

Flood risk at Lauder and Earlston: the historical record

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A pro bono report

Context

The report explores the history of flooding from the Leader Water and Turfford Burn. If something more useful than *risk assessment* is to emerge from the Earlston Flood Study, it will be important to understand why redevelopment in Earlston has never quite grasped the limitations imposed by its setting alongside the Burn, in spite of drainage improvements undertaken in the late 1890s and again in the late 1960s.

Perhaps because of the recurrent flooding problem with the Turfford Burn, flood risk at Earlston from the Leader itself has not always gained the attention it deserves. SEPA's flood-risk map indicates that a large Leader flood could have high impact there.

A few residents and businesses are exposed to flood risk from both the Leader and the Burn. However, the large majority are principally vulnerable to one rather than the other. This will understandably influence their expectation of actions to be prioritised following the Earlston Flood Study. This split could make for a rocky road if the two problems continue to be kept under one umbrella.

The situation at Lauder is helped by special factors that have in the main kept development away from the Leader Water. There are relatively few properties currently mapped as at risk from the Leader Water. However, it is demonstrated that the flood-risk modelling and mapping work has not taken adequate account of the historical flood record.

A surprising planned development at Thirlestane makes Leader flood-risk topical from the Harry Burn to Earlston, and possibly beyond.

A summary of principal conclusions is provided. But the essence of historical flood review lies in the detail.

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1 Introduction

1.1 Notations

Particular sections of the report include extensive quotes from newspapers and other publications. Quotation marks are often omitted, although indenting is sometimes used to reinforce that material is verbatim. In general, the *source document* is stated immediately ahead of the quotation.

The ellipse (...) indicates that text has been omitted to aid readability. In quotations, text appearing within square brackets is always added commentary. This is typically used to clarify what the quotation is referring to.

The Turfford Burn is widely misspelt Trufford Burn in historical reports, and passes here without further comment. Other errors – some in spelling and some more general – are indicated by “[sic]”.

Where quotes are lengthy, **specific references to the Leader or Lauderdale** are often highlighted in red, **specific references to the Turfford Burn** in teal, and **specific references to the main Tweed** in blue.

Italics are used sparingly. Where they do appear, this is generally for emphasis or to highlight terminology.

1.2 Some formal references to historical floods

1.2.1 Tweed Catchment Management Plan

The Tweed Catchment Management Plan (Tweed Forum, 2010) notes:

The [Tweed] catchment has a long history of flooding with recent severe floods occurring in 1948, 1977, 1984 and 2008. Currently 9% of the catchment’s properties are considered at risk from flooding, mostly from riverine as opposed to coastal flooding.

1.2.2 Tweed Flood Risk Management Strategy

Some sections of the Tweed Flood Risk Management Strategy (SEPA, 2015a) make a passable attempt to summarise flood history, and recall important 19th Century floods. Further work would be needed to confirm this. However, the historical floods listed for the Leader are short-sighted and misleading:

Section for the Lauder PVA (pp40-47) asserts that “No significant floods have been recorded in this Potentially Vulnerable Area.”

That for Earlston (pp68-77) notes: “One significant flood has been recorded in this Potentially Vulnerable Area. On 1 October 2003 there was flooding on the Turfford Burn.”

Flooding problems continue to be experienced on the Turfford Burn but 1 October 2003 is not a flood date typically mentioned. This is likely a typo.

More usefully, Table 1 of the same document (SEPA, 2015a) asserts the Earlston PVA to have the joint 6th highest *annual average damages* from flooding within the Tweed catchment. [Strictly, these are *expected average annual damages*.] It was necessary to explore the contradiction.

It transpires that not all historical flood data held by SEPA are published. In respect of Earlston, SEPA (2014b) and SEPA (2017) disclose more of the recorded flood history as part of the development consultation process. The flood chronology revealed there is introduced in Sections 2.2.4 and 2.2.5, and dissected in Sections 7.4 and 7.5.

Section 1.4 of the Tweed Flood Risk Management Strategy (SEPA, 2015a) claims that “These [partnership] organisations are working more closely together than ever before. In local partnerships, here and throughout Scotland, SEPA has provided the technical analysis and ensured a consistent national approach is taken”. This may be an accurate account. SEPA has released historical data to SBC within the planning process.

But the words *a consistent national approach* are not wholly encouraging. As is now explained, generic modelling is a poor substitute for the analysis and reasoned interpretation of gauged and historical flood data.

1.3 Critique

The objectives of SEPA’s Tweed Flood Risk Management Strategy (SEPA, 2015a) are to:

- Avoid an overall increase in flood risk
- Reduce overall flood risk
- [and where appropriate] Accept risk by maintaining current levels of management

It is difficult to consider a strategy fit for purpose if flood risk assessments are routinely made and circulated with no more than token reference to the *actual* flood history.

1.3.1 Why the neglect of historical flood idea?

The reasons why historical flood data get neglected are rather complex. The basic reason is the over-reliance on automated model-based assessments of flood risk.

Around 2000

Automated assessments of flood risk became possible following publication of all-digital flood estimation methods in the UK Flood Estimation Handbook (Institute of Hydrology, 1999). The adoption of automated assessments was largely driven by insurance companies, assorted modellers and UK Government. Publication of a *Flood risk map for England and Wales* (Morris and Flavin, 1996) was a contributing factor.

In England and Wales, the decisive factor was that – as part of their response to the 1998 Easter Floods – Government decreed that flood-risk maps be published rather than supplied only to specialist agencies and companies.

It would have been possible – though messy – to publish flood-risk maps based on best practice: with detailed maps in those river reaches for which site-specific estimates (adjusted to incorporate historical flood data) had been undertaken, accompanied by roughly interpolated (or blank) maps elsewhere. The decision was taken to favour generic methods. These methods provide visually stunning maps: portraying flood risk throughout a river system. But they are not very reliable. It is not the modelling or mapping that is explicitly at fault. Rather, it is the failure of those specifying or undertaking the work to adequately respect gauged and historical flood data.

Reed (2002a) made the true position clear to specialists attending a discussion meeting at the Royal Society on 21-22 November 2001, ending with the words:

At critical sites, best estimates of flood risk will continue to require individual judgement. Key steps will be to determine the ancillary information that is most relevant, and to decide how this is to be integrated with flood-risk estimates from semi-standard or automated procedures.

Initially, there appeared to be less enthusiasm in Scotland for automated methods. However, Scottish Government ultimately followed a substantially similar course: commissioning and publishing generic flood-risk maps.

Flood-risk maps are quite often challenged. Even when demonstrated by reference to historical information to be wrong in a particular reach of river and floodplain, there can be a tendency for the incorrect mapping to re-exert itself. This is the nature of automated techniques. If special tricks are needed to correct the generic mapping locally, will these be remembered, forgotten at a later date or, worse, treated as reality?

Around 2010

A decade on from their first appearance, generic flood-risk maps of one kind or another had become big business for the larger consultancies: with research projects and technological developments to update and refine the maps – nominally to reduce their inadequacies. Environment Agency (2010) – a report on *Developing a prototype tool for mapping flooding from all sources: Scoping and conceptual method development* – highlights the extent to which hydrology in general – and historical flood information in particular – was now marginalised. Its review of techniques and possibilities provides a convenient basis on which to expose the divergence in thinking between new-broom modellers and old-school hydrologists.

The following verbatim quotes [with my commentary in square brackets] provide evidence of the skewed perspectives on the value and use of historical flood data:

1. Historical data can in some respects be considered as more reliable than modelled data, as it represents a “real” flood event, but only for the events that happen to have occurred and been observed. [What are *modelled data*? How can they possibly be of comparable reliability to *actual* flood data? You won’t find much historical data unless you look. If you search resolutely, you’ll find lots of information for most UK rivers.]

2. Historical data must also be associated with some probability to be of use in assessing flood risk, and for extreme events this may be difficult. [This is a misapprehension. There is no need to attach an annual exceedance probability (AEP) to an observed flood level/extent for it to be useful. *A count of the number of historical floods that have breached the modelled flood level/extent of a stated AEP may be enough to demonstrate that modelled outputs are gross underestimates.*]
3. It [historical data] also only tells us about examples of flood hazard in the past, and nothing about future scenarios. [This argument is irrelevant if the historical information indicates greater flood risk than projected by the latest favoured modelling approach that incorporates climate change and/or land-use change allowance. Hydrological and hydraulic modelling *can* be adapted to incorporate allowances for land-use and climate change and these techniques *can* be applied to “update” historical flood information, i.e. to adjust an old flood level to take account of the current/projected channel, floodplain, catchment and climate condition. The only thing lacking is willpower. *Too many practitioners have been mistaught to trust new models and to distrust old data.*]
4. One feature that must occur in the final overall map is the ability to tell which areas of the map are threatened by which types of flooding. This request is based on experience from the historical flood map that the EA publishes. The historical map shows an outline covering every area we have ever recorded as flooding. The first question anyone asks after having seen it is “yes, but when did it flood there?” [Is this arguing against the publication of historical flood extents simply to avoid embarrassment?]
5. We should try to avoid this situation with the all flooding map [i.e. the all-risk flooding map]. The map should be able to tell people which type of flooding poses the greatest risk in each area of the map. [This ambition highlights the fantasy of a single map that integrates and summarises all kinds of flood risk. It would be corrupt to label an output as a map of *all* flood risk if – in each specific location – it only shows the flood extent arising from the largest driver of flood risk: be this fluvial, pluvial, sewer or groundwater ... not to mention tidal or tributary interactions. Those in vulnerable locations are concerned either to appreciate or disguise the true flood risk. A doctored presentation helps no-one.]

The decision (taken 12 to 18 years ago) to publish basin-wide flood-risk maps promoted the production of universal maps of flood risk derived by *generic methods*. Reed (2009) considers the addiction to basin-wide hydraulic modelling a disease: giving it the name *hydropendicitis*. Critically, the decision side-lined thoughtful assessments of flood risk based on the integration of generalised methods with gauged and historical flood data in highly skilled site-specific studies.

The current position in Scotland

The cautionary words attaching to the SEPA flood-risk maps are currently:

The Flood Maps are indicative and of a strategic nature. Whilst all reasonable effort has been made to ensure that the Flood Maps are accurate for their intended purpose, no warranty is given by SEPA in this regard. Within any modelling technique there is inherent uncertainty. SEPA has assessed the confidence it has in the maps and has shaded areas where data is not appropriate for use or where no data is available. *It is*

inappropriate for these Flood Maps to be used to assess flood risk to an individual property.

The lack of shading in the current flood-risk maps for Lauder and Earlston suggests that SEPA considers them fit for their strategic purpose. The over-belief in modelling and the neglect of historical flood information are evident in the supporting documentation released with the maps (SEPA, 2014a):

The mapping of flooding is a dynamic process and the flood risk maps will be subject to review and change as we develop our input data, methodologies and techniques.

SEPA will work with responsible authorities and partner organisations to improve our confidence in representing flood risk across Scotland. Ongoing developments that SEPA is working towards include improvements in both flood maps and the risk maps produced off the back of these:

Flood Maps:

- Improving input data. For example, use new light detection and ranging (LiDAR) information that extends our coverage of higher resolution ground models
- Investigating how to effectively apply hydraulic modelling methods
- Considering where and how wave impact studies might improve confidence in outputs.
- Risk maps improving resolution of property and population datasets
- Improving the way risk is shown in the maps by grading receptors from low to high risk for each return period being mapped.

The map, as made publicly available on 15 January 2014, reflects the knowledge and data we have available at that time and were able to incorporate into our national methodologies.

The map released does *not* reflect the knowledge and data available. I suggest it reflects:

- The predilection of client and consultants for generic model-based methods that produce *impressive-looking* outputs;
- An unawareness of – or disinterest in – the *long-term* history of flooding.

Yet the map purports to represent infrequent flood events, with an AEP of 0.5%.

1.3.2 An irony

The side-lining of historical flood data is especially sad to see in Scotland. Some of the best endeavours to acquire, catalogue, interpret and publish historical information stem from research initiatives at the Universities of St Andrews and Dundee, e.g. McEwen (1985, 1987 and 1990) and Black and Law (2004).

1.3.3 Recap

Agencies do of course *say* that they are respecting historical flood data. For example, SEPA (2015b) advises that:

- They provide the planning authority with SEPA's observed *historical flood extents* (in support of the published 200-year flood extents);
- Local authorities themselves hold a large amount of historic data in their capacity as the local Flood Prevention Authority and that the flood risk management officer within the local authority should be involved in the appraisal of sources of flood risk.

It is difficult to integrate historic flood data within automated flood-risk mapping procedures. A token adjustment is sometimes made: with the use of historic flood information limited to one location within an entire river basin. This is fair practice in cases where historical flood information is concentrated at a particular site. But there is nearly always other information if one troubles to look. A new estate of 14 houses in East Hampshire neglected historical information and had to be abandoned (Robinson *et al.*, 2001).

The argument is sometimes made that climate change and land-use change make historical flood information unreliable or irrelevant. Such changes *do* make the interpretation and incorporation of historical data more challenging. *But information about floods that have actually occurred is always relevant.*

1.4 Planning creep

The term *planning creep* sometimes gets used. Here it labels the actions of planning authorities after a flood alleviation scheme has been introduced. The phenomenon is not widely discussed.

1.4.1 The phenomenon

A particular area within a town experiences repeated flooding. This begins to affect property values. In time, the planning authority is forced to acknowledge the flooding problem. Development and redevelopment slow down or cease, and the area may become somewhat run-down. Meaningful insurance cover against flood damage may no longer be available.

Eventually, a flood alleviation scheme is proposed. In order to get the scheme funded, it is necessary to demonstrate financial benefits: not least in the reduced frequency of flood losses. In due course, the scheme is built and the frequency of flooding reduces. However, the planning system responds by treating the flooding problem as essentially solved, even though it is well known that these are *flood alleviation* schemes not *flood prevention* schemes.

Redevelopment takes place and new development is allowed. Sometimes ground levels are raised to keep assets above the level to which the flood alleviation scheme has nominally provided protection. The outcome is for property values to rise, and equipment and possessions of higher value become resident close to, or on, the (defended or alleviated) floodplain.

This process tends to happen slowly and unobtrusively – hence the term *creep*. Flooding of property occurs less frequently than before the scheme was built. But, when a flood exceeding

the design capacity of the scheme arrives, the losses incurred are very much greater. Flood risk is the product of loss and probability. So flood risk may *rise* in consequence of a flood alleviation scheme.

1.4.2 Hereford City

Occasionally, the development of a flood alleviation scheme – in Hereford City, the ingenious Yazor flood diversion – is explicitly linked to redevelopment of a run-down flood-prone area. The upshot is that many of the gains from a flood alleviation scheme are quickly consumed by redevelopment. Reed (2011) asks: *Did those approving PPS25 intend this?* [PPS25 (DCLG, 2006) provided a Practice Guide to Development and Flood Risk; it was updated in 2008 and 2009, and superseded in March 2014. Somewhat different guidance applies in Scotland.]

While it may be reasonable for a planning authority to prioritise development and redevelopment in this way, they should not express surprise when flood risk re-emerges as a major problem.

1.5 Problems with the Turfford Burn

The Turfford Burn joins the Leader Water in Earlston, and presents its own major flood risk to the town. It is relatively well known that a flood alleviation scheme was built in 1967: the Turfford Burn Flood Prevention Scheme. Noted in SEPA (2015a) and http://apps.sepa.org.uk/floodmap/pdf/lookup_table_final.pdf, the scheme is summarised as: “The scheme operations include the construction of a diversion channel and culvert, main channel regrading and the construction of flood embankments.”

Given the continuing flood history of the Turfford Burn, either the 1967 scheme was too trifling or the phenomenon of planning creep has been at work in Earlston. An asset assessment undertaken by JBA (2007) assigns a *negative* benefit cost ratio to the 1967 Turfford Burn Flood Prevention Scheme. This finding may be consistent with the hypothesis that planning creep is the main factor accounting for continued major flood risk from the Turfford Burn.

The historical review (Section 3) reveals a very long history of flooding. The works in 1967 were perhaps undertaken in response to the major flooding that occurred as part of the Border floods of 12 Aug 1948 and 28 Aug 1956. But those Turfford Burn floods were moderate in comparison to the severe flooding experienced on 12 Aug 1890 and 5 Aug 1895.

It transpires that drainage works including a diversion were previously undertaken on the burn in 1898 and 1902. Special entries are included in the chronology to substantiate this.

Inappropriate land-use and development control account for many of the difficulties experienced with the Turfford Burn. Just how far back this goes is captured in the description of Wood (1899):

The name Hunt pools is applied to the green lying on both sides of the Braid Burn, at the Horse Market, and it may have been connected with “The Hunt” of the Earls. The character of the ground in former years used to be wet and spongy, fostered perhaps by the overflowing of the burn in times of spate. *On the north side of the stream, however,*

there were always deep, boggy pools, which have only been filled up in recent years by the rubbish of the village being shot there.

Aitken (1905) describes the burn thus:

A streamlet called the Trufford Burn [*sic*] runs on the south of the village, and joins the Leader at Cowdenknowes. The name is derived from the “peatary” which lay to the south-east, and in the olden times supplied the inhabitants with turf fuel till coal was raised from the Lothian collieries [*sic*] and transit of it made easy. The crossing or ford took its name from the peat or the turf, and so locally designated the burn itself. It is also called Clark’s burn, after the builder of the Cowdenknowes road bridge; and the Broad burn.

In addition to being frequently misspelt, the Turfford Burn has in earlier times been referred to as the Earlston Burn, the Braid Burn (Wood, 1899) and the Broad Burn (Aitken, 1905). Perhaps the burn was so named because it was known to broaden in flood conditions.

1.5.1 What will happen next?

Will the ongoing Earlston Flood Study (ECC, 2017) recognise that a strategic approach is required if parts of the town are to be spared from frequent overflowing of the Turfford Burn? Or will Scottish Borders Council prioritise redevelopment of vacant flood-prone sites and add to the considerable flood risk prevailing from the burn?

2 Introduction to the flood chronology

2.1 Sources and methods

Reed (2011) notes:

If the professional is to lean on history, it needs to be of the largest and most relevant events and to be judged from authoritative source material. There is nothing worse than a skimmed review. Even with best endeavours, one can never be sure that all important floods have been identified and adequately researched ... until an enterprising local uncovers evidence of a forgotten flood or an adversary reveals an overlooked change of datum.

Bayliss and Reed (2001) provide a detailed review of methods of historical flood analysis and point out that:

In Scotland, there are differences in institutional and cultural history, and the way archived material is organised. For those wishing to establish a historic flood chronology for a Scottish river, McEwen (1987) gives an insight into those sources of information that may be particularly relevant north of the border.

Bayliss and Reed stress the importance of *source analysis*. Two questions to be asked are:

- How motivated and qualified was the writer to record the events accurately?
- Is this an independent account of the event or is it essentially derivative?

But the more elementary question is:

- Does a prominent document that summarises the flood history of a particular river at least indicate the sources it is relying on?

It is disappointing when mistakes are made and (too often) then propagate.

Some of the methods used in the current review are now introduced.

2.1.1 Chronology of British Hydrological Events (CBHE)

The CBHE web resource is described by Black and Law (2004). It was launched in 1998 in an era when most searching was undertaken from offline documents. Although promoted by the British Hydrological Society and relaunched in 2016 (see: <http://cbhe.hydrology.org.uk>), CBHE has attracted only limited institutional support. It is largely a product of a few dedicated proponents.

Understandably, the system has limitations. When an enterprising hydrologist persuades company or client to devote resource to historical review, this seldom extends to uploading information in the format required by CBHE. In contrast to the National Flood Hazard Mapping System in Ireland (<http://www.floodmaps.ie>), CBHE lacks a map-based user interface of the kind expected by professionals trained to revere IT systems.

There is much in CBHE relating to the Tweed but only two entries mention the Leader catchment. These point to information sources for the 21 Sep 1891 flood.

2.1.2 British Rainfall yearbooks

Many early entries to CBHE derived from British Rainfall yearbooks published for 1860 to 1991. Their content and format varied greatly over the period, as resources and fashions changed. In some eras they provide remarkably detailed information about exceptional events. Coverage is uneven, with extreme events in London and south-east England gaining coverage more readily than those elsewhere. For example, the extreme flood on the Teviot at Hawick on 13 November 1938 gained no mention.

The British Rainfall yearbooks are now available online and can be freely downloaded from <https://digital.nmla.metoffice.gov.uk/archive/sdb%3Acollection%7C29627928-7fb1-43b2-b7ad-f63509127917/>. Optical Character Recognition (OCR) is imperfect but the ability to search on place and raingauge names within a given yearbook can be very helpful. The chronological layout of a yearbook is helpful when a particular flood date (or month) is known or suspected. However, criteria for heavy rainfall observations to be listed were not ideal. Being chiefly based on the 1-day rainfall depths, some notable storms spread over two rainfall measurement days are unlisted or understated.

Some of the British Rainfall volumes report on multiple years. Yearbooks up to 1939 include gauges in Ireland as well as the UK. Searching across all 127 volumes is not always very effective.

It is well known that online searches are more effective when the target name is unusual and spelt in only one way. Place names often feature in raingauge names (e.g. Lauder, Earlston and Chapel-in-Leader). Lists of rainfall observers feature in many of the yearbooks, and some are called Lauder. Lawderdale in County Leitrim in Ireland is sometimes reported or digitised as Lauderdale. From the 1911 yearbook onwards, raingauges in Scotland are explicitly listed by river basin. Thus the name Leader appears by default in all subsequent yearbooks.

One might expect the name Thirlestane to be unique. Entries for 1860 to 1881 for Thirlestane Castle do indeed relate to Lauder. The two special mentions are that:

- 1872 was exceptionally wet: [71% greater than the average of the preceding 15 years]
- 1876, the editorial remark: “The continued great dependence upon the single return from Thirlestane Castle is to be regretted; and also the great want of stations on the Lammermuir Hills.”

Returns for Thirlestane Hall appear from 1914 until 1930, but this is a property in Cheltenham. Remarkably, when returns for Thirlestane Castle reappear in 1957 and continue until 1964, it is a loose name for Thirlestane House near Ettrick: a property demolished in 1965.

2.1.3 Local newspapers

Online access to historical newspapers has advanced considerably over the last decade. OCR remains imperfect but this is in part offset by advances in the search options available. The ability to inspect *visual images of the original newspapers* is extremely helpful, and reduces

the scope for historical research to be contaminated by poor OCR or by handed-down interpretations of source information.

The *Southern Reporter* (1858-1945) was found to cover 26 of the flood events from October 1864 to June 1938. As helpful to confirming flood chronologies as local newspapers are, their authority of content and reliability of coverage had declined by 1970, and acutely after about 1980.

2.1.4 Internet searching

Internet searching can be an exceptionally rich route to forgotten information if sufficient time is available and the researcher is resourceful in the choice and combination of words.

The Leader Water does not lend itself too well to general searching. The word *water* is not always attached, and the word *leader* gets used in many contexts not referring to the river.

Lauder is a moderately good word to search on, although returns can be contaminated by Sir Thomas Dick, Harry and Estée Lauder. The foremost authored notable books on *The Great Moray Floods of 1829* and *Scottish Rivers* (Lauder, 1890).

Earlston provides a fairly good word for Internet searching. Most references relate to Earlston in Lauderdale, although an Earlston in Strathclyde and Earlstoun in the Water of Ken catchment in Dumfries and Galloway provide minor confusions. Historically, the name has been written in many forms, including: Arcioldun, Erceldoune, Ercheldon, Erchildon, Ercildoun, Ercildoune, Ercildune, Ersilton, Ersiltoun and Erslington, in addition to Earlston, Earlstoun and Earlston-on-Leader. The town is famed for an association with Thomas the Rhymer. The spellings Earlston and Earlstoun have predominated in the 200 years chiefly covered by this review.

2.1.5 Books

The history and antiquities of Roxburghshire and adjacent districts from the most remote to the present time (Jeffrey, 1855):

[p62]: It is maintained by some that the Leader is a corruption of *Laidur*, which means the lesser water often discoloured. By the lesser water, it is meant that it is less than the Tweed, which it enters at Drygrange, and the colour is descriptive of its appearance; when flooded, the soil through which it passes being of that kind liable to tinge the waters of the river. Others contend that the ancient name is *Leder* and signifies the stream which breaks out or overflows, and that this derivation is consistent with circumstances; it is alleged of the Leader, that after the melting of snow or the falling of rain, it overflows its banks and sweeps away mills and bridges. Both *etymons* are consistent with the circumstances—the first, however, is peculiar to the Leader, and the latter to all the mountain streams of the district. ...

Scottish Rivers (Lauder, 1890) chiefly concerns the Tweed and its tributaries, with Chapter XI devoted to the Leader. However the only mention of interest found is:

[p184]: The Leader is a very lively stream.

Being based in Fountainhall in the neighbouring valley of the Gala Water, T.D. Lauder was reasonably well placed to judge this.

Lauder and Lauderdale (Thomson, 1902):

[p185]: At that time [early 1790s] the Leader had no embankments, and floods frequently carried off corn and sheep. One such, of date 21st October, 1797, carried off the bridge at the foot of the river.

[p289]: [Speaking of the Common Tern] One of these birds was captured, running with a broken wing, in the field near the Eagle Gate, during the storm of 1891, when the Leader came down in full flood, filling the whole vale with its outspread waters.

The great Borders flood of 1948 (Wood, 2002) provides a retrospective on the extreme flood of 12/13 August 1948. The book focuses on impacts in East Berwickshire and East Lothian, and especially on the damage to (and restoration of) railway infrastructure on the East Coast main line. There is a brief mention of the Leader in the *Friday 13 August* chapter:

[p74]: It was still Earlston trades week and many local residents were still away on holiday, unaware that their homes are under three foot of water. When the Leader flooded this time, it flooded homes where it had never reached before, or since. It would be Saturday before the road was opened again, but gas, telephone and electric services would be unavailable for several more days. Beekeepers in Swinton lost all of their hives when the flood inundated the fields and the footbridges in Lauder were swept away.

The merging in one sentence of beehives in Swinton (30km to the east and on the Leet Water) with footbridges in Lauder is indicative of an anthology rather than a formal history.

Other books are referred to where relevant to particular entries in the flood chronology.

2.1.6 A source that is effectively missing

There are major continuing weaknesses because the Met Office does not allow unrestricted access to gauged data, and *has yet to digitise much of the pre-1961 rainfall data gathered under public funding*. This is doubly disabling because so many of those who teach, research, write and learn about flooding do so in a manner that does not give precedence to rainfall data (and other basic meteorological data).

Two generations of hydrologists have grown up to accept this, and do not appear to miss what they never had. The earlier generation had been trained to look for rainfall data: the original paper records or the published summaries that stuffed bookshelves or archive space.

Uploading the British Rainfall yearbooks (see Section 2.1.2) has been helpful to historical flood review. But there ought to be so much more. In addition to the rainfall data themselves, handwritten notes by the observer on the flipside of the monthly return of daily readings are amongst information about extreme events left in limbo in the paper archive.

Data held in archives can be surprisingly rich. In historical review of flooding in the Water of Leith, Reed (2002b) found *18 years of recording raingauge charts* from Harperrig Reservoir

in Bay 14 of the Scottish National Meteorological Archive at Saughton House, Edinburgh. They cover the period 1953-1971, excluding 1968, and appeared to be of good quality. Reed (2000c) indicated how these data – specifically, Dines tilting siphon rain gauge (TSR) charts *aka* Metforms 4424s – might play a role in testing the capability of Water of Leith flood control based on redeployment of the Harperrig, Threipmuir and Harlaw Reservoirs.

2.1.7 Social media

The evolution and eventual explosion of social media provide a source of information not to be neglected. Photos and video clips of flooding can be very valuable. But it is not always easy to find authoritative information or a seasoned commentary on particular flood events.

2.1.8 The 1970 to 1995 gap

The weakening of local newspapers after about 1970 can leave a gap in historical flood information that is reliably in the public domain. The advent of widespread internet posts and later of social media make this less of a problem after about 1995.

Historical flood information to span the 1970 to 1995 gap is held by SEPA from its predecessor bodies, and by local authorities. However, reorganisations, incomplete cataloguing and/or limited digitisation may mean that not all historical flooding information held is readily accessible even to SEPA and its partner organisations. Access may be especially difficult for non-partner organisations. One needs to know that information exists to be certain of recovery through Freedom Of Information requests.

For the Leader, the position is eased somewhat by earlier studies seeking to establish Tweed and/or Leader flood chronologies, and by the commencement of flow gauging at Earlston in October 1966.

2.2 Introduction to existing flood chronologies

2.2.1 McEwen (1985, 1987 and 1990)

McEwen (1985) did impressive and wide-ranging research which looked *inter alia* at planform changes in river channels and attempted to link them to the chronology of flooding and to land-use change. The Tweed and Leader were amongst the case studies considered in considerable detail. The papers that followed – including McEwen (1987) and McEwen (1990) – continue to be widely cited. McEwen's flood chronologies are discussed where appropriate in Section 3 and more fully in Section 7.1.

2.2.2 Reed (2002b)

Reed (2002b) reviewed historical floods on the Water of Leith (WoL) in Edinburgh. Although somewhat distant from the Leader catchment, the WoL chronology informed the selection of potential flood dates on which to search. It transpires (see Section 7.2) that at least five major historical floods are in common between the Water of Leith and the Leader Water.

2.2.3 JBA (2009)

The production of flood chronologies played an important part of work undertaken for the Environment Agency's North East Region (JBA, 2009). The study did not consider all-Scottish tributaries of the Tweed such as the Leader Water. However, the Tweed flood chronology presented in Appendix A.1 of JBA (2009) is relatively comprehensive.

Their discussion of land-use change within the Tweed catchment over the period of historical flood review is well-referenced. Land drainage and hill drainage for agricultural improvement are seen to have been a major feature in (especially) the first half of the 19th Century. The following are quotes from JBA (2009):

- The gauged record [for the Tweed] at Norham provides the basis for scaling historical floods. The highest gauged floods in the gauged data series from 1960 onward were on 22 October 2002 with a discharge of $1602 \text{ m}^3\text{s}^{-1}$ and 4 January 1982 with a discharge of $1518 \text{ m}^3\text{s}^{-1}$. The flood in 1982 had a significant snowmelt component.
- Potentially more important are the effects on flood flows of land drainage. Campbell (Date?) has compiled historic accounts of supposed effects of land drainage on flood flows dating from the early nineteenth century. Floods were said to have become more severe and to be of shorter duration due to the speeding up of the run-off by drains and the lack of wetlands in which water could be held for longer periods. Examples of such observations for the Tweed are those of Yarrell, (1841) and Scrope (1843):
 - 1837 This change has been brought about by draining the sheep farms on the hills, the effect produced being that a little summer flood which took a fortnight or three weeks to run off previous to 1795 is now completely run out in eight hours. The rain which formerly filled the bogs or side of the hills, and which then kept giving a constant and regular supply to the river, is now carried off at once by these drains to the different feeders, causing sudden and violent floods, and short as they are sudden, so that the flood is all run off before the river has had time to clear itself ... the draining has affected the smaller streams as well as the Tweed itself. (Yarrell, 1841)
 - 1843 “.....the effects of the furious spates which are continually taking place in the Tweed.....Before the hills were so well drained as at present, this was not so much the case; as the mosses gave out the water gradually, and the river continued full for a long time. But now every hill is scored with little rills which fall into the burns, which suddenly become rapid torrents and swell the main river, which dashes down to the ocean with tremendous violence....” (Scrope, 1843).

The Tweed Foundation (2009) quotes extensively from parish accounts from the 1830s to show that significant land drainage was already being carried out in the early part of the 19th century before the work was legally formalised in the Land Drainage Act of 1847 when the first government subsidies for drainage became available. He concludes that the storage capacity for water in bogs and hillsides must have been greatly reduced by this drainage, so the observations of floods running off more quickly now than in the past are likely to be correct.

All the above is taken directly from JBA (2009). The report cites in passing the Leader flood of 21 Sep 1891. Going beyond the JBA reporting, the following paragraphs from Scrope (1843), provide an angler's view of the extent to which agricultural practice changed the Tweed and its tributaries in the early 19th Century:

The hills are now so well drained, that the flood runs off rapidly; and thus the river soon falls in, and becomes too low for the fly, except in the strong streams. Before these complete drainages took place, the Tweed kept full a much longer time than it does at present; for the rains which fell remained in the mosses, which gave out the water gradually, like a sponge.

Now the hill sides are scored with innumerable little drains, which empty themselves into the burns, which burns soon become impetuous torrents; thus suddenly supplied, the Ettrick, the Yarrow, the Leader-water, the Ale, the Teviot, and the many other streams that empty themselves into the Tweed, come raving [*sic*] down from the mountains and from the lakes, and, with their united volume, raise that river to an alarming height in the space of a few hours, which then spreads over the haughs, and sometimes sweeps off corn and cattle, and levels the bridges in its irresistible course. In these awful spates, the water is too strong and turbid for fish to travel: the soil is washed away partially from the ploughed lands; and, as the practice of liming them is very prevalent, the waters are obnoxious to the fish.

2.2.4 SEPA (2014b)

SEPA (2014b) reveals some information held on historical floods at Earlston when responding in the consultation phase of SBC's Proposed Local Development Plan:

Allocation Sites EEA101 and EEA 200 in Earlston (Mill Road and Earlston Mill)

There is a long history of flooding in Earlston from both the Turfford Burn and the Leader Water. Damage to gas works, sawmill, and railway line was recorded in 1890. The level crossing which is thought to be on the right bank of the Leader Water adjacent to Melrose Road Bridge was flooded to a depth of 3 feet during this event. [*←This thought is mistaken; see Section 7.4.*] In 1948, homes, agricultural workshops, and businesses were flooded. Some homes were flooded to a depth of 36 inches and one house was flooded to 9 inches below the ground floor ceiling. Rhymers Woolen Mill which is on the downstream side of Mill Road (between Mill Road and Melrose Road) was flooded to a depth of 3-5 feet during the 1948 flood. ... Property was also flooded in 1984 and this event was not as severe as the 1948 event. Based on information gathered by the Tweed River Purification Board the largest flood event on the Leader Water was 1948 followed by 1881, 1984, 1990 and 1956.

It is very poor practice to cite historical floods by year only. This limits the ability to check information should a typo intervene. A more specific weakness is that one has to guess that the 10 Mar 1881 (rather than 22 Sep 1881) flood is being referenced. The SEPA (2014b) statement is discussed further in Section 7.4.

2.2.5 SEPA (2017)

SEPA (2017) reveals additional historical flood information at Earlston when responding to a specific planning application close to Rhymers Mill:

There is a well-documented history of flooding on the Leader Water and the area surrounding Rhymers Mill in Earlston. ... There are also records of this area flooding in 1881, 1890, 1948, 1956, 1984, 1990, 2002 and 2012.

It is again disappointing that the flood dates are not specified. The flood history may be “well documented” but only SEPA can judge this if the source information is kept out of the public domain. The SEPA (2017) statement is further discussed in Section 7.5.

2.2.6 ECC (2017)

An annotated timeline of flooding at Earlston was presented in a PowerPoint show at a recent public meeting (ECC, 2017). The slide showed 15 flood events, beginning with one in 1846. The month of flooding is given for all but the first event. [There were multiple floods in the Leader in 1846, but mention of the bridge at Cowdenknowes confirms this to be the 29 Sep 1846 event.] The ECC flood chronology is discussed later in Section 7.7.

2.3 Period covered by the review

Whilst some resource might be given to researching earlier floods, the approach taken here has been to develop a flood chronology for the last 200 years, i.e. from 1818 to 2017. The start date is a couple of decades too early for there to be authoritative coverage in newspapers. The weakest parts of the chronology are likely to be for:

- Years before about 1830;
- Periods of national emergency (notably, world wars);
- For reasons discussed in Section 2.1.8, years between about 1970 and 1995. [However, the flow gauging station at Earlston – dating from October 1966 – ensures that no major Leader flood is missed in this period.]

In drawing up the chronology, the aim has been to seek out specific evidence of flooding in Lauderdale. Although this chiefly relates to flooding from the Leader Water, some of the information gathered refers to its tributaries. Principal among them is the Turfford Burn (see Section 1.5) which is found to have an especially long and rich history of flooding.

2.4 Event classification

To aid inferences, the flood events are classified according to three sizes and four locations. For example, the notation:

- LLL denotes a very large flood at Lauder
- EE denotes a large flood at Earlston from the Leader
- TT denotes a large flood from the Turfford Burn
- K denotes a moderately large Tweed flood at Kelso.

Where the flooding incident is thought to relate primarily to surface-water, this is indicated by the suffix *Pluvial* and effectively disregarded. The study is focused on the fluvial-flood history.

Some subjectivity is inevitable. Where evidence to support the classification is considered weak, a question mark is added.

In grading the severity of the flood events, an attempt was made to target the *two* largest flood events in the last 200 years, the *three* next largest events, and the *five* next largest events. Accordingly, these might respectively be thought of *very loosely* as ≥ 100 -year, 40 to 100-year, and 20 to 40-year flood events. Thus, the default aim (at Lauder) has been to identify two LLL events, three LL events and five L events occurring in the last 200 years.

However, extreme floods do not occur to a particular rhythm. So the number of events assigned to a particular category is varied where a number of events all appear to be of considerable significance but are not readily distinguishable in size. The classification is chosen to reflect the scale of flooding. Prior to level measurement and flow gauging at Earlston commencing in October 1966, there is no standard reference point.

The outcome is a broad classification or banding of flood events rather than a formal ranking. When applying historical flood review to flood-risk estimation, the *count* of large floods is often enough to demonstrate that a flood-risk map has under-appreciated the risk it purports to represent.

It transpires – see Section 6.3 – that rather too many large and moderately large floods were identified. But the target was broadly met for the very largest floods.

2.5 Completeness of historical flood series

Because of the Tweed's larger scale and regional importance, there is fair confidence that major floods at Kelso have been identified. Indeed, levels recorded at Kelso Bridge have long been referred to in reports as "the Tweedometer". However, there is still scope to be misled and for interpretations to vary. Relying largely on McEwen (1990) but adding information from unspecified sources, Macdonald and Sangster (2017) provide a recent new categorisation of the largest Tweed floods at Kelso.

It is much less likely that the flood chronology is complete for the Leader. This is typical of lesser rivers: especially those that pass through few large settlements.

Some Leader floods arise from intense thunderstorms. Such localised events are more readily overlooked in historical searching. This applies somewhat more at Lauder than at Earlston. There is also the difficulty that – in geographically extensive extreme events such as the August 1948 Border Floods – reporting tends to focus on the more alarming and striking impacts than on cataloguing the impacts in all rivers. It is therefore possible that further searching or additional expertise may reveal that a major Leader flood has been overlooked or underappreciated.

It is important to note that damaging incidents occurring during world war or national emergency may not have been reported openly.

2.6 Historical prudence

Lauder is notable as a town founded at a generally appropriate level above the lively Leader: lively in its speed of flood response to heavy rainfall and in its geomorphologically active river and floodplain. In contrast, Earlston is a town that has encroached too close to the Leader and much too close to the Turfford Burn.

The Earlston situation is not uncommon. Historically, occasional flooding of basements or ground floors was often tolerated. A major element of flood risk has come from the changing expectations of those living in floodplains, and the higher value and greater vulnerability of contents and fixtures. In addition, development has often encroached too close to the natural floodplain. These patterns of behaviour continue.

In many respects, it is the Lauder experience that is unusual. Special factors – not least land ownership – have largely kept development out of the Leader floodplain. Given that Thirlestane Castle and the Earls of Lauderdale have been there for an exceedingly long time, this might be construed as *good use of historical knowledge!*

In some sections of the Lower Leader the river channel is more deeply incised. But there are still a number of haughs subject to inundation during major floods: not least at Earlston.

2.7 Tree-planting

Historical development in the upper Leader is to be contrasted with that in the lower Leader. The floodplain at Thirlestane and upstream has been kept relatively clear of tree-planting. The approach in developing the estate at Carolside was rather different, Hardy (1886):

There is a fine assemblage of well-grown timber round Carolside, filling up the valley from side to side with undulations of deep verdure, ... The mansion [i.e. Carolside] stands on one of the flats by the side of the Leader, small but handsome, surrounded by a well-treed park.

It is worrying that – in current times – tree-planting in floodplains is seen only as an asset, in the Borders as elsewhere. Two examples suffice:

- Email from DMurphy@scotborders.gov.uk on *A68 Soutra South to Oxtou Improvement - Headshaw Burn Bank Protection Measures*, 11 Jan 2011. “It is worth noting that, as part of the erosion protection works upstream of the Annfield Inn Bridge (arch bridge to the north of the A68, below the D47/5 side road to Carfrae), it is proposed to enhance the riparian corridor with additional tree planting.”
- Longer-term (and subject to review) development plans for SEARL006 (Georgefield East) in Earlston require: “Retention and management of existing woodland, including woodland along burns and shelter belts. Woodland structure planting to provide a setting and shelter for potential development, create a settlement edge, provide a wooded edge to watercourses and add variety to existing woodland.”

Once undermined by floodwater, trees are highly mobile and can lead to damage to structures or blockages downstream. Much the same applies in the modern era to wheelie bins and cars.

These are not unsubstantiated fears. There are reports of whole trees being carried downriver in 12 of the historical flood events assembled in the chronology. Seven of these reports refer specifically to the Leader. The lessons learned in Berwickshire from the August 1948 floods have been forgotten:

Berwickshire News, Tuesday 8 February 1949

Permanent bridges

Plans are being made for the permanent bridges [as opposed to Bailey bridges], but it may be some time before these are erected. In many cases they will not be on the same sites as the old bridges, and it is considered these bridges were in the wrong places. The Department of Agriculture have issued contracts for the re-fencing of haugh land, and this work is now under way. In order to prevent damage done by trees, should another flood arise, trees bordering the rivers in the County are being removed. Most of the damage in August was caused by uprooted trees.

My view is neither mainstream nor popular. Chris Davies (2016) notes that “The Environment, Food and Rural Affairs Committee has recognised the role of trees in mitigating flooding as part of natural flood management, and the EFRA Secretary of State recently announced a £19 million fund to plant trees, because of their contribution to locking up carbon. There are therefore many reasons why we should plant trees. Most importantly, perhaps, our constituents are overwhelmingly in favour of more trees being planted.”

While it is difficult to argue against the last sentence, a catastrophic flooding incident may eventually promote a more enlightened view: tree-planting is to be encouraged, but not in riverine corridors at sites intrinsically vulnerable to erosion.

3 The 1818 to 1966 flood chronology

The flood chronology seeks to list all major floods occurring in the last 200 years: from 1818 to 2017. When incorporating historical flood data into a formal analysis of flood frequency, the question typically arises as to whether the first *really extreme* flood in the historical record should be treated as the largest since the beginning of the period of abstraction (i.e. 1818 in this case) or from some earlier start date. In the expectation that this question may arise, Appendix A1 provides such information as has been noted for major floods occurring in the preceding 50 years, i.e. from 1768 to 1817.

This section of the report is long and detailed. The floods are considered in chronological order. The evidence from which a particular historical flood has been identified – and a rarity classification put forward – is that presented here. A brief synopsis is provided to help the reader pressed for time.

