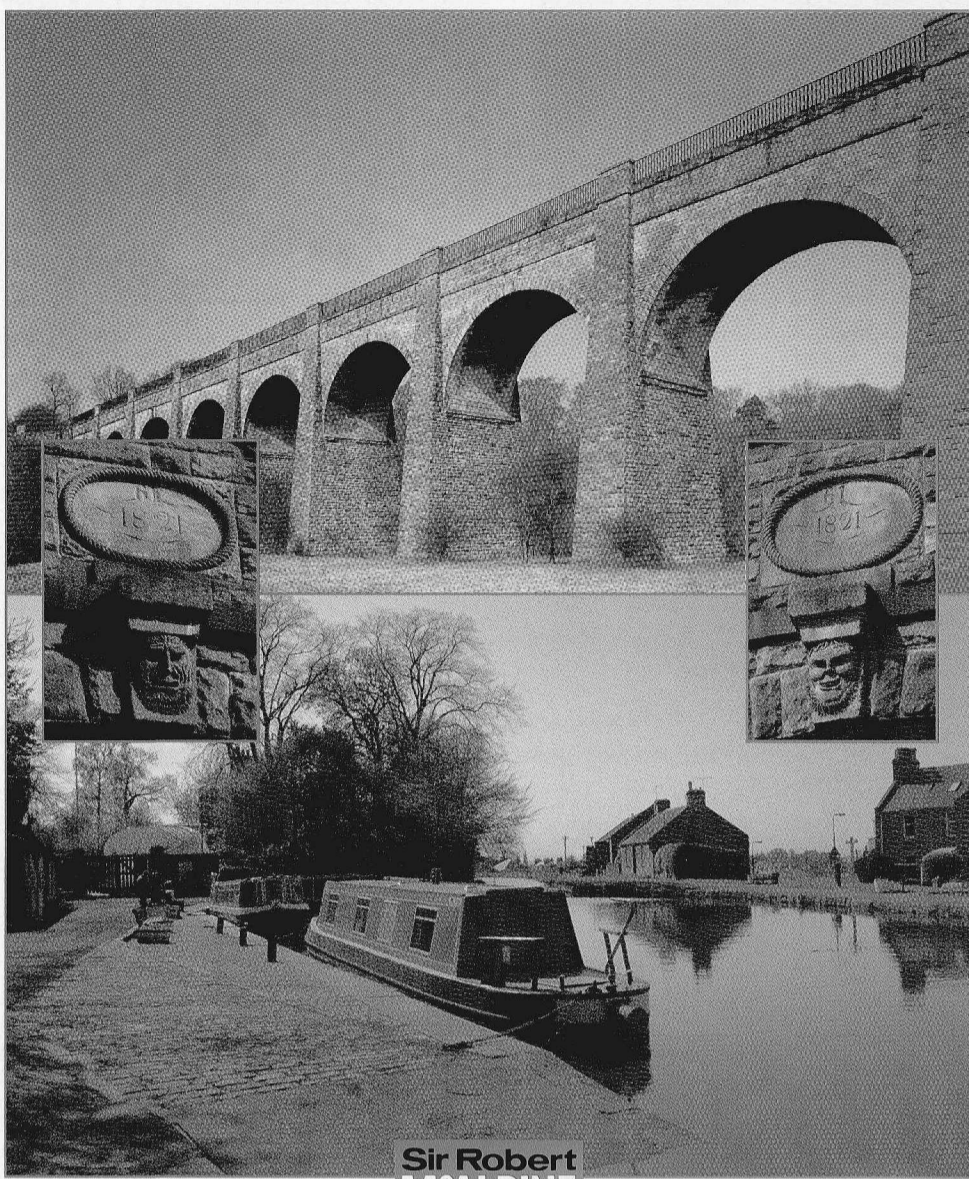


RCAHMS BROADSHEET 8
The Union Canal



Sir Robert McALPINE

Authorised in 1817 and completed in 1822, the Edinburgh and Glasgow Union Canal was built principally as a means of importing coal and lime into Edinburgh, but also with high hopes for passenger traffic.

The last of Scotland's major canals, the Union Canal embodies much of the engineering expertise that had accumulated over the previous half century. Known as the 'Mathematical River', it is Scotland's only surviving contour canal, for, with the exception of an original (and now buried) flight of locks at its western end, the canal follows the 240 feet (73.1m) contour throughout its 31½-mile (50.8km) length. It also incorporates Scotland's oldest tunnel, and the design and scale of its three principal aqueducts compare with the best in Britain. Unfortunately, the Union Canal's late appearance on the scene meant also that within 20 years of completion, its passenger traffic began to be lost to the railways, and by 1849 the canal itself was in the ownership of the Edinburgh and Glasgow (later the North British) Railway Company.

