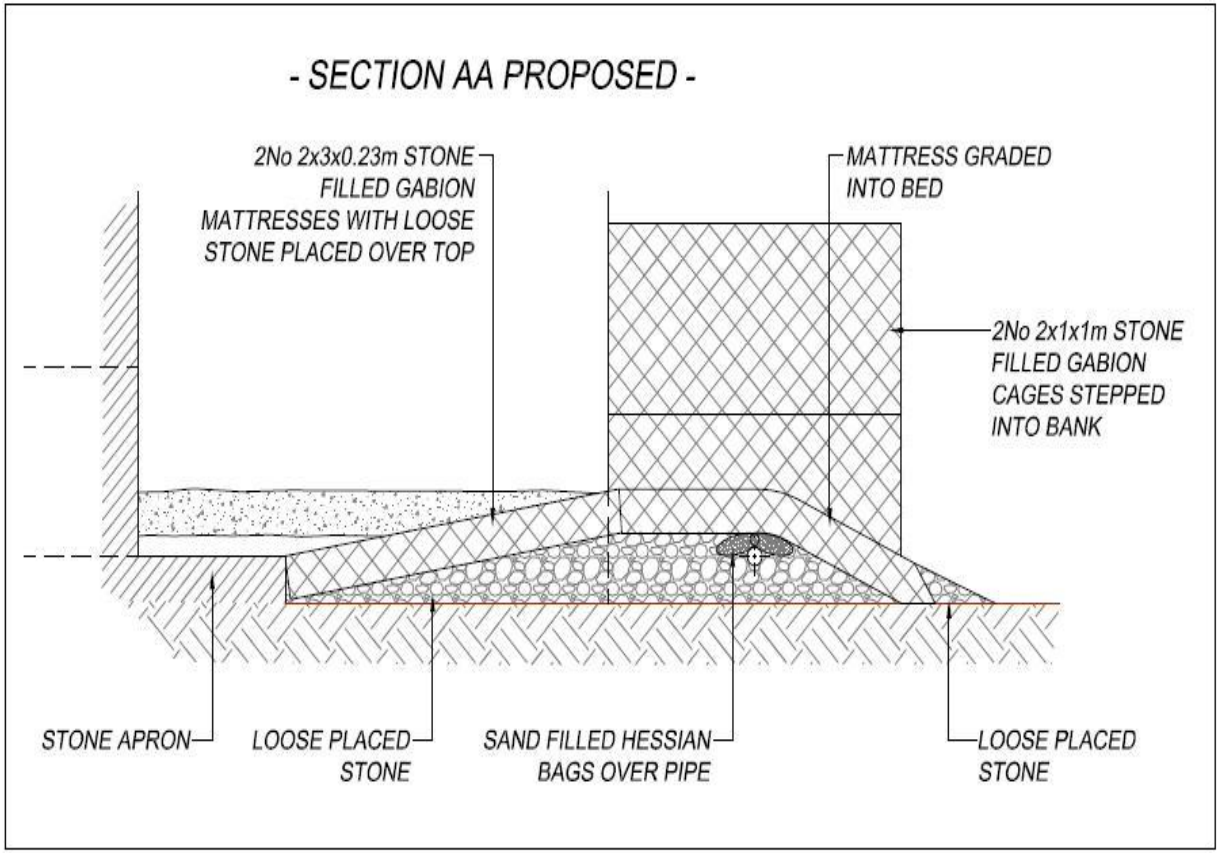
Interim works 2010

- Masonry removed
- Damaged wrapping removed
- Light surface damage repaired
- Pipeline crossing re-wrapped
- Protective matting applied
- Permanent solution planned