9 Feb 1831

LL?

EE?

KKK

[**Synopsis:** The February 1831 flood was remarkably severe across much of Northern Britain, with Aberdeen, Carlisle and Glasgow, Shrewsbury and York amongst the places notably struck. Rapid snowmelt was a feature. The first event in the flood chronology is problematic. Was the flood severe at Lauder and Earlston? The lack of retrospective mention in reports of the 29 Sep 1846 flood suggests that 9 Feb 1831 was no more than a significant flood in the Leader.]

pp30-31 of the Chronicle in *The Annual Register, or a view of the history, politics, and literature, of the Year 1831*

GREAT FLOODS. – The Snowstorm in the first days of the month having been followed by a sudden thaw, the Clyde rose, at Glasgow, to a greater height than had been seen for many years. ... At 3p.m. on the 9th, the water became stationary, and remained so for an hour and a half, when it began to subside. When at its highest, it was twenty-three and a-half inches lower than the great flood on the 12th of March, 1782, and one inch higher than the flood of 1823. [This quote indicates the likely date and severity of the 1782 flood in the Tweed. See Appendix A1]

...

The Tweed and Teviot began to rise on the evening of the 8th. On the 9th, both rivers were swollen far beyond the boundaries of their highest floods, and the whole country in the line of their course, especially below their junction, presented the appearance, not merely of the inundations of an ordinary river, but of an extensive estuary; all the rich haughs were covered with water many feet deep, and in many places the fields on the water-sides could not be defined but by the tops of the hedge-row trees which were still seen above the water. The oldest inhabitants on Tweed-side never before knew that river pour forth such a mighty torrent. A great portion of the fine park of Fleurs, and the whole of St. James's Green opposite, were covered many feet deep; the outer wall of the Duke of Roxburghe's old gardens was overtopped some yards, and the inner wall, with the fruit-trees growing against it, were deep in the water. At Kelso, the Tweed rose full twenty feet perpendicular, and great fears were entertained for the bridge, the torrent reaching far above the opening of the arches.

The History and Antiquities of Roxburghshire and Adjacent Districts from the most remote to the present time (Jeffrey, 1855)

The next great rising of the waters of the district [subsequent to October 1797, see Appendix A1] happened in the month of February 1831, and was caused by the melting of the snow. The waters of this flood elevated the Tweed at Kelso to about fourteen feet above its usual level. Although considerably higher than the flood of 1797, it does not appear to have committed any serious ravages during its existence. [This finding likely reflects on the seasonal timing of the flood, which presented few impacts to a local economy dominated by agriculture.]

<http://www.northumberland.gov.uk/NorthumberlandCountyCouncil/media/Planning-and-Building/planning%20policy/Studies%20and%20Evidence%20Reports/Flood%20Water%20Studies/1.%20SFRA%20Level%201/Level-1-SFRA-2010-AA.pdf>

February 1831 River Tweed **Exceptional flooding of the River Tweed and all tributaries following a snowstorm and thaw.** Flooding of Norham has only occurred once since. [This north Northumberland flood chronology has a nominal date of 2010. Mention of “all tributaries” may be thinking more of the Jed, Teviot and Till than the Leader.]

McEwen (1985, 1990) includes this as a big *Leader* flood but the evidence offered is weak and indirect. The argument is principally based on *mapped* changes in channel layout at the Leader/Cleekhimin and Leader/Boondreigh confluences. No evidence appears to be offered to tie these morphological changes to the 9 Feb 1831 flood specifically. It is not the most obvious candidate to explain marked channel-changes between maps published in 1750 and 1857. From other evidence we know of severe Leader floods on 21 Oct 1797 (see Appendix A1) and on 29 Sep 1846. The Leader may also have been affected in the regional flood of ~12 Mar 1782 (see Appendix A1).

The judgement here that the 9 Feb 1831 was not of the first order of magnitude in the Leader is in part guided by reportage of the 29 Sep 1846 Leader flood at Earlston: “The river was never known to be so high before.” That this was said only 15 years later suggests that the 9 Feb 1831 flood on the Leader was less outstanding than the 29 Sep 1846 event.

11 Jun 1835

LL?

E?

[**Synopsis:** A thunderstorm-induced flash flood in the Upper Leader causing fatalities at Carfrae Mill. It would be helpful to consult the Kelso Mail and Berwick Advertiser directly, to confirm the date of this flood event as 11 Jun rather than 18 Jun 1835.]

Drogheda Journal, or Meath & Louth Advertiser, Tuesday 23 June 1835

THE LATE STORMS

In consequence of the heavy speats, or of the bursting of some water-spout during the thunder storm of Thursday last, the Leader and its tributary streams became suddenly much flooded, by which three children, who had been amusing themselves about the water at the time of its rise, were unfortunately drowned. One of them a little girl of the name of Darling, living at Hill House, a short way above Carfrae Mill, was drowned in the burn which passes that place; and the other two were carried from Lauder Mill upwards of a mile down the Leader before their bodies could be rescued from the flood.—*Kelso Mail.*

Thunder Storm

Throughout the greater part of Tuesday thunder was heard in this neighbourhood; but on Wednesday forenoon it burst forth in one of the loudest peals we remember to have heard. The thundering continued with but little intermission for several hours, the lightnings were very

vivid, and followed each other with great rapidity. Impetuous showers of hail and rain followed. From the appearance of the Tweed to-day, the rain up the country must have been excessive. —*Berwick Advertiser*.

[1838 – incidental note]

<https://auldearlston.blogspot.co.uk/>

In 1832 Earlston Gas Works was built [on the floodplain of the Turfford Burn], with gas street lighting introduced in the village in 1838.

15 Sep 1839

L?

E?

KK

[**Synopsis:** A major flood in the Tweed, bringing down Norham Bridge which was under construction. Nothing specific found for the Leader. Riddell (1840) and Richardson (1846) pinpoint the flood as occurring on Sunday 15 September. This provides a classic example of distant newspapers ... in this case the (London) *Evening Mail* ... recycling previously published copy without clarifying the dates. The *Caledonian Mercury* entry was later found.]

Caledonian Mercury, Thursday 19 September 1839

THE WEATHER

THE LATE RAINS—The flood on Sunday morning, caused by the recent rain, occasioned very considerable injury, particularly in Peebles-shire, **where the water rose to an almost unprecedented height in the [Lothian] Tyne and the tributaries of the Tweed**. Hay, corn, and wood, were carried off, and the green crops injured, and even destroyed to a considerable extent, from the quantity of sand and gravel carried down and deposited upon the low lands. Roads, bridges, and embankments have also suffered; which causes the lines of the rivers to have the look of devastation. The flood in those parts has not been so great for the last thirty-two years. [←This refers to the September 1807 flood in the Tyne at Haddington. Events before 1818 were not explicitly searched for in this study.]

Evening Mail, Wednesday 25 September 1839

HEAVY RAINS—FLOOD IN THE TWEED

[Report attributed to the *Berwick and Kelso Warder*.]

On Saturday and Sunday last this part of the country was visited by rains of unusual copiousness and protracted duration, and which have not only been very injurious in their effects upon the crops, but were attended with great destruction of property, in consequence of **the Tweed having become swollen to a greater extent than has been witnessed for many years past**. [Well, not since Feb 1831.] On Saturday it rained unintermittingly [*sic*] during the whole day and succeeding night, until Sunday morning was far advanced, when a brief cessation took place; and on the latter day its effects became strikingly visible in the appearance of the Tweed. ... The following is an account of the aspect of the river, and the damage it occasioned in different parts of its course, the most serious part of which, we regret to say, is that sustained by the bridges now in course of erection across the Tweed at Mertoun and Norham; and we need scarcely say that it is peculiarly to be regretted that any part of either of these fine structures ... should thus have fallen a prey to the resistless element. At Kelso, we learn, from daybreak on Sunday, till about 1 o'clock a.m., **when it reached its greatest height**, the river continued to rise with great rapidity. **At that hour the Tweed, above its junction with the Teviot, was ascertained to have risen within less than a foot of the height it had attained on the 9th of February, 1831**. ... When at its greatest height the river completely covered the piers on which Kelso-bridge rests, being then at 14 or 15 feet above its usual level. From 1 o'clock the flood at this point subsided with as much rapidity as it had risen, and before 7 it had fallen upwards

of five feet. ... [Article goes on to talk about the loss of Norham Bridge and to refer a bit more widely. The OCR is of poor quality. The article gives the impression that rainfall and flooding was widespread “particularly in the north” and ends with ...] In Peebleshire in particular, great loss has been sustained by the [s]weeping away of bridges and the inundation of dwellings. [This last remark – together with that by Jeffrey (see below) – suggest that the flood was exceptionally severe on the main Tweed tributary itself.]

Perthshire Courier, Thursday 26 September 1839

THE LATE FLOODS

Kelso—In consequence of the heavy rain on Saturday, the Tweed overflowed all its banks. When at its greatest height, the river completely covered the piers on which Kelso Bridge rests, being then at least fourteen fifteen feet above its usual level. From one o'clock the flood subsided with as much rapidity it had risen, and before seven it had fallen upwards of five feet. The destruction of property caused by the occurrence of so high a flood at this season of the year must, we apprehend, be very great. The corn growing on the haughs is, however, generally in stook, and large quantities of it must, we fear, have been swept away by the flood. The quantity of paling, gates, trees, &c., borne down by the flood, was unusually great; and about nine o'clock, logs of wood, wheel barrows, pumps, &c., were observed floating down the stream. These were at once conjectured to be the materials employed in the construction of Mertoun Bridge, and this conjecture was soon confirmed by the appearance of what had evidently formed parts of the centres of the arches. *In the extent of mischief caused by it, therefore, the flood of 1839 will have, we apprehend, still more reason to be remembered than even that of 1831*, though, so far as we have yet heard, no lives have been lost by it. [To an agricultural community, the impacts from a severe flood in September would be intrinsically greater than from a somewhat higher flood in February.]

Riddell (1840):

The Anniversary [meeting last year] was held at Milfield (18th September), and was well attended. ... For several days previous the weather had been very showery, and remarkably cold for the season. On Saturday and Sunday the 14th and 15th, a very great quantity of rain fell, accompanied by an easterly wind. *On the 15th, all the rivers and streams in the country were swollen much beyond their usual bounds. In many places the banks were overflowed, and the water rushed with great impetuosity over the haugh lands, and did much damage by sweeping away entire fields of corn in some places, and in cutting up and otherwise destroying the pastures in others. The new bridge in progress of erection near Norham was carried away by the weight of the water and of corn pressing upon it, while the centering was still standing.* This circumstance will serve to distinguish the flood in the memory of the neighbouring inhabitants for many years to come.

Richardson (1846), pp134-137:

SUNDAY the 15th September, 1839, the rivers of Northumberland were flooded to a fearful extent in consequence of the very heavy rain which fell on the preceding day, and especially during the whole of the night, when it came down in torrents, and without intermission.

...

The river Tweed, on Sunday forenoon, rose to an unusual height, and, when not confined by the banks, spread itself over a wide extent of land; the increased expanse of water, and its impetuous rush to the ocean, giving the river an appearance of novel and imposing grandeur. In the course of the day the devastating effects of the flood upon property situated higher up the stream became strikingly visible in the singular

and indeed melancholy spectacle which the river presented, [its whole surface from side to side](#), in Berwick harbour and above the bridge, [being thickly strewn with sheaves of corn, large beams, trunks of trees, fences &c., and the carcasses of two or three pigs, as also that of a deer, were observed on the water](#). Some slight attempts were made to save part of the property thus carried down, but they were only successful to a very limited extent. A considerable quantity of wood was saved by being washed ashore, and next day a bar of iron, fifteen feet long, was found in the salmon nets of one of the fishings beside Berwick bridge. The value of the grain which was carried down, independent of any other kind of property, must have been very considerable. The damage sustained by Norham bridge was of serious character. When the river first assumed a threatening appearance on Sunday morning, people were engaged in removing a flock of sheep, from an island of about fifteen acres of extent, on the eastern point of which the central pillar of the bridge is placed. About ten o'clock the river was much swollen and waxing rapidly; apprehensions were then entertained of the work sustaining damage. [It was not, however, till between two and three o'clock in the afternoon that the temporary structure, partly supporting the immense wooden arch on the south side gave way before the force of the reckless current, which by this time was pursuing its heedless course with an awfully majestic grandeur](#). This accident was wholly owing to quantity of corn, trees, &c., which was being carried down the stream, collected in a body against it; a similar structure supporting the north arch remained uninjured. Great fear was now entertained for the safety of the arch, which was nearly completed, having a span of 190 feet. [The river continued to increase in size, and about two o'clock on Monday morning the entire arch was driven with indescribable violence from the masonry work, and was almost instantaneously borne away by the impetuous stream](#)—fragments of it were cast on the sides of the river, and others floated out to sea, and were cast on the coast about Spittal, Cheswick, &c. The damage done was estimated at about £2,000 or £3,000.

Jeffrey (1855):

Another flood occurred in September 1839. [On this occasion the Teviot and her tributaries did not rise within four feet of the flood in 1831, but the Tweed by itself nearly equalled the height of that flood](#). Great injury was done to the crops on the haughlands, especially on the banks of the Tweed; and two bridges which were in the course of erection at Merton and Norham suffered serious damages.

6 Oct 1841

[**Synopsis:** Not a major flood on the Tweed, and unlikely to have been much of a flood on the Leader. Newspaper reports shown below are delayed. Based on Richardson (1846), the correct date is around Wednesday 6 October 1841.]

Caledonian Mercury, Saturday 16 October 1841

GREAT FLOODS

The continued and heavy rains, which lasted from early on Monday morning till Friday afternoon, brought down the rivers and streams of this district, as noticed in our last publication, in great force. [This likely refers to the previous issue of the *Kelso Mail*, i.e. Saturday 9 October 1841, which I couldn't find.] The Tweed and Teviot each rolled down a vast body of water; but, unless on the haughs and meadows where the banks are low, [both those rivers kept within their ordinary bounds](#), though with a very small addition to their currents they must have broken

over the country far and wide. **The wild-running hill streams, descending from the Cheviots on the one hand, and the Lammermoors on the other, presented, however, a still more imposing appearance, coming down with almost irresistible force, sweeping away embankments, and flooding the adjoining low lands for miles.** The Bowmont, in particular, was very high; and it was with difficulty the substantial bridge which connects the two Yetholms was saved, by masses of stone being thrown in where the danger lay. The Kale was not comparatively so high, and we have not heard of any great damage being done by it; but further down the country the Till, swollen by the Collee and the Glen, overflowed the whole surrounding country, and a good deal of the crops being out, considerable loss has been sustained. The Till has not been so high for many years. **Of the Leader we have not heard further accounts than that, like the others, it was very high.** The Eden, also, coming from nearly the same source, was swollen to an unusual height, and, covering all the haugh lands, looked so like a splendid river that its usual appearance of a quiet moorland stream was completely lost sight of. So great was the overflow of its banks that the public roads in several places near its course were rendered almost impassable for two or three days. **We have heard of no sweeping away of bridges,** or any such like calamity; but by the Eden, as by every river and stream in the district, a great deal of damage has been done, which, though not very heavy in any of the details, must yet amount in the aggregate to a very great loss.

[Also printed in *Bristol Times and Bath Advocate*, Saturday 23 October 1841, where the story was attributed to the *Kelso Mail* of Saturday 16 October 1841.]

Darling (1842):

Soon after our last Anniversary Meeting [15 Sep 1841], rain fell in prodigious quantities, and we witnessed floods almost unparalleled in the annals of our times.

Richardson (1846), pp318-319:

1841 (Oct. 4).—On the evening of this day, Monday, a heavy rain commenced, which extended over a wide district, and continued with but little intermission until Friday, in consequence of which the rivers, especially in Northumberland, were flooded to an alarming extent. ... But further north the fall of rain would seem to have been still greater. **The Tweed rolled down a vast body of water; but, unless on the haughs and meadows where the banks are low, this river kept within its ordinary bounds,** though with a very small addition to its current it must have broken over the country far and wide. The wild-running streams, descending from the Cheviots, presented, however, a still more imposing appearance, coming down with almost irresistible force, sweeping away embankments, and flooding the adjacent low lands for miles. The Beaumont, in particular, was very high and it was with difficulty the substantial bridge which connects the two Yetholms was saved, by masses of stone being thrown in where the danger lay. The damage done by the Glen in its mad career, to dykes, caulds, bridges, and corn in stook, between Newton, and its confluence with the Till was immense. ...

30 Jul 1846

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[**Synopsis:** Summer 1846 was exceptionally wet, and there were a number of floods. See further flood entries below. A significant flood on the Tweed. The evidence of impacts at Lauder and Earlston on 30 July 1846 is relatively weak. The severity assessment for the Turfford Burn is based on the serious flood reported in the Eden Water; the catchment headwaters abut at Mellerstain.]

Kelso Chronicle, Friday 31 July 1846

THE WEATHER—The weather from the middle of the preceding week to Tuesday was uncommonly fine, and during that time the crops had made very perceptible progress towards maturity. On Wednesday, however, an unfavourable change took place; rain fell almost incessantly during the day till near six o'clock in the afternoon, when it ceased for a short time. About eleven o'clock at night the rain again commenced, accompanied by vivid flashes of lightning, and peals of distant thunder, and from that hour till nearly six o'clock yesterday morning, it descended in torrents, inundating several of the houses at the foot the Wood Market, to the no small annoyance of the inmates, whose situation amidst the surrounding darkness was any thing but enviable. The flooded state of the Tweed and Teviot yesterday showed that the rain must have been equally heavy to the south and west. The Teviot, we believe, has not been so high since the memorable flood in February 1831. All the low lands, skirting the margins of both rivers, were completely inundated, and considerable damage must have been done. Trees, wood, &c., floated down the Tweed in rapid succession, while immense quantities of hay and other material glided down the Teviot. About 11 o'clock in the forenoon the flood was at its height, and when viewed from the Bridge as it rushed impetuously along, presented a spectacle at once imposing and magnificent. From a calculation made, the current was flowing at a rate equivalent to ten miles an hour. We regret to state that the crops have sustained very great damage, and some of the fields in the vicinity are flattened as if levelled with a roller. Some idea of the quantity of rain which has fallen may be formed from the fact that, in the course of 19 hours, nearly 2½ inches have descended. Yesterday about noon the clouds began to disperse, and the sun shone forth with cheering effulgence, giving indication of more settled weather.

Dundee Courier, Tuesday 04 August 1846

THUNDER STORM AND FLOODS

KELSO—This district was visited on Wednesday evening and Thursday morning by one of the severest storms which we have experienced for a great number of years past. It rained, though moderately, throughout the whole of Wednesday, but towards evening it descended in torrents, and continued to do so throughout the whole of the night. Towards 10 or 11 o'clock at night, peals of distant thunder were heard preceded by vivid flashes of lightning, and the storm raged until four on Thursday morning, when the rapid rise of the rivers Tweed and Teviot began to excite some alarm in the minds of those who had property on their banks. Both rivers were soon in full flood, and the quantities of sheep, kay-ricks, carts, timber, and other materials which floated through the arches of Kelso Bridge indicated the havoc which the storm had been making in the upper districts. After the junction of the two rivers, the flood had a grand and imposing appearance. **The flood was at its height about eleven o'clock on Thursday forenoon, and judging from the quantities of materials that floated down the river the destruction to property on the haughs and lower lying grounds in the vicinity of the rivers must have been immense.** In many situations the public roads near the rivers were for a time impassable, being covered with water to the depth of several feet. **The Eden was never known to be so large,** having in many places completely overflowed its banks, and done very serious injury to the crops; the turnpike roads towards Ednam and Stichel were for a considerable time several feet deep in water. Stichel Linn afforded a splendid and imposing sight, the immense body of water rolling over that beautiful waterfall causing the spray, like a dense smoke to rise to a great height. We have accounts from all quarters of the great damage caused by these floods. The crops in all directions have been much laid, and we fear must have sustained much damage. —
Kelso Mail.

SELKIRK—On Wednesday night, between ten and eleven o'clock, we were visited by a violent thunder-storm, accompanied with heavy rain. The rain continued falling all night, and on Thursday morning the Gala was in high flood.

DUNSE—The neighbourhood of Dunse was visited with a heavy fall of rain on the evening of Wednesday the 29th and morning of Thursday the 30th ultimo. The Whiteadder and Blackadder were swelled to such a degree that considerable damage has been done to the crops on the banks of these rivers. A number of sheep and lambs were also carried away with the flood.

Newcastle Courant, Friday 7 August 1846

THUNDER STORMS AND FLOODS

The northern borders of Northumberland, and a very large portion of Cumberland, were on Wednesday the 29th ult. visited by terrific thunder storms, accompanied by heavy rain. Floods were formed on Thursday more extensive and disastrous than any that have occurred for many years. The following are reports from various localities:-

KELSO. Towards ten or eleven o'clock on Wednesday night, peals of distant thunder were heard, preceded by vivid flashes of lightning, and the storm raged until far on on Thursday morning. The Tweed and Teviot were soon in full flood, and the quantities of sheep, hay ricks, carts, timber, and other materials, which floated through the arches of Kelso Bridge, indicated the havoc which the storm had been making in the upper districts. *The Teviot on Thursday was much less than at the flood of 1831, but the Tweed did not reach her height on that occasion by several feet perpendicular. After the junction of the two rivers, however, the flood reached to within five feet of the highest mark of 1831,* and taking into account the season of the year, it was almost of an unprecedented description. The flood was at its height at about eleven o'clock on Thursday forenoon, and judging from the quantities of materials that floated down the river, the destruction to property on the haughs and lower lying grounds in the vicinity of the rivers must have been immense. In many situations the public roads near the rivers were for a time impassable, being covered with water to the depth of several feet. *The Eden was never known to be so large,* having in many places completely overflowed its banks, and done very serious injury to the crops; the turnpike roads towards Ednam and Stichel were for a considerable time several feet deep in water. At Makerstoun the water came down from the higher grounds at an early hour in the morning in torrents, and several of the houses were inundated, while the current of water made a gullet in the public road, which rendered it impassable. On the haugh grounds about Lee and Old Learmouth, and in that vicinity, considerable damage has been sustained by the loss of hay, corn, sheep, and pigs. Many of the houses in the lower part of the Wood Market of Kelso were inundated, owing to the common sewers in the locality being unequal to the carrying off of the immense quantity of water flowing in that direction. The Bowmont and the Kale waters were scarcely, if at all, swelled; *but the Leader, the Whitadder, and the Blackadder, were all in high flood and great quantities of hay ricks from the adjoining haughs were carried off.* The rain guage [*sic*] showed a fall of water of about 2½ inches in the course of 19 hours [presumably this was at Kelso]. The crops in all directions have been much laid, and must have sustained much damage.

8 Aug 1846

[**Synopsis:** Summer 1846 was exceptionally wet, and there were a number of floods. See other entries above and below. This event was not of high impact.]

Edinburgh Evening Post and Scottish Standard, Wednesday 12 August 1846

KELSO.— The last two or three days have brought us another deluge of rain, which will have the effect of giving at least a temporary check to the labours of the reaper; and the high

temperature and excessive moisture are beginning to create considerable anxiety for the safety of the corn crops, which are now so far advanced as to take great injury from broken wet weather. On Saturday, the rivers Tweed and Teviot were again in high flood; after the junction of the two rivers, the water at Kelso Bridge was within eighteen inches or two feet of the height it attained at the heavy flood on Thursday week [i.e. 30 July]; indeed the Tweed itself was rather higher than on that occasion, but the Teviot was considerably less. It is rare to see these rivers twice in such a flooded state within ten days, at this season of the year; and the fact of their having been so will give some idea of the immense quantity of rain that has fallen in the district within that period. The lower parts of the town during these two days have been two three times in a complete pool water, and in some places impassable, from the tremendous thunder showers. On Friday night it rained incessantly, and the lightning flashed continually with fearful violence. Throughout to-day (Saturday) the thunder has been growling at intervals, and there have been some of the heaviest torrents of rain we ever witnessed.

29 Sep 1846

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[**Synopsis:** A severe Leader flood with heavy impact throughout. The severity assessment at Earlston is in part direct and in part based on the report of the August 1895 flood (see later) which refers back 49 years to this event. The severity assessment for the Turfford Burn is inferred from the serious flood reported in the Eden Water; the catchment headwaters about Mellerstain. A very serious flood in the Tweed approaching Kelso but somewhat less so at Kelso Bridge after the confluence with the Teviot. The flood event came after an exceptionally wet summer. See other flood entries above.]

Edinburgh Evening Post and Scottish Standard, Saturday 3 October 1846

GREAT FLOOD IN THE TWEED

The present has been a remarkable year for floods in the Tweed and Teviot. On the 30th of July last, the Tweed, after its junction with the Teviot, was higher than it had been for fifteen years, having reached to within five feet of the celebrated flood of 1831; but the Tweed itself was not much flooded as the Teviot, which latter was considered to have reached its height of 1831. Again, on the 8th of August last, the Tweed at Kelso Bridge reached to within eighteen inches of the flood of the 30th; the Tweed on this occasion was much larger than on the former, but the Teviot was considerably less. On both occasions much damage was done, large quantities of hay ricks, timber, carts, and even sheep, having been carried down the stream.

We have now to notice a third flood, greater than either the preceding ones, which took place on Tuesday. Previous to Sunday last there had been a good deal of rain in this quarter, but the greater part of the latter day was fair, and even fine. During Sunday night, however, it commenced to rain heavily, and continued to do so, almost without five minutes intermission at any time, until Tuesday night. The streams in the vicinity began during the time to show the usual effects, becoming discoloured, and swelling rapidly; and between eight and nine o'clock on Tuesday night, the ~~Teviot~~ Tweed, previous to its junction with the ~~Tweed~~ Teviot was nine inches higher than in 1831, and much higher than in either of the cases above alluded; and even at Mayfield, below Kelso Bridge (although the Teviot was not beyond the size of an ordinary flood) it reached to within three feet of the highest mark of 1831. [SPECIAL INSERTION: It seems that critical words have been transposed. The commentary inserted here summarises conditions in the Tweed and Teviot *upstream* of their confluence at Kelso. In the first flood of the year (i.e. 30 Jul 1846), the Teviot had been especially high and considered comparable to its state in the 9 Feb 1831 flood, whereas the Tweed had been considerably lower than in the 9 Feb 1831 event. In the second flood (i.e. 8 Aug 1846), the Tweed had been 18 inches lower

than in the first flood, and the Teviot considerably lower. In the third flood (i.e. 29 Sep 1846), the Tweed was higher than in the 9 Feb 1831 flood but the Teviot was much lower, with the consequence that downstream of the confluence, at Mayfield in Kelso, the 29 Sep 1846 ... while largest of the year ... was 3 feet lower than in the 9 Feb 1831 flood.] As may be supposed, a considerable amount of damage has been caused. Immense quantities of timber, rural implements, railway sleepers, and other articles, carried away from the lower lying grounds, came down the stream; also several fishing and ferry-boats likewise came down. **The small river Eden, which falls into the Tweed between two or three miles below this, was also in high flood; the tollhouse, and other dwellings at Ednam, were inundated by the bursting of a large drain, and the inmates were compelled to leave them.** *Kelso Mail*.

Caledonian Mercury, Monday 5 October 1846

THE LATE FLOODS

...

GREAT FLOOD IN THE TWEED

... [Repeats the coverage as in the *Edinburgh Evening Post and Scottish Standard* above, again ascribing the story to the *Kelso Mail*. But also reports:]

...

EARLSTOUN—FLOOD IN THE LEADER

On Tuesday last the Leader rose to an alarming height in consequence of the heavy rains, and considerable damage was done. One farmer, we understand, has lost several corn stacks, which were carried down the stream; **a wooden bridge was swept away at Cowdenknowes; at Leaderfoot the bridge over the mill dam, having been undermined by the water, fell while the Galashiels Brewery cart was passing over it;** other casualties we have heard of, but being mere reports, it is unnecessary to detail them. **The river was never known to be so high before.**

Morning Advertiser, Tuesday 6 October 1846

[Has some of the same coverage as above but includes:]

KELSO, Oct. 1.

We have this week to record one of the greatest floods which has taken place in the Tweed for many years. On Monday, about noon, it began to rain, and continued without the slightest intermission till near five o'clock on the afternoon of the following day. The great quantity of rain which fell caused both the Tweed and Teviot to overflow their banks to a great extent. **About eight o'clock on Tuesday evening the flood was at its height, at which time the Tweed was ascertained at Makerstoun to be six inches higher than in 1831.** The Teviot was not unusually large. Much damage has been done along the banks of the river. Immense quantities of timber, rural implements, railway sleepers, and other articles, carried away from the lower-lying grounds, came down the stream. ... The small river Eden, which falls into the Tweed between two and three miles below this, was also in high flood.

Kelso Chronicle, Friday 9 October 1846

NOTICE

At a meeting held here this day, of some of the **principal Sufferers from the Unprecedented Flood of Tuesday,—**

It was resolved to call a Public Meeting on Monday the 12th current, in the Eagle Inn here, at Three o'Clock P.M., of **all the Tenants who have received damage from the overflowing of the River Leader, and its tributaries, to consider the peculiar and unfortunate situation in which the Tenantry farming on their banks are placed.**

All interested in this object are respectfully invited to attend.

Lauder, October 3, 1846.

Edinburgh Evening Post and Scottish Standard, Saturday 10 October 1846

THE FLOOD IN THE LEADER.—One of the sufferers writes as follows: —“Lauder, 7th October, 1846.—The Lauderdale tenantry, who have suffered very much from the late floods, are to meet on Monday next to consider their position. The farm next under me, on the same side of the water, cannot have suffered a loss of less than £1000. The farmer below that again had fifteen stacks of corn taken away with the water, and he had to be rescued from his house with a powerful swimming horse, brought from Whitslaid for the purpose. The Leader was so very heavy that it broke a strong embankment at the back of the [Thirlestane] castle, came right through the haugh to the Earl’s gate, inundated it, took away the bridge, and swept through a field of turnips—a fine crop of swedes. The porter of the gate and family had been taken out of their house by the skylight with ladders, ropes, and horses. I estimate my damage at £150. At the meeting it will be proposed to petition the landlords to bear a part of the loss—say to make an yearly [*sic*] abatement from the rent for the land that has been entirely taken away by the flood.”

[The Porter’s house referred to is the lodge (now demolished) at the Castle’s Eagle gates.]

14 Jun 1859

[**Synopsis:** Severe thunderstorm around Lauder but relatively minor impacts.]

The Berwick Journal, Saturday 18 June 1859

LAUDER

Storm—A severe thunderstorm visited this district on Tuesday, accompanied by a torrent of rain. Such was the violence of the rain that at Lammas Lodge, a streamlet few minutes rose to such a height that it carried off several sheep and lambs. A considerable number were got out before they were carried far, or the loss would have been more serious. As it was, it overflowed a considerable part of a turnip field, causing much damage to the land. The rain only extended to a short distance, many places close at hand not having had any. At Pilmuir, a heavy hail storm swept by, and hail of an uncommon size fell. To add to the casualties of this extraordinary thunder storm, a calf and two sheep were killed by the lightning in the same district.

12 Jun 1860

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[**Synopsis:** A Leader flood with impacts in Lower Lauderdale. But less significant than the 23 Oct 1864 flood, and much less significant than the 29 Sep 1846 flood.]

Caledonian Mercury, Saturday 16 June 1860

The flood of the twelfth

...

The *Border Advertiser* says that in Selkirk and the adjoining districts no such fall of rain has occurred within the memory of experienced observers. The Gala rose to a great height. The direction in which the rain came was not the “sirt” for a high Tweed flood, being south and east. The consequence was, that notwithstanding the almost incessant pouring for about two days, the Tweed at Abbotsford was not above ordinary flood height, although below the junctions of the Gala and Leader it was greatly augmented. It is said that the Leader has not been so high for twelve years back, and in many parts of lower Lauderdale great injury has been done by the washing of the turnpike roads. ... this being really the first flood of the season to do any good by cleansing out the beds of the rivers. [The cross-reference ties in roughly with the 29 Sep 1846 flood a little under 14 years previously.]

23 Oct 1864

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[**Synopsis:** Highest since 29 Sep 1846 on the Leader. Significant impacts at Earlston. Flood came after a very prolonged drought in SE Scotland, which attracted much attention in the *British Rainfall* yearbook.]

The Scotsman, Tuesday 25 October 1864

FLOODS IN THE TWEED AND TEVIOT

Our Kelso correspondent, writing yesterday, says—The Tweed and Teviot have been again brought down in high flood, the Teviot being particularly red and swollen. Large massy branches of trees and quantities of turnips whirling down in the flood told of the frightful devastation that must have been caused by the storm in the river uplands. The loss to farmers along the river banks must be very serious, but we have not as yet learned of any injury to life or property.

EARLSTON

Until within the last few days the Leader and its tributaries have not been in a state of flood since early spring, the former never having risen a foot during the whole summer. On Saturday morning, and during all the day, a very heavy rain fell, and at night it was accompanied by a stiffish wind. By nightfall the Leader was running wild and high, and it continued to increase in volume until a little past midnight, when it began to recede; and on Sunday it still continued in high flood. The river has not been so large since the year of the great flood, 1846; and by midnight on Saturday it continued to rise so fast that a number of persons inhabiting houses on the haughs removed to safer quarters. Judging from the timber that came down, some mill-caulds up the river must have been considerably damaged. A considerable portion of the embankment on the lower portion of the mill-lade of Rhymer's Mill [Earlston] is destroyed; and a fine strong service bridge put up by the railway contractor across the Leader here has been run off, along with two waggons which were left standing upon it as a protection, they being filled with stones as ballast. The land is now very wet; but late turnips and pasture lands will be bettered by the wetting, though perhaps overdosed.

Southern Reporter, Thursday 27 October 1864

THE STORM

...

EARLSTON

The storm predicted last week, and which burst with so much violence on our long line of seaboard—carrying wreck and ruin to many a happy home—was felt even in this inland district; and Saturday, and Sunday, will be long remembered as days of biting winds, and ceaseless pelting rain, raising the Leader and its tributary burns to such a height as has not been witnessed for a number of years; and which has been productive of a considerable amount of damage. The most considerable sufferer is Mr Lawton, railway contractor, whose service bridge across the Leader was totally broken down and a great part of it carried away. To prevent such a catastrophe the men, before dark on Saturday, placed on the bridge five trucks loaded with stones, to keep the bridge, as they thought, down, but no—trucks, bridge, and all went with one fell swoop down the water—one of the trucks getting jammed below the new railway bridge, while others were found a considerable way down the water. The railway bridge, which is in such an advanced state as to be clear of the centres [?], happily sustained no damage. [The

railway bridge itself was undamaged. It was the service bridge aiding its construction that was lost.]

Kelso Chronicle, Friday 28 October 1864

EARLSTOUN

Storm—The storm of last week was of a kind that has not been experienced here for a long time. **The Leader came down in greater flood than it has done since 1846.** Such a height had it reached on Saturday night as to be close at the doors of the houses situated nearest its banks, compelling their inmates to get out of bed at midnight from doubts of their safety. A service-bridge over the Leader erected by the railway contractor was carried away by the flood, and along with it several waggons filled with stones, which had been placed on it with the view of contributing to its staying qualities. Part of the embankment of Rhymer's Mill lade suffered some damage, as also the butts of the Rifle Volunteers on the Early Haugh.

British Rainfall 1864:

Matters were no better in the Border Counties, whence the following statement was received:—“At Kelso, on the 24th, the Tweed was 9½ feet above its ordinary level, great trees and vast quantities of farm produce being floated down. In many instances, the haugh lands are flooded, mills damaged, and one or more bridges carried away. At Haddington, the Tyne rose 12 feet, being higher than it had been for 18 years. In the Pentland Hills, whence the water supply of Edinburgh is obtained, the rainfall for the week ending Sunday, 23rd, was 6.5 in.; while the previous six months had only given about 10 inches. The water company's reservoirs, which had but a few days before been so low that the city had been on short supply, were full almost to overflowing on the Monday [24th]. Neither the previous drought, nor the present floods, have been paralleled for many years.”

The second period of drought, which commenced on September 22nd, continued until October 16th, immediately after which followed the heavy falls for which October was so noticeable. The remarkable disproportion of the October fall to that of all the rest of the year, in the south-east of Scotland, requires special illustration, which is given by the following table, showing some of the most marked cases. It is evident therefrom that at all the stations in the left-hand table at least one-third of the entire yearly depth fell in October. [The stations listed are Smeaton (*aka* Prestonkirk), East Linton, Yester, Haddington and Thurston (near Dunbar) – all from East Lothian, and Mowhaugh and Lilburn from North Northumberland. The period of preceding drought was so extended that soil condition may have accelerated the flood response to the heavy rainfall that arrived in late October.]

The rainfall observer at *Mungo's Walls*, *Dunse* [old spelling of Duns] noted: “This very dry year shows a large rainfall, as from October 19 to 29 there fell 8 in.—just the depth for the 5½ months immediately preceding.”

22 Jul 1867

TT

[**Synopsis:** Notable as an early damaging flood on the Turfford Burn that is specifically reported.]

The Scotsman, Wednesday 24 July 1867

THE WEATHER AND FLOODS

EXTENSIVE DAMAGE TO PROPERTY

...

EARLSTON—The extremely heavy and frequent showers of Sunday, and the uninterrupted rainfall of Monday, brought a high flood into Earlston Burn [*sic*] which falls into the Leader, a little below the town. Such a “spate” has not been witnessed here for many years. All the fields on the banks of the burn, in the neighbourhood of Earlston, were covered with water to a considerable depth. The gatekeeper’s house at the level crossing on the Berwickshire railway, at the east end of the town, and close to the burn, was so flooded with water on Monday night that the inmates were compelled to seek shelter for the night elsewhere. ...

20 Aug 1877

K

[**Synopsis:** A big flood in Edinburgh and the Borders but no great impacts in the Leader.]

Berwick Advertiser, Friday 24 August 1877

LAUDER

The constant rain which fell on Saturday, Sunday and Monday, has laid a great deal of the cereal crops. Several fields have the appearance of being run over with a roller. Potato disease has developed itself within the last three days with great rapidity, the haulms on several garden plots and rigs being completely blackened. **On Monday night the Leader was in full flood.**

Mossman (1900), [in Edinburgh]:

August 18 to 22. Very heavy and continuous rain with east (N.E. to S.E.) winds, 7.07 inches fell in the five days, the amounts for each of the days being as follows, 18th, 1.54 inch; 19th, 0.89 inch; 20th, 1.88 inch; 21st, 1.96 inch; 22nd, 0.80 inch. The Water of Leith overflowed its banks, houses in Warriston Crescent being flooded to the depth of 7 feet. All over the town extensive inundations took place in low-lying situations.

28 May 1878

[**Synopsis:** Severe but localised thunderstorm leading to flooding of the Lauder Burn.]

The Scotsman, Thursday 30 May 1878

A severe thunderstorm passed over the Lauder district on Tuesday. On the farm of Muircleugh three ewes and a lamb were killed. A waterspout burst near to the same farm, and did a great deal of damage. For a considerable distance the march dyke* between the burgh lands and Muircleugh was swept off. An area of three or four acres of growing grain was flooded, and the crop spoiled. **Lauder Burn came down in full spate**, and a little boy who was playing in the haugh below the manse narrowly escaped being carried away by the flood, only saving himself by holding on to a bush till assistance reached him.

[Royal Commission on Ancient and Historical Monuments and Constructions of Scotland, 1915. Sixth report and inventory of monuments and constructions in the County of Berwick (revised issue), Edinburgh, 176pp:.

*Ancient marches or dykes.—In Berwickshire, as in Galloway and other parts of the south of Scotland, there are a number of ancient marches or dykes which often can be traced for a considerable distance across country where they have not interfered with agriculture. They are usually formed of earth thrown up from the ditch which runs alongside the base.]

5 Mar 1879

[**Synopsis:** McEwen incorrectly lists 6 March 1879 as a notable Tweed flood at Kelso. It wasn't that special. The "rise of six feet" was presumably from a modest base.]

The Scotsman, Thursday 6 March 1879

FLOOD ON THE TWEED

Yesterday the Tweed and its tributaries came down in high flood, the Tweedometer at Kelso Bridge marking a rise of six feet. The spate will greatly facilitate the ascent of clean salmon and the returning of kelts seawards. The Ettrick and other tributaries of the Tweed are heavily flooded.

9 Jun 1879

[**Synopsis:** Severe thunderstorm after more general rainfall, but not a major Leader flood.]

Southern Reporter, Thursday 12 June 1879

LAUDER

Severe Thunderstorm—A Cow Killed— Monday last this district was visited by one of the most severe thunderstorms experienced for some years. Shortly after noon the storm commenced and continued without interval till after five o'clock. The lightning was very vivid, the thunder peals startlingly [*sic*] loud, and the rain descended in torrents, causing considerable damage to some of the turnip drills. At Carfrae Mill, a valuable cow, belonging Mr Henderson, was struck by the electric fluid and killed instantaneously. The loss of the animal is covered by insurance.

Berwickshire News, Tuesday 17 June 1879

EARLSTON

Thunderstorm.—On Monday afternoon a severe thunderstorm was experienced in this district. The thunder peals which were loud and long, and the vivid flashes of the lightning seemed to be simultaneous, and had a most startling effect. The storm seemed to be travelling from south to north. It was accompanied by a heavy fall of rain, and a shower of unusually large hailstones. The lightning struck trees on the farms of Georgefield and Fans, and a sheep and cow were reported to be killed by it in the neighbourhood. **The Leader came down in full flood in the evening.** The weather ever since has been close and warm, and vegetation is making rapid progress. On Thursday and Sunday heavy rain also fell. Sunday evening was very close and sultry.

14 Jul 1879

[**Synopsis:** A significant flood in the Water of Leith; the one that Reed (2002b) failed to pinpoint. But nothing much in the Tweed.]

The Scotsman, Tuesday 15 July 1879

THE WATER OF LEITH FLOOD

As the result of the heavy rainfall, the Water of Leith came down early yesterday morning in high flood, and kept waxing in size till about four o'clock in the afternoon. In consequence portions of the river banks and retaining walls in and near Edinburgh gave way, with the result that several gardens and other grounds were completely flooded. At Coltbridge, we understand, a market gardener is a severe sufferer through his glass-houses and garden crop having been

washed away. In the village of Water of Leith the stream, when at its highest, came within a few yards of some of the dwelling-houses; and it was said by some of the natives that this was only the second time in twenty or thirty years that the water had risen so high. ...

...

KELSO

In the Kelso district there was an incessant fall of rain for forty hours, with a cold north-east wind. Yesterday forenoon the showers were heavy at intervals. In the evening the Tweed marked a rise on the Tweedometer of six feet, with a rising water, and the rain still falling.

British Rainfall 1879

Observer note in July: 14th.—*North Esk Reservoir* ... Great flood, doing much damage. ... 6.40 inches in July at Marchmont House (NE of Greenlaw) after a wet June.