From the early 1790s onwards, engineers had been commissioned to survey and report upon possible routes, most of them following direct lines between Leith and Glasgow. It was not until 1813 that a plan by Hugh Baird, resident engineer of the Forth and Clyde Canal, set out the advantages of effecting a link with that canal near Falkirk and creating an Edinburgh basin in the Fountainbridge area of the city. His plan was adopted, and an Act of Parliament of 1817 provided for a canal five feet (1.5m) deep to run from 'near the City of Edinburgh' (later Port Hopetoun) and to join the Forth and Clyde 'at or near Lock Number 16, opposite to Camelon House' (later Port Downie). The estimated cost was £240,500. Construction work began at the eastern end in March 1818, and by 1822 the canal was complete and in use. At about £461,760, the actual cost was almost double the estimate.

As built, the canal was 37 feet (11.3m) and 20 feet (6.1m) at the surface and bottom respectively. From above Camelon, at the western end, a curving flight of 11 locks brought the canal down 110 feet (33.5m) in just over half a mile (0.8km) to the level of the Forth and Clyde Canal at Port Downie. In 1823, a year after completion, the canal was extended westward some 1,710-feet (512.2m) to a new terminus (Port Maxwell) in order to reduce the distance for passengers walking between the two canals. Also in the Falkirk area, the owner of Callendar House had forced the canal company to

take a circuitous route around his estate, necessitating the construction, west of Glen village, of a deep cutting and a 2,070-foot (631m) tunnel excavated through solid rock.

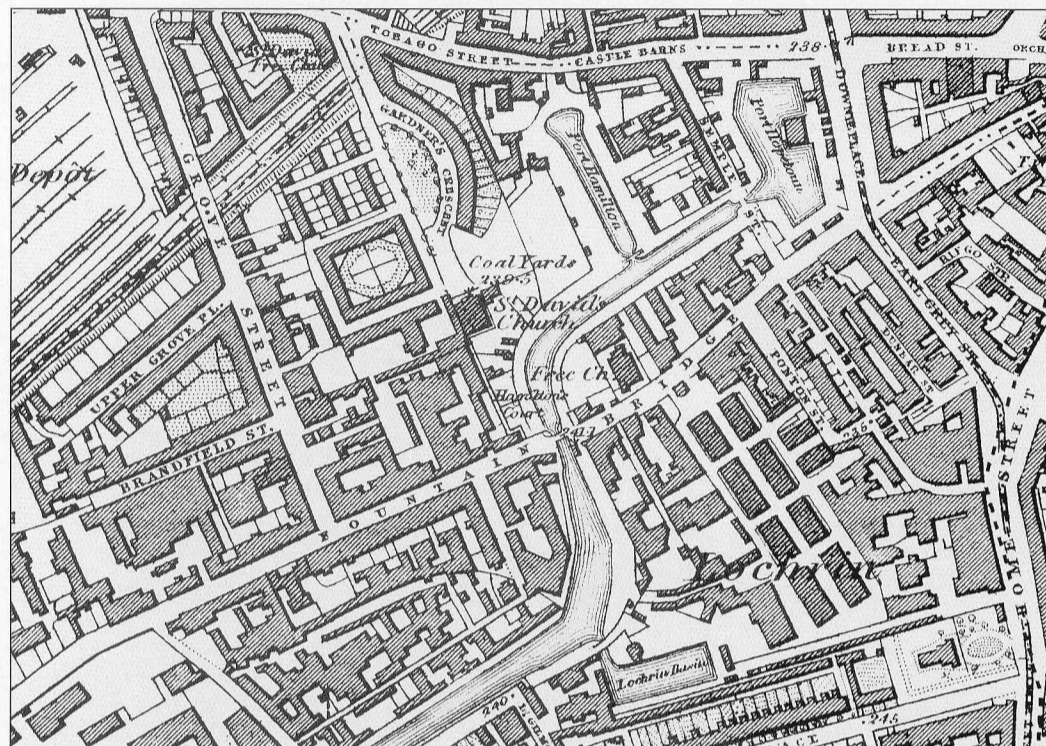
The canal feeder system was a noteworthy engineering achievement in its own right. It entailed the creation of a reservoir at Cobbinshaw (NT 0158), high in the Pentland Hills, the water running down the Bog Burn and other successor streams before emptying into the River Almond at Midcaldor, below which the water is deflected into a feeder channel on the west bank of the river. This three-mile (five km) channel, a canal in miniature, crosses the Almond on a Baird-designed cast-iron aqueduct and then, traversed by small overbridges and cutting through four tunnels, it eventually flows into the Union Canal immediately west of the Almond Aqueduct, 75 feet (22.9m) above the river from which it is drawn.