River Trothy Tributary

Permanent ‘hard engineered’ solution planned 2011

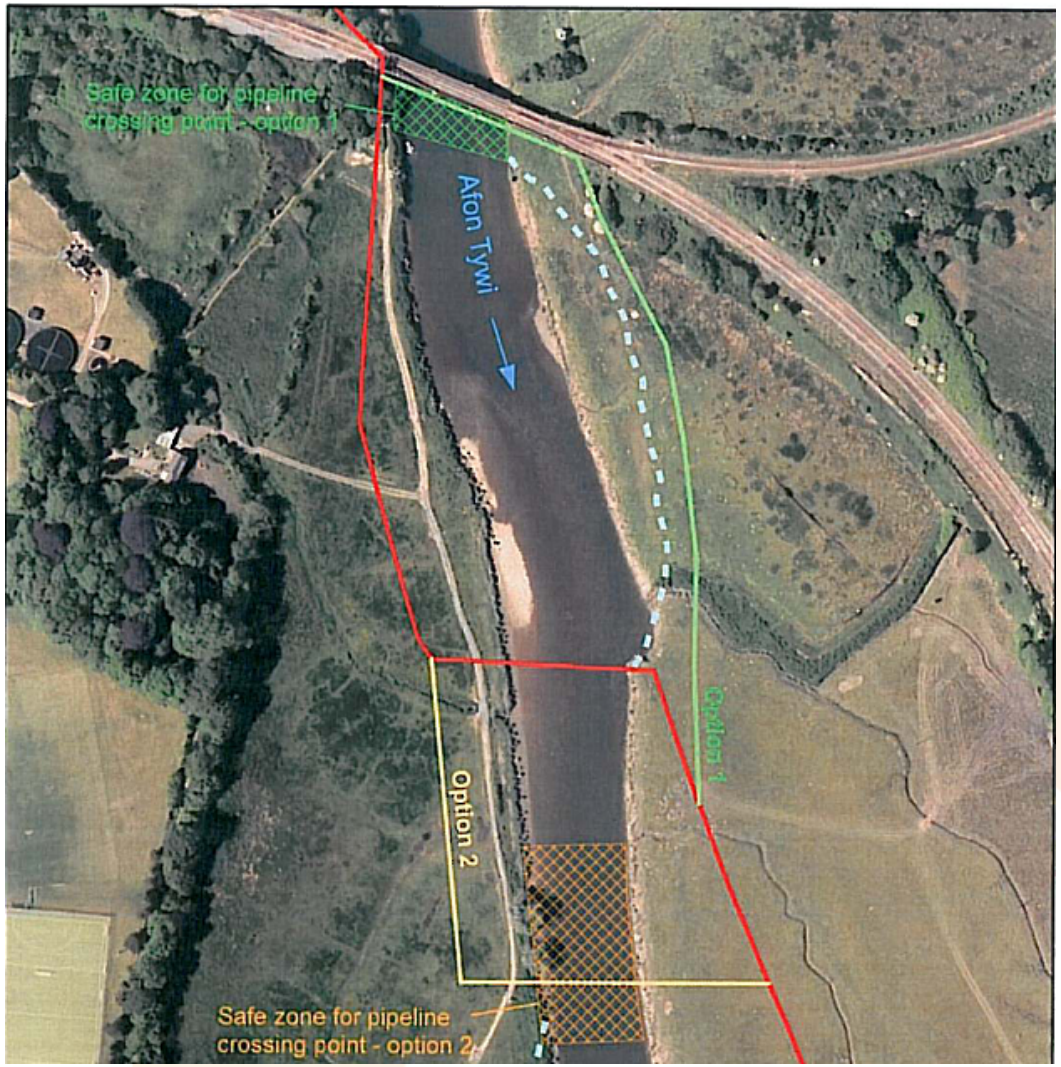
- Gabion cages over pipe stepping up either bank
- Loose stone in scoured bed area levelled up to original stone sets and tapering off to bed downstream
- Hessian sand bags over crown
- Reno mats formed and laid blended to side of bridge structure and into bed downstream
- Small stone chippings poured onto completed filled mattresses to blend into any gaps



River Tywi, Carmarthen

Tidal estuary

- 150mm 17.2bar pipeline
- Hard engineered solution ruled out primarily due to cost and resistance from EA
- Originally planned as a HDD diversion project, but trial bore holes identified unsuitable ground conditions



River Tywi, Carmarthen

Tidal estuary

- Alternative solution proposed using soft engineering to provide a bio-diverse solution

- Sustainable (potential life span of 50 – 100 years), acceptable to statutory conservation bodies

Monk Bretton Bridge,Rye

Similar scheme to that proposed for River Tywi

Before

The technique does use some form of hard engineering to protect the toe of the new bank, this is complimented by using natural / native materials to form & stabilise the new bank

After

An example of 'soft engineered' river bank remediation works adjacent to the Monk Bretton Bridge at Rye (Note: Details taken from the Environment Agency Project Excellence Awards 2006)

River Kenn, Devon

Parallel pipeline section at risk

- 500mm 33.8bar pipeline
- Single feed to Devon and Cornwall constructed 1968
- River broadly straight in vicinity following channel straightening prior to 1955
- Two ‘new’ meanders identified as threat to pipeline during ground-survey in 2004