10 Mar 1881

LL

EE

KKK

[**Synopsis:** An exceptional snowmelt and rainfall induced flood affecting many large rivers, including the Tweed. Some ice flows. Just above its confluence with the Teviot, the Tweed flood was reported to be 6 inches higher than in February 1831. *Southern Reporter* of Thursday 24 September 1891 indicates that Leader was worse on 21 Sep 1891 than on 10 Mar 1881. Reports from Earlston and Lauderdale mention severe dislocation due to snow and wind but no explicit mention of flooding in Lauderdale found beyond a drowning at Earlston. It is prudent to accept the SEPA (2014b) assertion – see Section 7.4 below – that the “1881” flood at Earlston was lower than 12 Aug 1948 but higher than the 3 Nov 1984 event. It would be good to see the source information held by SEPA and to confirm that it relates to 10 Mar 1881.]

Southern Reporter, Thursday 10 March 1881

[Severe flood from Gala Water. Explicit reports from Earlston and Lauderdale mention severe dislocation due to snow and wind but no mention of flooding in Lauderdale.]

Berwickshire News, Tuesday 15 March 1881

EARLSTON

Boy Drowned.—On Thursday forenoon last, a great sensation was produced in this town the news that little boy had fallen into Haughhead mill-dam and been drowned. The news proved only too true. The little boy ... had been amusing himself with some playmates at the dam, where it is crossed by a small bridge, and losing his footing had fallen on the upper side of the bridge. The cries of his companions brought to his aid a young man who was near. He did his utmost to reach the little fellow, but was unsuccessful. **The dam, running very full from the flooded state of the Leader and its affluents**, quickly carried the body down.

Berwickshire News, Tuesday 15 March 1881

PAXTON [←Just upriver from Berwick]

The Tweed.—The rise of the river on Thursday morning was the greatest here since 1831. A stone in Tweedhill grounds marks the height that year. **In August, 1877, the rise was marked in Paxton grounds, but on Thursday last the water was three feet higher than the latter mark.**

Southern Reporter, Thursday 17 March 1881

Great and disastrous floods

No matter how heavy a snowstorm, no matter how severe a frost, no matter how great a flood, there is always somebody to tell us of the occurrence of something of the kind as great, if not greater, within their recollection. But it seems as if both living memory and tradition are at a

loss for a precedent to the great floods which were devastating the Border counties of Scotland last week. Notwithstanding occasional partial thaws, vast quantities of snow had been lying all along the Border ranges since the heavy falls of the second week of January, and this was added to by about six inches of even fall on the 4th and 5th of this month—the latter storm being accompanied by a gale, and drift, and consequent blockading of railways, and disasters on the sea coast, which will cause it long to be remembered and spoken of. A thaw—the first really decided change to freshness of the year—set in with the beginning of last week, before which the snow melted off with remarkable rapidity, and the main rivers and their tributaries were rising into flood on Tuesday. On Wednesday there was a heavy and continuous rainfall and a strong fresh wind to hurry on the melting of the snow, and in the afternoon the rivers had already been swollen into what was looked upon as great flood size. But this was nothing to what was coming. After nightfall the rush increased with fearful rapidity, and by nine o'clock the Yarrow, the Ettrick, the Tweed, and the Gala, with every rivulet by which they are fed, had run to a height never before seen by that venerable personage “the oldest inhabitant” (whoever he may be), and were carrying destruction in their course to an extent of which the past has no record, and of which the present shrinks from estimating.

KELSO. Not since the great flood of 1831 has the Tweed risen to so great a height as it did at an early hour on Thursday morning. Till Wednesday morning the river was comparatively little affected; but as the day advanced it rose gradually, and by the afternoon the Tweedometer above Kelso Bridge indicated rise of nearly seven feet above summer level. By ten o'clock in the evening the waters had overflowed the banks in many places, covering Teviot road and Mayfield road, and sweeping on with force which threatened great damage. With increasing rapidity the river continued to rise till two o'clock on Thursday morning, when the flood was at its height—fourteen feet above the ordinary level, or only some twenty two inches under the flood of 1831. On Floors grounds, however, the flood marked six inches above that of 1831, and the lower depths registered at the Tweedometer is accounted for by the fact that the Teviot was not so greatly swollen on that occasion.

British Rainfall 1881, March 1881 note by observer at Abbey Gate, Melrose:

A good deal of S[now] fell at the beginning of the month, and being accompanied by high wind blocked all the railways in the district; it was followed by R[ain], which, with the melting S[now], caused the Tweed to rise higher than at any other time since 1846, destroying much property.

Southern Reporter, Thursday 8 June 1882

County Meeting—The annual meeting of the Commissioners of Supply for the purpose of allocating the bridge money for the year was held here on Tuesday—the Marquis of Lothian presiding. The Clerk intimated that he had received two applications for bridge money, one for an additional grant of £34, 2s in connection with the bridge at Glendouglas, the Jedwater Road, and the other for £50 towards the erection of a foot suspension bridge over the Leader, near Earlston, the former bridge having been carried away by floods of ice the other year. It was explained that the Earl of Haddington had contributed £20 towards the Earlston bridge. After some conversation both applications were granted.

Southern Reporter, Thursday 24 September 1891

[This is a retrospective mention of the 10 Mar 1881 flood when reporting the 21 Sep 1891 event→.] 1881 was the year of floods in the southern counties equally as memorable as those of this week. These were on the night of Wednesday and Thursday the 9th and 10th of March, 1881. Snow had been lying deep, a thaw set in, and a great rainfall followed. What between the deluging rain and the fast-melting snow the rivers and burns throughout the whole southern

division of Scotland were raised to a higher level than had been seen for half-a-century, and the damage then done was immense. **It may be that the streams falling into the northern side of the Tweed—such as the Lyne, the Caddon, the Gala, and the Leader—may have been as high or even higher on Monday [i.e. 21 Sep 1891] last than they were in March 1881,** but those flowing into the main river on the southern side—such as the Ettrick and Teviot were not in specially noticeable flood, **and this accounts for the Tweed being not so high by 2½ feet as it was in the 1881 floods. Then the Tweed at Kelso Bridge was 14 feet above summer level.** The maximum rise of the river at the same place on this occasion was 2½ feet (11½ feet) below that.

W.M. (1905):

[Written 24 years after the event, and anonymously, this account merits somewhat less weight than the more contemporary reports.]

In a severe winter the Border valleys are noted for their low temperature. Indeed, it is stated that the minimum temperature recorded for Great Britain was recorded in the southern part of Berwickshire during the memorable frost of January 1881. A winter such as that (1880-81) is fruitful in experiences to be remembered for a lifetime. The snow lay deep not only on the hills but over the whole district. The frost was intense, the thermometer on several nights falling to 10, 16, 18, and even 20 degrees below zero, and every pond, burn, and river was ice-bound. **In the early spring came a flood which, on Tweed at least, was heavier than any previously recorded, and enormous damage was done at many places on the banks of that river.** [The temperatures quoted above are in °F, and correspond to temperatures of -23, -27, -28 and -29 °C.]

22 Sep 1881 L E T

[**Synopsis:** Not as large a Leader flood as on 10 March 1881. Some flooding from the Turfford Burn.]

THE WEATHER AND CROPS

Jedburgh

What the result will be of the heavy rain generally experienced throughout Scotland on Wednesday and Thursday last probably cannot yet be estimated with accuracy, As a consequence of the heavy rains, floods have been in many localities. ...

Kelso:—**The Tweedometer at Kelso on Thursday night indicated a rise of about six feet.** ...

Berwickshire News, Tuesday 27 September 1881

EARLSTON

The Weather.—Last week was very unfavourable for harvest work, and very little work was done, owing to the continuous rains. On Wednesday evening rain fell heavily, and continued to do so until Thursday evening without intermission. **The Leader and its tributaries were in high flood—the Trufford Burn was especially in great volume.** ...

Woman Found Drowned.—On Friday forenoon the dead body of a woman was found in the burn that joins the Leader near to the town. ... **She was seen walking by the side of the burn the previous day which was exceedingly wet, in consequence of which the burn was in high flood.** How the unfortunate woman got into the burn can never be certainly known, but a strong impression prevails that she committed suicide by throwing herself into it. It is reported that

she had suddenly and unaccountably left her home at Stow and come to Earlston, where she had been only some eight or ten days before her death.

Southern Reporter, Thursday 29 September 1881

EARLSTON

Harvest.—Cutting, though much retarded by the continued wet weather, is progressing, and on several farms the corn will all be in stack by the end of the week. There was little done through the whole of last week, the heavy rains putting a complete stop to all outdoor labour, while the damage done to the crops, cut and uncut, will be difficult estimate. “Leading” is still a work of the future, a few stacks in the barnyard of Earlston Mains being all the grain we have up to the beginning of this week seen secured. The heavy rainfall of last Wednesday afternoon and Thursday brought down the Leader in high flood, **carrying along with it uprooted trees** and sheaves of corn from the upper haughs. In the course of Thursday afternoon **the water was nearly as high as it was at the break of the storm last winter** [i.e. 10 March 1881]. **The burn** [i.e. Turfford Burn] **also was very high, the Horsemarket Green being all under water.**

12 Aug 1884

[**Synopsis:** A famous thunderstorm but no report found of flooding in the Leader.]

Edinburgh Evening News, Thursday 14 August 1884

THE LATE LORD LAUDERDALE

Further particulars of the accident to the Earl of Lauderdale, who, as previously reported, was injured by lightning on Tuesday and died the same night, show that his lordship, along with two keepers, had gone out shooting on the moors on the Twelfth to Broadshawrig, one of his sheep farms in the Lammermoor. [Broadshawrig is in the upper reaches of the Blythe Water which drains into the Boondreigh Water.] They were overtaken at one o'clock by a severe thunderstorm. While they were making their way for shelter to the farm-house and when about 150 yards from it the lightning struck his lordship, who was riding on a pony. The pony was killed instantly, and the Earl was thrown to the ground. The keepers were within three yards and felt the electric shock distinctly. They picked up his lordship, believing him to be dead. His hat was rent to tatters, and his watch and chain fused. After being laid down in the house he began to show signs of life, and gradually recovered so far as to recognise his keeper and express his gratitude. However, he never rallied much more, and died soon after midnight. His lordship had only been six years in possession of the estates. He was among the first landlords to give permission to his tenants to kill all ground game. He also made liberal abatements on the rents of his tenants. The news of his lordship's death in such a tragic manner caused much regret. He was twelfth earl, and was hereditary standard-bearer of Scotland and deputy-lieutenant of Berwickshire. He was born in 1822, and succeeded his cousin Thomas the eleventh earl in 1878. He took no part in politics, although he had Conservative leanings. The late Earl is said to have been at one time a goods guard on the Exeter Railway.

Jedburgh Gazette, Saturday 16 August 1884

Three sheep, the property of Mr Wilkinshaw [Walkinshaw?], of Burnfoot, Lauder, were killed by the lightning.

Kinross-shire Advertiser, Saturday 16 August 1884

DISASTROUS THUNDERSTORM

A thunderstorm of singular severity passed over the greater part of Scotland on Tuesday. The atmospheric conditions favourable to the production of thunderstorms appear to have

developed themselves with remarkable rapidity and intensity during Monday night, for the storm broke out in the south as early as six on Tuesday morning, travelled to the north, east, and west, and burst over Edinburgh with almost unsurpassed violence at half-past nine. It had only partially passed over by four in the afternoon. During several hours the lightning was intensely vivid and the flashes recurred with almost unexampled frequency. The thunder between ten and one o'clock was most alarming. From 11.30 to almost noon a strange darkness prevailed, so deep and so widely experienced that it is regarded as one of the most remarkable features of the storm. The rainfall was excessive, and was accompanied with heavy showers of hail. Much flooding and several minor casualties are reported in Edinburgh. While out shooting near Lauder, the Earl of Lauderdale was struck with lightning, and so severely injured that he died the same evening. His pony was killed on the spot, but the keeper escaped. The storm raged over a wide area of country, and there are reports of loss of life, loss of cattle, and much damage by flooding. The storm was the most severe experienced in Scotland since July 1873, and, in some respects, was even more alarming than that witnessed then. On Tuesday night there was much lightning and some thunder; and early on Wednesday morning the atmosphere was very sultry, and the sky heavily overcast.

Mossman (1900):

During recent years, the severest storm experienced was that of August 12, 1884, when the Earl of Lauderdale was killed.

1884 Thunderstorm August 12. **Thunderstorm of tropical severity for several hours. The storm was general over the country. Very heavy rain fell.**

12 Aug 1890

TTT

[**Synopsis:** An exceptional summer storm having high impact, especially on the Turfford Burn at Earlston. A serious flood on the Gala Water but no evidence found of major impacts from the Leader.]

Edinburgh Evening News, Wednesday 13 August 1890

FLOODS ON THE BORDERS

In consequence of yesterday's heavy rain the Gala rose rapidly in flood, and early this morning at Stow reached an exceptional height. All the adjoining haughs and some of the low lying roads are submerged. A good deal of damage has been done to hay standing in ricks on the banks, a considerable quantity being swept away. At midday the river was falling. It has not been so high for nine years.

Our Border correspondent writes to-day: The downpour of rain which commenced on the Borders yesterday continued last night and till this forenoon, when the weather cleared. The cereal crops, which in some parts of Roxburghshire and Berwickshire are ready for cutting, have suffered severely, especially where there was a good bulk of straw. Hundreds of acres are so badly laid that it will be impossible to cut the crop with a reaping machine, and it will be necessary to reap it by hand. A large portion of the grain crops have, however, withstood the storm wonderfully well. The Tweed, and all its tributary streams, especially the Gala, are in high flood. At the gauge at Kelso Bridge this forenoon the Tweed registered four feet above the normal height of the river. Some haugh lands are flooded. **On the Berwickshire railway between Gordon and Earlston a considerable length of the line is under water to a depth of nearly a foot**, and trains this morning had to proceed with great caution over the inundated

portion. In the neighbourhood of Kelso the line early this morning was under water for a considerable distance, and at Fountainhall the station was nearly surrounded with water. The rainfall at Abbey Gate, Melrose, during the 24 hours to ten o'clock this morning, was 2.47 inches ...

Edinburgh Evening News, Thursday 14 August 1890

FLOODING AT EARLSTON. The heavy rainfall which prevailed on the Borders caused much damage in the Earlston district. The Leader and its affluents were in full flood, and the Trufford burn overflowed its banks, doing much damage to the crops, especially on the farm of Georgefield, tenanted by Mr David Allan. The saw-mill premises of Messrs Brownlie and the skinnery of Mr Sanderson, situated on the banks of the burn, have been also much damaged. Much wood from the saw-mill, and many skins and a quantity of wool from the skinnery, were swept away, and a large shed connected with the latter was all but wrecked. The gas works, situated close to the Burn, were inundated, and the water getting into the retorts, the manufacture of gas was summarily stopped. The railway a little to the east of the town was also considerably damaged by the water, which washed away the ballast from between the sleepers, rendering it a somewhat critical business for the early trains to pass over the metals. The bowling-green presented the appearance of a small lake.

The Scotsman, Thursday 14 August 1890

EXTRAORDINARY RAINFALL AND DAMAGE BY FLOODING

...

A Marchmont correspondent writes:—On Saturday the 9th a change of weather took place and on the following days the rainfall was quite unusual in this district. Saturday, 9th, .05 in. fell in four hours; Sunday, 10th, .75 in. fell in twelve hours; Monday, 11th, .21 fell in twenty hours; Tuesday, 12th, 2.10 in. fell in eighteen hours—3.11 in. [in total] Between twelve noon and two o'clock on Tuesday 1.40 in. fell. Such a heavy rain has laid all the heaviest cereals, doing much damage. [This is Marchmont House to the NE of Greenlaw: a long established primary site returning rainfall and other met data from 1867 to 1980. The rainfall depth published in *British Rainfall 1890* for August was 5.92 in., very much above average.]

...

From Kelso it is reported that an exceptionally heavy fall of rain was experienced in that district between Tuesday night and yesterday morning, and considerable damage was done by flooding all over the district. The roads were in some places rendered impassable. The Tweedometer at Kelso Bridge registered 5 feet of flood water, and the rivers were still rising.

An Earlston correspondent writes:—On Tuesday rain fell incessantly, accompanied now and then by thunder and lightning. After dark the rain poured in torrents. The Trufford Burn, an affluent of the Leader, overflowed its banks, and poured over the adjoining fields, causing much damage. Ricks of hay on the banks were swept away, and these blocking up the narrow bridges by which the railway and the road cross the burn, the waters forced a passage for themselves. The cottage at the level crossing near the town was filled with water to the depth of nearly three feet and the inmates had to leave precipitately, and find refuge with neighbours at a safe distance from the flood. The gasworks, too, situated close to the burn, were inundated, and the water getting into the retorts, the manufacture of gas was summarily stopped. The sawmill premises of Messrs Brownlie and the skinnery of Mr Sanderson also suffered much from the flood, being situated on the very bank of the burn. Much wood was carried away, and a large shed in the skinnery was all but wrecked, many pelts and a quantity of wool being swept off by the flood. The railway a little to the east of the town was also considerably damaged by the water, which washed away the ballast from between the sleepers, rendering it a somewhat critical business for the early trains to pass over the metals. A staff of men was speedily got

together, and the road put into a condition of security. **The flood has been more disastrous than any that has occurred for a long time.** The crops on the farm of Mr Allan, Georgefield, which borders the burn, have suffered considerably. The bowling-green in the east end of the town is still submerged, presenting the appearance of a small lake ...

Southern Reporter, Thursday 21 August 1890

EARLSTON

DESTRUCTIVE FLOOD —On Tuesday of last week rain fell incessantly, accompanied now and then by thunder and lightning. After dark the rain poured in torrents; **the Trufford burn tributary of the Leader overflowed its banks and poured over the adjoining fields, causing much damage.** Ricks of hay on the banks were swept away, and these blocking up the narrow bridges by which the railway and the road cross the burn the waters forced a passage for themselves. **The cottage at the railway level-crossing near the town was filled with water to the depth of nearly three feet, and the inmates had to leave precipitately and find refuge with neighbours.** The gasworks, situated close the burn, were also inundated, and the water getting into the retorts the manufacture of gas was summarily stopped. The sawmill premises of Messrs Brownlie and the skinnery of Sanderson suffered much from the flood, being situated on the very bank of the burn. Much wood was carried away, and a large shed in the skinnery was all but wrecked, many pelts and a quantity of wool being swept off by the flood. The railway a little to the east of the town was considerably damaged by the water, which washed away the ballast from between the sleepers, rendering it a somewhat critical a business for the early trains to pass over the metals. A staff of men was speedily got together and the road put into a condition of security. The crops on the farm of Mr Allan, Georgefield, which borders the burn, have suffered considerably. The bowling green in the east end of the town was submerged and presented the appearance of a small lake. **This flood has been more disastrous than any that has occurred for a long time.**

British Rainfall 1890

[August] 12th and 13th.—*Melrose, Abbey Gate* (XII). L, T and heavy R, 2.47 in. falling in 24 hours, and 1.45 in. in 11 hours; total for the two days, 2.54 in.

[Rainfall depths for 24 hours ending 09:00 on 13 August:]

St. Boswell's (Elliston)	2.35 in.
Kelso (Springwood Park)	3.51
Melrose Asylum n. g.	2.25
Gorebridge (Middleton)	2.66
Liberton (Alnwick Hill Res.)	3.51

[The two sites registering 3.51 inches in one day are respectively 33 km NW and 25 km SE of Lauder. Given the readings at St Boswells, Kelso and (see above) Marchmont House, it is clear that both the Leader and Turfford Burn catchments experienced exceptional rainfall on the 12th, and the earlier rainfall (see above at Marchmont House) will have helped to prime the catchment. The raingauge at Cowdenknowes began reporting measurements in 1890 but its long-record series used by McEwen (1985) was only digitised from 1898.]

21 Sep 1891

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[**Synopsis:** An exceptionally high impact Leader flood, especially at Lauder and upstream. Very widely reported. Aggravated by the preceding weeks being very wet.]

Scotsman, Tuesday 22 Sep 1891

The storm of wind and rain which began on Sunday ... The abnormal rainfall sent the rivers down in flood, some of them even surpassing the flood marks of 1846. [No clear mention of which rivers. Edinburgh didn't get it as bad as elsewhere in SE Scotland.]

The Scotsman, Wednesday 23 September 1891

At the North Esk reservoir ... the average annual rainfall is 38 inches. In the forty-six hours ending at seven o'clock yesterday morning, there was registered a fall of 5.20 inches. [North Esk Reservoir is about 26km W of Soutra.]

Southern Reporter, Thursday 24 September 1891

GREAT AND DISASTROUS FLOODS

Consequent on a prolonged rainstorm and severe gale, the third week of September, 1891, will long be remembered as one of fearful disasters in Scotland, and in many parts of England as well. Without any material barometrical indications, there was a sudden change in the weather conditions early on Sunday morning. From Thursday the 10th till Sunday the 13th of the month the weather was abnormally warm for September. On Monday the 14th a good deal of rain fell, and the temperature lowered immediately. From Tuesday till Saturday night, however, the weather was to be described as "fine," and, to the ordinary observer, there appeared no signs of such a coming heavy and prolonged rainfall and gale as that which has so terribly marked the first two days of this week. **About one o'clock on Sunday morning rain set in, and the fall may be said to have been continuous for nearly forty hours.** Then, about ten o'clock on Sunday night the wind suddenly burst into a gale, and raged furiously for the following twelve hours. By mid-day [on Monday] the gale had greatly moderated, and the rainfall lessened, and by nightfall the storm had passed off. **This was the weather experience in Selkirkshire, and would seem to have been that of most other places affected.** At Selkirk, however, the storm, though quite as prolonged, was nothing like so violent as in other places—notably the more northerly counties of Mid-Lothian and Peebles and the upper part of Berwickshire. Indeed, the storm as experienced in Selkirkshire can scarcely be said to have been exceptionally severe—as storms off the east or north rarely are. Thus the Etrick and Yarrow, though running full, did not anything like reach the height they had done three weeks previously—on Tuesday, the first of the month, when the Etrick at Selkirk was running as high as it had been seen for ten years.

1881 was the year of floods in the southern counties equally as memorable as those of this week. These were on the night of Wednesday and Thursday the 9th and 10th of March, 1881. Snow had been lying deep, a thaw set in, and a great rainfall followed. What between the deluging rain and the fast-melting snow the rivers and burns throughout the whole southern division of Scotland were raised to a higher level than had been seen for half-a-century, and the damage then done was immense. [←This text was a scene-setter comparing the current 21 Sep 1891 flood with the 10 Mar 1881 event.] **It may be that the streams falling into the northern side of the Tweed—such as the Lyne, the Caddon, the Gala, and the Leader—may have been as high or even higher on Monday last than they were in March 1881,** but those flowing into the main river on the southern side—such as the Etrick and Teviot were not in specially noticeable flood, **and this accounts for the Tweed being not so high by 2½ feet as it was in the 1881 floods.** Then the Tweed at Kelso Bridge was 14 feet above summer level. The maximum rise of the river at the same place on this occasion was 2½ feet (11½ feet) below that. The losses, especially to farmers, by this latter flood must necessarily be much greater than was experienced ten years ago, because of the ripening crops being submerged or carried off, as they have been in many instances. We do not here give the distressing details of the damage done and the losses sustained, as these are more or less fully spoken of by our correspondents.

Southern Reporter, Thursday 24 September 1891

GREAT AND DISASTROUS FLOODS

LAUDER

The Leader rose rapidly, and reached its highest point about nine o'clock on Monday morning, carrying away in its course bridges, corn, live stock, and indeed every impediment, and endangering many lives. Twelve feet of rise is the calculation. The keeper of the Eagle Lodge at Thirlestane and his wife were rescued from a perilous position in the early morning, the house being flooded several feet deep, and the water racing through the gateway. The haughs were one sea of turbid water. The principal bridge destroyed was that at Boon, of two arches, and of stone masonry; and several others are gone. News continue coming in of losses and damage done. The farmer of Nether Howden has lost heavily in sheep—three or four scores, it is said. Among other losses are—Lylestone, ten acres of grain have been swept away; The Haugh [presumably Lauderhaugh], both sheep and grain; St Leonards [SE from Lauder] and Bridgehaugh [E from Blainslie], a great deal of grain has been swept away. In Thirlestane Castle grounds many fine old trees have been uprooted and large branches strewed everywhere. Within twelve miles on the course of the Leader eleven bridges have been carried away.—Our Blainslie correspondent writes:—Bridgehaugh Mill was entirely surrounded, and the water stood five feet deep in the mill. The miller has sustained great loss, having had his whole crop of corn and potatoes entirely swept away. It was with difficulty that his horses, cows, and pigs were saved, and he and his man had narrow escapes from drowning. He will have lost over £100. The loss to Chapel estate is estimated at between £1000 and £2000. The farmers having crops standing in stook along the valley within sweep of the flood have lost all, and sheep, calves, pigs, reapers, trees, tables, chairs, &c., were to be seen floating down with the current at Blainslie.

Glasgow Herald, Thursday 24 September 1891

THE RECENT STORM

LOSS OF SHEEP IN LAUDERDALE

Reports to hand from Lauderdale show that the effects of the rainstorm and flood there have been of an unusually serious and distressing character. As already reported, nearly all the bridges on the Leader, for the most part built of stone and lime or iron, have been swept away or wrecked. There is, indeed, only one bridge remaining intact above Lauder, that at Carfrae mill. The bridges at Boon, Whitslaid and other places have gone down, and that at the Eagle Lodge was saved only through relieving the great pressure upon it by excavating a track for the escape of the surging waters. It is estimated that it will take from £5000 to £6000 to repair the damage done to the roads and bridges alone in Lauderdale. Sheep flocks have suffered greatly. So far as ascertained, from 200 to 300 sheep have been drowned. Nether Howden [E of Oxton] and Adinston [*sic*] have lost about four score sheep and lambs apiece, and no doubt in the absence of details this loss in Upper Lauderdale may fairly be taken as representative of what occurred in the lower part of the valley. The grain crop in stock and root crops also form a very considerable part of the farmers' loss. Whole fields have been carried away, and it is reported that on one at least of the smaller farms there is scarcely a sheaf of oats left. A good deal of damage was likewise done in houses by flooding. In consequence of the fall of the bridge at Stow all mail and passenger traffic for Lauder is now being conducted via Earlston.

Berwick Advertiser, Friday 25 September 1891

THE FLOODS IN LAUDERDALE

Reports to hand from Lauderdale show that the effects of the rain storm and flood in that district have been of a most serious character. Nearly all the bridges on the Leader have been swept

away or wrecked. Indeed above Lauder only one bridge, that at Carfrae Mill, remains intact. The bridges at Boon, Whitslaid, and other places have gone down and that a [sic] the Eagle Lodge was saved by cutting a track for the escape of the surging water. It is estimated that it will take from £5000 to £6000 to repair the damage done to roads and bridges alone in Lauderdale.

EARLSTON

Heavy rain fell without ceasing on Sunday and continued throughout Monday. **This brought down the Leader in higher flood than has been seen since 1846.** Trees, bushes, wood from the sawmill, stooks. &c., were swept away in great quantities. The people living in a house near the dye-work had to evacuate the premises. At the factory and the dye-house the overflowing water prevented work being carried on during Monday.

The Scotsman, Friday 25 September 1891

BERWICKSHIRE, ROADS TEMPORARILY SHUT

Notice is hereby given, that the following roads in the West District of Berwickshire ... in consequence of the recent floods, have been shut up until further notice, viz.:-

- (1.) Road, leading from the road between Lauder and Earlston, near St Leonard's, to Boon, from the point where the road branches off to St Leonard's Mill, to the other side of the Leader;
- (2.) The Oxton road from its junction with the Edinburgh and Lauder road, near Annfield Inn, to Braefoot; and
- (3.) The road from High Cross to Carfrae Mill **for the distance of 100 yards on either side of Longcroft Burn** [←an alternate name for the Cleekhimin Burn].

Geo. Rankin, Joint Clerk, West District Committee, Lauder, 23d September 1891.

Southern Reporter, Thursday 22 October 1891

EARLSTON

ANGLING ASSOCIATION. —At a public meeting in the Templar Hall Friday evening —Mr George Wood in the chair—**an angling association was formed**, of which Mr William Binnie was elected secretary, and Mr George Pringle, treasurer. ... The members of the association will also make it their business to see that in the **reconstruction of the cauldts at Leaderfoot and Earlston, destroyed by the recent flood**, fish ladders be provided (in accordance with the Tweed Acts), whereby salmon may have free access to the upper reaches of the Leader.

Berwickshire News, Tuesday 19 July 1892

BERWICKSHIRE COUNTY COUNCIL

A SPECIAL MEETING of the COUNCIL the COUNTY of BERWICK, will be held in the TOWN HALL, DUNS, MONDAY, 25th July, 1892, 10.15 a.m. for the purpose of considering, and, if thought fit, of approving of a resolution by the County Road Board, dated 15th December, 1891, **to re-construct the following Bridges destroyed by floods in the West District, viz. :—(1) Cleekhimin Bridge, (2) Annfield Inn Bridge, (3) Hartside Bridge, and (4) Boon Bridge**, also to approve of a resolution to be passed by the said County Road Board at a Meeting on 25th July current, **regarding the increased estimated cost of rebuilding said Bridges**. GEO. HOUSTOUN-BOSWALL, Convener, J. WILSON, County Clerk. County Clerk's Office, Duns, 16th July, 1892.

[Annfield Inn Bridge is an old bridge across the Headshaw Burn, carrying a side road off the A68 to Carfrae (as opposed to Carfraemill). Gilvear and Milner (2008) provide a photo. Hartside Bridge is presumably over the Mountmill Burn or its tributary, close to Hartside.] These three bridges are all over tributaries of the Upper Leader. Boon Bridge is over the Leader immediately downstream of its confluence with the Boondreigh Water.]

British Rainfall 1891:

20/21 September 1891 note by observer at *Abbey Gate, Melrose*:

The Tweed has been known 4 ft. higher, but its tributaries the Gala and Leader have not been so high in living memory.

20 September 1891 note by observer at *Gorebridge, Middleton*:

Terrible gale and 3.35 in. of R[ain], causing great and destructive floods.

MARCHMONT HOUSE.—August and September were extremely wet, 13.00 in. of R falling in the two months. Destructive floods occurred injuring roads and bridges, and carrying away sheep.

Loney (1891):

Marchmont House: 6.36 inches in August 1891 (inc. 1.80 on 17th) and 6.64 inches in September 1891 (inc. 2.04 on 20th).

Berwickshire News, Tuesday 29 November 1892

MEETING AT EARLSTON

Colonel Hope of Cowdenknowes, County Councillor for Earlston District, addressed his constituents in the Corn Exchange on Wednesday. Mr Allan, Georgefield, was called to the chair. After a few preliminary remarks from the chairman, Colonel Hope gave a brief *resumé* of the work of the Council for the last three years. ... He also alluded to the great expense caused by the floods of last year destroying so many of the bridges in this district. He contended in the Council for sharing of the whole County in their re-construction, but was outvoted.

Richardson (1892):

On 21st September 1891 the Tweed rose 11 feet above its normal level at Melrose Bridge (opposite The Pavilion), as shown on the flood-gauge on the Bridge. On Sunday, 20th September 1891, heavy rain fell all day and night, and next day the rain continued, accompanied by a violent storm of wind from the north-east. Fields and meadows on both banks of the river were flooded, and the Tweed acquired the dimensions, strength, and appearance of an arm of the sea with a strong tide running. The Gala, Leader, Leithen, and other tributaries of the Tweed, were in greater flood on 21st September 1891 than had been known for many years.

Thomson (1902):

One of these birds [a common tern] was captured, running with a broken wing, in the field near the Eagle Gate [Thirlestane], during the storm of 1891, when the Leader came down in full flood, filling the whole vale with its outspread waters.

[The same quote appears in an unattributed article on *Wild life of Lauderdale* relating unusual seabird arrivals. *Berwickshire News*, Tuesday 15 January 1924.]

5 Aug 1895

TTT

[**Synopsis:** A devastating flood on the Turfford Burn. On top of the 12 Aug 1890 and 21 Sep 1891 events, this probably explains why drainage improvement works on the Turfford Burn finally gained traction.]

The Scotsman, Wednesday 7 August 1895

THE FLOODING AT EARLSTON

It is forty-nine years since there was such serious flooding as was experienced at Earlston on Monday night. There had been frequent showers during the day, but in the afternoon the rain came down heavily and continuously. The quantity of sand brought down from the higher ground choked the drains, and the roadmen were kept constantly clearing the culverts. The building yard of Messrs Rodger was converted into a lakelet, and access to the adjoining houses was cut off by the roadway being completely under water. The fields to the south of the railway station were also quite submerged, and the skinnery was the scene of much devastation. The Trafford [*sic*] burn, swollen greatly beyond its usual bounds, rushed headlong through the skinnery grounds, carrying everything before it, and causing much destruction of property. In the eastern part of the town the flood was much worse. The whole of the East Green was under water, and some gipsies who had pitched their camp there found their dwellings surrounded by water, while the adjoining roadway was also under water to an extent which rendered it quite impassable. The row of houses opposite the Parish Church was also cut off from all communication, and persons going east had to pass through the churchyard. The railway embankment at this point was also so damaged by the flood as to cause some apprehension for the safety of trains, and a squad of men were set to work to strengthen the embankment. Many acres of garden ground, fields, and roadway were thus under water when the flood was at its height, which was about seven o'clock. About that hour the rain became lighter, although it did not cease for some hours later. The flood rapidly abated, however, and yesterday morning the roadways were mostly clear, but the flooded ground has a very dismal appearance.

Southern Reporter, Thursday 8 August 1895

[Repeat of the above article but with a clarifying addition at the end:]

Most of the damage was done by the Trufford burn, as the Leader, though very much swollen, was nothing unusual for a time of flood.

Southern Reporter, Thursday 15 August 1895

EARLSTON

Parish Council

...Mr Allan having drawn attention to the flooding caused by the overflow of the Trufford Burn in cases of heavy rainfall, the Council appointed Colonel Hope and Mr Allan as a deputation to interview the authorities of the North British Railway and others interested as to the possibility of cleaning out the run of the burn in such a manner as to prevent damage from such overflow as recently occurred.

Southern Reporter, Thursday 31 October 1895

EARLSTON

Parish Council

The Chairman reported that he had been in communication with the North British Railway authorities in regard to the deepening of the Trufford Burn to prevent disaster on the occurrence of floods. The engineer of the Company having reported favourably on the feasibility of the proposed scheme (after personal inspection and examination), the Company had signified that they would offer no objection to deepening the burn to the extent of eighteen inches from a point about a hundred yards to the east of the level-crossing to very near to where the burn discharges into the Leader. The consent of the proprietors on the banks of the burn will have to be obtained, as well as the sanction of the County Council, before the work is commenced.

11 Nov 1895

E T

[**Synopsis:** Another flood on the Turfford Burn, albeit much less serious. The Leader also in flood.]

Southern Reporter, Thursday 14 November 1895

At Hawick the Teviot was higher than for several years, inundating Wilton Lodge public park, overflowing the haughs, entering low-lying houses in the town, and doing a great deal of damage to property. In some cases trees were uprooted, slates torn off the house roofs, and windows and chimneys greatly damaged. The Trufford Burn at Earlston was swollen to an unusual height, and overflowed on to the East Green and the roadway adjoining. The Leader was in high flood, and a portion of the cauld, to the extent of about 15 feet, was carried away. The Tweed had not been in such heavy flood this season, and at Kelso on Monday the river showed a rise of about eight feet perpendicular.

[**29 June 1896 – a meeting not a flood event**]

Southern Reporter, Thursday 2 July 1896

County Council. A meeting of the West District Committee of Berwickshire County Council was held in the Court-room on Monday afternoon. ... Some correspondence between Professor Armstrong and the county clerks anent [i.e. about] Boon bridge was read. Professor Armstrong desires the west end of Boon bridge to be lifted, that he may examine the bedding plates, and that he may be able to give an exact report on the state of the bridge. The meeting agreed take measures to meet the wishes of the Professor in the matter. ... The Chairman intimated to the meeting that the Parish Council intended deepening the Trufford burn, as a preventive to those disastrous floods which have of late years been frequent; and he asked the meeting to agree to contribute towards the scheme, which it was estimated would cost about £75. It was resolved to give £10. It was agreed that in future the minutes be printed, and copies issued to all concerned. Earlston drainage scheme was the next item on the agenda paper. The Clerk having intimated that the usual formalities had been observed and that the district had been formed into a drainage area, a committee, consisting of Colonel Hope and Mr Allan, with three others to be nominated by the Parish Council, was appointed to draw up a drainage scheme.

[**September 1897 – incidental note**]

Southern Reporter, Thursday 30 September 1897

EARLSTON

Drainage.—The work of draining the eastern section of the town has been begun with the digging out of a large purifying tank at the Easter Green, by the side of the Trufford Burn, by George Simpson, Redpath, one of the contractors.

17 Oct 1898

[**Synopsis:** A near-miss event on the Turfford Burn at Earlston.]

Edinburgh Evening News, Tuesday 18 October 1898

The Tweed

Up to last night the heavy rains had had comparatively little effect on the Tweed, the register showing a rise of only about nine inches. Since then it has risen very rapidly, and to-day it is in heavier flood than it has been for several years. A good deal of haugh land near Melrose is submerged, and some cultivated fields partially so. ...

Earlston

A portion of the new drainage system, opposite the U.P. Church, which had only been put in a few weeks ago, collapsed, and the roadway sank for ten or twelve feet. Both the Leader and the Trufford Burn are in high flood, and threaten to overflow their banks if the rain continues.

12 Jul 1899

E? (Pluvial)

[**Synopsis:** Thunderstorm leading to minor surface-water flooding at Earlston.]

Southern Reporter, Thursday 20 July 1899

EARLSTON

Last week's thunderstorm

The thunder storm on the 12th lasted a great part of the afternoon, and was accompanied with torrents of rain. The lightning flashes were frequent and vivid, and the quickly-following thunder crashes showed the near neighbourhood of the lightning. The heavy rainfall, which flooded the streets, and could not for a time, from its great volume, find a way into the surface drains, laid flat some fields of grain to such an extent that it seems unlikely ever to regain its upstanding position.

24 Feb 1900

[**Synopsis:** A minor flood in the Upper Leader.]

Southern Reporter, Thursday 1 March 1900

GREENLAW

Weather Notes—A considerable staff of workmen were employed in clearing the roads in this district last week, and the work was not completed till Saturday. The partial thaw which set in on Friday became more decided during the night, and being accompanied with a high westerly wind, a great quantity of snow disappeared. The Blackadder was in high flood on Friday, and rose to even greater volume on Saturday. There was a severe storm of rain and wind from the east on Monday evening, and the rain continued, more or less, during Tuesday, when the Blackadder was again in flood, running even higher than last week.

EARLSTON

The Weather—The snow storms of last week have given place to fresh weather, though wet and windy. The snow in this immediate neighbourhood has nearly all disappeared, but out in the country the roads are still deeply covered, having been drifted to immense depths. Roadmen have been busily engaged casting these roads, which in places are still nearly impassable, and the wayfarer has often to make a detour through fields so as to get along.

LAUDER

A Funeral Party's Difficulties—On Saturday the funeral of the farmer of Threeburnford took place under most difficult circumstances. Owing to the recent storm, the road from the farm to the churchyard at Channelkirk was almost impassable with snow drifts. For the three days between the death and the funeral forty men were hard at work trying to clear the road, but

their work was far from done when the funeral party had to set out. The distance to be traversed was about three miles, and for a good portion of the way the mourners walked by the banks of the Leader, knee-deep sometimes in the water, which had overflowed the banks. At one stage of the journey the coffin had to be taken from the hearse, which could go no further; and as a short cut to the burial place, the mourners, in relays, carried their burden up a steep hill. It was noted that the flood was threatening the new light railway between Lauder and Fountainhall.

3 Jul 1900

T

[Synopsis: A minor flood on the Turfford Burn; less so on the Leader.]

Southern Reporter, Thursday 5 July 1900

EARLSTON

Heavy Rainfall.— On Tuesday morning about four o'clock, and again between 8 and 9, there was experienced the heaviest rainfall of this very wet season. The rain fell in large heavy drops, with such momentum to cause much havoc gardens in breaking down vegetables and bushes. The Trufford Burn overflowed the Georgefield road near the railway level crossing, and has not been in such flood since it was cleaned out and partially re-embanked two or three years ago. The Leader also came down in heavy flood, and operations at the new drainage works were again at a standstill for the day owing to the depth of water standing in the tank. The land is now soaked and somewhat soured by the enormous rainfall, which is causing some anxiety to farmers. It is the worst possible weather for the hay harvest.

10 Aug 1901

LL (Pluvial)

[Synopsis: Significant pluvial flooding at Lauder; minor flooding at Earlston]

Berwickshire News, Tuesday 13 August 1901

LAUDER

The most severe thunderstorm that has visited Lauder for many years was experienced on Saturday. Thunder and lightning continued all morning. High-street was a complete flood, and many houses in the Row were flooded. The storm continued till about three in the afternoon.

EARLSTON

On Saturday morning, about 9 o'clock, a storm of thunder and lightning broke over this place. The lightning flashes were most frequent and the peals of thunder very long and loud. During the storm the darkness was so great that shops and dwelling houses had to be lighted up. There was a renewal of the storm in the afternoon, with increased violence, The rain came down in perfect sheets of water, flooding the streets, and temporarily beating down the crops, which, in this district, have not suffered from laying as much as might have been expected. The Leader came down very heavy in the evening, an agreeable sight to anglers, whose expectations of better sport than they have been getting of late have been greatly raised.

Southern Reporter, Thursday 15 August 1901

TERRIFIC THUNDERSTORM

LOSS OF LIFE AND GREAT DAMAGE TO PROPERTY

A severe thunderstorm, probably unprecedented in its deration, passed over the country on Saturday, in the most of places commencing about nine in the morning and continuing till three or four o'clock in the afternoon. While the storm was pretty general, it appears to have been at its worst all along the east of Scotland, the south of Scotland, and the north of England. In all

quarters it was accompanied by torrents of rain, which in some places caused considerable flooding.

...

EARLSTON. Nothing like Saturday's thunderstorm has been experienced since the 12th of August, 1884, when the Earl of Lauderdale was killed lightning. The first distant mutterings of thunder were heard shortly after eight o'clock in the morning. From nine o'clock till eleven the storm raged, and then there was a lull for a while, but about two o'clock there was a renewal, with much increased violence. The flashes of forked lightning occurred with startling vividness and unusual frequency, and quickly after each flash the thunder roared and crashed and reverberated, while the rain poured down in torrents, choking up sewers, flooding the streets, and beating down the standing corn. In some places near the town, though not in it, there was a fall of hail, which, however, was not long continued. Both in the forenoon and the afternoon during the storm it grew so dark that shops and private houses had to be lighted with gas or oil. Notwithstanding the violence of the storm little or no damage seems to have been done. The deluge of rain which brought down the Leader in high flood has had the effect of thoroughly cleansing the channel of the river, and washing away all the foulness contracted during the long drought. A great many carts loaded with hay were caught in the drenching rain, and had to put in to any shelter that could be found, some of them being unlucky enough to be exposed to all the violence of the storm.