The five-arched Almond Aqueduct is the smallest of the three major aqueducts designed by Baird with advice from Thomas Telford. These impressive structures are handsomely constructed with tapering rock-faced piers and, inside, incorporate iron water troughs, 13 feet (4m) wide and 6 feet (1.8m) deep, spanning the hollow arches in place of the usual clay, a technique first introduced by Telford at Chirk on the Ellesmere Canal. The eight-arched Slateford Aqueduct over the Water of Leith on the outskirts of Edinburgh is 500 feet (152m) long, while at 810 feet (247m) in length and 86 feet (26.2m) in height, the 12-arched Avon Aqueduct is Scotland's grandest, second only in Britain to Telford's celebrated Pontcysyllte Aqueduct.

Designed for barges and low passenger boats, the Union Canal was traversed by fixed masonry overbridges. They are of a standard plain but elegant segmental-arched design, and the towpath abutments of most of them have been deeply scored by tow-ropes. Most of the bridges which carry minor access roads have iron railings instead of solid stone parapets, but their arch keystones were uniformly inscribed with numbers in sequence from east to west, 62 in all. The penultimate western bridge at Glen village (No 61) is a larger than normal structure spanning the gorge on the approach to the canal tunnel. Its keystones bear human masks, the one on the eastern face smiling and that on the west weeping. The faces are said to reflect the relative ease and difficulty of engineering work on either side of the structure, since the short distance westward involved the grim task of building a long tunnel and 11 locks. Cruder versions of the same faces gaze out from the keystones of the immediately adjacent arch over the Glen Burn.



Edinburgh, Port Hopetoun, c. 1825; engraving depicting the approach to the canal terminus. (SC677939)



Edinburgh, canal basins, 1855; coloured version of first edition Ordnance Survey map at 1:2500 scale (Edinburghshire Sheet 2) highlighting the Edinburgh canal basins at Lochrin, Port Dundas and Port Hopetoun.



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Further information about the Union Canal and about the sites illustrated in this broadsheet is available from the NMRS at the address given above. The NMRS is open Monday to Thursday 9.30 - 16.30 and Friday 9.30 - 16.00.

In the preparation of background material for this broadsheet RCAHMS acknowledges the assistance of Professor Roland Paxton of Heriot-Watt University, RCAHMS Commissioner and Chairman of The Institution of Civil Engineers' Panel for Historic Engineering Works (PHEW), Mrs Sandra Purves, Secretary of the Scottish Group of PHEW, Professor Chris Eilbeck and Guthrie Hutton.

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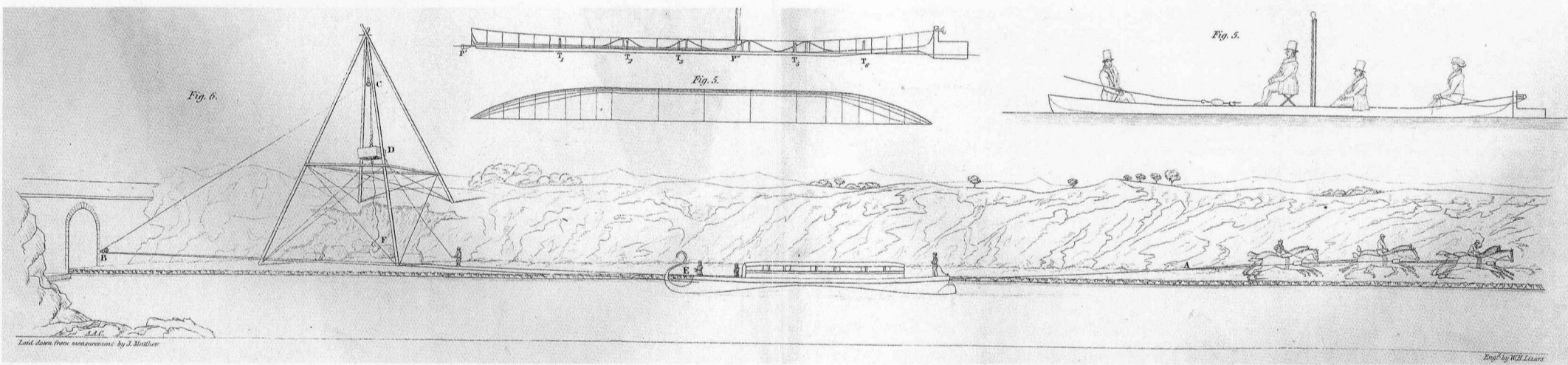
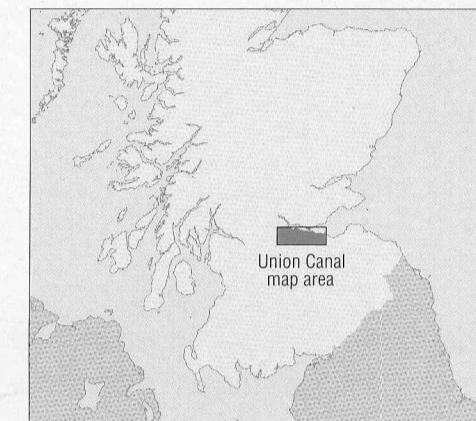
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Front cover:
Avon Aqueduct from south-east.
Lilnithgow; Manse Road Basin and Canal Centre from south-east.
Carved keystones and panels on Bridge No 61 ('The Laughin' and Greetin' Bridge'), Glen village, Falkirk, (inset left) west, (right), east.

