

Topic Proposal & Preliminary Question

Proposed Title:

Analysing the Relationship Between Rainfall, Storm Overflows, and River Water Quality in Carmarthenshire

Proposal:

This research will examine how rainfall intensity affects storm overflow events and the impact on river water quality in Carmarthenshire, Wales. This area is an ideal study area due to its mix of urban and rural catchments, which makes it valuable for analysing rainfall influences on overflow activity and river pollution. Storm overflows release untreated wastewater during heavy rainfall, which adds to river pollution. Understanding this relationship is important for managing water sustainably amid changing climate conditions.

Carmarthenshire has a combination of high rainfall patterns and several wastewater overflow sites, particularly around Carmarthen, Llanelli and Ammanford. Therefore, its major rivers, such as the River Towy and Loughor, are well monitored by Natural Resources Wales (NRA), providing reliable data on water quality responses to wet weather. Carmarthenshire offers good data from various sources for quantitative analysis and regression methods. This includes rainfall records from the Met Office and NRW, storm overflow data from Dŵr Cymru Welsh Water, and river quality indicators from NRW.

Preliminary Research Question:

To what extent does rainfall intensity influence storm overflow activity and associated changes in river quality in Carmarthenshire?

Annotated Bibliography

Carmarthenshire County Council, 2019. *Flood Risk Management Plan*. [Online]
Available at: <https://www.carmarthenshire.gov.wales/media/v41p5no4/flood-risk-plan-2019.pdf>

[Accessed 1 December 2025].

Dŵr Cymru Welsh Water, 2025. *Annual SFW SO EDM Return*. [Online]
Available at: <https://corporate.dwrcymru.com/en/community/environment/event-duration-monitoring>

[Accessed 8 December 2025].

Met Office (UKMO)a, 2020. *Location-specific long-term averages*. [Online]
Available at: <https://www.metoffice.gov.uk/research/climate/maps-and-data/location-specific-long-term-averages/gchzjb39w?>

[Accessed 7 December 2025].

Met Office (UKMO)b, 2025. *MIDAS Open: UK daily rainfall data*. [Online]
Available at: <https://data.ceda.ac.uk/badc/ukmo-midas-open/data/uk-daily-rain-obs/dataset-version-202507/carmarthenshire>
[Accessed 7 December 2025].

Natural Resources Wales (NRW)a, 2023. *Storm Overflows*. [Online]
Available at: <https://naturalresources.wales/about-us/what-we-do/our-roles-and-responsibilities/water/storm-overflows/?lang=en>
[Accessed 8 December 2025].

Natural Resources Wales (NRW)b, 2025. *Annual environmental performance report for Dŵr Cymru Welsh Water*. [Online]
Available at: <https://naturalresourceswales.gov.uk/evidence-and-data/research-and-reports/water-reports/annual-performance-report-for-dwr-cymru-welsh-water/?lang=en>
[Accessed 8 December 2025].

(Carmarthenshire County Council, 2019)

This article is the Flood Risk Management Plan by Carmarthenshire County Council in 2019 (2025-2030 consultation currently under review), and it maps flood hazards across Carmarthenshire from rivers, the sea, surface water, groundwater and reservoirs – identifying the high-risk ‘Policy Unit’ areas. It sets out how the council, as Lead Local Flood Authority, will cooperate with other agencies, such as NRW and Dwr Cymru Welsh Water, and communities to reduce flood risk through structural defences, drainage maintenance, and sustainable water management practices. The document highlights how increasing rainfall and land drainage pressures can overload sewer and drainage systems, making overflow events and water quality risks more likely to happen.

(Met Office (UKMO)a, 2020)

This source provides long-term climate averages for Carmarthenshire, specifically for Carmarthen and Pembrey Sands, including data on rainfall, temperature, and sunshine. The Met Office shows monthly and annual baseline climate conditions for standard periods, typically 1969-1990 and 1991-2020. This is useful for understanding typical rainfall patterns and seasonal variability, and supports research on flood risk and hydrology by giving reliable climate norms. Although the data do not include individual rainfall events or extremes, they are reliable for understanding climatic norms and comparing observed or projected changes. This source is credible, up to date and produced by the UK’s national meteorological service, making it a strong supporting reference for environmental and flood-risk studies

(Met Office (UKMO)b, 2025)

This dataset provides quality-controlled daily rainfall totals recorded by meteorological stations across Carmarthenshire, forming part of the UK Met Office's MIDAS Open Collection. This dataset includes station metadata, daily precipitation (mm), and quality assurance flags, making it a robust source for analysing varying rainfall patterns. For this research, the dataset offers the necessary resolution to identify rainfall-driven overflow events and compare them with pollution indicators and is suitable for long-term trend assessment. As an openly accessible, nationally maintained dataset by the Met Office and BADC, it is highly credible and aligns well with academic research in hydrology and environmental management.

(Natural Resources Wales (NRW)a, 2023)

This source is useful for the research because the NRW explains what storm overflows (CSOs) are and why they operate during heavy rainfall. They describe Wales's combined sewer systems and how rainfall can trigger overflow discharges. NRW outline their regulatory role of permitting, monitoring, enforcement, and setting environmental conditions. Importantly, the source explains mandating the installation of Event & Duration Monitors (EDMs) on overflows to record exactly when and for how long spills occur – along with why overflows occasionally discharge in dry weather conditions rather than rainfall. The source provides the research with important context for understanding how rainfall links to storm overflows and potential water-quality impacts.

(Natural Resources Wales (NRW)b, 2025)

This webpage provides NRW's annual assessments (2018-2024) of Dwr Cymru Welsh Water's environmental performance, including pollution incidents, storm overflows, and permit compliance. The report offers reliable regulatory data that can support the research on how rainfall relates to overflow events and water-quality impacts. They are useful for identifying long-term trends, though the data are often presented for the company rather than specifically for Carmarthenshire, so local datasets may still be needed.

(Dŵr Cymru Welsh Water, 2025)

This dataset provides information on storm overflow (SO) discharges monitored by EDMs across Welsh Water's service area, including Carmarthenshire. It records spill counts, spill durations, and monitored asset locations between 2021-2024. For this research, this dataset is crucial as it allows precise correlation of rainfall events (from MIDAS or Met Office data) with overflow activation and helps quantify the frequency and duration of discharges. The data are officially reported by Welsh Water and regulated by NRW, making them authoritative and reliable. Limitations include that this only covers monitored overflows, so unmonitored or emergency overflows may not be included. It provides primary quantitative evidence.