LAUDER. **The storm was the most severe that has visited Lauder for many years. Thunder and lightning continued all morning. High Street was a complete flood, and many houses in the Row were flooded.** The storm continued till about three in the afternoon.

[September 1901 – incidental note]

Southern Reporter, Thursday 19 September 1901

EARLSTON. The enlargement of the bowling green **by the diversion of the Trufford burn** is again on the tapis [i.e. under discussion], many members thinking that a most desirable course, while others are of opinion that an attempt should be made to get a new green in a more favourable situation. The former seems to be the course least beset with difficulties.

30 Dec 1901

T

K

[Synopsis: Significant flooding from the Turfford Burn.]

The Scotsman, Wednesday 1 January 1902

THE LEADER AND ITS TRIBUTARIES

Earlston—The Leader and the Trufford Burn rose to a great height last night, the latter overflowing its banks at the East Green, which was wholly under water. On each side of the railway crossing the ground was quite flooded, and the road to Georgefield was rendered impassable. **At the gas-works, adjoining, the manager's kitchen was flooded, the water rose to within a few inches of the furnace, and some of the [gas] pipes became filled with water.** It is feared that the lighting in the town will be defective this evening. Since one o'clock yesterday morning the waters have been gradually subsiding.

Edinburgh Evening News, Thursday 2 January 1902

THE FLOODS IN SCOTLAND

Earlston gas supply stopped

At Earlston, the flooding made itself most seriously felt at the gasworks, which are situated in close proximity to the Trufford Burn, an affluent of the Leader. The water made its way into the pipe conveying the gas from the purifiers to the holders, and notwithstanding the most strenuous exertions, it could not be stopped, so that no gas could be supplied to the town. By the bursting of a culvert on the Lauder Road, between Chapel Lodge and Birken-side, a deep hole was made in the roadway, rendering it impassable. It has been fenced round, and lights will be shown at night. [See next paragraph.]

Serious landslip near Earlston

As a result of the flooding in the beginning of the week, a serious subsidence has taken place on the road leading from Earlston to Lauder. [Likely at Legerwood Burn culvert?] At a bend in the road adjoining the estate of Chapel, **a culvert gave way, and a mass of earth, about 200 cubic feet in extent, was carried down into the Leader underneath. A gap in the roadway has been made to the depth of about ten feet,** and communication between Earlston and Lauder can in the meantime only be made through Chapel, the use of a private road having kindly been granted by the proprietor. After the accident a man fell into the gap that had been made in the roadway, but he was rescued without serious injury.

Southern Reporter, Thursday 2 January 1902

KELSO

Both Tweed and Teviot were greatly flooded on Tuesday. At Kelso bridge there was a rise of fully twelve feet perpendicular, the highest point reached for about twenty years. The road between Kelso and Teviot Bridge was submerged fully four feet. A great area of land was flooded, and quantities of timber, turnips, and debris passed down.

EARLSTON

The Leader and the Trufford Burn at Earlston rose to an enormous height on Monday night, the latter overflowing its banks at the East Green, which was wholly under water. On each side of the railway crossing the ground was quite flooded, and the road to Georgefield was rendered impassable. At the gasworks adjoining the manager's kitchen was flooded. The water rose to within a few inches of the furnace, and some of the pipes became filled with water. The result was that no gas was available on Tuesday evening. **The melting of the snow caused a good deal of flooding in some of the houses at the West End.** There has been a serious subsidence on the public road, between Chapel Lodge and Birken-side, at a part under which a large culvert passes. The whole mason work has given way, leaving a cavity in the road over fifteen feet deep.

Southern Reporter, Thursday 9 January 1902

EARLSTON

Restoration of Gaslight.—After the partial eclipse at the Gasworks caused by the flooding of the Trufford Burn, the town has been restored to the light of gas, the want of which for couple of nights made the residents feel how uncomfortable and cheerless the streets were without the usual illumination.

[October 1902 – incidental notes]

Southern Reporter, Thursday 16 October 1902

West District Committee

It was reported by Earlston Drainage Construction Committee that the drainage works both east and west had been completed, and were now in operation.

...

Mr Dickinson reported that **the Dod Mill bridge had been rebuilt** in the most satisfactory manner, the cost being £172, 4s 6d, which is only £2, 4s 6d above the probable estimate.

9 Feb 1903

TT

[**Synopsis:** Serious flooding from the Turfford Burn, amid floods elsewhere in the Tweed basin.]

Edinburgh Evening News, Monday 9 February 1903

RAINSTORM AND FLOODS

RAILWAY LINES IMPASSABLE

WIDESPREAD DAMAGE

EARLSTON

Both the Leader and the Trufford Burn overflowed their banks, and a huge track of low-lying land is now under water. About two o'clock this morning, **the Trufford Burn was rushing past the old Skinnery, adjoining the railway station, with a tremendous roar, and the house occupied by Mr James Tully, contractor, completely surrounded with water to the depth of about a foot. Mr Tully had some difficulty in getting his four horses out of the stable, and they had scarcely been placed in safety in the stables of the Black Bull Inn, than the water swept into the stable like a torrent. The East Green was completely under water, and part of the roadway at the railway crossing was quite impassable. The Gas House was flooded, and the furnaces partly extinguished, the floor of the kitchen being also under water. A large pool was formed in the playground of the Public School, the heating of the school being prevented by the fireplace being under water.**

FLOODING

MELROSE DISTRICT

In the Melrose, Galawater, and Lauderdale districts, rain fell almost incessantly from Saturday till early this morning, accompanied at times by a gale. Many roads were rendered almost impassable, and some churches had very small attendances. The rivers Tweed, Gala, and Leader are heavily flooded this morning. The Gala has overflowed its banks, and the water is covering many fields like large lake. The weather is now more settled.

GALASHIELS

After the severe rainstorm which raged during the whole of Saturday and yesterday, the rivers and their tributaries in the district are in high flood. **The Tweed overflowed the roadway at Galafoot and the local butchers had to wade knee-deep into the burgh slaughter-houses this morning to get out their supplies.** The most serious flooding occurred in the centre of the town, and considerable damage was done to property.

TWEED EIGHT FEET ABOVE NORMAL AT KELSO

As the result of the rain and windstorm during Saturday night and Sunday, the Tweed at Kelso is coming down in raging flood to-day, **the indicator at Kelso bridge registering eight feet above the normal level of the river.**

Berwickshire News, Tuesday 17 February 1903

EARLSTON

Flood—The heavy rain which fell continuously all Sunday week brought down Leader and the Trufford Burn in high flood. **The latter overflowing its banks poured over the lower grounds in**

the east of the town, covering the East Green and part of the school playground, and rendering the Georgefield road impassable for a time. The water entered the heating chamber of the school, and stood so deep that no fires could be lighted on Monday morning. It also flooded the kitchen of the gas manager's house, and got into the ash pits of the gaswork, and all but extinguished the fires, rendering the production of gas a matter of the greatest difficulty on that and succeeding days. The burn at the old skinnery flooded Mr Tulley's stable, compelling him to remove his horses to the Black Bull Inn stables, and threatening to inundate his dwelling house, the inmates of which watched all night in fear of being overtaken by the flood. Luckily, about 2.30 a.m., the rain ceased, and the waters rose no further afterwards, but contrariwise soon began to fall. The water poured down from the higher grounds in the neighbourhood of the town on to the roads on the lower level, and stood deep thereon in some places nearly all Monday. **No such flood in the Trufford Burn has occurred for years.**

Southern Reporter, Thursday 19 February 1903

EARLSTON

THE LATE FLOOD—The gasworks plant has been so seriously affected by the late flooding that it has been with difficulty that a continuous supply of gas has been maintained. Now and again of late it has suffered temporary eclipse, and some people have been compelled to have recourse to other means of illumination. To obviate the recurrence of this inconvenience, the company are said be disposed to consider the adoption of such alteration in the works as would have this desirable effect.

[March 1903 – incidental note]

Berwickshire News, Tuesday 31 March 1903

County of Berwick

ANNUAL SANITARY REPORT; WEST DISTRICT

...

Drainage—Earlston is the only special drainage district. The new main sewers and purification works have been completed during the year at a total cost of £2537 0s 9d. The house drains have been connected with the new sewers, with the exception of one or two cases, and these are being attended to. The new sewers will regularly and evenly transmit all waste water and all excreta, hour by hour and day by day to the purification works, and the old sewers, which are open and leaky, are utilized for land draining and for carrying off flood water. The work has been costly, but the inhabitants are to be congratulated for their enterprise.

...

JOHN McCRAE. County and District Sanitary Inspector. County Buildings Duns, 21st February, 1903.

[April 1904 – incidental note]

Berwickshire News, Tuesday 12 April 1904

County Council

WEST DISTRICT COMMITTEE meeting

This Committee was held in the Court Room, on Monday week.

[Annual report on roads and bridges]

...

Bridges

During the year the following re bridges have either been rebuilt or repaired:—The small bridge near East End Farm, Earlston, has been rebuilt and lengthened two feet, and the approaches to the bridge have filled some three feet at deepest point on west side; ... The bridge near Cleekimin [*sic*] Toll has been lengthened with brick arches 13 feet on east and 9 feet on west side respectively, with strong wooden handrails, and the posts fixed into the concrete. ... Fans

Loanend—I am sorry this bridge is still unfinished. . . . The report was approved The bridge over the Trufford Burn, near the station at Earlston, the meeting agreed had to be upheld by the Railway Company, and the parish representatives, with the Surveyor, had the business of what was required in the way of its repair committed to their care. The Craigsford Bridge at the Roxburghshire end being in a dangerous state of disrepair, . . .

Dr Young's Report for 1903. (a) General Sanitary Condition.

Drainage

Earlston is only special drainage area in the district. The new sewers and purification tanks have now been in use for more than a year. They are so far working efficiently, but some alterations in details require to be made, and are now under consideration. . . .

22 Jul 1904

E (Pluvial)

[**Synopsis:** Thunderstorm at Earlston. Some surface-water flooding.]

Berwickshire News, Tuesday 26 July 1904

EARLSTON

Thunder Storm—On Friday afternoon a thunder storm broke over the town, when the rain fell literally for a while in sheets. Such a torrential rainfall has rarely, if ever, been witnessed within living memory. The Market Square was for a time like a lake, the sewers being utterly inadequate to carry off the water that fell in such phenomenal quantity. In some places the grain crops have been badly laid, but there is every hope that the lodging of the grain will only be temporary, it is not a stage that precludes the expectation of recovery from such a flattening.

[**October 1904 – incidental note**]

Berwickshire News, Tuesday 18 October 1904

County Council. The West District Committee of Berwickshire County Council met in the Court Room, on Monday afternoon. . . . The Clerk, Mr Rankin, read a letter from the North British Railway Company, admitting liability for the [repair of the retaining wall at the bridge over the Trufford Burn](#). The work of repairing the said wall had now been begun.

25 Mar 1905

[**Synopsis:** Flooding again – albeit minor – from the Turfford Burn.]

Southern Reporter, Thursday 30 March 1905

Weather. —After fine weather in the early part of last week, a great deluge of rain occurred on Saturday, which brought down the Leader and the Trufford Burn in spate, [the latter overflowing its banks in several places near the town. The bowling green was for a while like a pond.](#) Heavy rain again fell on Monday morning.

...

West District Committee Meeting.—A meeting of the West District Committee of Berwickshire County Council was held in the Court-room on Monday—Colonel Hope the chair. In the Surveyor's annual report, which was submitted, was stated that the condition of the roads in the district was, with few exceptions, steadily improving. . . . The parapets of Craigsford bridge had been rebuilt, and the side walls repaired and pointed, at a total cost of £53 Considerable repairs had been found necessary to the parapet and retaining walls of the bridge over the Trufford Burn, on the Earlston and Redpath road. The railway company

had admitted their obligation to the parapet and retaining walls of the bridge, and the work was expected to be completed shortly. ...

19 Oct 1906

[**Synopsis:** No more than a minor flood on the Turfford Burn. However, the event provides a subsidiary example to that of 24 Dec 1937 of the Burn's vulnerability to snowmelt flooding.]

Berwickshire News, Tuesday 23 October 1906

EARLSTON

Friday last was the most tempestuous October day experienced here for years. The previous day was up till evening very fine for the season of the year. On Friday morning snow began to fall early in the morning, and it continued without interruption all day, only in the latter part of it changing its form to a kind of sleety rain. The snow and sleet were accompanied by a violent westerly wind, which increased as the day advanced, rendering all locomotion difficult and disagreeable. Nobody was likely to have faced such a storm unless compelled by dire necessity. The Trufford Burn and the Leader were in high flood, **the former overflowing its banks, turning the Pleasaunce [sic] and the neighbouring parts into the semblance of a lake.**

8 Jan 1908

T

[**Synopsis:** Disruptive flooding again from the Turfford Burn.]

Berwick Advertiser, Friday 10 January 1908

EARLSTON

On Wednesday **the river Leader was in high flood at Earlston, and some of the roads in the Haughhead district were rendered well-nigh impassable.** The Trufford Burn also overflowed its banks, and great inconvenience consequently experienced. The East Green was partly under water, and the children at the Public School, which immediately adjoins the Green, had to be sent home.

25 Mar 1908

T

[**Synopsis:** Yet more flooding from the Turfford Burn.]

Berwickshire News, Tuesday 31 March 1908

EARLSTON

The weather of last week was remarkable for heavy rainfall. The Leader and the Trufford Burn both came down in top flood. **The latter finding its way on Wednesday to the heating chamber of the Public School, and made it impossible to keep up the fire which heats the Schools.** At one o'clock, therefore, the School had to be dismissed for the day. The road across the bridge over the burn to Georgefield was for some time impassible [sic] owing to the overflowing from **the raging flood.** Luckily the rain storm moderated by the following day, when the School fire could be kept alight, and the water on the Georgefield Road had subsided so as to permit the wayfaring man to pursue his journey by that highway.

? Sep 1909

LL??

[**Synopsis:** Said by McEwen (1985) to be a severe thunderstorm leading to a significant flood in the Upper Leader causing the Cleekhimin Burn to shift its course close to its confluence with the Leader Water at Wiselawmill. Not a major flood in the Lower Leader. I have failed to pinpoint the date of this flood. This illustrates the scope for locally severe events to escape detection when constructing a flood chronology.]

McEwen (1985, p1096) says there was a flood event on the Cleekhimin Burn according to Estate Plans. McEwen (1985, p886) “Perhaps this major Channel shift can be related to the localised, convective flood event of 1909 (as shown on the Lauderdale estate plan (RHP 20739; see below). The flood flow attempted a major avulsion across the fan but the course of the flood water did not create a permanent new channel for the burn.” The occurrence is not cited by Werritty and Hoey (2004).

Figure 3.1 shows the Lauderdale Estate Office plan (Reference RHP 20739) as presented by McEwen (1985). Perhaps the original drawing has more details on it. The plan appears to show a single broken line sketched – highlighted here by a red ellipse – on a standard base-map of the era.

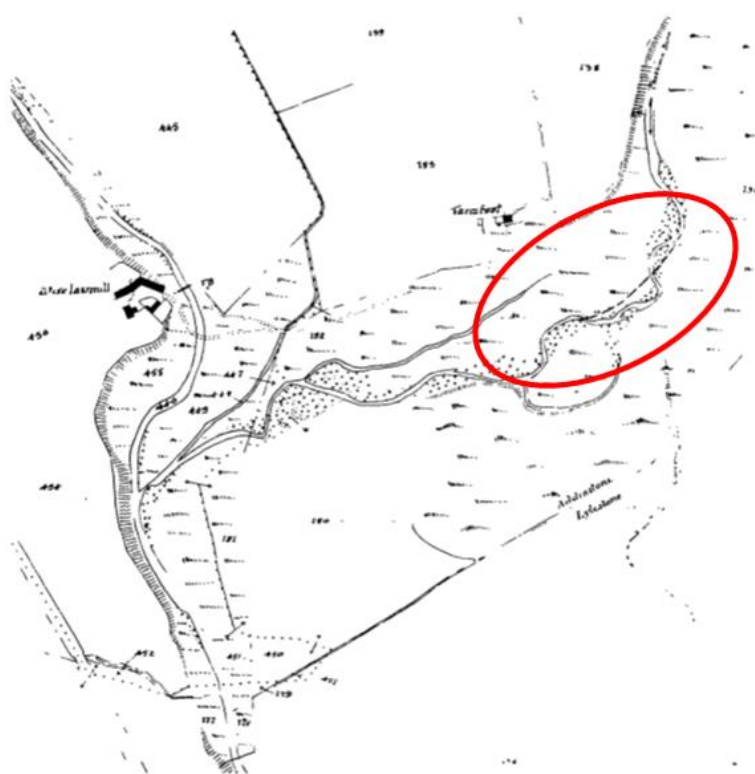


Figure 3.1 1909 Plan of Wiselawmill and Farmfoot

29 Aug 1910

L

E?

K?

[**Synopsis:** A significant flood in the Leader and Tweed, though nothing too major. A near-miss on the Turfford Burn.]

The Scotsman - Wednesday 31 August 1910

LEADER IN FLOOD

HORSE DROWNED

Leader water has been running in high flood for the last two or three days, and a breach has been made in the cauld at Haughhead, Earlston, just above the ford there, which is in frequent use by drivers of carts and other vehicles, and under ordinary weather conditions is safe.

Yesterday morning a man driving a lorry with two horses set out from Haughhead Sawmill to cross the ford, and when he had got near the opposite bank the leading horse lost its footing, fell into the water, and was drowned. It is thought that the fall of the horse was occasioned not wholly by the weight of the swollen river, but by some sudden seizure of cramp.

“SPITTAL POINT” WASHED AWAY

The great spate in the Tweed has been instrumental in washing-away a large part of the sandy tract at the mouth of the river Tweed known as “Spittal Point.” The Tweed was still in flood yesterday, and a quantity of *debris* was floating seawards.

Southern Reporter, Thursday 1 September 1910

MELROSE

THE STORM.—All last week, owing to the intermittent rains, the Tweed had been gradually rising, till on Monday, accelerated with the rainstorm on Sunday, it reached a considerable height, overflowing its banks and sweeping down the valley. Considerable damage has been done to the crops; at Abbotsford Haugh a number of hay ricks have been carried away by the flood, while the haughs adjoining Millmount Farm, and the Anny Road were inundated. Cutting operations which were being carried out on Saturday have been stopped, while disease is beginning to show itself amongst the potatoes. [The masons who have been pointing the bridge over the Tweed at Darnick have lost a lot of their plant owing to the rising of the river.](#)

EARLSTON

...

THE DETRIMENTAL WEATHER.—A great deal of rain fell during the course of last week, and retarded the commencement of harvesting operations, which, but for the unfavourable weather, would have been in progress on several farms. On Sunday night rain fell heavily and incessantly for hours—throughout the day there had frequent showers—and the Leader and the Trufford burn were on Monday morning in high flood.

LAUDER

LEADER IN FLOOD— The stormy weather of the past week or two culminated on Sunday night in a severe storm of rain and wind, which has caused additional damage to the crops, which are now in a very battered condition. [The Leader rose steadily during the night and on Monday morning was running at high flood, higher in the opinion of some than it has been for 17 years, when the bridges were swept away.](#) [It’s actually 19 years since September 1891. But near enough.]

PEEBLES

TWEED IN FLOOD— The heavy rains of Friday, Saturday and Sunday brought down the Tweed and Eddleston waters in great floods. On Monday morning the Tweed overflowed its banks in several places, and did a large amount of damage to hay crops, which were ricked in fields adjoining the river. Several of the fields standing in grain were completely flooded, and the farmers who intended to start harvest operations could not make a commencement.

4 Aug 1912

[Synopsis: Not an important event.]

Southern Reporter, Thursday 8 August 1912

EARLSTON

RAINSTORM—Sunday was throughout the wettest day experienced here for a very considerable time. Rain began to fall early in the morning, and continued till nightfall and after, without intermission. In the evening the downfall was hardly so heavy as in the earlier part of the day. The Leader and the Trufford Burn came down in flood, but not in such volume as might have been expected from the heavy and long-continued rainfall.

18 Jun 1914

L

[Synopsis: A severe thunderstorm in the headwaters of the Leader, leading to a flash flood in the Leader. The thunderstorm also affected many of its left-bank tributaries. Somewhat less serious at Earlston.]

Berwickshire News, Tuesday 23 June 1914

LAUDER

On Thursday afternoon one of the most severe thunder storms that has been experienced for many years, broke over the district and was most felt at Addinston and Longcroft, the farms of Messrs Dickinson and McKaw. At Addinston between twenty and thirty acres of turnips were completely washed away and about 20 yards of dykes broken down. Lambs and sheep were washed for a considerable distance down the fields, where they were saved by some of the workers on the farm. The water rushed down the fields with a terrible force, taking everything before it; and at the Bridge near Boghall, the road was completely flooded and all traffic was stopped for same time. At the Hill House, one of Messrs Dickinson's farms, a chimney stalk was struck by the lightning and considerably damaged, 2 of the herds were knocked down with the shock, and some of the fields of turnips on the farms were washed clean out.

EARLSTON

A NARROW ESCAPE—On Thursday, when the Leader, in consequence of the thunderstorm, rose with such alarming speed, a little boy, Andrew Tulley, five or six years of age, while playing at the cauld at Rhymer's Mill, was unable get out of the way of the rush of the water and was swept off into a deep pool. Luckily, some anglers seeing the situation, got hold of the youngster and landed him on dry ground. He was none the worse for his ducking, but had he not been fished out promptly the result might have been serious.

THUNDERSTORM—On Thursday afternoon was experienced a sharp thunder storm, though of no long duration. The lightning flashes were numerous and brilliant, and the thunder claps frequent and long reverberating. The rain that fell was torrential, and the Leader came down in flood, and spread over some fields in the neighbourhood of the town. The river brought down in its tumbling waters much fencing and other debris. A sheep, a swine, and many chickens fell victims to the sudden flooding, and were swept along in the troubled waters. On Sunday afternoon, there were heavy thunder showers accompanied with a few flashes of lightning, and some distant thunder. Some damage, it is said, has been done by the rains washing away soil and destroying crops.

LEGERWOOD

THUNDERSTORM—A heavy thunderstorm passed over the district on Thursday afternoon. For fully 2 hours, there was a continuous roll of thunder and vivid flashes of lightning accompanied by a deluge of rain, which caused a good deal of flooding and damage, especially among the turnip. There was a renewal of the storm on Sunday, but it was not of so alarming a character as on Thursday.

WESTRUTHER

LIGHTNING WORKS HAVOC—Terrible damage to cattle, sheep, house [?] and household property has been done in the Westruther district of Berwickshire during the recent thunderstorm. A house at Wedderlie, occupied by Mr John Maltier, farm steward, was struck by lightning. The lightning came down the chimney, splitting the grate and doing a lot of damage to masonry inside. Pictures were smashed, ornaments broken, and other articles of furniture very much damaged.

LAUDER

GREAT DAMAGE CAUSED BY THE STORM

On Thursday afternoon one of the most severe thunderstorms that has been experienced for many years, broke over the district, and was most felt at Addinston and Longcroft, the farms of Messrs Dickinson and McKaw. At Addinston between twenty and thirty acres of turnips were completely washed away and about 20 yards of dykes broken down. Lambs and sheep were washed for a considerable distance down the fields, where they were saved by some of the workers on the farm. The water rushed down the fields with terrible force, taking everything before it; and at the Bridge near Boghall, the road was completely flooded and all traffic was stopped for some time. At the Hill House, one of Messrs Dickinson's farms, a chimney stalk was struck by the lightning and considerably damaged, 2 of the herds were knocked down with the shock, and some of the fields of turnips on the farms were washed clean out, and the loss is thought to lie between £200 and £300. **Mr Jackson, of Carfrae Mill, had some of his fields completely destroyed, and it must be a great loss to him, and at Boon the storm was greatly felt. The water rushed down the fields with great force until it reached the Leader, coming down in full flood. Great damage was done all over the district.**

Berwick Advertiser, Friday 26 June 1914

Earlston

Earlston received its fare [*sic*] share of the severe thunderstorm and flood which passed over the country on Thursday. **Fortunately, the visitation was not attended with so serious consequences as it was in some other places, and the damage done was not so great as might have been expected.** During the day there were indications of the elemental conflict that was coming, but it was not until between five and six o'clock in the evening that the outburst took place, and it came so suddenly that every one was quite taken by surprise by its violence and the overwhelming force. At the time, several young boys were playing at the cauld in the immediate vicinity of the Rhymer's Mill, when the water of the Leader all at once rose in an extraordinary manner, and one of them —Andrew Tulley, about five year of age—was caught by it and swept into the rushing stream. He had gone under the water three times before he was caught hold of and brought to land; and after being taken home, thoroughly rubbed and put to bed, it was found that he was none the worse for his ducking. Meanwhile the waters of the Leader continued to rise, rapidly, and in twelve minutes they had risen several feet above their usual height, and greatly extended their banks on both sides. There had also been repeated and vivid flashes of lightning, both of the sheet and forked description, followed by terrific peals of thunder. The rain also descended in torrents, completely flooding the streets, choking some of the drains, and causing large pools of water to be formed. The Trufford Burn, and its usually

placid waters rushed along in turbulent and impetuous fashion. As the evening advanced, the rain abated and the thunderstorm ceased. **The Leader continued for some hours in full flood, its water being of a muddy nature, and bringing down with it pieces of wood and branches of trees, showing that there had been considerable wreckage in its mad course.** In the East end of the town a large quantity of mud and sand had been carried down from the farm of Earlston Mains, and deposited on the Gordon Road, causing an obstruction to the traffic for some distance. This, however, was promptly removed by the road authorities on the following day. Considering the suddenness and severity of the outbreak, it is remarkable that the damage caused has been so comparatively slight. There was a renewal of the thunderstorm on Sunday afternoon between one and two o'clock, when there were several loud peals, accompanied by a heavy fall of rain. There were also occasional showers in the course of the evening. Yesterday the storm seemed to have spent itself, and there was a cloudless sky and an abatement of the great heat of previous days.

Gordon

A very severe thunderstorm passed over the village between 6 and 7 p.m. on Thursday last. The lightning was very vivid and was both sheet and forked. Flash followed flash in quick succession and rain fell in torrents for about half an hour, causing a great deal of flooding by the gratings getting choked up with the rush of water and mud sand [*sic*]. Many of the houses were not a little flooded and in one case the mats floated out of the front door by the onrush from the back. Seldom has such a severe thunder storm been experienced here, but luckily no very serious damage was done to buildings, stock or other property, excepting that the roads were badly washed in some places and new sown turnips suffered considerably.

Lauder

A severe thunderstorm accompanied by heavy floodings, passed over the district on Thursday afternoon. Considerable damage has been wrought.

6 Dec 1915

T

[**Synopsis:** Snowmelt and rain gave rise to a flood in the Turfford Burn. A complementary example to that of 24 Dec 1937.]

Edinburgh Evening News, Wednesday 6 December 1915

FLOODING AT EARLSTON

The Leader and the Trufford Burn have overflowed their banks. The roadway in Church Street, Earlston, is six inches under water. The streets are impassable in some places and traffic has had to be stopped.

Southern Reporter, Thursday 16 December 1915

EARLSTON

Alarming Flood

The sudden thaw after the heavy fall of snow on the 5th inst. caused the Leader and the Trufford Burn to come down in heavy flood. The burn in the east end of the town was up to the doors of some of the houses, and in the gardens and elsewhere the water stood at a considerable depth. **Not for many years has the burn overflowed to such an extent.** The sudden thaw has been followed by frost and snow. So far as the winter has gone it has been unusually severe, and promises to merit the record of the preceding month, which has been pronounced the coldest for many years.

18 Aug 1920

K

[**Synopsis:** A severe flood in the Water of Leith (Reed, 2002b) affected the Roseburn district especially. A moderately large flood in the Tweed but no reports found of flooding from the Leader.]

The Scotsman, Thursday 19 August 1920

DAMAGE TO CROPS IN BERWICK DISTRICT

Grain crops in the Berwick district are believed to have suffered greatly through the heavy rain and wind storm which swept over the district during the night of Tuesday and Wednesday morning. The Tweed came down in heavy flood, and on the low-lying lands flooding has taken place. On Wednesday tree trunks and fencing was coming down the stream in large quantities, and it is feared that low-lying farms in the Border districts will have suffered from the deluge. ...

HEAVY RAINFALL AT DUNS

Heavy rain fell in Duns district, from midday on Tuesday till Wednesday morning without cessation. The local streams were all in top flood, and considerable damage has been done to crops. A good deal of hay is still outstanding. The rainfall at Duns Castle for the twenty-four hours up to 8 A.M. yesterday morning was 1.77 inches, the highest recorded for several years for the same number of hours.

RIVER TWEED A RAGING FLOOD

The incessant downpour of Tuesday and yesterday caused considerable flooding in the Melrose district. The Tweed rose rapidly, and yesterday was in raging flood, while many of the adjoining fields were submerged.

OVER 8 FEET OF FLOOD WATER AT KELSO

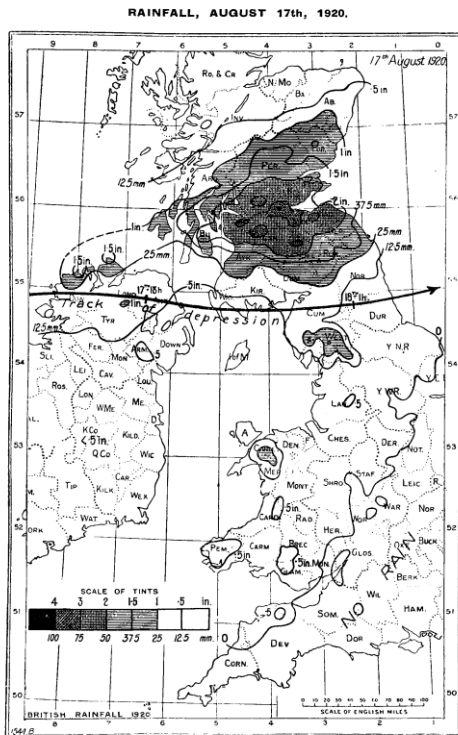
Owing to the excessive rainfall from Tuesday evening until yesterday morning the rivers Tweed and Teviot have been running in heavy flood. [The Tweedometer at Kelso Bridge yesterday registered 8½ feet of flood water.](#)

GALASHIELS MILL STOPPED OWING TO FLOODING

The rainstorm which set in on Tuesday afternoon and continued during the night was one of the worst experienced in Galashiels district. Rain fell in torrents for more than twelve hours, and in consequence there was serious flooding in the Tweed and Gala Water districts. The Gala rose to a higher level than it has done since the memorable flood of September 1891, when so many bridges were carried away or damaged. ...

British Rainfall 1920

[Isohyetal map published of rainfall on 17 Aug 1920 (see below). Leader on the periphery of the heaviest rainfall.]



24 Aug 1925

[**Synopsis:** Fluvial flooding in parts of the Upper Leader, and pluvial flooding in Lauder. But a relatively minor event.]

Southern Reporter, Thursday 27 August 1925

LAUDER

Heavy Rain—One of the heaviest downpours within living memory occurred throughout Lauderdale on Monday, just after mid-day. The shower continued for over an hour, and in a remarkably short time the streets were running with water. The gutters were inches deep, and in many places drains choked and were only cleared in time to prevent the flooding of property. **The Leader came down in heavy spate, and the hill streams, which for some weeks have been almost dry, were converted into torrents.** Although the sky had the appearance of thunder, none resulted. One saving feature of the shower is that the flood has cleared the trout streams in which weed was beginning to gain too firm a hold. As far as can be gathered, no such shower has been experienced **since the storming August 12 of last century [1884]**, when the Earl of Lauderdale was killed by lightning on the Lammermoors.

27 Jul 1927

L E

[**Synopsis:** A severe thunderstorm leading to serious flooding in some left bank tributaries of the Leader: especially the Boondreigh Water. Found only at the eleventh hour of this review. The *Berwickshire News* report is excellent in capturing the intense but spotty nature of the flooding and the drama of some of the impacts.]

Berwickshire News, Tuesday 2 August 1927

THE THUNDERSTORM EFFECTS IN BERWICKSHIRE

On Wednesday a severe thunderstorm passed over the western part of Berwickshire doing great damage to crops, corn being badly laid, and young turnips washed from the ground and sanded up. The local streams came down in high flood, and several sheep were drowned. **At Dod Mill, on the road between Duns and Lauder, at one time about 50 cars were held up through the bridge which here spans the Boondreigh Water being unable to take the swollen waters of the stream, the volume of water being increased by that which poured down the road itself from either side of the bridge. The bridge itself stood the test but the abutment walls on both sides gave way.** At other points on the roads in the West District, cars were held up in a similar fashion, while in some cases dwelling houses and outbuildings were flooded. The evening train from St. Boswells to Duns got through without delay but the early train from St. Boswells which conveys the mails and daily papers to the county town, was delayed about an hour on Thursday morning through a renewal of the rainstorm causing flooding of the railway track near Gordon, in the vicinity of which area a large acreage of low lying ground was under water, large pools still being in evidence on Saturday. As usual in the case of such storms, the rainfall was local and somewhat erratic. Motorists from Edinburgh via Soutra Hill reported that though heavy rain was falling, the Leader at Carfrae Mill was normal, but its affluents from the east, **the Longcroft, Earnscleugh, Boondreigh, and other burns, were raging torrents,** carrying down a huge volume of turbid water to swell the main stream in the lower part of its course. At the same time the Blackadder and Eden were little above their previous level, although both these streams rose subsequently. Something similar is reported from the Upper Whitadder [*sic*], where the Fasney [i.e. Faseney Water] coming from the west, rose suddenly about 3 feet, the water being described as “coming down like a wall” while the Whitadder itself was little affected. Motorists journeying in Roxburgh had the experience of crossing from one valley where the stream was flowing bright and clear into another where a muddy welter of water was sweeping over the haughs. While in both counties it was no uncommon thing to run out of a flooded area to dry roads. Although partial in its manifestations, the storm was wide spread over the Borders. A party of holiday-makers from Duns crossing the hills between Moffat and Peebles by the Devils Beet Tub were when just about summit level witnesses of what appears to have been a water spout, a huge black cloud from which an inky-black “tail” depended [i.e. hung down] obscuring the landscape and bringing in its train a torrential downpour.

Workman Marooned

On the old Blythe Road a party of workmen were engaged in stone breaking operations, and here the flood did much damage. [Like Dod Mill, this is in the Boondreigh subcatchment.] Waggon, engine, and stone-breaker were surrounded with water with alarming force. One of the workmen had a time of excitement and alarm, and for a period was in considerable danger. The flood came upon him so suddenly that he was unable to reach a place of safety, and for five hours [*sic*, five hours intended?] he was marooned in the waggon. He was ultimately rescued, when the waters had subsided a little, by means of a rope thrown out to him when he was removed from his dangerous position.

Reports of loss to stock are received from various parts of the district. **A number of sheep were killed by lightning at Blythe, Thirlestane and Burncastle. When the storm was at its height, several cattle were in imminent danger, and were standing in water up to their bodies.** They were ultimately removed, however, with considerable difficulty, to safety.

The storm is stated to be the severest experienced within living memory.

An Oxtou Correspondent writes:—On Wednesday, a most extraordinary heavy rainfall and hail shower, accompanied with thunder and lightning, took place in Western Berwickshire. Every small burn became a roaring torrent, and the Boondreigh [*sic*] and Brunty Burn which unite

before coming to the Mill Brig [i.e. bridge at Dod Mill], on the Lauder-Duns road swelled their torrents, so that the Brig could not contain them with a result that part of the parapet of the Bridge was carried away, and great damage was done to the Haughs which lie between it and Burn Brig [*sic*, Boon Bridge], where it falls into the Leader. **It is 15 years since such a flood took place here [Sep 1909?], but this one is by far the worse, the consequence being that every water gate north of Born Brig [*sic*, Boon Bridge?] to that of Broadshaw Rig has been carried away.** Great damage has also been done to some of the corn fields near Lauder. The thunder storm is the most severe since that of August 1884, when the Earl of Lauderdale was robbed [of his life] on the Moors near Broadshawrig. On that occasion the rainfall was moderate.

Southern Reporter, Thursday 4 August 1927

EARLSTON

THUNDERSTORM— A terrific thunderstorm broke over Earlston on Wednesday, accompanied by a deluge of rain, and raged for over three hours. **The Leader came down in such volume as has not been known at Earlston for 37 years, carrying before it entire trees which had been uprooted, and inundating [*sic*] many fields and destroying hay crops.** [It seems likely that the comparison was with the 21 Sep 1891 flood rather than the 12 Aug 1890 event.]

22 Sep 1927

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[**Synopsis:** A significant flood in all the rivers under review.]

Hawick News and Border Chronicle, Friday 23 September 1927

DELUGE OF RAIN

The forty-eight hours' rainstorm which swept over a great part of Scotland this week has had most serious consequences. ... **At Kelso, the Tweed rose gradually yesterday from 4 feet in the morning until in the early evening the Tweedometer at Kelso Bridge registered 11½ feet of flood water.**

For more than 48 hours Melrose experienced a continuous downpour rain, with the result that flooding has been general. The Tweed rose rapidly, and yesterday developed into a torrent, with submerged fields all along its course. Darnick Burn burst its banks, overflowed on to the road, and inundated some of the adjoining houses, while at Newstead the river and the mill lade had combined to form a lake. Nearly fifty tons of earth came away from the railway embankment near Drygrange, and temporarily blocked the Berwickshire line. [Darnick is just W of Melrose.]

Berwickshire News, Tuesday 27 September 1927

Worst Harvest Since 1871

The rainstorm following upon the heavy rainfalls since August, has caused serious damage to the grain crops. In the Lothians, it is stated that farmers are experiencing the worst harvest since 1871. This is the opinion of a farmer who remembers that year. The present harvest has been the most expensive, so far as the cost of reaping is concerned, in the memory of any living farmer; and even after the grain was reaped the weather has been so unfavourable for harvesting operations that few dry days have come together. At the latter end of last week there was a fair interval, which enabled lying grain to be cut, and the earlier-cut crops to be secured in fair condition. Unless the weather changes quickly to cold drying winds, this season's grain crop will yield a very poor return.

Railway Water-Logged

The Leader was brought down in great volume, and even the little tributary stream known as the Trufford Burn that flows into it was swollen to great proportions, flooding the adjacent fields. Mr James Ballantyne, Coal Agent and Crofter, had much of his cut corn washed away by the deluge, and Burnside Cottage, occupied by Mrs Tully, was penetrated by the rising waters and inundated to the height of several feet. From the level crossing eastward the railway line was water-logged for a considerable distance, and the banks on the railway side in the neighbourhood of Drygrange are reported to have subsided.

Mails Delayed

Lauder and district did not escape its share of the rainstorm last week, experiencing about 44 hours' continuous downpour, as a result of which the Leader and its tributaries overflowed their banks and many fields were flooded. The mails were delayed a considerable time on Friday owing to the main line being washed away at Heriot.

OVER FIFTY HOURS CONTINUOUS RAINS

Incidents of the storms on the Borders

On Wednesday and Thursday of last week the Borders experienced over 50 hours continuous rain which did untold damage to crops, resulted in loss of stock, and caused considerable flooding, and in the loss of life of a Duns postman. Tweed was in bigger flood than since 1881.

Rain began to fall on Tuesday evening and never ceased except for brief intervals until Friday morning; almost 60 hours of continuous rain. The following rainfall was recorded by Mr Wm, Cowieson, at Nisbet Gardens [Nisbet House Gardens, Duns]:

Tuesday .78 inches; Wednesday 1.70 inches; Thursday 1.29 inches

Rain began to fall at Kelso on Tuesday evening and continued without cessation. The rain gauge at Broomlands, just outside the town, registered 1.72 inches for the 24 hours ending at 9 a.m. on Thursday, while for two days the total was 2.38 inches. The Tweed at Kelso Bridge registered nearly ten feet of flood water, early on Thursday afternoon, with prospects of a further rise. ... The rainfall continued to be very heavy up till Thursday night, when the Tweedometer at Kelso Bridge registered fully 12 feet of flood water. The total rainfall for the three days ending at 9 a.m. on Friday morning, as registered at the rain gauge at Broomlands, was 3.22 inches. Riverside roads were rendered impassable, and the water rose to the doorsteps of the houses at Mayfield. The scene from the Terrace over the junction of the Tweed and Teviot was a particularly impressive one, the island known as the Anna being covered except for the tops of the trees, the raging torrent stretching right over Teviot Road to the Springwood Park boundary wall.

Southern Reporter, Thursday 29 September 1927

LAUDER

FLOODING DAMAGE— In consequence of the heavy rains which prevailed on Wednesday and Thursday, much serious damage was done to property and crops. The Leader and its tributaries overflowed their banks, and many fields in the low lying districts were completely submerged. At St Leonard's [near Leader/Boondreigh confluence] the corn sheaves in one field were carried away, but luckily caught on a hedge which saved them being carried down the river. Some bushes planted on the banks of the Leader at this field were torn away and tons of earth were torn out of the banks. A number of large trees and stobs [stumps] were carried down the river, and many of the footbridges on Longcroft, Soonhope, and the Howe [← all in Cleekhimin valley: with The Howe furthest up; it is NNW of Riddel Law] were carried away

by the force of the water. Luckily the water gates at Boon Dreich [*sic*] had not been placed in position since the last flood, although the wood for these was lying ready to erect.

DAMAGE AT EARLSTON

Earlston was again deluged last week by torrential rains. The Leader came down in great volume and even the little tributary stream known as the Trufford burn was [... repeat of *Berwickshire News* report]. ...

THE FLOOD ON THE BORDERS GREAT LOSS AND DAMAGE TO CROPS RIVERS RAGING TORRENTS

The floods which have followed three days' steady rain in the Border district came to a height on Thursday, when low haughs in every district were being swept by streams which had overflowed their banks, and stooks, hay coles [?] and stock (in a few instances) were swept away in the raging torrents to the sea.

In the upper reaches of the Tweed the scene at caulds and dam-heads was an appalling one. Big as the floods in August were, this flood was much greater. The Gala and the Tweed rose to an abnormal height. Large quantities of debris, trees, gates, fences, etc., were carried down. At Galafoot, where the Gala joins the Tweed, the adjoining haughlands were like a lake. The waters were thrown back and invaded the Galashiels burgh slaughter-houses to a considerable depth, and sheep and cattle which were in the booths had to be taken out. The Gala has not attained to such a high flood mark since the great flood of September.

WHAT THE RAIN GAUGE SHOWED

The rainfall registered at Nisbet for the three wet days last week was follows:– Tuesday, .78 inches; Wednesday, 1.70 inches; Thursday, 1.29 inches; a total of 3.77 inches. ... At Marchmont [House, NE of Greenlaw], there was recorded 4.09 ins. of rain between Tuesday night and Thursday night, i.e., in approximately 48 hours.