The Union Canal was closed in 1965 by Act of Parliament and road construction soon limited the navigable lengths of canal. In partnership with Scottish Enterprise and seven canalside local authorities, British Waterways Scotland successfully bid for funding from the Millennium Commission and the European Union to undertake Britain's largest canal restoration project, The Millennium Link. This £84.5m project restored navigation to the Union and Forth and Clyde Canals in 2002, thereby allowing boats to travel once again between Edinburgh and Glasgow, and between the North Sea and the Atlantic Ocean. The regenerative effect of this restoration is already showing along its 110km length.

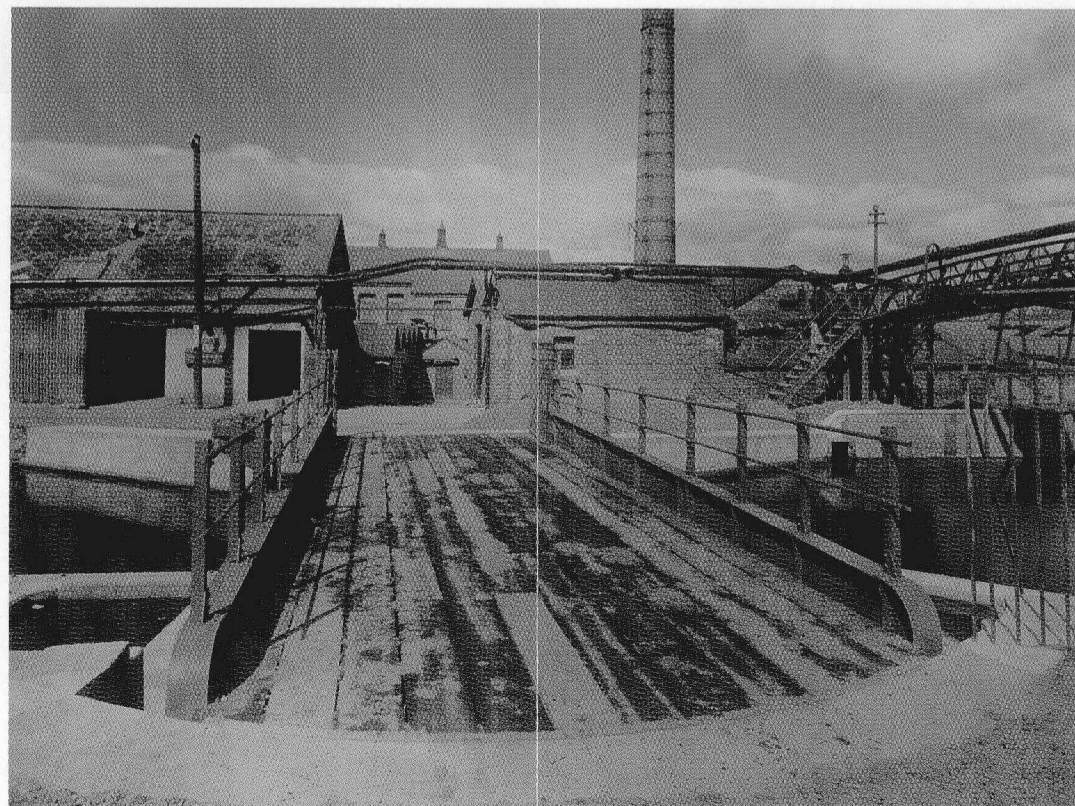
The Falkirk Wheel, the world's first rotating boatlift, was constructed to re-join the two canals. Created to replace a flight of 11 locks which linked the two canals at Camelon, this magnificent structure stands 115 feet (35 metres) high and each of its two giant caissons can carry four boats at a time in a 15-minute lifting and lowering operation. It was opened by Her Majesty The Queen on 24 May, 2002.

The Falkirk Wheel Visitor Centre is open every day 09.00-18.30 (last entry 18.00) and admission is free. For further information telephone 01324-619888, and for details and bookings for a boat trip experience telephone 08700-500208.