River Kenn, Devon

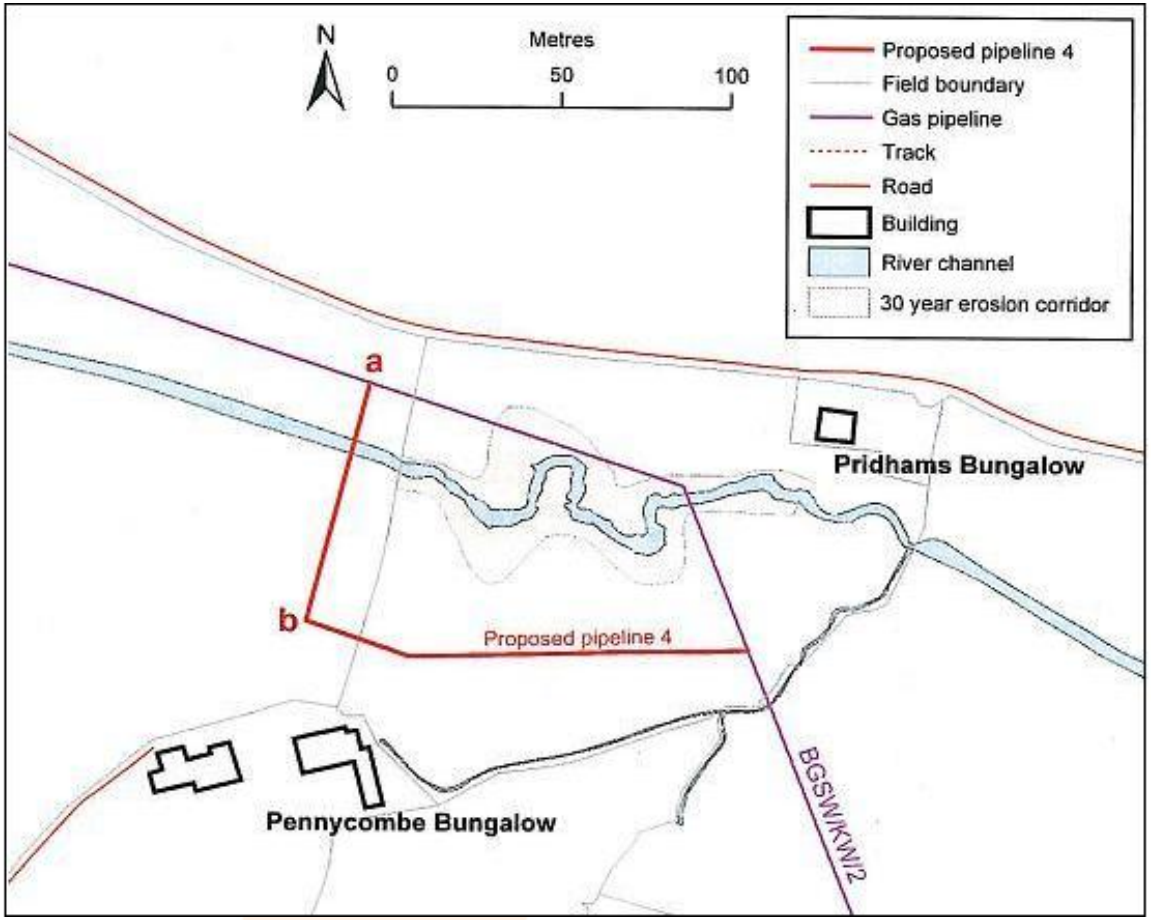
EA policy to allow natural development of meanders

- Two year geomorphologic assessment commissioned
- Erosion aggravated by grazing animals breaking down light sandy soil bank
- Environment Agency and expert advice ruled out all protection options

River Kenn, Devon

Diversion completed 2010

- 200m diversion approved in 2009
- Detailed consultation with EA
- The River Kenn flows into the Exe Estuary which is designated as a Ramsar site, a SSSI and a SPA
- Construction completed in late 2010
- New section well outside of 30 year erosion corridor



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Sidford, Devon

Erosion exposes IP pipeline

- Significant flood event exposes swan-neck previously in ditch bank
- Threat to adjacent road structure
- Negotiation with landowner and local authority
- 200m diversion of water course approved and carried out in 2009

Sidford, Devon

Diversion of watercourse completed 2010

- Diverted water course immediately following works
- Solution estimated lifetime > 30 years

WALES&WEST UTILITIES

Exposed abandoned pipes

Responsibility beyond end of life

- Remove abandoned sections at risk when diverting or count the cost later

Questions