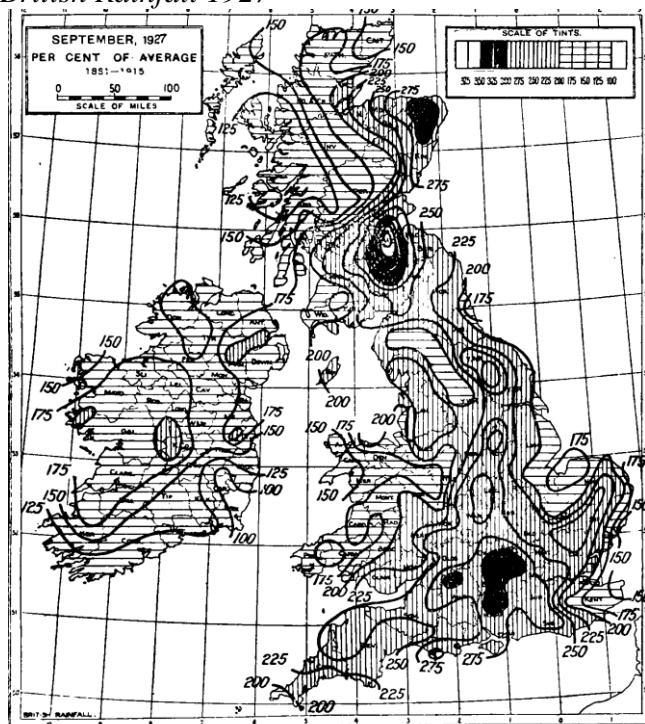
Craw (1927)

[p129, report of meeting at Tweedmouth on 12 Oct 1927]

Members gathered at the Tweedmouth end of the old road bridge at 12.15, and were met by Mr A. M. Meldrum, Assistant Engineer, who conducted the party over the works of the new bridge, explaining the methods of construction employed. The arch of the northmost or widest span of the bridge had been completed since the last visit of the Club, but the decking of this portion was still incomplete. Considerable trouble and some damage had been caused by the flood of 23rd September, when many large trees and other wreckage were brought down by the river.

[McEwen (1985) implies about 2.9" at Cowdenknowes over the two rain-days. The month was fiercely wet: see map above from BR 1927.]

British Rainfall 1927



Rainfall, September, 1927, as per cent. of average.

5 Jul 1929

EE (pluvial) T

[**Synopsis:** A severe thunderstorm in the Earlston district, giving rise to surface-water flooding and flooding in some local burns including Turfford Burn.]

Berwickshire News, Tuesday 9 July 1929

WORST THUNDERSTORM FOR 40 YEARS

A violent storm broke over Earlston and district on Friday accompanied by vivid flashes of lightning and torrential rain and hail. The storm, which commenced shortly after midday, raged with tropical severity for 4 hours or thereabouts. Some parts of the streets were knee deep in water, and several houses were in danger of being flooded, the residents having to make wide detours to reach their homes. The destruction done to gardens was also great, the produce in many cases being ruined. Two cart horses, belonging to Mr Chas. Scott, farmer, Redpath, were instantaneously killed by lightning, and 11 sheep on Moss Houses Farm [in headwaters of the Kedslie Burn right-bank tributary of the Leader upstream of Earlston] were also destroyed. ... This is the worst thunder storm experienced at Earlston for 40 years.

Southern Reporter, Thursday 11 July 1929

LAUDER

WORKMEN'S NARROW ESCAPE. Lauder escaped to a great extent the severe thunderstorm which visited the Borders on Friday, although at Upper Blainslie those working in the quarry had a startling experience. Lightning struck a tree not 20 yards from where they were, splitting it to the roots and knocking the top completely off. Mr Thomas Redpath, Lauder, and Mr Albert Halliday, Blainslie, received a shock. The lightning seemed to be attracted by an anvil which was standing nearby, and Redpath got the shock in his leg and right side. Halliday received it in the arm. They were shaken and dazed for quite a while. Several of the vanmen were storm-stayed for a few hours at various farm places owing to the severity of the storm.

[*British Rainfall 1929* says that Cowdenknowes recorded 2.20" on 6 July 1929 although McEwen labels this as 5 July. She gives the 2-day total as about 3.2" on 4-5 July 1929. So there's a day's discrepancy between BR and McEwen. Other info in BR 1929 suggests that the error is with BR *not* McEwen. The heavy rain was mainly on 3-4 July, though only East Anglia is mapped. Things were overshadowed in the yearbook by the Nov 1929 Rhondda floods which themselves were overshadowed by the Wall Street crash of 29 Oct 1929. The isohyets of % rainfall for July suggest that the month was as much of a hotspot in the Borders as in East Anglia. Earnsclough Burn and Marchmont House had 3.78" and 3.88" in July, respectively. So these aren't massive totals.]

≈26 Aug 1930

L?

[**Synopsis:** Date may be a couple of days out. Not such an important flood although impressive photos found in the Scottish Border Archive.]

Southern Reporter, 28 August 1930

FLOODING

Lauderdale has experienced very heavy downpours of rain during the week. The Leader and its tributaries have been extremely high and have overflowed their banks, in some places to a considerable extent. Several fields were either entirely or partially under water, and has retarded harvesting operations. The corn is laid flat, and of course this will necessitate the employment of scythes.

HBNC provides *monthly* rainfall data. This shows relatively high depths in August 1930:

6.13"	at	Earnsclough Burn (Blythe Rig)
5.83"	at	Burncastle
5.61"	at	Cowdenknowes

[**October 1930 – incidental note**]

Berwickshire News, Tuesday 21 October 1930

SANITARY CONDITIONS IN COUNTY; Inspector's Annual Report

West District

Drainage—Flooding in Kidgate, Earlston, occurred [i.e. tended to occur] after heavy rainstorms. A storm overflow has not yet been provided.

17 Aug 1931

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[**Synopsis:** A very large event in Tyne, Whiteadder and Gala, with devastating impacts. No reports found for the Leader but photographs in Scottish Border Archive collection SBA-32 confirm a significant flood in the upper catchment in August 1931. This is consistent with reports of later Leader floods on 10 Nov 1934 and 24 Dec 1937 which refer back to an event in late summer 1931 and (from 1937) six years ago.]

Southern Reporter, 20 August 1931

By six o'clock the Gala had reached a higher level than it had ever attained since the memorable flood of September, 1891, when nearly all the bridges over the river were swept away or seriously damaged, and immense destruction was done to property.

Hawick News, Friday 21 August 1931

GREAT RAINSTORM

Central Scotland, the Lothians, and the Borders experienced on Monday torrential rainfalls, which resulted in widespread flooding. The floods were most severe in the Haddington mid Gala Water districts, and extensive damage was done. In the first-mentioned district forty families are temporarily homeless, and crops in many instances have been completely destroyed. ... The rivers Teviot and Slitrig were in high flood, the Slitrig in particular reaching a very high point. Fortunately there was no flooding in Hawick.

A severe thunderstorm swept over Hawick shortly before six o'clock on Sunday evening, accompanied by drenching rain. The rainstorm in the Gala Water valley on Monday was said to be the worst experienced for over forty years, and there was a good deal of flooding. ... In Galashiels thousands of people lined the river banks or stood on the bridges watching the rising waters. ... At Galafoot, where the Gala joins the Tweed, great scenes were witnessed, but [fortunately the Tweed and Ettrick were not affected in the same way as the Gala](#), or the flooding would have been more serious than it was.

KELSO'S EXPERIENCE

Following the heavy thunderstorm which swept the town during the week-end, Kelso experienced incessant rain Monday, which assumed torrential proportions. [The river Tweed rose rapidly, and at a late hour on Monday night was flooding from 10 to 12 feet above the normal depth. Fields and paths joining the river banks were submerged, and in many cases crops, already laid low by the rain, were partially under water. Campers in low-lying places were forced to retire to higher ground, leaving tents and baggage behind them to be swept down by the river. Further up the river whole fields lay under water. The flood was the worst experienced for some years.](#)

Berwickshire News, Tuesday 22 December 1931

BERWICKSHIRE COUNTY COUNCIL

Earlston Flooding

A letter was read from the Secretary of Earlston Reading Room, and Library [as to the flooding during the summer at Burnside Cottage, which is their property, and which closely adjoins the Trufford Burn](#). After hearing a written statement of Mr Coupland, and a further explanation by Major -Sharpe, the Committee decided that this was a matter the riparian proprietors.

HBNC provides *monthly* rainfall data. This shows relatively high depths in August 1931:

6.31"	at	Earnsclough Burn (Blythe Rig)
5.35"	at	Burncastle

[November 1932 – incidental note]

Berwickshire News, Tuesday 22 November 1932

[Part of a long report of a Berwickshire County Council Public Health Committee meeting]

In regard to [council housing at] Earlston a letter was read from Miss A. Cairns, Burn View, complaining that the erection of a retaining wall at the new houses would increase the risk of damage to her garden by the Trufford Burn when in flood. Mr Coupland explained that Miss Cairns's garden was very low, and had been occasionally flooded. The retaining wall was intended to protect the Council's property, and it was up to other proprietors to take a similar step. [Flooding seemed to occur more frequently than formerly owing to the bed of the burn being silted up](#). The wall should not cause any increased flooding, but a slight alteration might be made on it, and the bed of the burn might be cleared opposite the Council's property.

The opinion was expressed that the adjoining proprietors should take joint action toward cleaning the burn, which Mr Coupland described as a sort of “No Man’s Land” at present. The Committee agreed to leave the matter in the hands of Mr Coupland.

10 Nov 1934

E?

[**Synopsis:** Quite big in the Leader – whole trees being swept down – but not really an important flood.]

The Scotsman - Monday 12 November 1934

BORDER RIVERS IN FLOOD

Big rise in the Tweed

LEADER OVERFLOWS

The River Tweed and its tributaries, Gala Water, Leader, and Teviot, were in exceptionally big spate at the week-end owing to the heavy rains. In many places the rivers overflowed their banks, causing some damage. The Tweed rose eight feet in many parts, [the highest rise recorded since late summer in 1931](#). Farmsteads and outhouses near the river were in danger of being flooded on Saturday until the river receded. It [the Tweed] rose again yesterday, but did not reach the same height. Residents at Dryburgh Cottages and Mertoun Mill, St Boswells, were on a constant lookout, as the swollen river threatened to flood them out.

The Leader overflowed its banks at Earlston and at Leaderfoot, where it joins the Tweed. Trees were among the things swept down, and in the smaller tributaries, large numbers of salmon have been seen “running.”

24 Dec 1937

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[**Synopsis:** Interesting that Earlston could suffer from all sources (surface-water, Turfford Burn and Leader) in what was a minor but in large part snowmelt-driven flood. The surface-water problem came from snow on the local hillside thawing rapidly even in midwinter. A good example of the role that wind can play in promoting rapid snowmelt. Precipitation in December 1937 was more than double the long-term average. So the event followed a wet period.]

The Scotsman, Thursday 23 December 1937

THAW CONTINUES

Mild but Windy Day in Edinburgh

FLOODING IN LOCHABER

Edinburgh enjoyed mild, indeed, it might almost be called warm, weather yesterday. The wind rose during the afternoon, approaching a gale force at times, and there were heavy showers of rain in the evening. **The thaw appears to be becoming general.** A strong south-westerly wind, accompanied by heavy rain throughout Tuesday night and yesterday morning, put an end to the dry, frosty weather experienced in Lochaber for the past month. [The Lochaber bit is not relevant but indicates the general weather pattern.]

Berwickshire News, Tuesday 28 December 1937

Fear of flooded houses

At Dryburgh, four and a half miles south-east of Melrose, the height was measured as 12 feet, but it was believed to be even higher at Mertoun Cauld, near which two dwelling-houses stand

on the river's banks. The occupants feared that their houses would be flooded, and had an anxious time before the level of the river showed signs of receding. St. Boswells golf course, which adjoins the river, was almost entirely covered with flood water.

At the junction of the Tweed and the Teviot at Kelso, there was twelve feet of flood water on Thursday morning. The road by the side of the Teviot was flooded to a depth of three feet and was impassable to traffic. The mill which stands the month [mouth] of the Teviot was flooded half-way up the bottom storey windows. The Kelso-Coldstream road was under water to a depth of 50 inches.

Southern Reporter, Thursday 30 December 1937

EARLSTON

STREETS FLOODED. Owing to the sudden thaw which set in on Thursday the river Leader came down in great volume the following day, rising to a tremendous height and overflowing its banks. Large numbers of trees, bushes and other debris were to be seen floating down stream. It is over six years ago since the Leader was seen so high in spate [i.e. 17 Aug 1931]. At the East end of the village residents were much alarmed in the early hours of Thursday morning by the rapidly melting snow which poured down the steep declivity from the higher ground adjacent to Earlston Mains, till it reached the main street. Here the drainage could not cope with the enormous volume of water, with the result that in a short time the roadway was knee-deep. Eventually the water reached the steps in front of the dwellings. To make matters worse, the Trufford Burn, which is only fifty yards distant from the main road, also overflowed, thus making the situation still more dangerous. A part of the railway line near by was jeopardised. As time went on, however, the waters abated, and the drains were cleared. This is by no means the first occasion on which this flooding has occurred, due, presumably to inadequate drainage. Surely something should be done to divert the volume of water at this part of the village, as residents are getting alarmed, not to mention the inconvenience caused to householders in the vicinity, when going to and from their work.

[Above story was repeated in *Berwickshire News* of Tuesday 4 January 1938 but with the last sentence omitted.]

British Rainfall 1937



Rainfall, December, 1937, as per cent. of average.

2 Jun 1938

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[Synopsis: A decent flood on the Leader though few adverse impacts reported.]

Berwickshire News, Tuesday 7 June 1938

MUCH FLOODING

River bursts banks and floods main road

Berwickshire rivers last week reached their highest level for some years, and adjacent haughs and fields were flooded extensively.

...

On Thursday torrential rain fell in Lauder and district all day with the result that the Leader overflowed its banks and caused much damage such as the bursting of the banks and the uprooting of trees and fences. The occupants of a caravan on the banks of the Leader at the Leader Bridge, were forced to leave their dwelling until such a time as the flood subsided. So high was the level of the water on Thursday afternoon that it reached the windows of the caravan. An alarming spectacle was presented as a result of the storm practically all the Leader Haugh were [*sic*] inundated with water.

Southern Reporter, Thursday 9 June 1938

EARLSTON

Angling. For the past week the river Leader has been more productive. With three feet of fresh water, anglers have had good sport. Fly-fishers have been doing well, especially with dry fly, several anglers having sixteen, fourteen and ten trout respectively. The locals were out in force on Wednesday, and nearly all were successful. ... The river with the continuous rain of Thursday has risen fifteen feet —the largest flood for many years.

13 Nov 1938

KK

[Synopsis: This was an exceptional flood on the Teviot and a bad flood on the Tweed. But no mention of the Leader.]

Sunderland Echo and Shipping Gazette, Monday 14 November 1938

WIDESPREAD FLOODS

Widespread floods in Scotland, Wales, and North-West England have followed the mild spell. Many roads in the Border districts of Scotland were impassable yesterday after torrential rain. The level of the River Tweed at Kelso is 15ft. above normal, stated to be the highest since 1881.

Berwickshire News, Tuesday 15 November 1938

THE RIVER TWEED BURSTS ITS BANKS

Cattle and sheep washed away

MANY ROADS RENDERED IMPASSABLE

Swollen by the abnormal rains at the weekend, the River Tweed, rising almost fifteen feet above its usual level for his [*sic*] month, raged down its course on Sunday, bursting its banks, causing widespread flooding, and doing damage on a large scale.

Houses were invaded by flooding water, cattle and sheep were swept away, trees were torn up, and small wooden out-houses near the the [*sic*] river's path swept away.

At Kelso the Tweed was running at 15 feet above normal in the forenoon, and although it had subsided a little before nightfall further rain threatened to swell the waters to even greater proportions. Sheep, bullocks, pigs, henhouses, and massive tree trunks were seen drifting beneath Kelso Bridge at various times during the day.

Roads Impassable

The road from Kelso to St. Boswells, via Maxton, was rendered impassable at that part, close to Kelso Bridge, south of where the Teviot joins the Tweed. About three miles below Kelso, near Biggham, the main road to Berwick was also impassable, and motors had to proceed via the Cornhill-Wark-Kelso road.

Gardens at Kelso were flooded, while there was four feet of water on the ground floor of Kelso Mill. Residents in houses close to the river below Kelso Bridge are becoming anxious lest the water should rise to even greater heights. On Sunday night it was right up to their doorsteps and to get to the town they had to wade well over the ankles.

At a sawmill about a mile south of Kelso a considerable quantity timber was washed away by the flood. On Sunday morning a large number of people at Coldstream watched the fastly-rising waters. By mid-day the retaining wall which was built after the subsidence at the Brae Heads, was completely submerged.

Jedburgh Gazette, Friday 18 November 1938

Men rescued in Teviot flood

Railway undermined; Bridge damage

Two men marooned, then rescued; bridges torn away: railway undermined between Jedfoot and Nisbet: stock drowned; damage to plant at Ancrum Bridge; and a sea of water down the valleys of Tweed and Teviot were among the incidents and results of flooded rivers in the Borders following hours of torrential rain on Saturday night and Sunday morning.

HONEYBURN RESCUE

The two men marooned were William Lothian and Alexander Stirling, workers on Honeyburn farm just on the Hawick side of Denholm. They went out across the low-lying fields adjoining the river Teviot to attend to some cattle about 7.30 on Sunday morning. While some distance across, the Teviot burst its banks further upstream at a bend, and the sudden onrush of the flood down the field behind them cut off their retreat to the main Jedburgh- Hawick road. With the water rushing in all round they were marooned on a little "island."

Fortunately, the worst of the storm was past, and when their plight was discovered it was realised that they were in no great danger provided the river, which had begun to fall, did not rise again. ... About ten men assisted by wading into the flooded field, which at one point, it was stated, reached up to the neck, and succeeded in bringing the two men across to safety. They had been marooned for fully four hours. ...

...

Bridges wrecked; Stock drowned

...

BORDER FLOOD SCENES

Two foot-bridges carried away at Hawick; timber, live-stock, huts swept in front of the torrents; houses flooded; roads impassable, and rabbits fighting for their lives—these were reports from all quarters of flooded Tweedside and Teviotdale on Sunday.

The two bridges wrecked at Hawick were iron structures which had already withstood many floods. One spanned the Teviot near Victoria Laundry and the other at Mansfield on the way to the football ground. Each of the bridges carried electric cables and gas mains, and these services were dislocated. Each bridge was carried several hundred yards down the river, where they lay, twisted masses of steel.

17 Jul 1940

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[**Synopsis:** The wartime date makes this event hard to research. This was likely a flood at all sites. June and early July had been dry but a very wet spell began with heavy rainfall on 10 and 11 July and again on 17 July.]

[A newspaper headline – seen by Reed (2002b) but not recorded – implied that this storm was worse in the Lammermuirs than over the Water of Leith catchment. *Dundee Telegraph* of 20 July reported that a 2-year old boy all but drowned in a “flooded home-made air-raid shelter” in Berwick. Greater concerns were for the rainfall needed to fully break the ongoing drought.]

[*British Rainfall 1940-1942* reports heavy rainfall in NE England extending into SE Scotland. West Hopes gauge in Lammermuir Hills registered 2.78” on 17 July 1940: an impressive 7% of its annual average depth. **The gauge was close to the dam of Hopes Reservoir, completed in 1933. The site is less than 1.5km N of the headwaters of the Leader catchment:** namely, Bullhope Burn and the Grain Water, tributaries of the Soonhope Burn which feeds into Cleekhimin Burn.]

[*Berwickshire News* of Tuesday 14 September 1948 (see extract later) reports that in the month of July 1940, Cowdenknowes near Earlston received 6.03”. Swinton (1946) reports this and other monthly totals in Berwickshire – all of them greater – including 7.34” at Marchmont.]

[**March 1947 – incidental note**]

Berwickshire News, Tuesday 11 March 1947

THE BIG THAW SETS IN

The thaw set in at the week-end. Heavy rain fell in Berwick on Monday morning. It is expected that there will be much flooding in the country districts.

Poles lent a hand to hew a way through four to six feet drifts on Soutra Hill, near Lauder. A mile away, on the other side of the crest, a snowplough from the Berwickshire end came to meet them, and the road was cleared for single-line traffic on Tuesday. [Previous Tuesday?]

Mid-Jan 1948

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[**Synopsis:** A prolonged wet period leading to floods in some larger rivers in Britain and parts of Europe. Exceptionally wet in the Borders, though floods in the Tweed were relatively modest. Some flooding in Earlston.]

The Scotsman, Thursday 8 January 1948 **BORDER FLOODING**

As a result of heavy rain flooding is general in many parts of the Border counties. Many ploughed fields are lying under flood water, which is over a foot deep in some areas, and low lying ground near the rivers is also covered. On two occasions this week, the River Tweed has risen to seven feet above normal level, and tributaries also in very heavy spate.

Berwickshire News, Tuesday 13 January 1948

BORDER FLOODING

Flooding was fairly general throughout the Borders last week and worried farmers. On some farms work on low-lying ground came to a complete standstill. Wednesday's heavy rain, which was followed by driving sleet, was preceded by two wet days earlier in the week, and the flood water was lying over a foot deep in many parts, including the Kelso and St. Boswells road. On two separate occasions last week, the River Tweed reached the seven-foot mark above normal level.

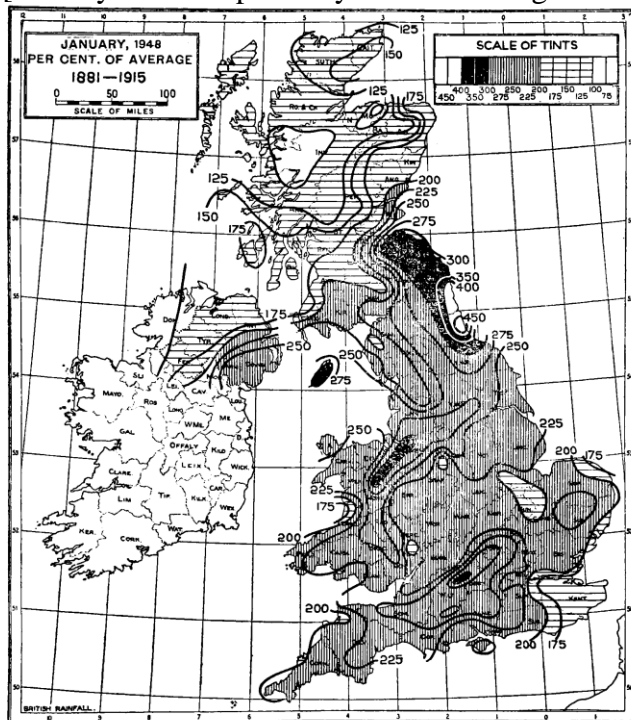
Berwickshire News, Tuesday 20 January 1948

EARLSTON

As a result of the recent heavy rainfall, **many parts of Earlston village have been flooded**. Kings and Co.'s yard being under water, also approximately 50 yards of the roadway. A section of roadway at the West End has also been converted into a miniature lake.

British Rainfall 1948

[January was exceptionally wet in NE England and SE Scotland:]



Rainfall, January 1948, as per cent. of average

12 Aug 1948

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[**Synopsis:** Renowned extreme flood event throughout the Borders, not least in Berwickshire. Flood in Leader Water was itself severe, with unprecedented flooding of property in Earlston.]

Berwick Advertiser, Thursday 19 August 1948

Leader Followed Two Courses

The cloth mill of Messrs Simpson and Fairbairn, and the engineering works of Messrs J. Rutherford and Sons were damaged when the River Leader burst its banks at Earlston.

Only a few houses were affected by the flood, these being in the lower half of the town, beside the river. But householders had to move furniture and valuables to upper rooms when the water swept inside. In some houses the level reached over three feet. The mill and the engineering works were right in the path of the Leader when it burst its banks a few hundred yards from the town and swept down in two separate streams.

Jedburgh Gazette, 20 August 1948

Much damage was done in Lauderdale when the Leader and its tributaries came down in full spate. At Eagle Gate Lodge, Thirlestane Castle, the water rose to three feet inside the house and the inmates were rescued early in the morning.

Berwickshire News, Tuesday 24 August 1948

FLOOD RECORD AT FLOORS CASTLE

The Duke of Roxburghe, Floors Castle, Kelso, writes as follows: I think the following facts are of interest and should be recorded as resulting from the disastrous storm which hit the south-east of Scotland on 12th August.

The Tweed extended 3 feet 8 inches beyond and 6½ inches higher than the highest previous flood of 1831, which is recorded by a stone mark in the park here with the following inscription: "Height of flood, 2 p.m., 9th February 1831".

The rainfall recorded at Floors for the 24 hours 8 a.m. 12th August to 8 a.m. 13th August was 6.12 inches.

When one realises that the previous maximum, recorded 117 years ago, was exceeded it is not surprising that the devastation caused was so violent and widespread. [The previous maximum refers to the flood level not the daily rainfall total, although both will have applied.]

Earlston cottages for war veterans

Despite the inclement weather there was a large attendance at the official opening of two cottages donated by Simpson and Fairbairn, Ltd., at Mill Road, Earlston, to the Scottish Veterans' Garden City Association.

Major Home Robertson acted as chairman over the proceedings and the Earl of Haddington officially declared the cottages open by turning the keys of the front doors.

Mr Nelson, of Simpson and Fairbairn, Ltd., formally handed the cottages over to the Garden City Association, and Mr Salverson, chairman of the association, thanked him and the firm for their splendid gift.

A vote of thanks Messrs Simpson and Fairbairn, Ltd., was accorded on the motion of the chairman, while the Earl of Haddington proposed a vote of thanks to the chairman.

The occupiers of the cottages will be Mr and Mrs Young, who were flood victims at Cumledge Mill, and Mr and Mrs Robertson, Earlston. [Cumledge is on the Whiteadder near Duns. The Robertsons of Earlston may not have been flood victims.]

Berwickshire News, Tuesday 14 September 1948

THE WEATHER OF AUGUST

Highest rainfall recorded [at Swinton House, 34 km E of Lauder]

By Rev A. E. Swinton

It is remarkable how many extremes of weather have occurred in the last decade. I have recorded my lowest temperatures, sunniest month, warmest month, wettest month. Now I have beaten my own record in respect to the last. In July, 1940, recorded the highest rainfall for any month, 7.15 inches. I remember well one very wet Sunday when I had to drive to Eyemouth early in the morning to take duty. It seemed as if the rain would never stop. It began during the night on July 13th and at the end of that rainfall day (9 a.m. G.M.T.) 1.50 inches had fallen in 12.8 hrs. The next day .90 fell in 16.7 hours. So that in 2 days 2.49 inches fell, but I think the rain was continuous: in other words it lasted for 29.5 hours.

I thought that was about the worst Berwickshire could do, but it was a feeble effort compared with Aug. 12th, 1948, when we had 5.10 inches. Unfortunately the pen of my hyetograph stuck at its top notch, so I cannot say exactly how long the rain lasted but it was less than 24 hrs. About 6 o'clock 1 inch fell in half an hour.

Serious

The total rainfall for August was 10.15 inches which shows that the month would have been wet even without the deluge of Aug. 12th. I have made enquiries and found that the highest rainfall in Berwickshire that day was 5.55 at Tweedhill. Whitchester had 4.77, Duns Castle 4.73, Manderston 4.81, Nisbet 5.02, Kelso had 6 12, Carham Hall 6.25. At the "Blue Bell," Pallinsburn there was only 4.47, so it looks as if the most intense rain was in the Tweed valley. A fall of this magnitude was serious enough, but what made the flooding so disastrous was the rain which preceded it.

On Aug. 7th, I recorded 1.37 ins which was part of 28 hrs continuous rain. Each day from the 5th to the 11th there was rain amounting in all to 3.04 ins., which is more than we usually have in a month. On Aug. 11th the rainfall varied from 1.21 at Manderston to .68 at Whitchester, so that for the 2 rainfall days 11th and 12th together, water corresponding to an additional $\frac{3}{4}$ or 1 inch was precipitated. Before the 12th the ground was completely saturated: there had been neither wind nor sun to dry it. (I recorded no sun between Aug. 5th and 13th). Burns and rivers were absolutely full. All the water ran off at once. No wonder the floods were so disastrous!

It would be interesting to make a comparison between this August and the next wettest month July, 1940. Unfortunately "British Rainfall" for that year has not yet been published, although during the first war when the British Rainfall Organisation was a voluntary association "British Rainfall" appeared during the year following that with which it dealt. There can no greater indictment of Government Control than the fact that the Air Ministry has not produced any volume since that for 1939. However the Berwickshire Naturalists Club published the statistics which I collected for our county.

Heaviest previous fall

In July, 1940, the [monthly] rainfall ranged from 8.79 at St. Abbs to 6.03 at Cowdenknowes. The heaviest fall previously recorded in Berwickshire in one day was 3.30 on June 24th, 1911, at Duns Castle, which was the maximum fall, except for two places in Cumberland, in a widespread rainstorm. Mr Leadbetter recorded 2.37 at Swinton House. It may be asked. What is the greatest rainfall ever recorded in one day. On June 28th, 1917, 9.56 ins were measured at Bruton in Somerset. The heaviest fall of this tremendous rainstorm fortunately occurred at the headquarters of several streams which flowed in different directions. In our recent floods all the water converged towards the Tweed. ...

It was the most sunless August in my records with only 77 hours. The maximum temperature, 75 occurred on the 1st. the only day with a temperature over 70. Last year we had 20.

The Berwick Journal, Tuesday 30 November 1948

[Report of *Health Committee of Berwickshire* meeting at Duns on 24 November:]

Lord Haddington said he thought it advisable to accept the houses when they were offered to them. "I do not like the idea of accepting agricultural houses when we know we have nobody to put into them," added Capt. McDougal. It was agreed to make application **for two houses to replace those damaged by the flood at Earlston.**

British Rainfall 1948

The rainfall event is remembered for its large spatial extent and great depth over one day. But p35 notes that, at Swinton House [N of Coldstream], 1.85 in. was recorded in 120 minutes commencing 16:40 on 12 August 1948.

Berwickshire News, Tuesday 1 March 1949

County Council briefs

Mr Knox the County Engineer is to report on the safety of Cleekhimin School following a statement by Capt. A. R. McDougal that the school was not safe following the floods of last year.

Berwickshire News, Tuesday 3 May 1949

The cottages at Rhymer's Tower, Earlston, he said, had been for some time in a very bad state of repair and the minimum sum required to render them habitable was thought to be between £200 and £250. **The properties were further damaged in the severe floods in August.** As even this expenditure would not bring the cottages up to the requirements of the local authority's bye-laws, and as no local tradesman could be found to undertake the work, it was reluctantly decided to apply to the local authority for closing orders, and these were issued on 3rd March last. Notices had been received requiring the cottages to be demolished in about a year's time.

Berwickshire News, Tuesday 24 May 1949

RESTON-DUNS LINE RE-OPENED

The railway between Reston and Duns, on the Berwickshire branch line from Reston to St Boswells, re-opened for passenger traffic yesterday (Monday), after having been closed since the floods of August last year. **The question of the re-opening of the remainder of the line, Duns to Earlston and St Boswells**, also closed since August, was discussed at Duns at the weekend, when a meeting took place between representatives of the County of Berwick and ...

Berwickshire News, Tuesday 1 November 1949

Floods

Mr Knox reported that the recent storm had helped the Gordon and Greenlaw water supplies. Damage had been done to the pipes at Ayton and Cockburnspath. The banks had held despite the fact the works had not been completed.

Major Askew said the bank at Cleekhimin had burst and the water had nearly reached the school. They had been told the bank would be alright. **They must take action to protect the school. Mr Knox said the cost would exceed the value of the school.** It was agreed to submit the position to the Department.

Berwickshire News, Tuesday 29 November 1949

EARLSTON

The Department Health has agreed that the two houses to be erected at Earlston, be of the traditional type if the cost is reasonable. These houses are to be erected to replace flood damaged ones.

McEwen (1985)

[McEwen reports rainfall data for Cowdenknowes, just downriver from Earlston: 0.25" on 11 Aug and 3.3" on 12 Aug 1948.]

Wood (2002)

There is a brief mention of the Leader in the *Friday 13 August* chapter:

[p74]: It was still Earlston trades week and many local residents were still away on holiday, unaware that their homes are under three foot of water. When the Leader flooded this time, it flooded homes where it had never reached before, or since. It would be Saturday before the road was opened again, but gas, telephone and electric services would be unavailable for several more days.

25 Oct 1949

[**Synopsis:** Severe flooding in North Northumberland, especially at Wooler. A near-miss flood at Lauder.]

Berwickshire News, Tuesday 1 November 1949

LAUDER ESCAPES FLOODING

There was no flooding in the vale of the Leader last week during the storm, probably owing to the recently [*sic*] clearing of the river beds. At one time fears were felt in case the Leader overflowed its banks adjacent to two houses at the Eagle Gates, Lauder.

At 2 a.m. on Wednesday the water reached the top of the river bank and the two families were evacuated to the Old Church Hall, Lauder. The two families, ... and ..., were involved in the floods of 1948. The water level fell before it reached their homes.

British Rainfall 1949

West Hopes gauge in Lammermuir Hills registered 3.30" on 25 October 1949: an impressive 10.9% of its annual average depth. [The gauge was close to the dam of Hopes Reservoir, completed in 1933. The site is less than 1.5km N of the headwaters of the Leader catchment: namely, Bullhope Burn and the Grain Water, tributaries of the Soonhope Burn which feeds into Cleekhimin Burn.] Lauder (The Roan) registered 2.31" and Earlston (Cowdenknowes) recorded 1.95". [McEwen (1985) reports a 3-day total at Cowdenknowes of 3.03" but incorrectly ascribes this to 24-26 October rather than 23-25 October. There had been appreciable rainfall (of 1.05") two days before the main storm, not one day afterwards. This is confirmed by the timing of the flood peak at Lauder.

[September 1954 – incidental note]

Berwickshire News, Tuesday 7 September 1954

COUNTY ROADS MATTERS At a meeting of the Roads Committee of Berwickshire County Council on Monday last, Mr Fenton, Surveyor, reported that repairs for Cleekhimin Milne Graden culvert and Howdon bridges were included in the estimates for 1954-1955.

Mr Fenton said the school side of Cleekhimin bridge was now suffering from water scouring the abutment. Mr Scott Aiton said: "I hope the Surveyor will remember the river is very difficult to control in a flood. It can move about 40 yards either side in a night."

28 Aug 1956

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[**Synopsis:** A regionally important flood, generally somewhat smaller than the 12 Aug 1948 event. Direct evidence of the scale of flooding in the Leader is somewhat lacking. SEPA likely holds information from predecessor bodies so their ranking of Leader floods is to be given weight. Source material is desirable to confirm that Turfford Burn and Leader impacts at Earlston have been adequately distinguished.]

Hartlepool Northern Daily Mail, Wednesday 29 August 1956

The Rivers Tweed, Till, Tyne and Whiteadder were reported to have subsided, between four and six feet during the night, and most roads in Berwickshire, where the rivers had overflowed in 14 places, were passable.

But landslips were reported at Hawick (Roxburghshire) and Lauder (Berwickshire), and the A.A. said that five roads were still blocked by floods in the Border areas.

Berwick Advertiser, Thursday 30 August 1956

[Did a big spread on the floods in the Borders and North Northumberland. But no mention of the Leader as such.]

Jedburgh Gazette, Friday 31 August 1956

The Tweed at Galashiels had also spread out over the surrounding landscape, and a vast volume of water was flowing at Leaderfoot Bridge. [But that is referring to the Leaderfoot Bridge over the Tweed, not that over the Leader.]

Berwickshire News, Tuesday 4 September 1956

The residents in Earlston were awakened early on Tuesday morning by serious flooding at the East end of the town. Houses were marooned by water to a depth of 18 inches and parts of the road were closed, being under water. The yard and workshops of King and Co. were all under water and work was suspended. The Trafford [*sic*] burn submerged parts of the railway line. At the West end of the town the river Leader was a raging torrent and houses in close proximity were in danger of being flooded. The road leading to Haughhead was flooded and a fire tender was used to pump water from the roadway.

[p3, col 1:]

Owing to a subsidence at Lauder a road diversion was put into operation.

[p3, col 6:]

Mr Dryburgh, the Berwickshire Road Surveyor, reported three roads were closed on Tuesday. They were Cranshaws and Red Kyle Lodge road, Lauder-Earlston and the Swinton-Paxton road.

Berwickshire News, Monday 26 November 1956

Berwickshire roads

...

Earlston road priority

The programme of major road improvements for 1957-58 was submitted, and it was pointed out that priority would be given to the west road (Berwick-Duns-Earlston).

Following a question by Mr R. Scott Aiton, it was stated that the amount of £3,500 set aside for Bog Hall Bridge, was for widening the bridge. "This is something very necessary," commented Mr Scott Aiton.

Plans for improving Posties' Corner, on the Duns-Berwick road were also submitted. It is proposed to straighten out both comers.

Consideration was given to the probability of widening roads at Summerfield, Earlston. There was an area of ground there, said Mr Scott Aiton, which could be used for a children's playground. It was agreed that the County Road Surveyor, and Mr Scott Aiton visit the site.

... Gravel and stones have been deposited at Cleekhimin Bridge as a result of the recent flooding, and it was agreed that measures should be taken to reform the channel at a cost of £88 6s. Since the beginning of time the river had given trouble, said Mr Scott Aiton.

British Rainfall 1956

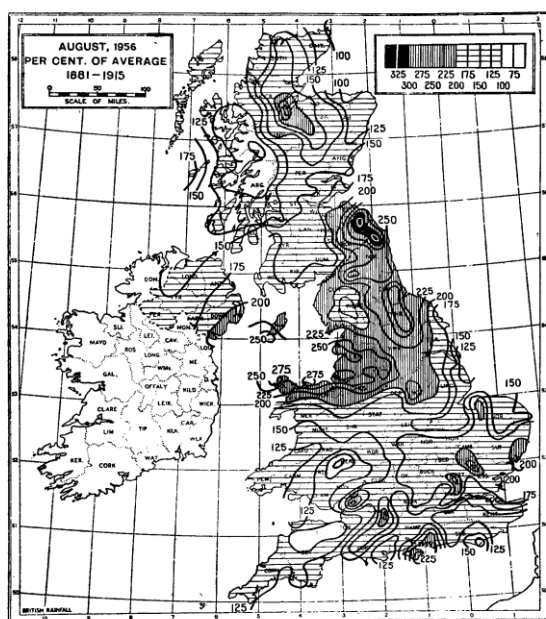
[p48:]

BR 1956 notes heavy rain on 27 Aug 1956 inc. 2.40" at Earlston (Cowdenknowes), 3.79" at Marchmont House and 2.68" at Swinton House.

[p58:]

Depressions moving north-eastwards over Ireland and Scotland on the 13th and across Wales on the 18th brought rain and gales to many areas. Showers between the 19th and 21st were followed by further heavy rain on the 23rd and 24th, particularly in Wales. Thundery showers on the 25th were once again replaced by general rain over England, Wales and southern Scotland on the 26th. Rain persisted into the 28th over North Wales, much of northern England and southern Scotland, and was intense at times. [Marchmont House had 10.86" in August. 498' above sea level. AARF 32.2".]

BRITISH RAINFALL 1956



Rainfall, August 1956, as per cent of average

Ransom (2001), pp117-8:

The year 1956 produced another wet summer in Scotland. ... A month later, on 28 August, heavy rain over 24 hours produced flooding in the Borders, in the districts most affected in 1948. The effects were less serious than before, but still serious enough. ... The up “Elizabethan” morning express to King’s Cross, which had left Edinburgh, was brought back and set off to go via St Boswells and Tweedmouth as in 1948. But that branch became flooded too, and the train was further diverted to follow the rest of the Waverley Route to Carlisle. The up “Flying Scotsman” was sent by the Waverley Route too, but when the line had to be closed because of flooding near Melrose, it had to be brought back to Edinburgh and sent via Carstairs. Comparable diversions and dislocations followed, but it proved possible to make good the flood damage by 30 April. [←Potentially misleading. Contemporary newspaper reports said the line was open again *two days after the flood.*]

[1966 – incidental note]

Turfford Burn Flood Prevention Scheme was promoted in 1966 and approved in 1967.]

4 Noted floods since 1 October 1966

[1966: Flow gauging of Leader at Earlston commenced in October 1966.]

Table 4.1 lists the eight largest floods in the 51-year period commencing 1 October 1966. These correspond to the eight largest annual maximum (AM) floods recorded at Earlston. [None of the water-years providing the seven highest ranking AM floods had a second-ranking flood greater than the eighth highest AM flood.] Slightly different flood rating curves are used before and after 1 Jan 1980. However, these eight floods also correspond to the eight highest flood levels (in m AOD) in the Leader at Earlston. [Although the peak-over-threshold (POT) flood series has a number of gaps in it, there is general confidence that the annual maximum series is unaffected.]

Table 4.1 *Eight largest floods, Leader at Earlston, 1966-2016*

Rank	Flood date	Peak flow (m ³ s ⁻¹)
1	3 Nov 1984	227.0
2	6 Oct 1990	167.7
3	22 Oct 2002	167.5
4	3 Jan 1982	148.9
5	8 Nov 2000	129.5
6	3 Nov 1998	125.6
7	1 Apr 1992	113.0
8	25 Sep 2012	108.0

31 Oct 1977 **L (pluvial)**

[**Synopsis:** Severe flood in the Ettrick. Not an especially large Leader flood at Earlston. A POT flood slightly larger than the 13th AM out of 51 years. McEwen (1985, p 1096) says that the *Scotsman* reported that the High St in Lauder was flooded. The Lothian and Borders Police memorandum of 1 November 1977 on *Major flooding incident in Selkirk Area on Monday, 31st October, 1977* reported: “Flood damage in Lauder minimal.” (Bell, 1997)]

3 Jan 1982 **L E KK**

[**Synopsis:** A severe flood on the Tweed caused by rainfall and snowmelt. JBA (2007) rank it as the fifth largest flood since (and including) the 9 Feb 1831 flood, but their assessment is for the Tweed at Norham not Kelso. SEPA archives inherited from Tweed RPB will provide information such as that quoted by McEwen (1985): “Ice breaking caused a huge flood on Tweed below Kelso, it was the highest level since the disastrous flood of 1948 although levels generally appear to have been around a metre below that event.” The 3 Jan 1982 flood was the 4th largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966.]

3 Nov 1984

LL?

EE

[**Synopsis:** A major flood on the Leader. It was the largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966. SEPA (2014b) indicates the Leader flood at Earlston to be smaller than the 10 March 1881 event but greater than the 28 Aug 1956 event: warranting the EE classification. SEPA or SBC archives may hold information about impacts at Lauder.]

[1989 – incidental note]

<https://auldearlston.blogspot.co.uk/2017/07/earlston-historic-bridges.html>

The railway bridge across the Leader at Earlston was demolished in 1989.

6 Oct 1990

EE?