Hermiston; engraving of 1840 showing a solitary wave experiment being conducted on the Union Canal by John Scott Russell. (Courtesy of Professor J C Eilbeck, Heriot-Watt University, Edinburgh).

The John Scott Russell Aqueduct (1889) which carries the Union Canal over the Edinburgh City By-Pass (A720) at Hermiston is named after the great Victorian engineer (1808-82) who, in 1834, first observed and then tested the phenomenon of what he described as the solitary wave of translation along the straight length of the Union Canal to the west. He noted that when a rapidly-moving horse-drawn boat suddenly stopped, the water around the prow kept moving 'in a state of violent agitation, then suddenly leaving it behind, rolled forward with great velocity, a smooth and well-defined heap of water, which continued its course without change of form or diminution of speed. I followed it on horseback, and overtook it still rolling on at a rate of some eight or nine miles an hour, preserving its original figure some thirty feet (9.1m) long and a foot to a foot and a half (0.3 - 0.5m) in height. Its height gradually diminished and after a chase of one or two miles I lost it in the windings of the channel.' The significance of this discovery was not fully appreciated until the 1960s, since when it has informed the complex dynamic behaviour of wave systems throughout many important areas of applied science.



Polmont, Westquarter; Nobel ICI Factory, 1930; view from south showing swing bridge over the Union Canal designed by Sir William Arrol and Company Ltd. (SC678688)



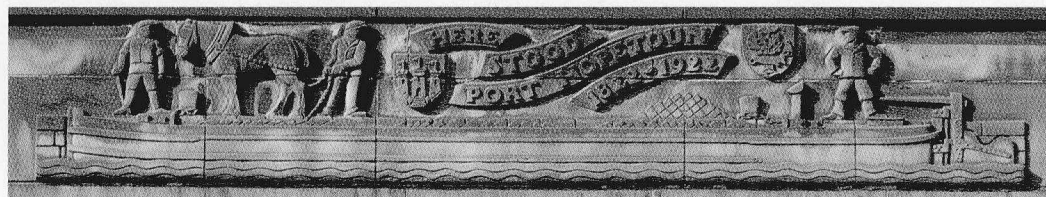
Almond Aqueduct; south face of arch over river with control sluice discharging surplus canal water. This overflow froze in February 1895, famously creating a 75-foot (23m) pillar of ice. (SC678656)



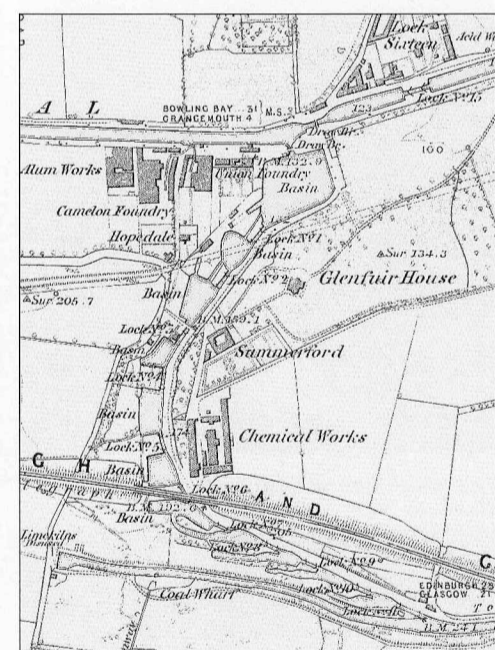
Edinburgh, Port Hopetoun, c. 1923; warehouse and quayside from south-west. (SC677924)



Edinburgh, Port Hopetoun, c. 1923; entrance at the corner of Downie Place and Castle Barns (now Lothian Road and Morrison Street respectively) from north-east. (SC677910)



Edinburgh, Lothian Road, Lothian House; commemorative centennial frieze of 1922 marking the site of Port Hopetoun basin. (SC701773)



Camelon, Falkirk, 1864; coloured version of first edition Ordnance Survey map at 1:10,560 scale (Stirlingshire sheet XXX) highlighting the curving flight of 11 locks and associated basins which linked the Union Canal to the Forth and Clyde Canal over a distance of about half a mile (0.8km) and through a height difference of 110 feet (33.5m). The actual junction was just to the east of the Union Inn.



Camelon, Falkirk; early 20th-century view from west of the upper flight of locks south of the railway bridge. (Courtesy of Guthrie Hutton) (SC707484)



Slamannan Railway, yard and canal basin, 1865; coloured version of first edition Ordnance Survey map at 1:10,560 scale (Stirlingshire sheet XXX) showing the layout as extended across the canal to Bo'ness in 1846. Authorised in 1835 and opened in 1840 to link with a specially-created basin on the Union Canal, this was one of the earliest public railways in Scotland, the rails having been originally bedded on stone blocks.

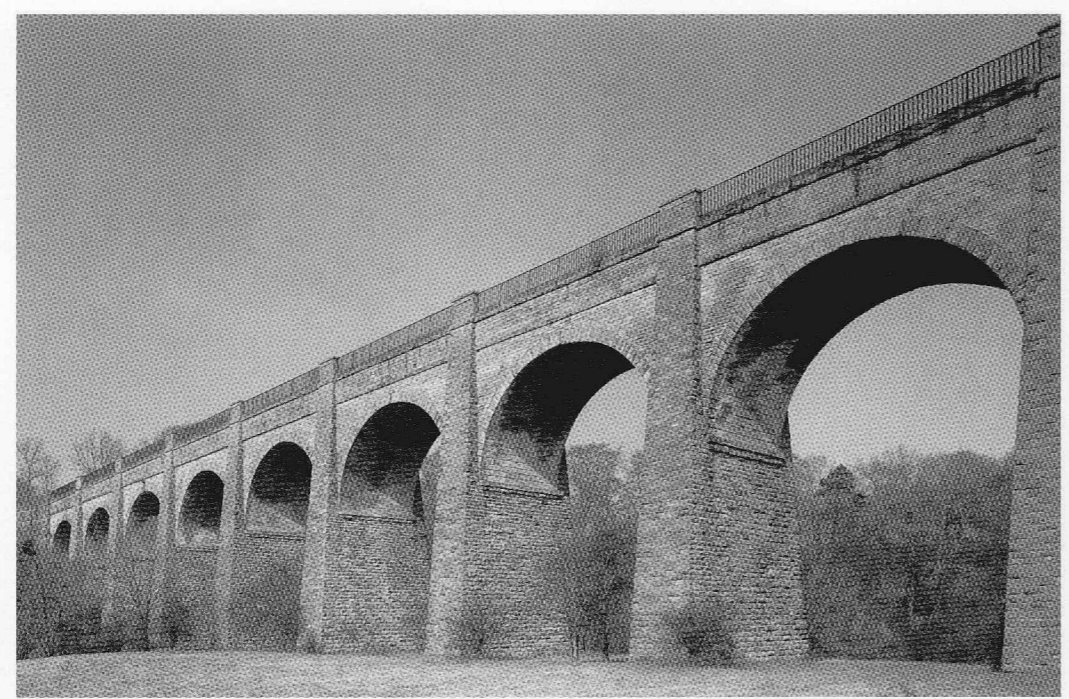


Slamannan Railway, yard and canal basin (A); vertical aerial view. (SC681518)