[**Synopsis:** A significant flood on the Leader. It was the 2nd largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966. No direct reports found of specific impacts in Lauder or Earlston. However, the flood comes in a period that is not well covered online. SEPA (2014b) indicates this Leader flood at Earlston to be smaller than 3 Nov 1984 but larger than 28 Aug 1956: thus warranting the EE classification. SEPA or SBC archives may hold additional information about flood impacts. For reasons discussed below, very heavy rainfall on the Boondreigh Water catchment was likely a key factor in this flood.]

[**Special note:** It would be exceptionally helpful to see the information that underscores the statement in SEPA (2014b) that 28 Aug 1956 < 6 Oct 1990 < 3 Nov 1984. This reckoning is pivotal because it provides a bridge between the gauged flood data at Earlston and the historical floods before gauging began in October 1966. The SEPA statement has in turn raised the classification of the 22 Oct 2002 flood to EE because the recorded flood peak level (2.531 m) is only a millimetre below that (2.532 m) recorded on 6 Oct 1990.]

<https://www.riverlevels.uk/leader-water-earlston#.Wl-M8HnLixA> states that the highest level recorded at the Leader Water at Earlston is 2.53 m, reached on Saturday 6th October 1990 at 9:00pm. Yet the AM flood data (see Table 4.1) imply an appreciably higher one on 3 Nov 1984. Online information can sometimes be misleading.

Flow data for Earlston from standard sources (<https://nrfa.ceh.ac.uk/>) indicate a flood peak of 167.7 m³s⁻¹ but a daily mean flow of only 53.6 m³s⁻¹ on 6 Oct 1990 (and very much less on the following day). This indicates that the flood peak at Earlston was especially spiky. This would be consistent with short-duration and severely intense rainfall on the central Leader catchment leading to a flash flood – with the heaviest rainfall perhaps concentrated on the Boondreigh Water catchment. Had the flash flood occurred on the Upper Leader catchment, the flood peak would have been attenuated by the extensive floodplain storage available upstream of Thirlestane. [Compare this with the flood of 22 Oct 2002 and contrast with the 7 Sep 2008 flood.]

British Rainfall 1990

On the 6th [of October] a deepening depression moved across southern Scotland to the North Sea, the associated cold front moving rapidly across England and Wales. [1-day depths of 60 to 74 mm reported at six gauges on the NW side of the Moorfoot and Lammermuir Hills. Gauges in the Leader catchment are listed in Table 4.2 where Blythe (in Boondreigh subcatchment of the Leader) recorded 47 mm on 6 Oct 1990. Monthly totals reported at Lauder

S Wks and Scoured Rig were respectively 1% less than and 1% more than the 171 mm recorded at Blythe, suggesting that the central area of the Leader catchment experienced broadly similar heavy rainfall.]

Table 4.2 Extract from *British Rainfall 1990*

		RAINFALL 1990																	
Number	Station	Co no	Grid reference	Altitude m	Av 1941-1970 mm	Rainfall in millimetres												Highest daily fall	
						Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	mm
<i>Leader (Tweed)</i>																			
912318	Lauder S.Wks	061	NT540472	159		98	106	27	20	35	91	48	46	52	169	41	112	845	
912505	Scoured Rig	061	NT584520	360	875	97	109	20	14	41	110	46	53	(75)	173	48	(120)	906	
912526	Blythe	061	NT585495	262	859	108	94	21	21	33	104	47	52	74	171	47	110	882	
																		47	6Oct

1 Apr 1992

[**Synopsis:** This was the 7th largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966. No reports found of specific impacts in Lauder and Earlston. However, the flood comes in a period that is not well covered online. SEPA or SBC archives may hold information about impacts.]

3 Nov 1998

[**Synopsis:** This was the 6th largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966. No reports found of specific impacts in Lauder and Earlston. However, the flood comes in a period that is not well covered online. SEPA or SBC archives may hold information about flood impacts.]

8 Nov 2000

[**Synopsis:** Autumn 2000 produced exceptional flooding in many parts of England and Wales but not in South-East Scotland. This was the 5th largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966. No reports found of specific impacts in Lauder or Earlston. SEPA or SBC archives may hold information about flood impacts.]

[1 August 2001 – incidental note]

Water-level recording commenced on Leader at New Mills, a couple of kilometres upstream from the Harry Burn confluence at Thirlestane.

22 Oct 2002

EE?

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[**Synopsis:** This was the 3rd largest Leader flood at Earlston recorded in 51 years commencing 1 October 1966, though only the 4th highest flood recorded at New Mills (Lauder) in 16 years commencing 1 August 2001. This flood event was notably milder at New Mills than at Earlston. The storm likely affected the Boondreigh Water much more strongly than the Upper Leader. SEPA (2017) lists this as an important flood. SEPA or SBC archives may hold information about flood impacts. JBA (2009) have this as a major Tweed flood at Norham:

smaller than 9 Feb 1831 and 13 Aug 1948, but comparable to 28 Aug 1956. ECC (2017) flood record mentions Crossing House in the 2002 flood entry. Presumably the Turfford Burn was in flood at Georgefield Road?]

[**Special note:** It would be exceptionally helpful to see the information that underscores the statement in SEPA (2014b) that 28 Aug 1956 < 6 Oct 1990 < 3 Nov 1984. This reckoning is pivotal because it provides a bridge between the gauged flood data at Earlston and the historical floods before gauging began in October 1966. The SEPA statement has raised the classification of the 22 Oct 2002 flood to EE because the recorded flood peak level (2.531 m) is only a millimetre below that (2.532 m) recorded on 6 Oct 1990.]

Flow data for Earlston from standard sources (<https://nrfa.ceh.ac.uk/>) indicate a flood peak of $167.5 \text{ m}^3\text{s}^{-1}$ and daily mean flows of $51.3 \text{ m}^3\text{s}^{-1}$ on 22 Oct 2002 and $51.6 \text{ m}^3\text{s}^{-1}$ on the following day. This suggests that the flood peak at Earlston was quite spiky. This would be consistent with the heaviest rainfall occurring on the central Leader catchment – perhaps concentrated on the Boondreigh Water catchment. [Had the flood been centred on the Upper Leader catchment, the flood peak would have been attenuated by the extensive floodplain storage available upstream of Thirlestane. Compare with the flood of 6 Oct 1990 and contrast with the flood of 7 Sep 2008.]

<https://www.berwickshirenews.co.uk/news/floods-cripple-services-1-241885>

Floods cripple services

... The A1 at Reston and Ayton was closed for short periods on Tuesday due to surface water and motorists struggled to complete their journeys as roads were closed in many other parts of the region.

Worst affected were the A6105 between Earlston and Gordon and Duns and Foulton, the A697 between Coldstream and Greenlaw, the A6089 Whiteburn to Gordon and the A6112 Duns to Mountpleasant. Roads officer Darren Silcock said: “Duns has been quite badly affected and there were some serious problems at Eyemouth although these were isolated to two spots. There was also a landslide in the Earlston and Gordon area.”

22 Jan 2003

[**Synopsis:** This was the 7th highest flood recorded at New Mills (Lauder) in 16 years commencing 1 August 2001. At Earlston, it was a POT flood of $85.4 \text{ m}^3\text{s}^{-1}$ comparable in size to the 10th ranking AM in 51 years commencing 1 October 1966. A minor-ranking flood. SEPA or SBC archives may hold information about flood impacts.]

? Oct 2003

[**Synopsis:** SEPA (2015a) implies a damaging Turfford Burn flood on 1 Oct 2003. ECC (2017) says “Significant flood recorded on the Turfford Burn” in October 2003. There was no flood on the Leader Water. There was something of a flood response at New Mills on the 21 Oct 2003: the water level rising from a low level of 0.057 to a peak of 0.282 m. Might the Turfford Burn flood have been on 21 Oct 2003? No reports found of specific impacts in Earlston. SEPA or SBC archives may hold relevant information.]

6 Aug 2008

[**Synopsis:** The peak water-level recorded at New Mills (Lauder) was the 6th highest in 16 years commencing 1 August 2001. The flood at Earlston was not the annual maximum (see next event) but it was roughly equivalent to the 20th highest AM flood peak in 51 years of data commencing October 1966. This was a relatively minor flood.]

7 Sep 2008

L?

[**Synopsis:** An important Upper Leader flood that initially slipped through the net. The flood is thought to have peaked in the early hours of 7 Sep 2008. The peak water-level recorded at New Mills (Lauder) was the 3rd highest in 16 years commencing 1 August 2001. The flood at Earlston was the 16th highest AM flood peak in 51 years of data commencing October 1966. If the usual Gringorten plotting-position formula is adopted, the 16th ranking of 51 annual maxima is accorded a return period of 3.3 years and an AEP of 30.4%. Not at all a rare flood in the Leader. *Although not on the face of it a major flood, the event had a number of very important features.*]

The flood extent at Thirlestane

There is photographic evidence that, perhaps 16 hours after the peak, the flood extended beyond the mapped 0.5% AEP flood contour close to the Harry Burn confluence with the Leader Water. Yet the peak water-level recorded at New Mills (Lauder) was only the 4th highest in 16 years commencing 1 August 2001. **This points to a major defect in the flood-risk mapping of the Leader.**



Figure 4.1 7 Sep 2008 flood, close to Harry Burn confluence with Leader (NT529486)

The SEPA flood-risk map indicates that the 0.5% AEP flood on the Leader stays well clear of the Standalone plantation yet the photograph refutes this. This appears to have been no more than a medium-sized Leader flood. The peak water-level recorded at New Mills (Lauder) was only the 4th highest in 16 years commencing 1 August 2001. It was the 16th highest AM flood peak at Earlston in 51 years of data commencing October 1966.

This flood was not remotely on the scale of the historical floods of 9 Feb 1831, 21 Sep 1891 and 12 Aug 1948. The photograph demonstrates that flood risk mapping in this reach of the Leader is comical in its deviation from reality.

Given the degree of absurdity, the New Mills water-level data warrants scrutiny by SEPA. Was the flood unusually concentrated on the Mid Burn and Harry Burn: which join the Leader downstream of New Mills? Could the New Mills water-level have been affected by bypassing? Given the instrument's location on the upstream face of the road bridge, any bypassing would have needed to have occurred from the Leader Water to the Mid Burn well upstream of New Mills. Does the raw water-level data show any sign of the level at New Mills running steady at its peak value (suggesting a bypassing effect) or of sensor/recording malfunction?

The natural flood attenuation effect of the floodplain in the Middle Leader

Flow data for Earlston from standard sources indicate a flood peak of $73.2 \text{ m}^3\text{s}^{-1}$ on 7 Sep 2008 and daily mean flows of $56.8 \text{ m}^3\text{s}^{-1}$ on 6 Sep 2008 and $37.8 \text{ m}^3\text{s}^{-1}$ on the following day. The flood yielded at Earlston only the 16th highest flood peak in 51 years but the fifth highest daily mean flow.

This flood provides an example of a moderately large flood on the Upper Leader that led to a sustained high flow in the Leader at Earlston but not a relatively modest flood peak. Backed up by the photographic record of Figure 4.1, the occurrence points to the attenuating influence of natural floodplain storage in the Upper and Middle Leader for medium-sized floods.]

23 Aug 2009

[**Synopsis:** No flood response at all at New Mills, and the peak flow recorded at Earlston was a mere $19.7 \text{ m}^3\text{s}^{-1}$. This was not a flood in the Leader. But a Turfford Burn problem arose at the new High School. This seems odd given the reference below to constant heavy rains rather than a thunderstorm. Perhaps a design or teething problem with drainage?]

<https://www.thesouthernreporter.co.uk/news/new-earlston-school-hit-by-flooding-1-108471>

The Southern Reporter, Wednesday 26 August 2009

EARLSTON's multimillion-pound flagship high school is the latest of the Borders' brand new secondaries to suffer from flooding problems. The new school at Earlston only opened its doors for the first time to pupils last Thursday, but **constant heavy rains last weekend saw the school's still under-construction sports pitches and car park flooded**, with reports that seeping water had also affected the games hall, whiteboards and projection equipment.

"There has been some flooding of part of the grass pitches at Earlston High School," said a council spokesperson. "From the start of this project, it has been accepted that some of the school pitches are on a flood plain. The school building is not. Any alteration to the watercourse would not have been possible as it may have created problems with flooding in Earlston itself. The council and SBEP have always accepted that flooding of the pitches will happen. We are using this opportunity to check that all drainage facilities are functioning to their best ability and also checking agreed procedures for dealing with the aftermath of any flooding."

4 Sep 2009

[**Synopsis:** This was the 6th highest flood recorded at New Mills (Lauder) in 16 years commencing 1 August 2001. At Earlston, it was the 18th ranking AM in 51 years commencing 1 October 1966. A relatively minor flood in the Leader.]

5 Apr 2010

[**Synopsis:** This was the 8th highest flood recorded at New Mills (Lauder) in 16 years commencing 1 August 2001. At Earlston, it was the 28th largest AM flood recorded in 51 years at Earlston. If the usual Gringorten plotting-position formula is adopted, the 28th ranking of 51 annual maxima is accorded an AEP of 54% and a return period of 1.9 years. A very minor flood in the Leader. But the Turfford Burn gave significant problems at the new High School.]

www.earlstonhigh.scotborders.sch.uk/.../SUB%20GROUP%20MIN%2028TH%20APR...

EARLSTON HIGH SCHOOL

PARENT COUNCIL SUB-GROUP MEETING

TUESDAY 28TH APRIL 2010

End of Term – **Proved a very stressful end of term with the floods**, and the cancellation of the Spring Concert was very disappointing especially for the senior pupils who were not able to showcase their talents.

25 Sep 2012

L?

[**Synopsis:** This was the highest flood recorded at New Mills (Lauder) in 16 years from 1 Aug 2001, and the 8th largest Leader flood at Earlston recorded in 51 years commencing 1 Oct 1966. There are three years of data missing at New Mills. If the usual Gringorten plotting-position formula is adopted, the 1st ranking of 13 annual maxima is accorded an AEP of 4.3% and a return period of 23 years at New Mills. The 8th ranking of 51 annual maxima is accorded an AEP of 14.8% and a return period of 6.8 years at Earlston. The rarity estimate at New Mills is highly approximate, and likely an exaggeration. This was a moderately large Leader flood at Lauder but less so at Earlston.]

The photos below are of Craigsford Bridge at Earlston, taken by Gillian Donaldson and downloaded from: <http://myhiddenscottishborders.blogspot.co.uk/2014/09/water-water-everywhere-but-how-to-get.html>. Unless there is a mistaken recollection, the flood photo will have been taken on 25 Sep 2012 or 12 Oct 2012. My guess is the former. The dry-weather photo is said to have been taken on ≈10 September 2014, when flows in the Leader were indeed low: about 0.45 m³s⁻¹. This corresponds closely to the reference low-flow Q₉₅, i.e. the flow exceeded 95% of the time.

The following information comes from SEPA (2014b): a relatively detailed response to the Proposed Local Development Plan for Scottish Borders Council. It is by nature somewhat derivative: “Recently, a member of the public contacted SEPA to inform us that there was flooding of Haughhead Road and it was close to property north west of the allocation site [EEA101 – Earlston – Mill Road] in 2012. This event had a return period of less than a 1:15 years.” [This comment likely refers to the 25 Sep 2012 event.]

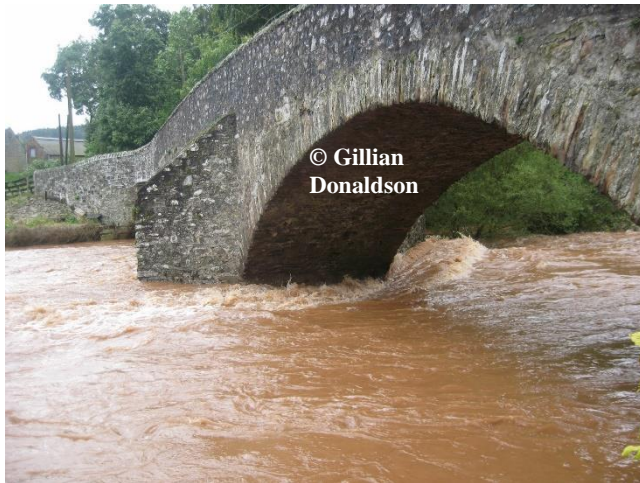


Figure 4.2 *The Leader Water at Craigsford Bridge:* (a) An Autumn 2012 flood
(b) An Autumn 2014 low flow

12 Oct 2012

T

[**Synopsis:** The worst of several floods in summer/autumn 2012 on the Turfford Burn. The flood in the Leader was relatively minor: the 13th largest recorded in 16 years at New Mills (Lauder) and (at most) the 14th largest Leader flood at Earlston recorded in 51 years. If the usual Gringorten plotting-position formula is adopted, the 14th ranking of 51 annual maxima is accorded an AEP of 26.5% and a return period of 3.8 years. Some online coverage of the Turfford Burn flood. SEPA or SBC may hold additional information about its impact.]

http://www.bordertelegraph.com/news/13540037.Earlston_counts_cost_of_flash_floods/

SEVERAL households in Earlston are getting that sinking feeling after being hit by flash flooding for the fourth time in as many months.

Heavy rain throughout the early hours of Friday morning left many roads in the central Borders closed.

But it was the east end of Earlston which, once again, appeared to take the brunt of downpours.

At the height of Friday's floods ... told us: "We have been trapped in our home again. The water didn't manage to get into the house but our garden has been ruined - this is the fourth time this summer." "Something needs to be done quickly to stop the burn from flooding so easily. We've been at the council for years about this - they don't seem to care. I tried phoning the council this morning and I'm told the flood officer is on holiday."

Around a fortnight's average rain fell during the Friday morning storms. Roads around Bowden, St Boswells and Kelso were also badly affected. **But it's the regularity of the problems around the Turford Burn [sic] in Earlston that has angered locals.** Mr Hawkes added: "I have told my insurance company to sue the council. They should be doing a lot more."

Workmen from the Scottish Borders Council did help with the clean up. And leader David Parker, who represents the Earlston area, admitted his authority were struggling to find a solution. He said: "The volume of rain falling from the sky is above anything we've witnessed before - this has been the wettest summer on record." "Earlston is a problematic area but it is a natural water course and there is only so much you can do. Creating water storage is an option we've used in other places but where do you dig a big hole in Earlston?"

Friday's floods also left much of Earlston High School's playing field under water. A spokesman for the local authority told us: "We provided assistance at the time, and has since carried out an initial investigation into the cause of the flooding." "It appears that the some bank protection at Turford Burn collapsed, causing water to flow into the school rugby playing fields, and then onto the road at the Crossings area." "The council is now looking into what measures can be taken to reduce flooding in the future."

An impressive photograph of flooding accompanies the Border Telegraph article and can be viewed on the above link. This shows flooding on Georgefield Road. The RH property appearing in that photo is the former Level Crossing cottage/house. Land levels under the LH property may have been raised but the road level is little-changed. The railway ran between these properties, crossing Georgefield Road at a slight angle. Comparison of the photograph with a Google Street View images taken a few years earlier suggests a depth of water of about three inches (75 mm) on 12 Oct 2012 at the time of the photograph. The road has a dropped kerb on the side in view.

There is also video footage of flooding on Georgefield Road on the town side of Turford Burn, near Earlston Primary School. See: https://www.youtube.com/watch?v=hbog-CNKA_8.

<http://www.itv.com/news/border/2012-10-12/torrential-rain-causes-floods/>

Torrential rain has caused floods in many parts of the region. Roads in the Scottish Borders have been affected by flooding following torrential rain overnight. **The main A68 trunk road was particularly badly affected by floods and surface water on Friday morning.**

26 Dec 2015

[**Synopsis:** 9th ranking POT flood in 16 years at New Mills. 20th ranking AM in 51 years at Earlston. If the usual Gringorten plotting-position formula is adopted, the 20th ranking of 51 annual maxima is accorded a return period of 2.6 years and an AEP of 38.3%. Not at all a rare flood in the Leader.]

22 Nov 2016

[**Synopsis:** 2nd ranking POT flood in 16 years at New Mills. 9th ranking AM flood in 51 years at Earlston. There are three years of data missing at New Mills. If the usual Gringorten plotting-position formula is adopted, the 2nd ranking of 13 annual maxima is accorded an AEP

of 11.9% and a return period of 8.4 years at New Mills. If the usual Gringorten plotting-position formula is adopted, the 9th ranking of 51 annual maxima is accorded an AEP of 16.7% and a return period of 6.0 years. This Leader flood at Earlston was of fair size but not of a rarity one would expect to lead to major impacts.]

According to *Terrenus Land & Water (2017)*:

Personnel from Scottish Borders Council attended the area around Rhymers Mill on the 22nd November 2016, immediately following the peak flow event and provide a photographic record of their findings. The photograph included debris build up on the upstream face of Clatteringford Bridge [*sic*, presumably Craigsford Bridge is intended] and a trash line on the northern bank of the parkland upstream of the bridge.

5 Gauged flood data

Whereas the earlier floods are classified according to impact reports, the more recent floods on the Leader are judged mainly by reference to the gauged flood data.

5.1 Comparison of flood data for New Mills and Earlston

From 1 August 2001, gauged data are nominally available for the Leader from both New Mills (a little upstream of Lauder) and Earlston. The New Mills data are water levels only.

Perhaps the New Mills station can be bypassed in the highest floods. If so, the recorded peak water levels may under-represent the very largest events. The distribution of daily maximum water levels (see Figure 5.1) shows no sign of truncation. Given the circumstances reported for the 7 Sep 2008 flood – see relevant entry in Section 4 above – it will be worth questioning this for the six highest floods so far recorded at New Mills, i.e. the 25 Sep 2012, 22 Nov 2016, 24 Sep 2012, 6/7 Sep 2008, 21/22 Oct 2002, and 6 Aug 2008 events.

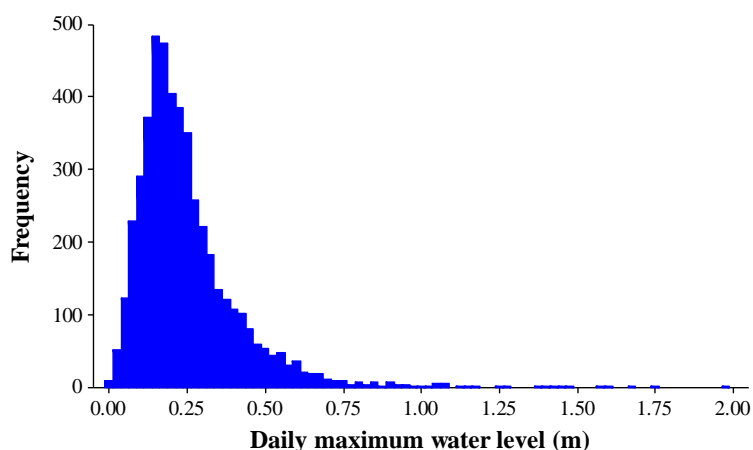


Figure 5.1 Distribution of daily maximum water-levels recorded at New Mills

SEPA publish water-level data on <http://apps.sepa.org.uk/waterlevels/> showing the last three to four days of 15-minute data.

From another website it was possible to download water-level data from 31 March 2017 to date. The comparison below uses data downloaded on 18 February 2018. Being daily mean values, the data should strictly be plotted as castellated. However, to do so would obstruct comparison within a single diagram.

These data are to be considered no more than provisional. There appear to be some unexplained changes in datum at one site or the other. Does the New Mills sensor suffer from shifts in its calibration? Or do the differences relate to bed erosion/accretion at one or other of the gauged sites? Does a cauld or the remnant of a cauld (e.g. at Mill Meadows) attract debris that leads to shifts in the relationship between water levels recorded at New Mills and Earlston?

The floods in the period shown in Figure 5.2 are relatively minor, but the flashiness (i.e. fast-rising nature) of the Leader is evident, not least in the flood of 7 June 2017 (Day 67 in the diagram). The hydrograph patterns from about Day 250 onwards show a less coherent pattern, with some peaks evident at Earlston that are not prominent at Lauder. This is likely explained

by the influence of the (no less flashy) Earnsclough and Boondreigh Waters, tributaries which join the Leader downstream of New Mills but upstream of Earlston.

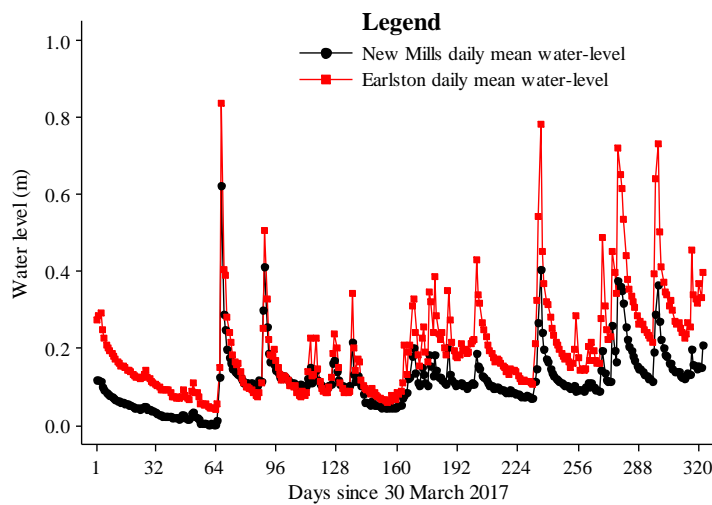


Figure 5.2 *Daily mean water-levels at New Mills and Earlston*

Because of missing data (1003 days at Earlston and 1186 days at New Mills) there are only 3833 days in common between the two records, i.e. about 10.5 years. A semi-formal comparison can be made by comparing the daily mean water-level at New Mills with the water level at Earlston inferred as corresponding to the reported daily mean flow. SEPA may hold the original water-level data for Earlston, allowing a slightly more rigorous comparison.

As one might expect, the degree of association is moderately strong (see Figure 5.3). The daily mean water-level at New Mills explains 82% of the variation in that at Earlston. Part of the unexplained variation may reflect the kind of datum differences evident in Figure 5.2.

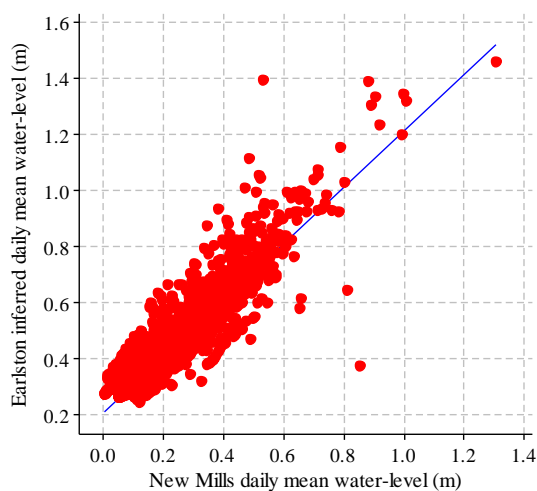


Figure 5.3 *Association of daily mean water-level at Earlston to that at New Mills*

The outlying points on the plot correspond to particular floods, notably that of 21/22 October 2002. In that instance, the peak level at Earlston appears to have occurred about a day later than at New Mills. This flood event was notably milder at New Mills than at Earlston. I suspect that the heaviest rainfall occurred in the central Leader catchment and was perhaps concentrated on the Boondreigh Water catchment.

The annual maximum (AM) flood series for Earlston is thought to be complete for the 51 water-years commencing 1 October 1966. The peaks-over-threshold (POT) series for New Mills is affected by gaps in the record. The main missing period is from 12 Jan 2004 to 29 Mar 2007. While it is not thought that a major flood at New Mills has been missed, it is appropriate to reduce the effective POT record length there from 16.5 years to 13.3 years.

With its record being 3.8 times longer, one might expect the Earlston AM ranks to be typically 3 to 5 times the New Mills POT ranks. The final column of Table 5.1 draws attention to the exceptions.

Table 5.1 *Noted floods in common period of record between New Mills and Earlston*

Flood date	New Mills POT rank (in 13.3 years)	Earlston AM rank (in 51 years)	Comparison between Leader floods at New Mills and Earlston
22 Oct 2002	4	3	Milder at New Mills
22 Jan 2003	7	10	Milder at New Mills
6 Aug 2008	6	~20	
7 Sep 2008	3	16	Somewhat rarer at New Mills
4 Sep 2009	6	18	
5 Apr 2010	8	28	
25 Sep 2012	1	8	Rarer at New Mills
12 Oct 2012	13	14	Milder at New Mills
26 Dec 2015	9	20	
22 Nov 2016	2	9	

Four relatively minor Leader floods – those on 4 Sep 2009, 5 Apr 2010, 12 Oct 2012 and 26 Dec 2015 – have been included in the historical flood review. The AM rank of each of these is well outside the top ten of floods in the 51 years of gauged record at Earlston. These events have been included because of flooding problems on the Turfford Burn or other topography.

5.2 Period from 1 October 1966 to 31 July 2001

In this earlier period, only one of the noted floods – that of 31 Oct 1977 – lies outside the top ten of floods in the 51 years of gauged record at Earlston.

Table 5.2 *Noted floods between 1 October 1966 and 31 July 2001*

Flood date	Earlston AM rank (in 51 years)
31 Oct 1977	13
3 Jan 1982	4
3 Nov 1984	1
6 Oct 1990	2
1 Apr 1992	7
3 Nov 1998	6
8 Nov 2000	5

Integrating Table 5.1 and Table 5.2, it is seen that each of the top ten AM floods has been explored in the historical flood review. Perhaps the AM series unconsciously influenced the searching for historical flood data.

6 Summaries of the flood chronologies

The information gleaned in the review of floods is summarised in Figure 6.1, Figure 6.2 and Figure 6.3, where the classifications are shown. The diagrams span the 200 years ending on 31 December 2017.

This study focuses on Lauder and Earlston. Classifications are not summarised for the Tweed at Kelso, although a few observations are offered in the next section.

6.1 The Leader Water

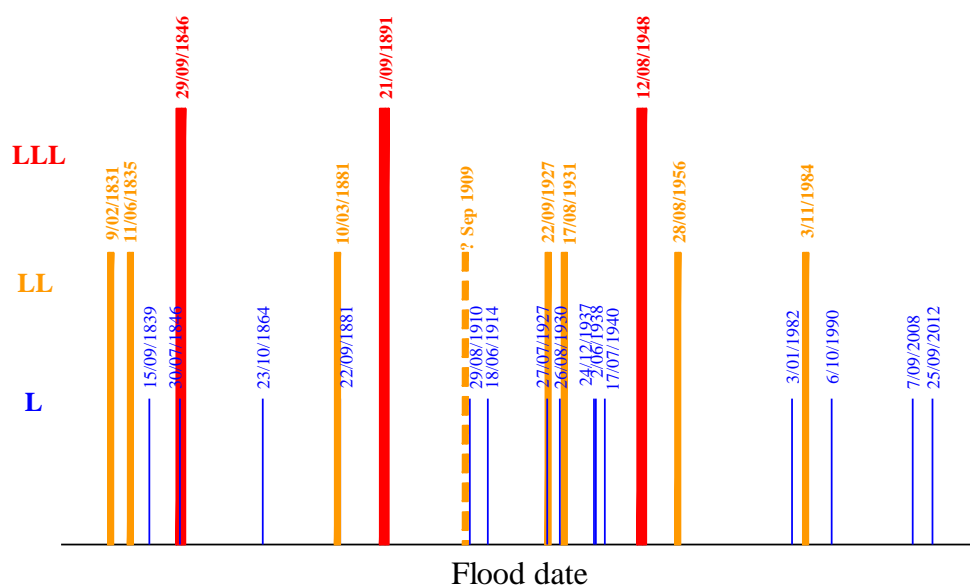


Figure 6.1 Summary of flood chronology: Leader at Lauder

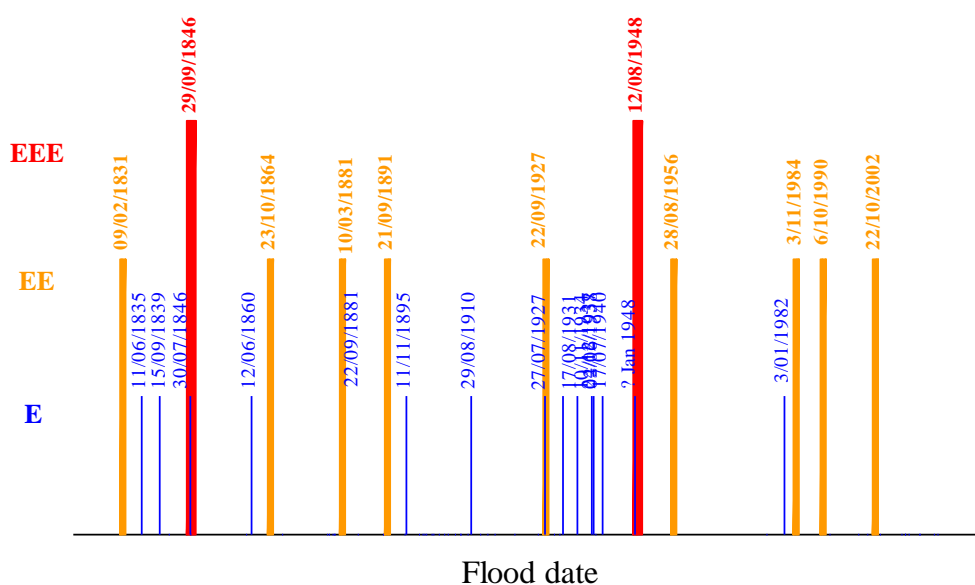


Figure 6.2 Summary of flood chronology: Leader at Earlston (E)

6.2 The Turfford Burn

The flood chronologies up to about 1970 are relatively well documented in local newspapers. The later chronologies for Earlston and (to a lesser extent) Lauder have been informed by gauged flood data at Earlston (from 1 October 1966) and New Mills (from 1 August 2001). However, the chronology for the Turfford Burn has no such support.

The sparsity of reports after 1956 (see Figure 6.3) may be a combination of chance and of the improvements wrought in 1967 by the Turfford Burn Flood Prevention Scheme. But flooding problems persist and more information is needed to substantiate these.

Presumably there will be local residents with knowledge of floods that led to the Georgefield Road becoming impassable for a period – a relatively standard yardstick – and any that were considerably worse. One of these may be the October 2003 [1 or 21 Oct 2003?] flood referred to in ECC (2017).

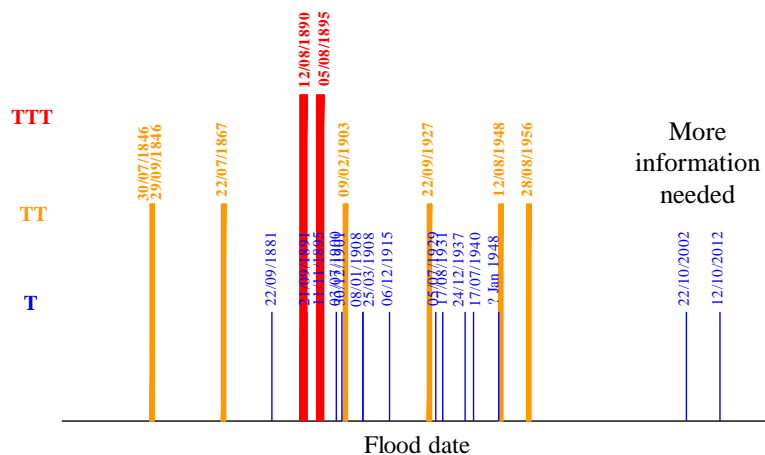


Figure 6.3 Summary of flood chronology: Turfford Burn (T)

6.3 Targets

The targets set in Section 2.4 to identify roughly two very large, three large and five moderately large floods have been overshot. But the research has been successful in identifying the most severe Leader floods: three at Lauder (29 Sep 1846, 21 Sep 1891 and 12 Aug 1948) and two at Earlston (29 Sep 1846, and 12 Aug 1948), and the two most severe floods on the Turfford Burn (12 Aug 1890 and 5 Aug 1895).

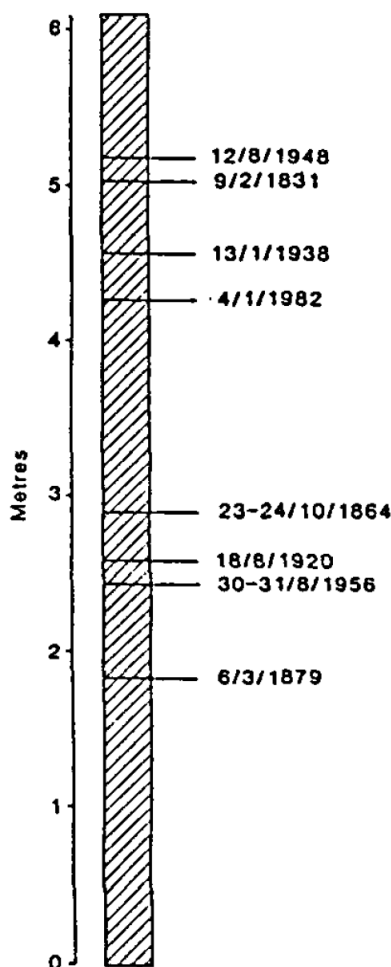
7 Comparison with other flood chronologies

7.1 McEwen (1985, 1990)

McEwen (1985) presents flood chronologies for the Leader and the Tweed, along with some other Scottish rivers. The flood chronology for the Leader is further explored in McEwen (1990). This later publication is taken to be the more authoritative, and provides the outputs discussed and dissected here.

7.1.1 Tweed

Box 7.1 *Tweed at Kelso chronology from McEwen (1990)*



Discussion and dissection

The vertical presentation provides an excellent visualisation of the Tweed at Kelso flood chronology. It gives precedence to indicating the magnitude of the floods. Their dates are listed in commendable detail. The data are said to derive from flood markings at Kelso Bridge, *aka* the *Tweedometer*.

The 13 Nov 1938 flood is noted but mistyped as 13/1/1938. The text of the paper alternates references to Jan 1938 and Nov 1938.

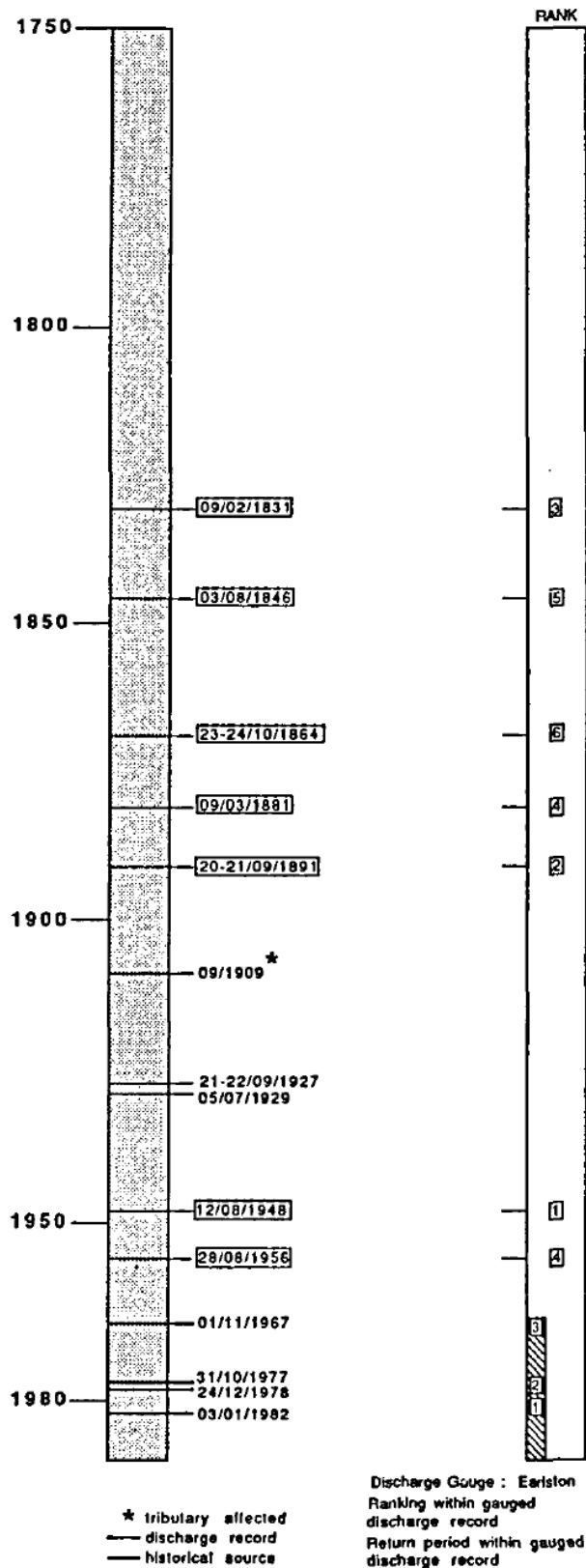
The Aug 1956 flood peaked on 28 not 30-31.

The Tweed flood of 5 Mar 1879 was not especially large at Kelso. "A rise of six feet" has been misconstrued.

A number of significant floods – e.g. those on 29 Sep 1846, 15 Sep 1839, 10 Mar 1881 and 22 Sep 1927 – were overlooked by McEwen.

7.1.2 Leader

Box 7.2 Leader chronology from McEwen (1990)



Summary

The presentation is more confusing than that in Box 7.1. The vertical scale indicates time, with the year 1750 at the top and 1985 at the bottom. The flood dates are listed in commendable detail. Ranks of a kind (see next section) appear alongside the more notable flood events, but their basis is rather vague. The Tweed River Purification Board's own reckoning of historical Leader floods may have played a part.

Ranked floods and dates are shown also for flows gauged at Earliston from 1966. The two sets of ranks are loosely integrated. The critical phrase is that: "According to the ranking of the TRPB, none of these gauged events rank in the first 5 on the Leader since 1831". The words "since 1831" do not aid clarity.

McEwen indicates the seven largest pre-instrumental (i.e. pre-1966) floods by their dates appearing in bounding rectangles. At least five of these – 12 Aug 1948, 20/21 Sep 1891, 9 Feb 1831, 9 Mar 1881 and 28 Aug 1956 – are held to be greater than the then highest gauged flood of 3 Jan 1982.

The asterisked flood of Sep 1909 relates to a severe flood in the Cleekhimin Burn. The source of the date of this flood is unclear. Might Sep 1909 be the month when the Cleekhimin Burn channel realignment was surveyed following a highly localised storm?

7.1.3 Further discussion

The geomorphological work of McEwen (1985 and 1990) attempted to link mapped changes in channel planform to particular historical floods. Although highly enterprising, the links made are not always convincing. McEwen includes 9 Feb 1831 as a big *Leader* flood but the evidence offered is weak and indirect. The argument is principally based on *mapped* changes in channel layout at the Leader /Cleekhimin and Leader/Boondreigh confluences. No evidence appears to be offered to tie these morphological changes to the 9 Feb 1831 flood specifically. [It is not the most obvious candidate to explain the marked channel-changes between maps published in 1750 and 1857. From other evidence we know of severe Leader floods on 21 Oct 1797 (see Appendix A1) and on 29 Sep 1846. The Leader may also have been affected in the regional flood of ~12 Mar 1782 (see Appendix A1).

Confusingly, two Rank 4 floods are indicated: 9 Mar 1881 and 28 Aug 1956. Yet so too is a Rank 5 flood!

McEwen (1985 and 1990) assigns a return period of 90 years to the 3 Jan 1982 flood. This is a gross exaggeration. The 6th largest flood in (say) 200 years cannot be anything like as rare as that. If the usual Gringorten plotting-position formula is adopted, the 6th ranking of 200 annual maxima is accorded an AEP of 2.8% and a return period of 36 years.

The 3 Aug 1846 flood date is incorrect. The flood was on 30 Jul 1846. This was quite a large flood on the Leader and Tweed. But the much more severe 29 Sep 1846 flood is overlooked. Perhaps in consequence, McEwen exaggerates the severity of the 9 Feb 1831 Leader flood.

It is possible that judgements were unreasonably influenced by:

- An extreme value analysis of daily rainfall data from a long-record gauge at Cowdenknowes;
- An assumption that Tweed flood rankings at Kelso Bridge are indicative of Leader flood rankings;
- Speculating as to which flood event sparked significant channel changes: most notably near the Leader/Cleekhimin confluence at Wiselawmill.

One adjustment made between McEwen (1985) and McEwen (1990) was to interchange the ranks assigned to the 9 Feb 1831 and 20/21 Sep 1891 Leader floods were interchanged. This correction was needed, but the rarity of the 9 Feb 1831 flood continued to be over-egged.

7.2 Reed (2002b)

This relatively detailed historical flood review of the Water of Leith made considerable reference to rainfall data – exploiting the rich historical records available for Edinburgh – in addition to newspaper reports and local history books. Reed classified Water of Leith floods simply: distinguishing Severe and Significant floods from a range of lesser events. The outputs are summarised in Table 7.1. It is coincidental that an equal number of Severe and Significant floods were found. The impacts were principally judged from reported flood levels at Roseburn (close to Murrayfield). [←There is sometimes information to be found in place names!] The Water of Leith (WoL) floods that Reed (2002b) failed to pinpoint were on 18 Nov 1795 (see Appendix A1) and on 14 Jul 1879.

Table 7.1 *Notable floods in the Water of Leith – from Reed (2002b)*

Flood date	Severe	Significant	Also a Leader flood?	Comment
1795	✓			Failed to pinpoint date
8 Oct 1832	✓			
29 Sep 1846		✓	✓	
1878/1879	✓			Failed to pinpoint date
15 Oct 1907		✓		
8 Aug 1920		✓		
18 Aug 1920	✓			
22 Sep 1927		✓	✓	
13 Aug 1948	✓		✓	
4 Nov 1984		✓	✓	
6 Oct 1990		✓	✓	
26 Apr 2000	✓			

It might be thought that the WoL flood chronology has no relevance to the Leader. Their catchment centroids are almost 50 km apart. Yet five of the 12 WoL floods are found to coincide with Leader Water floods:

- 29 Sep 1846
- 22 Sep 1927
- 12/13 Aug 1948
- 3/4 Nov 1984
- 6 Oct 1990.

The catchments are not too different in scale and are of similar altitudinal profile and permeability (judged from gauged BFI). But it is their shared meteorological setting that marks them out. Sustained and spatially extensive summer and autumn storms are a particular feature in South-East Scotland.

Commonality of floods has not been checked for events after 2000. The most remarkable feature of the severe 26 Apr 2000 WoL flood was its uncharacteristic seasonal timing.

7.3 JBA (2009)

In a substantial study for EA North East Region, JBA (2009) consider historical floods on the Tweed and conclude:

Information is insufficient to indicate whether the early floods of 1782 and 1797 were of a magnitude equal to or greater than the floods in 1982 and 2002. *Analysis therefore commences with the 1831 flood.*

Summary of flood ranking:

- 1948 = Rank 1, $Q = 1950 \text{ m}^3\text{s}^{-1}$ [13 Aug 1948]
- 1831 = Rank 1, $Q = 1950 \text{ m}^3\text{s}^{-1}$ [9 Feb 1831]
- 2002 = Rank 3, $Q = 1602 \text{ m}^3\text{s}^{-1}$ [22 Oct 2002]
- 1956 = Rank 3, $Q \geq 1518 \text{ m}^3\text{s}^{-1}$ [28 Aug 1956]
- 1982 = Rank 5, $Q = 1518 \text{ m}^3\text{s}^{-1}$ [4 Jan 1982]

... evidence from flood marks and descriptions suggests that floods in [13 Nov] 1938, [17 Aug] 1920 and [10 Mar] 1881 were also major (but lower) floods.

Floods are chiefly referred to by year in the main report. The full dates – indicated in square brackets above – are taken from the Tweed flood chronology in Appendix A.1 of JBA (2009).

The summary nominally refers to the flood history at Norham, the lowest point at which flow in the Tweed is gauged. However, the study incorporates information from flood markings at Kelso Bridge and elsewhere. The catchment differences between Kelso and Norham are substantial. The River Till tributary represents about 60% of the considerable area that intervenes: increasing the Tweed catchment from about 3300 km² at Kelso Bridge to 4390 km² at Norham.

Using information from Greathaugh Shiel near Coldstream, JBA infer the 21 Sep 1891 Tweed flood to be somewhat lower than that of 10 Mar 1881.

Time did not permit a detailed comparison with the Tweed floods noted in Section 3. It was insufficiently relevant to the goal of developing a flood chronology for the Leader. JBA (2009) is helpful in its references to historical land-use effects on flooding: some of which relate to the Leader (see Sections 2.2.3 and 8.1).

[One find in the (present) historical review is that, following the severe Whiteadder flood of 25 Sep 1872 – thought to be the largest since 1846 (presumably 29 Sep 1846) – monks at Abbey St Bathans recorded the dates and heights of “chief Whitadder floods” until Oct 1903 (see Craw, 1921). It transpires that McEwen (1985) knew of this.]

7.4 SEPA (2014b)

There is a long history of flooding in Earlston from both the Turfford Burn and the Leader Water. Damage to gas works, sawmill, and railway line was recorded in 1890. The level crossing which is thought to be on the right bank of the Leader Water adjacent to Melrose Road Bridge was flooded to a depth of 3 feet during this event. [*←This thought is mistaken; see below.*] In 1948, homes, agricultural workshops, and businesses were flooded. Some homes were flooded to a depth of 36 inches and one house was flooded to 9 inches below the ground floor ceiling. Rhymers Woolen Mill which is on the downstream side of Mill Road (between Mill Road and Melrose Road) was flooded to a depth of 3-5 feet during the 1948 flood. A member of the public described flood water as coming up to the house which is on the north east boundary of the allocation. Property was also flooded in 1984 and this event was not as severe as the 1948 event. **Based on information gathered by the Tweed River Purification Board the largest flood event on the Leader Water was 1948 followed by 1881, 1984, 1990 and 1956.** Recently, a member of the public contacted SEPA to inform us that there was flooding of Haughhead Road and it was close to property north west of the allocation site in 2012. This event had a return period of less than a 1:15 years [*sic*].

It is disappointing that floods are labelled only by year. Does 1881 refer to the 10 Mar 1881 or the 22 Sep 1881 event? On the balance of evidence gathered, my guess is the former.

The development in dispute is at Rhymers Mill, and the quoted flood history ought to focus on the Leader Water. Credibility is undermined by the statement “The level crossing which is thought to be on the right bank of the Leader Water adjacent to Melrose Road Bridge was flooded to a depth of 3 feet during this [12 Aug 1890] event”.

The level crossing was in fact on the *left* bank of the *Turfford Burn* and almost a kilometre away from the Leader Water. The level crossing was on Georgefield Road, adjacent to its bridge over the Turfford Burn. [See in particular the description of the 12 Oct 2012 flood.]

The muddling of references to Turfford Burn and Leader flooding is very unfortunate. The correct historical information for the 12 Aug 1890 flood is that “[The cottage at the railway level-crossing near the town was filled with water to the depth of nearly three feet ...](#)”.

The SEPA document is seeking to note the largest floods. It is unsatisfactory that the severe Leader floods of 29 Sep 1846 and 21 Sep 1891 have been overlooked.

In the circumstance of a planning dispute, it may be reasonable to choose to emphasise the more recent extreme floods: events that an applicant can less readily dismiss as irrelevant. However, when flood-risk mapping purports to represent the extent of flooding that has an annual exceedance probability of 0.5% (i.e. the 200-year event), credibility is undermined when two of the three largest Leader floods in the last 200 years are airbrushed from history. Risk assessment should take account of the full history of flooding on the *relevant* watercourse.

7.5 SEPA (2017)

SEPA (2017) lists Leader floods known to have flooded the area surrounding Rhymers Mill in Earlston:

There is a well-documented history of flooding on the Leader Water and the area surrounding Rhymers Mill in Earlston. ... There are ... records of this area flooding in 1881, 1890, 1948, 1956, 1984, 1990, 2002 and 2012.

It is again disappointing that floods are labelled only by year. This leads to ambiguities in both 1881 and 2012.

The 12 Aug 1890 flood is again incorrectly listed as a Leader flood, and the highly significant 29 Sep 1846 and significant 21 Sep 1891 events are wrongly omitted (see Section 7.4).

The appearance of the 3 Nov 1984, 6 Oct 1990 and 22 Oct 2002 floods is understandable. These are the three largest floods recorded since gauging of the Leader at Earlston began in October 1966. But the mention of quite so many recent floods might suggest that flooding of the Earlston haugh has become more frequent, when there is no real evidence of this in Figure 6.2. The 22 Sep 1927 Leader flood was appreciably higher than that of 25 Sep 2012, and likely many others were too.

7.6 Macdonald and Sangster (2017)

Macdonald and Sangster (2017) present flood chronologies for 12 major British rivers, including the Tweed. Confusingly, floods are sometimes explicitly ranked and sometimes placed in severity classes that are themselves ranked. The analysis for the Tweed leans on

McEwen (1990) and “other sources”. Time did not permit a detailed comparison with the Tweed floods noted in Section 3.

7.7 ECC (2017)

An annotated timeline of flooding at Earlston was presented in a PowerPoint show at a recent public meeting (ECC, 2017). The chronology is reproduced in tabular form in Table 7.2.

The ECC study is work in progress. At present, the flood chronology is not very authoritative. The minor floods of 29 Aug 1910 and 10 Nov 1934 are included. The major Leader floods of 10 Mar 1881, 21 Sep 1891, 22 Sep 1927 and 28 Aug 1956 are overlooked. The significance of the 29 Sep 1846 Leader flood is underplayed.

Mention of the Leader Water being high during the 12 Oct 2012 Turfford Burn flood is one of few historical references to conditions at the Turfford/Leader confluence. What was the source information? How far is the backwater effect thought to have extended up the Turfford Burn?

The two largest historical events on the Turfford Burn – i.e. 12 Aug 1890 and 5 Aug 1895 – are listed and their allocation to the Burn rather than the Leader Water is correct. However their great significance is not highlighted.

It is unhelpful to compound the two flood-risk problems: that from the Leader and the more frequent and pressing one from the Turfford Burn. There is significant flooding from both rivers in some events (e.g. 22 Sep 1927 and 28 Aug 1956). But the principal flood impacts chiefly arise from one or other watercourse, and it is misleading to integrate them. One hopes that the outcome of Earlston Flood Study will be forthright about this.

If the two chronologies are to be shown on a single timeline, the Turfford Burn floods ought to be labelled from above and the Leader floods from below.

Table 7.2 Noted floods at Earlston from ECC (2017)

Flood date	Leader Water	Turfford Burn	Comment; source
1846	✓		A wooden bridge was swept away at Cowdenknowes
July 1867		✓	The Turfford Burn overtopped its banks
August 1890		✓	Turfford Burn overtops its banks.
August 1895		✓	“The Turfford Burn ... came down in flood and submerged the fields on its bank near where it joins the Leader.....the street in the east end of Earlston is impassable and flood water from the burn is pouring into houses at the end of the railway crossing and other houses near the bank” – <i>The Scotsman</i>
Dec 1901		✓	Town level flooding. Flooding to East Green; the railway crossing under water and road to Georgetown impassable. – <i>The Scotsman</i>
February 1903	?	✓	“The Leader and the Turfford Burn came down in high flood, the latter overtopping it’s banks at the east end of Earlston” – <i>The Scotsman</i>
August 1910	✓		High flow on the Leader Water for two or three days, and a breach made in the weir at Haughhead.
November 1934	✓		The Leader overflowed its banks.
August 1948	✓	✓	“Homes, agricultural workshops and businesses were flooded. Railway bridges washed away and railway embankments collapsed; 4 culverts collapsed; 6 roads subsided. Some homes were flooded to a depth of 36 inches, one was even flooded to within 9 inches of ground floor ceiling level. Rhymers woollen Mill on the downstream side of Mill Road was flooded to a depth of 3-5 feet. A member of the public described flood water coming up to the house south of the football ground and pavilion on Mill Road.” On the 12 th August the gauges in Earlston were 3.3 and 3.23 inches. It is suggested that this is a 1 in 200 year flood event.
November 1984	✓		Town level flooding on Leader Water at Earlston.
April 1992		✓	Flooding at AA Catering on Station Road.
October 2002	✓	✓	Flooding to the grounds of Rhymers Mill Cottage Crossing House, as well as the school grounds.
October 2003		✓	Significant flood recorded on the Turfford Burn.
October 2012	?	✓	Flooding to Georgefield Road bridge and playground in Earlston; flooding at the confluence between Turfford Burn and Leader Water. High water levels on Leader Water.
December 2015		✓	STORM DESMOND Flooding to Church street as a result from runoff from the north. Flooding similar to 2012 event and flooding to playing fields and school car park resulting in cars flooded.

8 Flood risk management in the Leader

In a study as detailed as this, one gains some familiarity with and understanding of the catchment. Various questions arise:

- What impact has there been from land-use change over the last 200 years?
- What impact is there from climate change and how may it progress?
- What about river channel changes?
- What options exist for flood risk reduction in the Leader catchment?

8.1 Land-use change

I agree with JBA (2009) that agricultural improvements [←my shorthand description] led to a more efficient drainage system at the end of the 19th Century than at its outset. In the modern era, floods of all sizes pass through to the Tweed relatively quickly. Although it is not my specialism, I tend to agree that these changes were mainly focused in the first half of the 19th Century. The flood history before 1818 (see Appendix A1) is of reduced relevance.

8.2 Climate change

It is appropriate that flood-risk estimation makes allowance for climate change. The flood history of the Leader – as with some other rivers when one digs deep (e.g. Reed, 2003) – shows quite a range of flood-producing mechanisms.

Although meteorological conditions have not been specifically researched in the current study, the flood chronology reveals at least three types of event that have given rise to serious flooding in the Leader catchment:

- A. Spatially extensive summer or late-summer rainstorms of long duration rainfall, e.g. 29 Sep 1846, 21 Sep 1891, 22 Sep 1927, 12 Aug 1948 and 28 Aug 1956;
- B. Winter flood events arising from a combination of rainfall and snowmelt, e.g. 9 Feb 1831, 10 Mar 1881 and 3 Jan 1982;
- C. Highly localised convective storms, e.g. 22 Jul 1867, 12 Aug 1890 and 5 Aug 1895 on the Turfford Burn, and 11 Jun 1835 and Sep 1909 (putatively) on the Upper Leader.

Climate change will influence the propensity for such floods to arise. Type A floods are perhaps those best recognised locally. They are something of a Borders phenomenon. How will their frequency be altered by climate change?

Perhaps Type B floods will become less frequent. The 3 Jan 1982 flood was less severe than the 19th Century floods in which snowmelt was a major factor. However, the exposure of Earlston town to surface-water flooding arising from rapid snowmelt from the south-facing slopes of Huntshaw Hill is a curiosity that should not be overlooked. [Snowmelt was implicated in flooding of Earlston on 30 Dec 1901, 19 Oct 1906, 6 Dec 1915 and 24 Dec 1937, with the Turfford Burn implicated in some of these events.]

Looking at the flood chronology of Section 3, perhaps the most striking pattern is the wealth of Type C floods before about 1931 and their paucity thereafter. Might some highly localised floods have been missed through a decline in local reporting? Or is the pattern just the caprice of climate?

There are differing views on the effect of global warming on the frequency and severity of thunderstorms. Recent research at the University of Edinburgh (Finney *et al.*, 2018) suggests that lightning may strike less often as the planet warms. A more mainstream view is that global warming will increase the energy available to thunderstorms and that we can expect heavier summer thunderstorms (e.g. Kendon *et al.*, 2014). These views are not necessarily contradictory. Global warming increases the capacity of the atmosphere to hold water, and is likely to increase the maximum rainfall rates experienced. However, changes in circulation patterns may mean that appropriate conditions arise less frequently. Risk is the product of frequency and consequence. So the flood risk from thunderstorms may or may not increase.

Given the paucity of thunderstorm-influenced floods in the historical record after 1931, one hopes that the flood impacts will not come as too much of a shock to the infrastructure and a surprise to residents when a really severe thunderstorm next strikes the Upper Leader or the Turfford Burn.

8.3 Geomorphology

The Upper Leader and its main tributaries are geomorphologically active. This is quite a specialist topic.

McEwen (1985) compares maps from different eras to demonstrate that channels have migrated to new positions from time to time, not least in the lower reaches of the Cleekhimin (*aka* Longcroft) Burn and at its confluence with the Leader. Graham (1949):

“... while a point of slightly rising ground between the Leader Water and the foot of the Cleekhimin Burn was evidently made use of to avoid involvement in wet and treacherous haugh-land. ... South of the highway from Edinburgh to Kelso, a footpath—once evidently hedged throughout on both sides, although most of the western bank has been ploughed away—continues the same line, along the tongue of raised ground of which mention has already been made. It leads to the ruined house of Farmfoot, near the junction of the Cleekhimin Burn with the Leader Water, and from the house the 6-inch map marks a track, now destroyed by floods, running on to a ford on the Leader at Wiselawmill (515518).” [←That’s a 100 m grid reference within the NT 100-km square.]

The most succinct summary of the mobility of the Cleekhimin Burn is provided by Mr Scott Aiton who according to the *Berwickshire News* of Tuesday 7 September 1954 said [in the context of the A697 road bridge]:

I hope the [County] Surveyor will remember the river is very difficult to control in a flood. It can move about 40 yards either side in a night.



Figure 8.1 *Cleekhimin Burn and road bridge, 29 April 2010*

Another location in which the channel planform has shifted notably is at the confluence of the Boondreigh and Leader Waters at Boon Bridge.

Gilvear and Milner (2008) consider geomorphological factors in widening the A68 carriageway at the Annfield Bridge crossing of the Headshaw Burn: one of the headwater tributaries of the Leader Water.

8.4 Scope for flood risk reduction

8.4.1 Past flood management on the Leader Water

Flood gates?

McEwen (1985) is incorrect to assert that “On the Leader, between 1857 and 1900, *flood gates* were constructed at Birkwood Haugh and above Earlston, implying that over this period one or more major destructive flood must have occurred.” There seems to have been a confusion with “water gates” designed to prevent stock from escaping along the burn in dry weather to the wrong grazing. Such gates may trap debris and lead to afflux (i.e. an undesirable increase in water level) in flood conditions e.g.

Figure 8.2. It was considered good practice to remove such gates when not needed or when floods might be expected.



Figure 8.2 *17 August 1931 flood, Leader near Oxtan (Ref. SBA/32/5)*

The *Southern Reporter* of Thursday 29 September 1927 states that “Luckily the *water gates* at Boon Dreich [*sic*] had not been placed in position since the last flood, although the wood for these was lying ready to erect”. Use of the word “luckily” and the adjective “water” is consistent with my view that these gates were not intended for flood management. [McEwen (1990) adds to the confusion by marking flood gates on a plan of the Leader catchment. The mapping is schematic, with no tributary structure shown. Gates are marked on the Leader not far upstream from Earlston. The positions may correspond to former cauld (i.e. weirs) on the Leader that fed water to Haughhead Mill and to Mid Mill & Rhymers Mill. Some evidence of the latter cauld remains.]

Riparian embankments

Current-day OS 1:25000 mapping shows evidence of riverine embankments of one kind or another in much of the reach from Thirlestane down to the Leader/Boondreigh confluence. There is more limited evidence remaining of embanking upstream of Thirlestane. Likely this reflects the more mobile geomorphology in the river system above Thirlestane. Such embankments appear in some older maps. There is reference to clearance of the river bed in reporting of the near-miss flood of 25 Oct 1949:

Berwickshire News, Tuesday 1 November 1949

LAUDER ESCAPES FLOODING

There was no flooding in the vale of the Leader last week during the storm, probably owing to the recently [*sic*] clearing of the river beds. At one time fears were felt in case the Leader overflowed its banks adjacent to two houses at the Eagle Gates, Lauder.

Perhaps the material cleared raised riparian embankments afresh in some sections.

The river is given to varying its channel topology and alignment during large floods. McEwen (1985) highlights this by reference to maps from different eras and deduces that the behaviour is flood induced and substantially natural. This is undoubtedly correct.

The braided nature of the Leader and Cleekhimin Burn is evident especially close to their confluence. The present-day main channel is particularly sinuous close to the confluences with the Harry and Washing Burns.

8.4.2 Past flood management on the Turfford Burn

The flood chronology demonstrates frequent damaging floods from the Turfford Burn.

It is known from the chronology that schemes to reduce the impact of Turfford Burn floods on Earlston were undertaken in 1898, 1902 and about 1967. Some of this work aimed to improve foul and surface-water drainage.

There continues to be major flood risk from the Turfford Burn. Some of this is inherent in Earlston’s original siting alongside the burn. As discussed in Section 1.5, much of the flood risk stems from development and unsuitable redevelopment being allowed too close to the burn in the five decades since the 1967 Flood Prevention Scheme.

A more subtle effect is that Earlston took its water supply from productive springs at Fansloanend in the heart of the Turfford Burn catchment. Appendix A2 offers glimpses of the supply system and the difficulties experienced. [In addition to bouts of major leakage, the system suffered from a rather poor initial design, a reluctance to invest in additional storage, and an element of competition from an adjacent supply feeding Mellerstain House and Farm. When finally constructed, it seems that the additional storage was positioned close to the source rather than close to the village, and was never sufficiently water-tight to bring into service.]

The relevance to flood risk in the Turfford Burn is as follows. For maybe about a century – from commissioning of the Earlston Water Supply in 1879 to its final abandonment once “regional water” had become available – spring water was drawn off at a rate of (say) 15,000 to 30,000 gallons per day, or 0.8 to 1.6 l s⁻¹. While this amounts to a trivial diminution of flows in the Turfford Burn, the effect of no longer taking the supply is perhaps to restore the Fansloanend area to its former typically wetter condition. Baseflow contributions to flows in the Turfford Burn will be somewhat higher, and the local area around the source head will be more often primed to produce flood runoff when heavy rainfall occurs. Reed (2014) uncovers a dramatic case where abandonment of long-term groundwater abstraction led to springs re-emerging and compromising development plans.

However, this does not seem to be the situation at Fansloanend, and no evidence has been found that typically wetter ground conditions there have been noted since cessation of the spring-water supply to Earlston. It seems likely that drainage works to enhance agricultural and other use of the land is the strongly dominant effect, to which sections of rectilinear channels upstream of Fansloanend provide evidence. Fans Bog, Lillie’s Bog and Yarlside Bog (see citations in Appendix A2) no longer appear to be the features they once were.

Drainage of these peat bogs will undoubtedly have exacerbated flood risk to Earlston. But the works are thought to date from the 19th Century: possibly topped up in the mid-20th Century push to produce more food. The drainage works likely all pre-date the 1967 Turfford Burn flood prevention scheme.

8.4.3 Future flood management on the Turfford Burn

Minor adjustments to the Burn within Earlston do not seem likely to achieve great gains. One only has to look at the outcome of the 1967 Flood Prevention Scheme to see that the benefit from minor works is short-lived, being quickly consumed by development and rising property values.

There was mention of the possible scope for *natural flood management* in the PowerPoint presentation to the interim consultation meeting about the Earlston Flood Study (ECC, 2017). This ties in with the relevant section of SEPA (2015a), which notes:

A flood protection study has been recommended for Earlston to assess whether modification of conveyance, installation/modification of fluvial control structures, flood defences and natural flood management could reduce flood risk. The study should also consider the viability of property level protection. Natural flood management options that should be considered include river/floodplain restoration and sediment management. The assessment should also consider these actions in combination and the potential benefits and disbenefits to locations both upstream and downstream.

The recommendation of property-level protection appears sound. In essence, property owners are encouraged – perhaps with a combination of carrot and stick – to make their gardens, buildings, contents and lifestyles more resilient to occasional flooding. This is good practice where feasible. It is not obvious how such thinking is to be applied further to sports fields and car parks that have (in effect) been designed to flood relatively frequently.

A reference to *natural flood management* has become almost standard. In common with *sustainability*, the term has a rather elusive meaning. Both give an impression of holism and modernity. The jargon can sometimes be a cover for loose thinking, box-ticking or deferring the grasping of the nettle that a major flood alleviation scheme is required.

Funding is of course an important constraint. But the public should note that *money spent on studies and assessments and mapping and consultations is money unavailable for flood risk reduction*. Few consultants work on a *pro bono* basis, so this truth is seldom advertised.

The richness of the flood history, and the desire of local authorities to see development to complement the flagship Earlston High School, suggest that a strategic scheme may be needed to reduce flood risk in the Turfford Burn.

Stream layout and topography suggest that a flood alleviation scheme for the Turfford Burn – comprising an embankment, throttle pipe and grilled overflow – might be positioned downstream from Loanend Covert and upstream from the stream confluence south of Purvishaugh. A storage placed here would control almost 40% of the catchment draining to Earlston. This may be enough to make a significant reduction in Turfford Burn flood frequency at critical sites in Earlston. The prevalence of spring flows (see Appendix A2) could present a challenge to ensure that structures are well-founded and water-retaining. Current high qualities of land-use – both agricultural and environmental – could influence the feasibility and acceptability of such a scheme.

Or will a large number of small schemes – consistent with some definitions of natural flood management – be advocated in the ongoing Earlston Flood Study? If so, it is to be hoped that recommendations are based on what has been found to work in similar situations elsewhere. Recommendations based solely on modelling may not be trustworthy. [The models themselves may be well researched. Typically, it is the assumptions made about input rainfalls that tend to be presumptive.]

A thoroughly puzzling comment is made about the Turfford Burn in JBA (2007):

Local headwall improvements would improve standard [of protection] to 5 year, but would need large scale works. Probably better to review flood risk in Lauder as a whole as largest area of risk at Leader Water.

The second sentence makes no sense at all. How can anything to do with the Leader Water help to reduce flood risk from the Turfford Burn?

Given the long history of flooding from the Turfford Burn, there is inevitable nervousness that planning decisions may not take adequate account of flood risk even if a strategic flood alleviation scheme is promoted.

8.4.4 Future flood management on the Leader Water

It is fanciful to think that Earlston might gain from a strategic flood alleviation scheme around Lauder. A *storage scheme* gains little if it is wholly sited on the natural floodplain. The critical point that modellers and others appear to overlook is that these floodplains already fulfil an important role in flood attenuation. [Understanding is not helped by the 0.5% AEP flood extent above Thirlestane being a gross underestimate (see Section 9). The moderate Upper Leader flood of 7 Aug 2008 (see relevant entry in Section 4) manages to demonstrate both of these features surprisingly well.]

In rural sections of a river, an *embanking scheme* can sometimes be contemplated whereby agricultural land is protected from frequent flooding so that floodplain storage is reserved to accommodate flood flows above a high threshold. Such embanking has occurred historically in the middle and upper reaches of the Leader. Current-day OS mapping shows sections of riverine embankment in the reach between Lauder and Boon. But one only has to know the history of (not least) the Cleekhimin Burn to realise that the Leader tributaries are too flashy and geomorphologically active for the integrity of an embanking scheme to be long-lived.

Construction of engineered flood defences at Earlston to reduce the frequency of flooding from the Leader might be considered. Their configuration might need to leave the haugh (i.e. the natural floodplain) available to floodwater. Would sufficient benefit accrue from a scheme that defends property only on the perimeter of the haugh?

8.4.5 Summary

It seems prudent to continue to look to the planning system to keep new development out of the floodplain and to guide acceptable types of redevelopment of flood-prone areas.

Making flood-vulnerable property more resilient to flooding is to be recommended, ideally backed up by effective flood warning. The Turfford Burn at Earlston High School is amongst sites monitored in real-time: it appears to alert maintenance crews to the need to clear blockages (see: https://www.scotborders.gov.uk/info/20035/flooding/287/view_water_levels_at_priority_grilles). There may be scope to provide wider flood alerts based on water level and rate of water-level rise. Perhaps the website already fulfils this role.

9 The SEPA flood-risk map

9.1 Brief overview

The SEPA fluvial flood-risk map (see: <http://map.sepa.org.uk/floodmap/map.htm>) displays estimated flood extents (i.e. flood footprints) for high, medium and low risks. The risk levels chosen are not very informative. Relatively few established communities are at a SEPA high risk (i.e. 10% annual probability) of flooding. But almost all riverine property is at a SEPA medium risk of flooding. This is set as an annual probability of flooding of just 0.5%, i.e. *twenty times* less frequent than the SEPA high risk criterion. The SEPA low risk is set at an annual probability of 0.1%, i.e. *five times* less frequent than the SEPA medium risk.

Leaving exceptional topics – such as the safety of dams and critical infrastructure – aside, most flood-risk assessment and flood management problems lie in the very wide interval between the SEPA high and SEPA medium risk levels. Away from steep-sided river valleys, one might expect the medium-risk flood extents to be much wider than the high-risk ones.

This is of course a qualitative view. SEPA might reply that the maps are based on detailed topographic data and advanced hydraulic modelling. If the maps don't feel right, tough: maybe your perceptions are wrong.

Only the larger flood-risk consultancies can seek to replicate the very detailed work that has gone into production of the SEPA flood-risk maps. Any lack of belief therefore needs to be expressed in a different way.

9.2 Testing the flood-risk map against the historical record

This research has amassed a wealth of information about actual flood events. It is necessary only to focus on the more severe floods. While there is no proof that a Leader flood larger than the 12 Aug 1948 event has occurred in the last 200 years, two floods appear to have equalled it at Thirlestane: the 29 Sep 1846 and 21 Sep 1891 events:

29 Sep 1846:

The Leader was so very heavy that it broke a strong embankment at the back of the [Thirlestane] castle, came right through the haugh to the Earl's gate, inundated it, took away the bridge, The porter of the gate and family had been taken out of their house [i.e. Eagle Lodge] by the skylight with ladders, ropes, and horses

21 Sep 1891:

The keeper of the Eagle Lodge at Thirlestane and his wife were rescued from a perilous position in the early morning, the house being flooded several feet deep, and the water racing through the gateway.

12 Aug 1948:

At Eagle Gate Lodge, Thirlestane Castle, the water rose to three feet inside the house and the inmates were rescued early in the morning.

So the simple test is this: with what frequency does the SEPA flood-risk map associate a depth of (say) 1 metre at the Eagle Gate at Thirlestane? These cannot all be rarer than the 200-year flood event!

There are other pieces of historical information that might be similarly tested, such as the five feet of water reported inside Bridgehaugh Mill near Blainslie in the 21 Sep 1891 flood. But it is the historical information at Thirlestane that most strongly challenges the existing flood-risk map.

If the test reveals a contradiction between the historical flood data and the flood-risk map, this will demonstrate that the generic modelling approach ignores the actual flood history and portrays a 0.5% AEP flood extent that is far too narrow at Thirlestane, and likely too narrow at other sites along the Leader.

10 Final remarks and caveats

This report is full of detail. It is the nature of historical flood review.

10.1 Principal conclusions

- a) Generic automated approaches to flood-risk mapping are over-rated. Their outputs are shiny but are model and modeller-dependent. Even the most capable T-year flood modeller makes unverifiable assumptions. The model outputs will not reflect reality if they fail to incorporate and respect *actual* flood data. These data can include observed, photographed or reported flood levels or flood extents, in addition to gauged flow data.
- b) If one looks, there is typically much historical flood information to be found for those UK rivers that threaten long-established communities such as Earlston and Lauder. Interpretation is seldom straightforward. It is a mistake to believe that historical flood data can prove a flood estimate to be correct. What they can do is to prove one wrong.
- c) The SEPA map of fluvial flood-risk appears to be in gross error at Thirlestane. Two strands of evidence support this statement:
 - i. Three floods in 200 years have been observed to yield a depth above ground level of about 1 metre at the former Eagle Lodge at Thirlestane: see Section 9.2 and the chronology entries for the 29 Sep 1846, 21 Sep 1891 and 12 Aug 1948 floods. <https://canmore.org.uk/event/716634> of Historic Environment Scotland quotes a national grid reference of NT 539880 473000 for the Eagle Lodge. It would be preposterous were each of these three floods assessed by the SEPA map to be rarer than the 0.5% AEP event.
 - ii. The rather modest Leader flood of 7 Sep 2008 was observed to flood part of the Standalone plantation at Thirlestane. Yet the 0.5% AEP flood along this section of the Leader Water is mapped as not extending to within 100m of the trees. How can this gross anomaly be accounted for?
- d) The Turfford Burn has presented a significant flooding problem to parts of Earlston throughout the last 150 or more years. There is no strong evidence that floods have become larger. However, the potential impact of flooding has grown as additional or higher-value property has been placed at risk.

- e) The study of flood risk does not change the actual frequency of flooding. What it can do is to change *perceptions* of flood risk. This can help in judging the likely benefits of flood alleviation schemes, the suitability of proposed redevelopments and the appropriate allocation of new sites for development.
- f) This report is *not* a study of flood risk. Rather, it provides historical information relevant to those undertaking such studies on the Leader Water and/or Turfford Burn.

10.2 Caveats

This study has been undertaken by an experienced and resourceful flood hydrologist without special visits. It represents three months' work.

Experts are not immune to making mistakes. In addition to possible typographic or logical error, I have only weak understanding of sediment transport in the Leader, and the extent to which bed erosion/accretion/dredging may have decreased/increased flood levels historically at gauging stations and against fixed assets vulnerable to flooding. Such shifts may – or may not – have relevance when the next really large flood comes down the Leader and sweeps much before it. You are reminded that this may include modern debris, in addition to the uprooted trees so very much in evidence in the historical record.

You must not rely on this report. Please use it to test and extend your own understanding of flood risk and of what individuals and professionals can do to ensure that those in positions of responsibility manage flood risk appropriately.

Those choosing to skim or downplay this report should note its open-domain status. Others may have greater patience and arrive at a different view. It will make me sing if you include the words *pro bono* when citing this report.

11 Acknowledgements

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Appendices

A1 Historical floods in preceding 50 years

The main report considers historical floods from 1818 to 2017. This Appendix notes some floods in the preceding 50 years i.e. in the period from 1768 to 1817.

12 Mar 1782

[**Synopsis:** A major regional flood, with snowmelt implicated. Severe in the Clyde and in Edinburgh. Uncertain how severe the flood was in the Leader, but Thomson (1902) was presumably writing from a Lauderdale perspective. As regards the flood in the Tweed, see comparison of 1782 in the entry below for the 17 Oct 1797 flood.]

Scots Magazine 1782

EDINBURGH

In the night between the 10th and 11th of March, there was a great fall of snow at Edinburgh, and the country adjacent, which continued with little intermission all the next day. The quantity that fell was much greater than has been known for many years, and rendered walking on the foot-pavement very dangerous, from the frequent falling of huge bodies of it from the tops of houses. The streets were likewise almost impassable by reason of a sudden thaw, accompanied with rain, which afterwards took place.

Thomson (1902):

A snowstorm, which raged from November to the end of March, occurred in 1782-3—“the black aughty-twa.” [“The Black 82” is a shorthand description of the 1782-83 Winter.]

18 July 1793

<https://en.wikipedia.org/wiki/Lauder>

Notable buildings in the town today include the Tolbooth or Town Hall, which predates 1598 when records show it being burnt by a party of Homes and Cranstouns led by Lord Home, in a feud between them and the Lauder family who were at the time sitting on the bench as hereditary baillies. **On 18 July 1793, during a severe and prolonged thunderstorm, a “ball of fire struck the steeple above the Tollbooth, and did considerable damage”.** [*Scotland – Edinburgh, July 18th*. The Times, London, Issue 2736, 26 July 1793, p4. Not seen.]

~9 Feb 1795

[**Synopsis:** A severe flood in in many parts of Britain characterised by snow and ice (inc. the breaking of ice jams), leading to unprecedented flooding on some major rivers including the Severn, Tees, Thames and Witham.]

Neal's Saturday Gazette, Philadelphia, Pennsylvania, 1847

Scotland was the scene of another terrible snow storm in 1794, which is the most extraordinary one of which there is any record. In one single night snow fell to the depth of eight or ten feet, and in some places the most lofty trees were entirely covered. By this one night's storm seventeen shepherds lost their lives, and thousands of sheep, besides other animals, were destroyed. One farmer alone lost fourteen hundred sheep. After the storm had abated and the snow had somewhat disappeared, there were found collected together (by its violence) in one spot, the dead bodies of two men, one woman, forty-five dogs, three horses, nine black cattle, one hundred and eighty hares, and one thousand eight hundred and forty sheep.

[In England] there was a frost from 24 December 1794 to 14 February 1795 with the intermission of one day's thaw that occurred on 23 January 1795. There were great floods throughout England caused by the melting snow in February 1795. A great part of the bridges were either damaged or destroyed.

18 Nov 1795

[**Synopsis:** The 18 Nov 1795 event was a major regional flood. Severe in the Clyde and in Edinburgh. Unclear how badly the storm affected the Tweed or the Leader.]

Scots Magazine 1795

EDINBURGH

[November]

18. This morning there was a very heavy and incessant rain, accompanied with a strong gale of wind from the N. E. and, if we may judge by its effects, a greater quantity never fell here in the same space of time. About ten o'clock the Water of Leith rose to such a height as completely to overspread the low grounds adjacent to it, and many of the houses situated on its banks were filled with water to the depth of several feet. The wooden bridge on Mr Rocheid's ground below Stockbridge, was completely swept away; as was also the one at Bonnington mills. The distillery at Canonmills at one time was surrounded with water, and a boat was procured to carry off the family in the house adjoining to it. About twelve o'clock, however, the river began gradually to fall, the rain having been succeeded by snow. The damage done is considerable.—In Leith harbour the river came down with such force and body as to float the shipping though it was low water, and several vessels were damaged by the rapidity of the torrent dashing them against each other. Two sloops lie sunk, both coal loaded. About a dozen of ship's boats have been carried away out of the harbour. At Dalkeith, Musselburgh, &c. the water of Esk rose to a prodigious height, it carried away the bridge at Dalkeith and every thing within its reach. Had the inundations taken place in the night-time, the consequences might have been fatal. **The storm had every appearance of being general.** In the west country it seems even to have been more violent than here, as appears by the following letter from Glasgow, Nov. 18. ...

Edinburgh Evening Courant, 11 October 1832

On Monday last [8 October 1832], the streams in our neighbourhood [Edinburgh], by the continued heavy rains on that day, became swelled to an extraordinary degree. On the Water of Leith, in particular, the floods came down with peculiar force and violence, and occasioned much damage in its course. The river was in some parts 8, 9 and 10

feet above its usual level, rushing along with the rapidity of a torrent, and sweeping away every obstruction to its progress. All the dam-heads [i.e. weirs] of the mills on this river have been more or less injured, and some of them carried entirely away. **This is said to be the highest known flood here since the year 1795.**

10 May 1796

[**Synopsis:** Richardson (1892) cites this as a severe flood at Kelso.]

21 Oct 1797

[**Synopsis:** Severe flood leading to the loss of the Leaderfoot bridge on the Leader and Kelso Bridge on the Tweed. Some commentators get the date of this flood wrong by up to five days.]

Caledonian Mercury, Monday 23 October 1797

We are sorry to hear that the beautiful bridge at Kelso, was, on Saturday, carried off by the flood; happily no lives were lost, which is very fortunate, being race week, and the town very throng. Mr Baird of Newbyth and Mr Hamilton of Wishaw, were about to cross the bridge.

The History and Antiquities of Roxburghshire and Adjacent Districts from the most remote to the present time (Jeffrey, 1855)

There exists no evidence of any great floods previous to May [March?] 1782. At that time it is said the waters of the district were greatly swollen, but we have not been able to discover any particular notices regarding it. The next extraordinary rising of the waters was in October 1797, **when the bridge over the Tweed [at Kelso] was swept away by the flood.** The storm began about six o'clock on the evening of Friday, and continued during the whole night with great violence. "On Saturday morning the Teviot overflowed the island below Maxwellheugh mill by itself, and the mill dam together with the public road from Teviot Bridge to the Bridge over the Tweed, as well as a considerable portion of the adjoining fields. The island in the Tweed, at its confluence with the Teviot, was so deeply laid under water, that the trunks of the trees growing on it were half immersed; whilst an immense body of water from both rivers descended with great velocity towards Kelso Bridge, rose very high behind the piers of the arches, and overflowed the banks below on both sides, inundating the road and fields from the bridge to Maxwellheugh-mill, forming altogether a spectacle truly sublime. It was observed early in the morning that the third and fourth arches had sunk a little below their usual level; from which it was concluded that the foundation had been completely undermined, and that of consequence these arches might be every hour expected to fall. ..."

Thomson (1902):

At that time [1791] the Leader had no embankments, and floods frequently carried off corn and sheep. One such, of date 21st October, 1797, carried off the bridge at the foot of the river.

Aitken (1905b):

The Leader-Foot bridge [at Drygrange] was founded in 1779 and finished in 1780. ... The bridge on the same line of road, crossing the Leader near Earlston, was designed and built by Frank Mowat. ... James Haig [of Bemersyde] in his Diary under date October 21, 1797, writes thus concerning the neighbouring Dryburgh road bridge over

the Leader, “The flood in Leader has carried off the bridge at the foot of it. It fell about 9 this morning, and at the same time Mr Tod’s mill dam.” [The Dryburgh road bridge is an alternate name for the Leaderfoot Bridge across the Leader at Drygrange. Confusing.]

Maxwell (1909):

[p140:] The noble [Kelso] bridge of five arches spanning the united waters of Tweed and Teviot was finished in 1803 by young John Rennie, to replace one built in 1754, which was swept away by the mighty flood of 26th [should be 21st] October 1797. Rennie’s bridge was the first one ever carried on elliptic arches, a design which he afterwards repeated in Waterloo Bridge, London. The bridge of 1754 was a successor to a “great stone brigg with arches” which the Scots broke down as a measure of defence against Protector Somerset in 1547.

A2 History of Earlston water supply – from *Berwickshire News*

Berwickshire News, Tuesday 24 June 1879

EARLSTON

Water Supply—Some time ago, complaints being rife as to want of water in the higher parts of the town, the local authority took steps to get an increased supply. After prospecting to a considerable extent they fell in with what they wanted on the South side of Fans farm. The Earl of Haddington, the proprietor, with his wonted kindness, did every thing in his power to help the Local Authority to a solution of their difficulty. The water, which has been analysed and declared to be first rate in quality, is collected at the Springs on Fans into a pipe which empties itself into a small tank at the rate of 44 gallons a minute. It is then conveyed in 6 inch clay-pipes for 1300 yards and then by 4 inch iron-pipes for 380 yards through a wood where it enters a reservoir built at the corner of Fansloanend Cover [*sic*]. This reservoir contains 15,000 gallons. Four-inch metal pipes convey the water thence to the old fountain-head where the new pipes are connected with the old. The new water-supply was turned on on Friday last, and is likely to prove unfailing, abundant, and wholesome. The cost of the whole work which has been executed in a manner highly creditable to the contractors is about £500, not a great sum when compared with the invaluable benefit of an abundant supply of pure wholesome water.