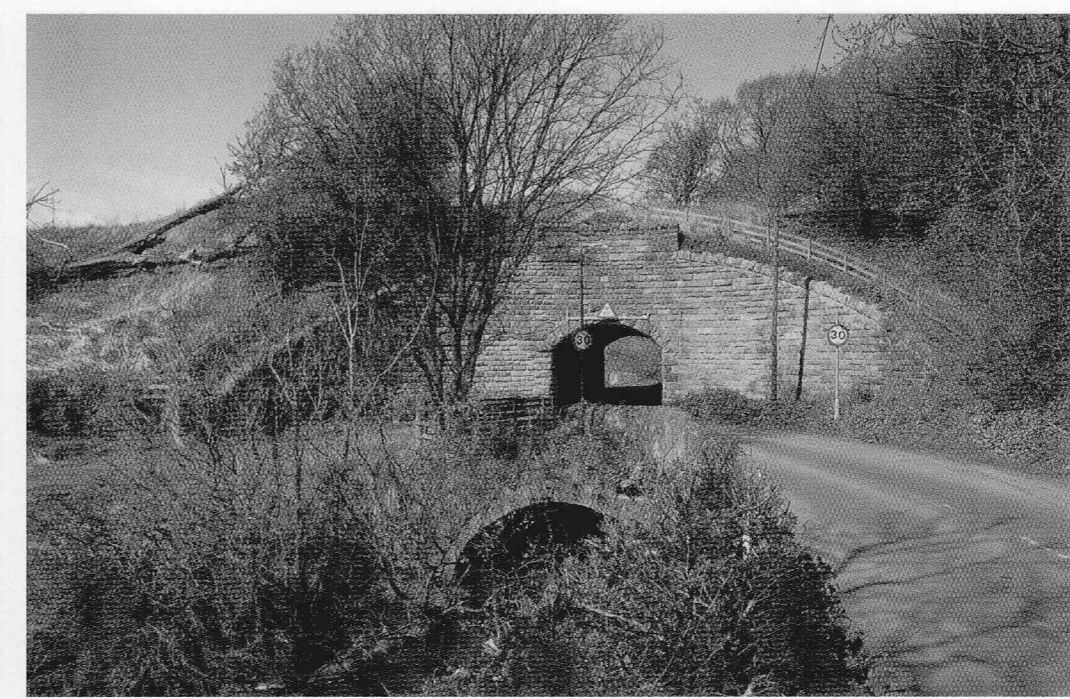
The Union Canal



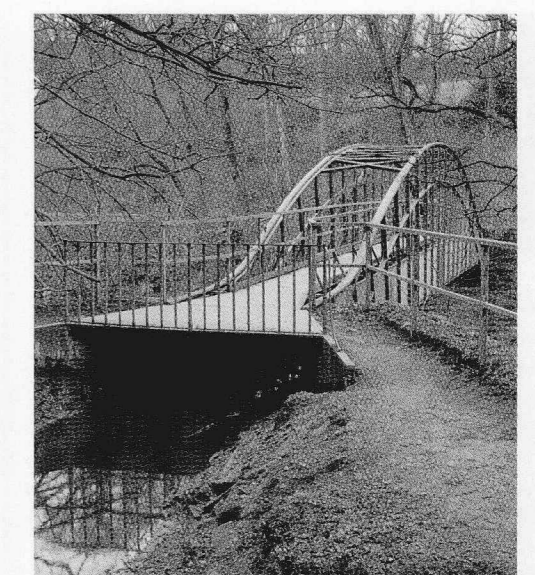
The Falkirk Wheel and extended canal system nearing completion, 2002; aerial view from west. (SC695562)
 A. The Wheel and Visitor Centre
 B. The Forth and Clyde Canal
 C. Lock 16 (later Port Downie)
 D. Flight of 11 locks (now infilled and superseded by The Falkirk Wheel)
 E. The Union Canal
 F. Port Maxwell (1823 extension)
 G. Modern canal extension



Avon Aqueduct from south-east. (SC361783)



Philpstoun; aqueduct over minor road to Gateside and Haugh Burn, from south. (SC678598)



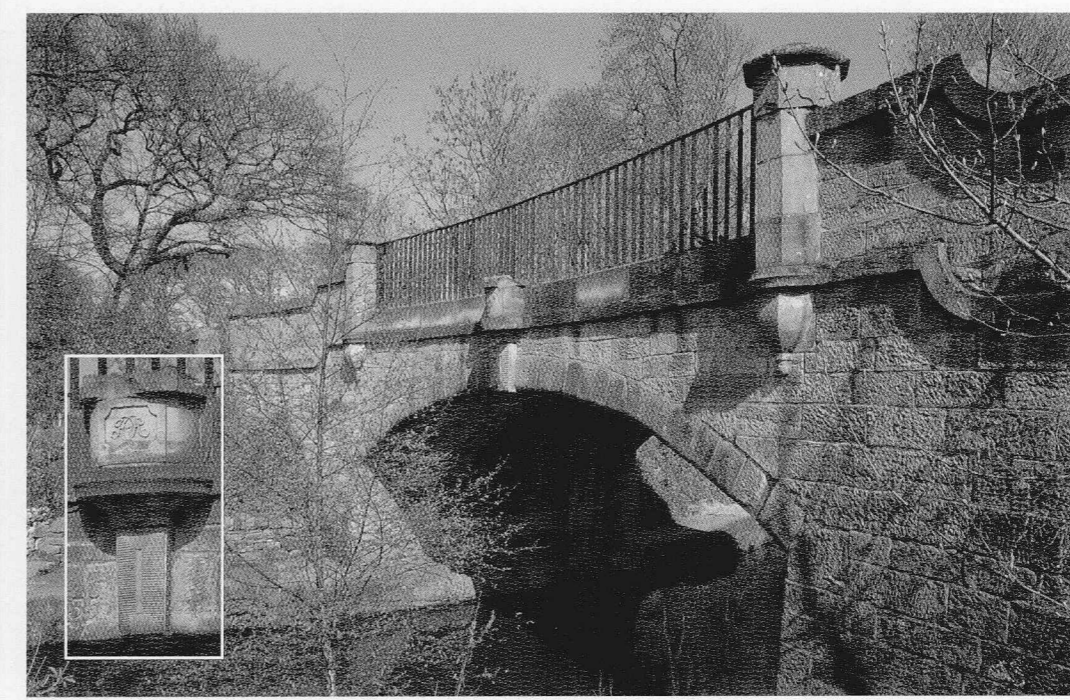
Almondell Country Park: cast-iron feeder aqueduct over River Almond from west. (SC700206)