Berwickshire News, Tuesday 14 June 1881

EARLSTON

The Water Supply—It is just two years since the present supply was introduced. The works at the time were approved by Government, and were the admiration of all who saw them; and from that day to this they have not exhibited the slightest flaw of any kind. The water rises about two and a half miles from the town in a small bed of springs, four to five yards square. These were absolutely isolated from all outside water, and they pour forth their treasure as clear as crystal to the rate of from 35 to 40 gallons per minute, and the water is pronounced by Dr Macadam to be excellent. Even last winter and spring, on 31st January and 31st March, the water issued at a temperature of 48 and 46 degrees respectively; and on the second of this month it was 47 degrees. It is conducted to a fine tank about 60 feet higher than the town, and a mile and a half distant from it, capable of containing 15,276 gallons, and which is always full to the brim, and generally overflowing. From this as has been said, more than 50 gallons may come daily to every individual; and all this costs but 6d per pound on the town rental—payable half by owner and half by occupier. These facts prove that Earlston may well be proud of its water supply as well as of its committee.

Berwickshire News, Tuesday 08 January 1901

EARLSTON WATER SUPPLY

CLEANING AND WATER COMMITTEE

A meeting of the above Committee was held in the Court Room, Earlston on Monday evening; ... The following report by the Water Officer, William Chisholm, was read by the Clerk as follows:—I have been over the water track, and found the tank in the Cover Wood full of water, and a large overflow. The cause of the surface water getting into the water supply on Friday, 21st current, was that the walls of the small tanks at the fountain head had been broken up for the piping of Fans and Mellerstain Water supply, and have not yet rebuilt. I have cut a track to serve till the walls are restored. There are 130 yards of the ditch from the east springs, which require to be cleaned out to lead all surface water past the springs. The Clerk laid on the table a report and plans as to Earlston augmented water supply scheme by Mr H. W. Taylor, C.E., Newcastle, whom the sub-committee had consulted as to the best mode of remedying the defective water supply. The Clerk read the report which entered into the subject in great detail, and with the utmost minuteness. Messrs Young and Allan expressed themselves highly satisfied with the report and plans, which they considered very good value for the fee of five guineas paid for them. It was agreed that the report should be circulated among the members that each of them might have opportunity of carefully reading it, and that thereafter a meeting should be held to discuss the question, and come to some determination on the subject. The following copy of the report:—

In accordance with the instructions of the Earlston Parish Council, I now have pleasure in reporting upon the proposed augmentation of the Earlston water supply. No trouble has been spared to present a really practicable, workable, and efficient scheme; levels have been taken, and surveys and inquiries made in the district to fully ascertain all the local conditions.

Population: The population of the entire parish of Earlston was 1623 in 1861, 1977 in 1871, 1767 in 1881, and 1766 in 1891. The nett population of the village of Earlston is about 1000, and has been practically stationary during the last two decades, and I have therefore taken this number as the basis of my scheme.

Quantity of water required—The domestic consumption of water will probably not exceed 13 to 15 gallons per head per day. A provision of 20 gallons will be ample, and will provide for all public and other purposes such as street watering, sewer flushing, etc. 1000 population plus 20 gallons per head equals 20,000 gallons per day. This will be equal to an average consumption of about 14 gallons per minute, but the maximum rate of consumption at mid-day is about 3 times the average (because water is used in larger quantities in the middle of the day) and therefore the water mains supplying the town must be large enough to easily deliver 42 gallons per minute.

Situation: The parish of Earlston is situated in the south west corner of the County of Berwick on the left bank of Leader water. The parish has an area of 10,000 acres, and is very hilly, rising from 333 feet above the sea level at Mid Mill to over 800 feet at Huntshaw Hill and Fans Hill, but for the purposes of this scheme the highest point to be supplied is the Police Station, 372 feet high (at present without supply.)

History of existing supply: In 1862, four inch cast iron pipes were laid throughout the village, eastward to point C (in the plan), where four springs south-west of Purveshaugh were tapped. In 1874 in consequence of these springs failing the four inch pipe was extended to point D, where a runner of water was tapped. This runner in effect was little

better than an open ditch, and as the surrounding fields were cultivated, the water was often discoloured. In 1878-79 it became necessary to find another source of supply, and consequently, after examining the district, it was decided to obtain water from five springs at the foot of Fans Hill, point F. A four inch cast iron pipe was therefore laid from point D to the east side of Fansloanend Cover (shown by blue lines) and a six inch sanitary pipe (shown by brown lines) was continued to the springs at point F. A small tank or reservoir holding 15,700 gallons or less than one day's supply was built in Fansloanend Cover at point E. In consequence of the distributing mains in the village being corroded, they were relaid in 1879 from point B westward (shown by blue lines.) There are now 119 water closets and 309 taps connected with the existing water mains.

Condition of Mains: The mains laid in 1878-79 were coated pipes (that is dipped in Angus Smith's composition), and are in good condition now. The old pipes laid in both 1862 and 1874 were uncoated, and are very badly corroded, so much that the bore has been reduced from four inches to two and a half inches. Its discharging capacity was tested by the Deacon Meter, and found to be only 23 gallons per minute, whereas the minimum requirements as stated above are 42 gallons per minute or nearly double. This accounts for the scarcity of water in the middle of the day, and I need hardly add that in case of fire the present supply would be quite useless.

Faults of existing scheme: The small intake tanks at the fountain head require some minor repairs which ought to be attended to at once. The engine tank at Fansloanend Cover is a very primitive arrangement; it has no bye pass, no screen and gauge. These I propose to add to the tank as shown upon the plans. There will be a small notched iron plate weir where the volume of water entering the tank can be readily gauged at any time. The water will then pass through a fine meshed copper wire screen in teak frame (not iron as it would set up galvanic action and destroy the screen) into the tank. I have introduced a nine inch brick wall or tongue along the centre of the tank, which will cause the water to circulate from the inlet to the outlet, thus avoiding stagnation. The usual overflow and washout pipes are provided. There are only two air valves and two air taps on the whole length of mains, and these are in the wrong positions, and almost useless in allowing the escape of air from the water pipes, which is the object of providing them. I have provided for six new air valves and no air taps as these latter are worthless. There are too few stop valves and washout valves, and I have provided three additional stop valves and two new washout valves. I was informed that there were no fire hydrants whatever, nor would they be of any use with the present supply as there is no available pressure. I have provided for seven ball valve fire hydrants, which can also be used as stand pipes for street watering, sewer-flushing, etc. There are no indicator plates of any kind marking the position of the different air stops, and washout valves, and fire hydrants which I have provided for in the estimates. The Deacon waste detecting meter is fixed on the main pipe at the east end of the village, the whole of the supply having passed through it constantly for several years. I understand that the meter is now out of repair, which is no more than need be expected. It was never intended that the whole of a supply should constantly pass through the meters, they are (as their name implies) intended for the detection of waste only. The usual and proper way is to insert them in a bye pass of which I have provided two, one at each end of the village, the meter to be moved to and used at each point when required, for which suitable couplings are provided. I recommend that the meter be sent to the makers to be overhauled and repaired.

Volume of water flowing at springs: I have not gauged the quantity of water issuing at the springs, but from what I saw I should judge that it will be fully 25,000 to 30,000 gallons per day. The water issues from the sandstone or freestone rock, proper precautions having been taken to insure that spring water only is tapped. I understand that this water has been analysed several times and has always been found thoroughly good.

Discharging capacity of mains: The new four inch water main from the engine tank to the Post Office will have a hydraulic gradient of 1 in 190, and a discharging capacity of 68 gallons per minute if the mouth of the pipe is open full bore at the surface of the street. It is very important to note that the pipe will only discharge this quantity at the surface of the street with a perfectly free outlet. If the point of discharge or outlet is raised, the quantity of water that can flow through the main is very rapidly reduced. If two dozen taps (there are 309 in Earlston without counting w.c.'s) were set running together, which is an ordinary everyday occurrence between 8 a.m. and 12 noon, the pressure of the mains, which at the utmost can never be more than 24 lbs per square inch, would at once down very appreciably. (I always use 74 to 100 lbs per square inch whenever the circumstances will admit it.) If two or three fire hydrants were discharging together in case of fire, although they would deliver a considerable volume of water at street level, there would be practically no pressure at all, and not nearly sufficient to force a jet of water on to the roofs of the houses. Therefore there would be no real fire protection. This is in consequence of there being such a long length of main between the village and the engine tank (nearly 2 miles) with such a very slight head or fall. I might here mention that the Local Government Board now insist upon adequate provision for fire extinction being made in all water supply schemes. Therefore it will be evident that some means must be adopted to maintain and keep up the pressure in the mains on such occasions as those mentioned above. This can be done in a simple and effectual manner by constructing another tank or reservoir as near the village as possible, and at as high an elevation as possible. This I propose to do by constructing a small reservoir at point A in Huntshaw-lane. The three inch main will be extended from the junction of Haughhead-road and New-street to this reservoir, and will have a hydraulic gradient of 1 in 42, and a discharging capacity of 66 gallons per minute. This reservoir will fill during the night when there is little or no draught upon the mains, and during the maximum consumption at mid-day will keep the mains fully charged, and so maintain the pressure in them by reason of its close proximity to the village. I trust it will be clearly understood that the reason this reservoir is required is because of the very small fall from the engine tank to the village, and the long distance it (the engine tank) is away. Had there been say 200 or 300 feet there would have been sufficient head to keep up a steady pressure in the mains without it.

Huntshaw-lane pressure maintaining— Reservoir: This Reservoir will be situated in Huntshaw-lane above the Police Station. It will hold 30,000 gallons or 1½ day's supply, thus providing for fluctuations in the consumption and maintaining a steady pressure in the mains. It is 22 feet square by 10 feet deep, constructed of concrete with an arched concrete roof carried by steel girders and cast iron columns, and a valve chamber at one corner. There is only one pipe connection to it which acts both as inlet and outlet. The inlet is at the top, and has an equilibrium ball valve which closes when the reservoir is full. The outlet is connected to the same pipe, but at the bottom of the reservoir there being a reflux valve fixed between the reservoir and the connection shown on the detail plan. The reservoir is provided with the usual overflow and washout pipes and valves,

and as designed is a solid substantial piece of work. The top water level is 400 feet above Ordnance Datum of [or?] 12 feet below the top water level of the engine tank.

Estimate—I estimate the cost of the whole of the works embraced in this scheme including engineer's charges, clerk of work's salary during construction, and a sum of 5 per cent for contingencies, at £127, but exclusive of compensation for surface damage (if any) and purchase of and for reservoir (about 100 square yards).

Time requisite for execution of works:—I anticipate the carrying out of this scheme will occupy about 5 months. The method I propose to adopt is to build the Huntshaw Reservoir first, allow it to fill, and then commence relaying the four inch main. This main would be laid in short lengths during the day and a temporary connection to the old main made when the day's work was finished, so that the reservoir could fill during the night. The reservoir would thus be able to supply the village distributing mains during the day time, and there would no stoppage in the supply even when the mains were being relaid.

In conclusion, may I say that my efforts have been to design this scheme with regard to efficiency as the first consideration, keeping an eye to economy in all details, and avoiding all deficient and costly work, while not overlooking future requirements. I believe the scheme I submit will conform to all the known requirements of the Local Government Board. Considerable thought, time, and care have been expended in designing it, and I trust it may be worthy of your consideration. Should it meet with your approval, I can assure you that no effort of mine or provision which foresight and experience can suggest should be wanting to expedite the work and carry it to a successful conclusion. —I am, yours faithfully, HARRY W. TAYLOR. Assoc. Mem. of Institute of Civil Engineers; Mem. of Society of Engineers; Mem. of Assoc. of Municipal and County Engineers; Fellow of Surveyors' Institution (by exam.) To the Berwickshire West District Committee.

[The proposed scheme was kicked into the long grass at a public meeting of the Water Committee in Earlston on 1 March 1901. See: *Berwickshire News*, Tuesday 5 March 1901, p7.]

Berwickshire News, Tuesday 16 April 1901

EARLSTON WATER SCHEME

A meeting of Earlston Water Committee ... A letter from the Clerk to the sub-committee, dated 1st March, was also read, explaining that the work formerly proposed to be done, viz., the renewing of the pipe from the tank to the commencement of the fire-clay pipe had been found unnecessary. ... The employment by the sub-committee of Mr Taylor to advise them was approved, and it was remitted to the sub-committee to get Mr Taylor to report whether the relaying of the main would have the effect of giving a sufficient supply of water to those who complained of the want of water, and also to ascertain what quantity of water is passing at present through the main, and if there is any waste of water by leakage otherwise, and how some cisterns do not receive any water while others about the same level are filled every day. ... It was agreed that a circular should be printed and circulated, stating the duty of the Water Officer in his visits of investigation as to pipes and taps in relation to waste or leakage.

Berwickshire News, Tuesday 21 October 1902

EARLSTON WATER SCHEME

... A report was read from Earlston Water and Lighting, Cleaning and Drainage Sub-Committees, as under:

Water —“The first meeting of the present subcommittee was held on the 27th January, when all the members were present and accepted office. Immediately thereafter the question of the inadequate supply was under consideration, and the Committee are now in a position to state that a new 4-inch main pipe has been laid for a distance of 2520 yards [*sic*] or thereby between the tank and the United Free Church, and also 280 yards or so of damaged 6-inch earthenware pipes beyond the tank have been replaced by new 4-inch iron pipes. It is expected that the total cost of these works will not exceed £600, the amount of the loan arranged for by your Committee. This Committee are pleased to say that the whole work was expeditiously carried out by the contractor, Mr Murdison, and to the satisfaction of their engineer, Mr Atkinson, C.E. The additional supply was turned on into the town on the 4th September with the most satisfactory results—all the houses in the higher parts of the town which were formerly almost altogether without water having now obtained an abundant supply. ...”

Berwickshire News, Tuesday 3 February 1903

The Clerk [to the relevant committee] stated that the Earl of Haddington did not see any necessity for taking the two extra springs at Fans bog into the cistern as was proposed, since the supply of water in Earlston was now in such a satisfactory condition. His Lordship is, therefore, not disposed to allow the Committee to take these springs into the main pipe direct. In regard to the fact that the Fans Steading drain is in close proximity to the present water supply, Mr Tunnard, Lord Haddington’s factor, has written to the Clerk of the Committee, Mr Sinclair, that the drain is so altered in its direction now that there is no risk of contamination to the springs.

Berwickshire News, Tuesday 26 July 1904

EARLSTON

Water Committee—A meeting of this Committee was held in the Court Room on Wednesday evening. The Chairman reported that the Committee appointed at last meeting along with the Clerk had met Mr Tunnard at Fans Springs on Thursday last, when after an inspection of the present water supply, an exchange of views took place on Mr Hunter’s analysis of the water. Mr Tunnard, on behalf of Lord Binning and himself, stated that they were perfectly satisfied with the purity of the present supply, but should the Committee hold another opinion he would be quite prepared to assist them any practical measures they might adopt to remove the objection mentioned by the analyst. He also stated that he was quite at a loss to know when and how to search for it. The Committee informed Mr Tunnard that they were in agreement with his views and would recommend that nothing further be done in the matter. Mr Tunnard said he would proceed immediately to take the additional springs into the tank at Lord Haddington’s expense as previously arranged. The Chairman further stated that Mr Tunnard and Mr Herbertson had expressed their regret that the town supply had been interfered with last week owing to extra pumping, and that in future every care would be taken to prevent any interruption of the town’s supply. The report was approved and the committee discharged.

Berwickshire News, Tuesday 18 October 1904

COUNTY COUNCIL

The West District Committee of Berwickshire County Council met in the Court Room, Earlston, on Monday afternoon. ... The following report by the Earlston Water, Lighting, Scavenging, and Drainage Sub-Committee, for the year ending 30th September, 1904, was submitted:

Water—The Sub-Committee beg to report that since last report the town has on two occasions been deprived of a water supply for the greater part of a day owing to pumping at Fans for the water supply to that farm and to Mellerstain House. As an outcome of this deficiency the Earl of Haddington has agreed to introduce additional springs into the cistern at Fans Bog at his

own expense upon the understanding that the water is not to be considered as part of what was taken in by agreement between Lord Haddington and the Water Committee in 1879, but it is to be held as a separate supply which belongs entirely to the Mellerstain Estate and which Lord Haddington may at any time cut off from the cistern or use for any purpose he thinks fit. The sub-committee unanimously agreed to this arrangement, which they expect will in future prevent any serious interruption to the town's supply during pumping operations at Fans Bog. The analysis of the present water supply and of the additional springs to be introduced by Lord Haddington has been obtained by the Sub-Committee, and considered satisfactory both by them and Lord Haddington. The sub-committee have had 14 fire hydrants put in throughout the town to cope with any outbreak of fire, and the fire-hose is now stored in the road-engine shed at the railway station as arranged for.

Drainage—On account of an outbreak of diphtheria, and acting under instructions from the Medical Officer of Health, the Sub-Committee gave orders to have all private connections with the Main drain thoroughly flushed, and this work was satisfactorily carried out. A careful inspection all the connections was made at the same time and anything found working unsatisfactorily was put right at once. ...

Berwickshire News, Tuesday 05 July 1910

Earlston Water Supply

A meeting of the Water Sub Committee of the Parish Council was held on Wednesday evening.

...

Mr Young said he thought by the agreement between the proprietor and the local authority, Earlston was only entitled to what water was left over after the proprietor's farm of Fans and the mansion house had been supplied, though he was sure the Earlston people were secure enough in the hands of the honourable proprietor. The Clerk, however, read over the agreement between the proprietor and the local authority wherein these words occurred that "a sufficient supply be left by him (the proprietor) for Earlston." The Chairman said the supply, which was adequate, was not in question, but the storage, and, he also explained in answer to Mr Yule, that when two days' pumping water took place at Fans the Earlston tank at the fountainhead did not fill as it only held storage for half a day. The pumping, he explained, was not out of the Earlston tank, but was in reality an intercepting of the water of the springs which in the absence of pumping flowed into the Earlston tank at the fountainhead. Mr Kerr thought that a tank to hold 80000 gallons was unnecessarily large and would cost more money in its construction than the £600 which had been fixed as the maximum cost, and that a tank to hold 50000 gallons would be amply sufficient. ...

Berwickshire News, Tuesday 27 September 1910

Earlston Water Supply

On Monday night, a meeting of the Water Sub-Committee was held in the Court Room. ...

The Clerk also read [a] letter from Mr Atkinson, engineer, submitting plan of work, specification, and an estimate of the probable cost, amounting to £569 14s.

Gentlemen, —In accordance with your instructions of your Committee, I beg to report as follows, as I think has been proved beyond doubt that the principal cause of the unsatisfactory state of Earlston Water Supply is the insufficient storage capacity of the reservoir which is at present not more than half a day's supply. After carefully considering the whole question as to the best means of improving the supply, in my opinion the most satisfactory method would be to increase the storage capacity of the reservoir to at least three days' supply allowing from 20 to 25 gallons per head per day,

and as the position of the present reservoir is too low to give a reasonable working pressure to the town, I would recommend that a new storage reservoir should be built at a higher level. A suitable site has been suggested to the east of Fans bog, which would increase the head by 25 feet or by 10.85 lbs. per square inch. By placing the reservoir as suggested it would admit of the water being taken from the pipe supplying the present reservoir where it passes the point referred to, and would also admit of any further springs that may be found in the bog being tapped at any future time if found necessary. This would necessitate the lay a little over 700 lineal yards of four inch cast iron water main to connect the proposed new reservoir with the present four inch main in Yarlside bog. I herewith beg to submit for your consideration plan and specification and estimated probable cost of the proposed works on the lines set out by the plan and specification, the work to be let in two separate contracts Nos. 1 and 2—Contract No. 1—Mason and Builder, probable cost, £392 4s; No. 2—Plumber, probable cost, 177 10s; total, £569 14s.

Mr Kerr proposed, seconded Mr Young, that Mr Atkinson's plan and specification be accepted, which was unanimously agreed to. ...

Berwickshire News, Tuesday 14 March 1911

Earlston Water Supply

OFFICER'S REPORT ON SCARCITY

Earlston Water Sub-Committee met on Monday evening ...

As Water Officer [Mr T. B. Murdison], I beg report to the Water Sub-Committee that there has been considerable inconvenience in the town last week owing to a scarcity of water, caused solely by pumping operations at Fans. As long as the engine pump works, there is no water running into our reservoir in Fansloanend wood, with the result that the reservoir is drained dry, air gets into the pipes, and three days pass before we get full supply. The worst part of the pipe which airlocks is that part lying between the small collecting tank in Lillie's bog and the reservoir in the wood. There are neither air nor cleansing cocks at that part, and I cannot assist the water to start in any way. The pipe has a small fall there, and it takes the water at least two days to expel the air, and another day to fill the cisterns in the town. ... It is pity air cocks were not fixed in that part **in 1902 when new pipes were laid**, but that was the fault of the engineer employed at that time who did not know that air fittings were required and did not specify them. I examined the whole water system between Earlston and the springs yesterday, and there is no leakage. There is a very abundant supply at the springs, and water was running well into the reservoir.

Copy of Medical Officer's (Dr Young's) letter to Water Sub-Committee:—I have to inform you that there has been such a scarcity of water in Earlston for the last week as constitutes a danger to the public health. In the higher parts of the town many households have only had water at their taps on rare occasions during that period. ...

The Clerk read a letter from the engineer, reporting that the contractor for the new tank (Mr Smeaton) was making but slow progress. The Clerk was instructed to write to the engineer to urge the constructor to push forward the work.

Berwickshire News, Tuesday 28 March 1911

Earlston

The following letter bearing on Earlston Water Supply has been written by Mr Herbertson, tenant of Fans, to Mr Dove, factor for Lord Binning:—"I am exceedingly sorry the Earlston people are suffering from want of water. For years I have done my utmost when pumping to

cause as little inconvenience as possible. There has always been a difficulty in the summer as there is very little storage for Earlston, and more water is used in the summer than in the winter, but it is a rare occurrence for the water to be scarce at this season, and I am afraid there must be something wrong with the pipes. This year we have pumped 19½ days fewer than last. I used to send notice to the water officer during the summer when we intended pumping, but I have not done so since there has been more water in the springs, as we cannot pump all the water during the winter months, and there is always a certain quantity going to Earlston. However, I will be very pleased to send a p. c. to the water officer the day before we pump and will only be too glad if I can do anything to prevent inconvenience to the inhabitants of Earlston. There is a report in the local papers by the water officer to the Earlston Water Committee, a copy of which I enclose, and would like to make a few remarks on it, as there are several inaccuracies in it. Firstly, he says, “the want of water has been caused solely by pumping operations at Fans.” We have not been pumping any more lately than formerly, and I herewith give you the dates on which we have been pumping during the last four months, viz:— ... Secondly he says, “As long as the engine pump works there is no water running into our reservoir at Fansloanend Wood.” This is not the case, as there are two springs contained in one pipe always running into the Earlston pipe, and these springs are not near our tank. Then the pump cannot pump all the water coming into the tank during the winter season, so that there is always a certain amount going to Earlston. We were pumping to-day and I went down to see the Earlston tanks, and I met Mr McDonald and Mr Yule, both members of the Water Committee, and these gentlemen will be able to corroborate the following. First all we went to the tank at Fansloanend and we found it full of water, then we went to the small collecting tank in Lillie’s bog, and found there a fair run of water which the supply pipe was taking all away. Next I let Messrs McDonald and Yule see the two springs which run direct into the Earlston pipes and are not near our tank, and lastly we came to our tank where the engine was pumping. There was a considerable quantity of water going down the Earlston pipe; we had it measured and found it was fully two inches. I caused the pump to be stopped, and when all the water was going down the pipe it was measured again and found there were four inches of water running—so whatever may be the cause of the scarcity of water, the fact remains that there are always two springs and the surplus water left by the pumps to go into the pipe whether we are pumping or not. I trust you will let the Water Committee know this, as the water officer’s report is decidedly misleading.”

Berwickshire News, Tuesday 6 June 1911

[Lots more blather about rights but not much factual content]

Col. Hope had said that the leak in the pipe (which had been discovered) was the cause of the deficiency, but this was not the case. It had been said that the crack in the pipe had caused leakage of 8000 gallons a day, but the water officer’s report put it at only 2000.

Berwickshire News, Tuesday 2 July 1912

EARLSTON WATER SUPPLY

Earlston Water Committee recommended the District Committee to adopt the Engineer’s report on the new reservoir which was as follows:—“I regret to report that the construction of the new reservoir is still unfinished, although very little remains to be done, if the work that has recently been done proves satisfactory when tested. I have been urging the contractor in every possible way to complete his work, but I am sorry to say, without avail. ...”

Berwickshire News, Tuesday 30 September 1913

Earlston Water Supply

Several years ago, in consequence of the defective water supply of Earlston, it was deemed expedient (writes a correspondent of “Edinburgh News”) to have an additional reservoir. It was

3 years since operations with this view were commenced, and the contract is still incomplete, because of a crack in the floor, which extends nearly the whole length of the tank. It was found there was an under pressure of undesirable spring ditch water, for which no arrangement had been planned to drain away before the floor was laid. The reservoir was most expensively built, with white enamelled brick work, and although the work was taken out of the hands of the contractors, and a large sum was spent in trying to repair the faulty floor by other tradesmen, all such operations have proved a failure. The tank has been thoroughly tested by the sanitary inspector and the water officer, and the result is that nearly 40,000 gallons of impure water has collected in the tank through the aperture on the floor, and this too, at the dryest season of an exceptionally dry year. **The most tantalising feature in the circumstances is the fact that the additional reservoir is now found to have been quite unnecessary, as the water supply has all along been well maintained without it.**

Berwickshire News, Tuesday 24 June 1919

Special meeting of Earlston Water Committee was held in Court Room on Friday, to consider condition of water supply. ... The Clerk submitted report from Mr Coupland, County Sanitary Inspector, as follows:—In pursuance of complaints as to shortage of water in Earlston, I have made several visits of inspection to the fountain head and along the pipe track. On Monday last, 9th inst., I was accompanied Mr T. B. Murdison, water officer, and we gauged the flow of water coming into the reservoir at Fans Bog at 33,739 gallons in 24 hours. If we take the population of Earlston at 1200 the supply of water available per head is 28 gallons a day. At the time of our inspection, 5.15 p.m., there was only 2 feet 4 inches in reservoir, and Mr Murdison assures me that very little of this water can be drawn on except by siphonage, owing to some defect in the gradient of the pipe. Incoming water was gauged by me on 12th Aug., 1913, as 38,970 gallons per day, so that there is a shortage of over 5,000 gallons at our last gauging. The capacity the reservoir is slightly over 47,000 gallons, equal to 39 gallons per head for a population of 1,200, but as present supply is less than that amount, it can be seen that when pumping is in operation for Fans Farm the Earlston supply must be immediately affected. Present position of matters is intolerable particularly for those residing in higher situated houses as they are sometimes without water for 3 or 4 days at a time. As I have already stated the available supply is 28 gallons per head but this is not nearly sufficient for a town such as Earlston, and in any case demands on the water will increase particularly so in view of the requirements of the Housing Bill now before Parliament as to the necessity of water being laid on premises and compulsory provision of water closets. Additional springs might be secured in Yarlside Bog, gauged by Mr Murdison and myself on Monday last at 27,000 gallons per day. These could be secured at a sacrifice of 9½ feet of head from high level mark of present reservoir. It will however be necessary to increase the conveyance capacity of the water mains. I find that in Earlston system a full running of 4 inch pipe is capable of supplying 60 gallons per minute but to meet requirements the supply should be equal to a delivery of 90 gallons per minute. A 5 inch pipe would hardly meet the case but possibly a new 4 inch main from Yarlside Bog, a distance of 1700 yards to a point where Earlston old supply main could be joined would meet the case satisfactorily. The old pipe may possibly be corroded and its conveying capacity restricted, but in any case there would then be two 4 inch mains right into the town. I am quite of opinion that unless an additional supply and an additional water main are provided, the water supply to Earlston cannot be considered sufficient for requirements. The report thereafter was fully considered by Committee, who were of opinion that proposed scheme would be very expensive at present time. It was pointed out that several additional springs could be diverted into present tank and as these springs could not be drawn upon during pumping operations at Fans, the supply would be considerably increased. After considerable discussion, Mr J. McDonald proposed and Mr Fisher seconded, that the water be shut off for one night so that the tank might be filled. When the supply was turned on again it would be found out whether

the increased pressure would give a good supply of water to houses at the higher elevations, and if so, then steps might be taken to increase volume of water entering tank. This was agreed to, and the Water Officer was instructed to have the experiments carried out and reported to a future meeting.

Berwickshire News, Tuesday 19 July 1921

EARLSTON

At Earlston during past week there has been an embarrassing scarcity of water and those houses situated at a high level were utterly deprived of that necessary element for some days. At first it was believed that this was due to the excessively dry weather now prevailing, but upon an examination of the reservoir near Fans by the Water Officer, it was found that the water supply was sufficiently ample but that a serious leakage had taken place near Purvishaugh. This necessitated the cutting-off on Sunday of the water supply for the whole town, to allow the necessary repairs to be made that day. On Monday another leak was discovered in High Street, but this also been attended to, and the supply of water is now as voluminous as ever.

Berwickshire News, Tuesday 8 November 1932

[Still being talked about. Still problems. Fans still the main source of supply. Copy not well digitised.]

Berwickshire News, Tuesday 14 February 1933

EXPERT TO BE EMPLOYED TO FIND LEAKAGE

Meetings of the West District Council and West District Joint Committee were held at Earlston on Monday. ...

Earlston Water Supply

They had all a copy of Mr Coupland's report; he had been carrying on a considerable amount of work in the interval since last meeting, and was satisfied the solution of the matter was a new pipe laid alongside the 4 inch main, from the springs. There was a tremendous leakage yet, and whether they should proceed with the main or try to find out where the leakage exists was the question.

Mr Lyal said that according to his calculations there was a leakage of 28,000 gallons per day between the Manse and the White Swan, was that correct.

Mr McDougal—According to the meter the leakage is between the Swan and the Church down there. There no doubt it is getting away and the quantity seems greater when the extra pressure is on. There is no doubt that there is supply of 57,000 gallons in the twenty-four hours; that is twice as much as should supply Earlston.

Mr Lyal—I say the first thing to be done is to find out the leak. Without the leakage there would be plenty water.

Mr Coupland—It would be just on the fine side for the higher houses. If you put a tank up there you would not get half the water up there that would be required. Messrs Warren and Stewart says there are 57,000 gallons coming to the White Swan. According to my calculations the new pipe to the White Swan would give supply to Broomliebrae, the level of which is 417 feet and the Thornfield House which are 388.

Col. Home—Supposing you put in new 6-inch pipe could you supply these houses without cisterns?

Mr Coupland—Yes, without any trouble.

Mr McDougal—If the leak was stopped and these houses supplied with cisterns it would save a lot of money.

Mr Coupland doubted if that would meet the case, and Mr Lyal said the leakage had got to be put right even if there was to be a new pipe. According to his calculations they were losing about half the water that was coming to the town. He did not see any good in losing all that water.

Capt. McDougal—In the meantime we should give instructions to find out the leak. Have you any reason to believe the pipe is in a bad state.

Mr Coupland—Undoubtedly there must be a big leak.

The Chairman—We are passing 58,000 gallons through this pipe and using 40,000. It is no use putting in a new pipe to get more water under these circumstances.

Capt. McDougal suggested lifting and relaying the pipe from the White Swan to the Manse. ...

Berwickshire News, Tuesday 4 July 1933

Earlston Water Supply

The Chairman said that at last meeting this question was left in the position that the local Committee should incur capital expenditure if necessary. It was thought that several leaks might be found and that the Committee should employ an expert if necessary, but it had done by the local people.

Mr Coupland stated, on the invitation of the Chairman, that the leakage was much diminished and the water supply was sufficient for the village with the exception of two or three houses at Thornfield. The Committee were satisfied this could be remedied by putting in a new 3 inch pipe [eh?]. At present the pipe was a 3-inch one as far as the square, with three 2½ inch pipes off it. The pipes supplying the lower part of the village could be restricted.

Estimates had been taken and it was agreed to accept the tender of Robert Murdison, amounting to £59 10s.

It was agreed to pay Messrs Waring and Stewart, C.E., their fees and expenses in connection with the abandoned water scheme covering a period from November 1931, to March 1932, and amounting to £33 17s 6d; as also £8 8s for coming back again in June, 1932.

Mr Coupland said this last item was really caused by the action of the Department of Health.

The Chairman—We employed them to produce a scheme and we can't get out of paying for it. They produced a scheme to bring the water from Cleekmae [*sic*] burn on the other side of the Leader, and it was very questionable if it would be any good in a dry summer. At some future time we might have to go and seek for a new supply and now would be a good time to go and have this supply tested. I think we might incur some small expenditure to inquire into this. They said it was a good catchment area.

Mr Coupland—There ought to be water there but like some of these burns, it seems to disappear in certain places.

The Chairman—They said there was water but at the November meeting Mr Hogg and others had doubts about it. It was to be tested in the spring but heavy rain came on and it was no use. It should be tested beyond Cairneymount and the Sheep pens.

Mr Hogg from his knowledge of the burn expressed his dubiety as to a supply being obtained from the burn in question.

Mr Coupland—The singular thing is that there seems to be plenty of water higher up on the flat.

Notes by the Man-in-the-Street ... Earlston extricates itself

Earlston, which I reckon is about the most progressive village in the County, is to be congratulated on having extricated itself from what seemed rather an awkward situation regards its water supply. The shortage experienced during recent years has been so serious that it looked as if a new supply would have to be introduced, but when a scheme had been prepared the estimated cost—some £4,000—staggered even the most adventurous spirits. The local Committee got to work to see what could be done to get the best out of the present supply, a considerable part of which was admittedly going to waste through leakage. Fortunately their efforts have been crowned with success and for an expenditure of something like £300 inclusive of what was spent over the head of the abortive £4000 scheme, Earlston is again in possession of a sufficient, if not lavish water supply. It may course, be, as Major Sharpe warned the District Council, that in the future perhaps not far distant, a new source of supply must be looked for, but for the present at least the situation is saved.

Berwickshire News, Tuesday 1 November 1938

Earlston Water

Major Sharpe stated that a somewhat serious position had arisen in regard to Earlston water supply. Up to the last week or two they had been very short; he really thought this was due to the usual cause, asking the supply do too much. Mellerstain estate had the first call on the spring they had there. That estate was putting in baths and W.C.s at various places, and definitely the spring was not sufficient. The Earl of Haddington had been good enough to restrict the amount taken for a few months until they got looked about them. Mr Mark had examined the place and had found another source of supply.

Mr Mark explained that the new source was on Yarlside. It would yield 21,000 gallons per day. There was another spring in a wood which would yield about 4,000 gallons. Together they could count 24,475 gallons per day, which should be ample. They had 10,000 gallons coming in now, so that should give them 34,750 gallons per day to keep Earlston going. Their tank held 70,000 gallons.

Major Sharpe: The tank has never been full for a long time.

Mr Mark: You require to put in a 10,000-gallon [?] duplicate tank.

Major Sharpe: Would you not pipe it in direct?

Mr Mark: No; I don't think so.

Major Sharpe: I think you should leave it to the Earlston Committee; Mr Mark to make up a schedule for them.

Mr Hogg enquired about an old subterranean source, and Mr Mark said they had not got properly into it yet. The supply there was about 4,000 gallons per day.

Major Sharpe: Is there no chance of it meeting the situation.

Mr Mark: It seems to fluctuate terribly.

Mr Runciman remarked that he was pretty short of water although it had been considered a wet summer.

... The contractor's final account for the work that has been going on in connection with Earlston water supply was submitted, and amounted to £1,503 3s 10d. The estimate was £1,439 8s. The extras had been passed by the engineers.

Berwickshire News, Tuesday 9 May 1939

Earlston Water Supply

Arising out of the minute, Major Sharpe drew attention to the position which had arisen as to the proposed augmentation of Earlston Water Supply. On 22nd March last, the West District Council had been informed that an expenditure of £600 would be authorised and no financial assistance could be given by the County Council. It had become necessary to engage an outside engineer which would mean that Earlston Water District would have to bear additional expense through no fault of their own. It had been decided to appeal to the County Council to bear this extra expenditure. The Finance Committee had made no recommendation as to this and he had therefore thought it necessary to make an appeal to the Council. Last year in September and October, Earlston was continually short of water. When the matter was looked into it was found to be simply a real shortage of water at the fountain head; there was nothing wrong with the pipes, but there was not sufficient water for the village. The Sanitary Inspector came along and found two springs which was proposed to take in to increase the supply. ... [But lots of wartime exigencies.]

Berwickshire News, Tuesday 6 February 1940

Earlston Water Again

Letters were read from two residents in the higher part of Earlston to the County Clerk complaining of the irregularity of the supply of water lately.

Major Sharpe said there had been bother with the Earlston water supply for 20 or 30 years. There was water enough but a very small fall and people had built houses in the upper part of the village to which the water would not rise when it was being run off in the lower part of the village. To help this they had put in a new pump but possibly people had been running off a lot of water during the frost and there had also been numerous bursts. What they had been doing was to turn off the water in the lower part of the village and turn it into the tank. They really could do no more.

Mr Knox said the writers of the letters were perfectly satisfied after he had explained to them the difficulties of the Local Committee and that if they went further the expense would fall on the District Committee, which they had not understood.

Major Sharpe—Every now and again there is failure in the supply through the water being cut off at night. There is also insufficient storage. They spent £1,000 at Yarlside in the hope of getting 22,000 gallons of water per day; they got 7,000 but the 15,000 gallons ‘spring’ disappeared; it seemed as if it had been surface drainage.

It was stated that improvements had been made at the pump at a cost of £20, and Major Sharpe said that all water supplies were low just now on account of the frost.

Berwickshire News, Tuesday 23 May 1950

EARLSTON WATER SUPPLY

In a letter received by Earlston Ratepayers’ Association, Mr J. J. Robertson, M.P. for Berwickshire, indicates that with regard to Earlston water supply he has passed on the information to the Secretary of State for Scotland. Berwick County Council meantime have adopted certain measures to check the waste and leakage in the present water system and they have arranged to instal meters on the service pipes of all large industrial users. The County Council, however, have not seen their way to improve the existing supply to Earlston by the duplication of the upper portion of the supply pipe. They have received a report from their consulting engineers but they consider that while the adoption of the proposal might effect some improvement during the greater part of the year the position would not be improved during the few dry months when the shortage is most felt. **They see no alternative, therefore, but to await the inception of the Earnsclough scheme.** The Council have pressed to be allowed to start the Earnsclough scheme at an early date, but in the present circumstances including claims from other local authorities to carry out water schemes no possibility was seen of allowing a start on that scheme until 1952.

Berwickshire News, Tuesday 23 December 1952

Earlston houses and water

Unless there are unforeseen difficulties **the Earnsclough water supply should reach Earlston by next July.** This was reported at a meeting Berwickshire County Council held at Duns on Wednesday. The Water Engineer said that all the material, with the exception of small articles which could easily be obtained, was now on the site. ...

Berwickshire News, Tuesday 3 November 1953

Plans

Plans were submitted in connection with alterations at Carfraemill Hotel, Lauder; Red Lion Hotel, Earlston; and Gordon Arms Hotel, Gordon. All were approved. Mr Lyal said some years ago members of the court had visited all the premises and suggested various alterations. Some were omitted because a water supply was not available. **Now that water was available at these places** he suggested that a sub-committee visit them and suggest various alterations. This was agreed to.

Berwickshire News, Tuesday 28 September 1954

... At the same time [as the larger Watch Burn/Water scheme for SE Berwickshire] about £200,000 is being spent on a supply scheme for Lauderdale and the western parts of the county.

Source

The source of the Lauderdale scheme is the Earnsclough Burn, a tributary of the River Leader. An intake has been formed at an elevation of 590 feet, compared with the 800 feet of the Water Burn reservoir. It is calculated that a supply of 250,000 gallons a day will be available from the intake. [The 590 feet is a typo. The Earnsclough Raw Water Intake is at an elevation of 950 feet.]

The construction of an impounding reservoir or alternatively, the bringing in of the adjoining Blyth Water, would increase the available supply very considerably, and, should the need arise, it could be taken eastward over the high ground into the area served by the Watch Burn scheme.

Extended

At the moment the main pipeline has been extended to Earlston. The scheme provides for augmenting the supply of the burgh of Lauder and, by agreement with Roxburgh County Council, for giving a supply in the marginal section of Roxburghshire that extends into Lauderdale.

Separate

Before, the landward parts of the County have been dependent on about 20 separate public water supply schemes serving individual villages. The sources are local springs, shallow wells, or intakes on small streams. These schemes sufficed to served [*sic*] only about 30 per cent, of the landward population.

It is estimated that the Watch Burn and the Earnsclough schemes when completed should supply 75 per cent.

CURRENT-DAY PROVISION

Earlston is fed from regional water: principally via Howden WTW. There are distribution service reservoirs in the Village and on the southern slope of Huntshaw Hill. The latter is fed from a pumping station at the Village DSR. An old 6" pipe ran up Huntshaw Road but that has been superseded by a 280mm HDPE main. A new 250mm HPPE is being put in from Newstead to Earlston to upgrade the supply from Howden. Work by Caledonia Water Alliance was scheduled to begin on 19 March 2018.

HYDROGEOLOGICAL NOTES

MacDonald *et al.* (2008) reports that:

- The Devonian sedimentary rocks generally form the highest productivity aquifers in the study area (with the exception of the Permo-Triassic sandstones; ...). Recorded borehole yields are typically in the range 1 to 2 l s⁻¹. **In some areas in the Lower Devonian, artesian conditions occur, such as near Earlston***. A limited amount of core analysis data is available for the Devonian aquifer in the area (Ball *et al.* in prep). In some areas in the Lower Devonian, artesian conditions occur, such as near Earlston. [*This appears to be referring to the springs near West Morriston and Fansloanend.]
- A study in the Devonian aquifer of Strathmore (Ó Dochartaigh *et al.* 2006) suggested that groundwater was mainly recharged within the past 40 years and mixed throughout the top 100 m of the aquifer. [Ditto]

MacDonald, A.M., Ó Dochartaigh, B.É., Kinniburgh, D.G. and Darling, W.G. 2008. *Baseline Scotland: groundwater chemistry of southern Scotland*. Groundwater Resources Programme, BGS Open Report OR/08/62, 76pp.

Ó Dochartaigh B.É. 2006. *An estimation of the resource potential of the aquifer at West Morriston Farm, near Earlston*. BGS Commissioned Report CR/06/197C.

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