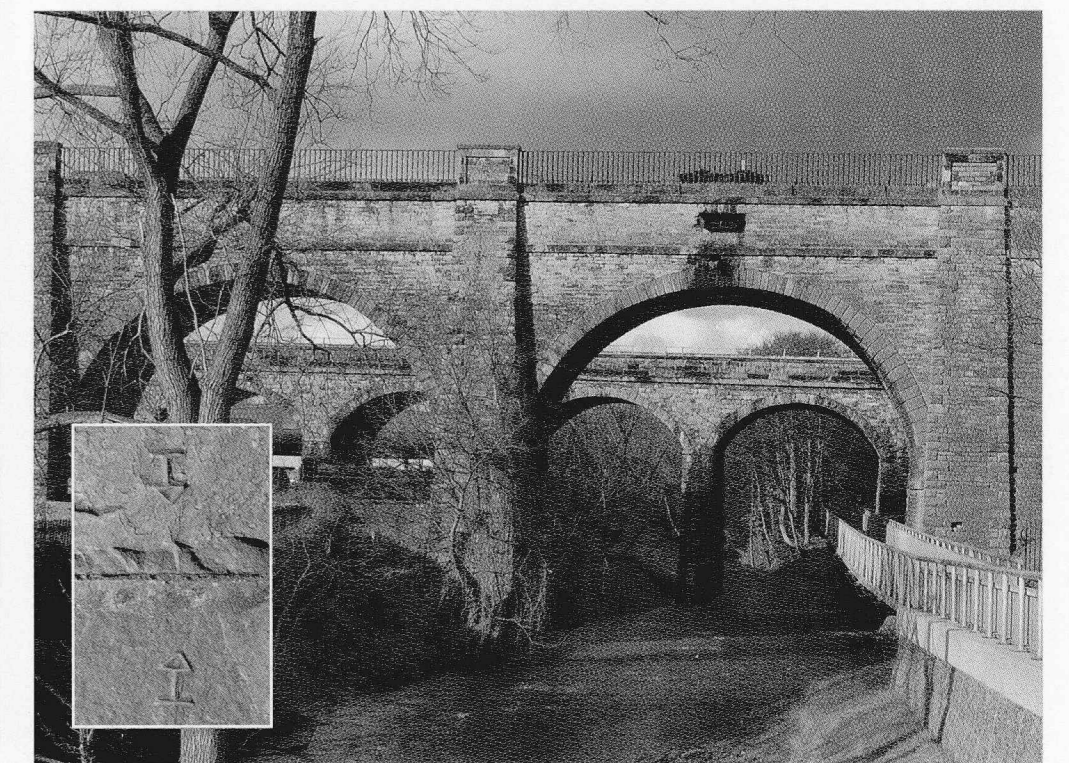
Almond Aqueduct: oblique aerial view showing feeder flowing into canal from bottom centre (south). (SC677934)



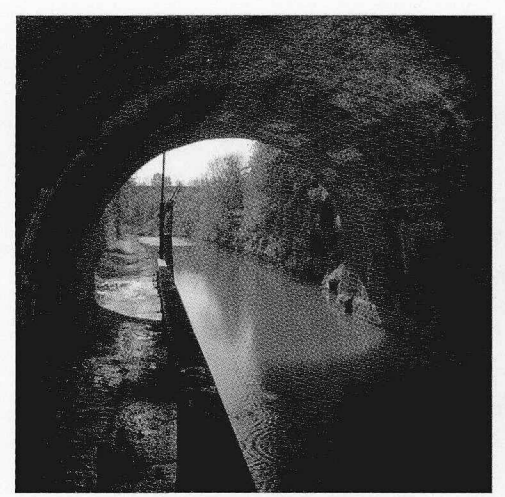
Woodcockdale; stables and cottage block from south-west. (SC700203)



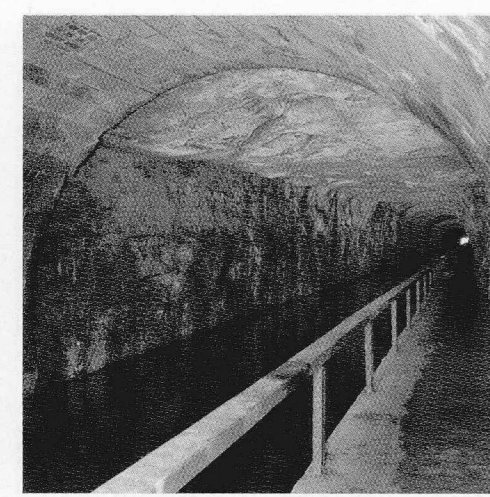
Craighton Bridge (No 35); west face (SC678564), and (inset (SC678600)) Hopetoun monogram carved on central bracket.



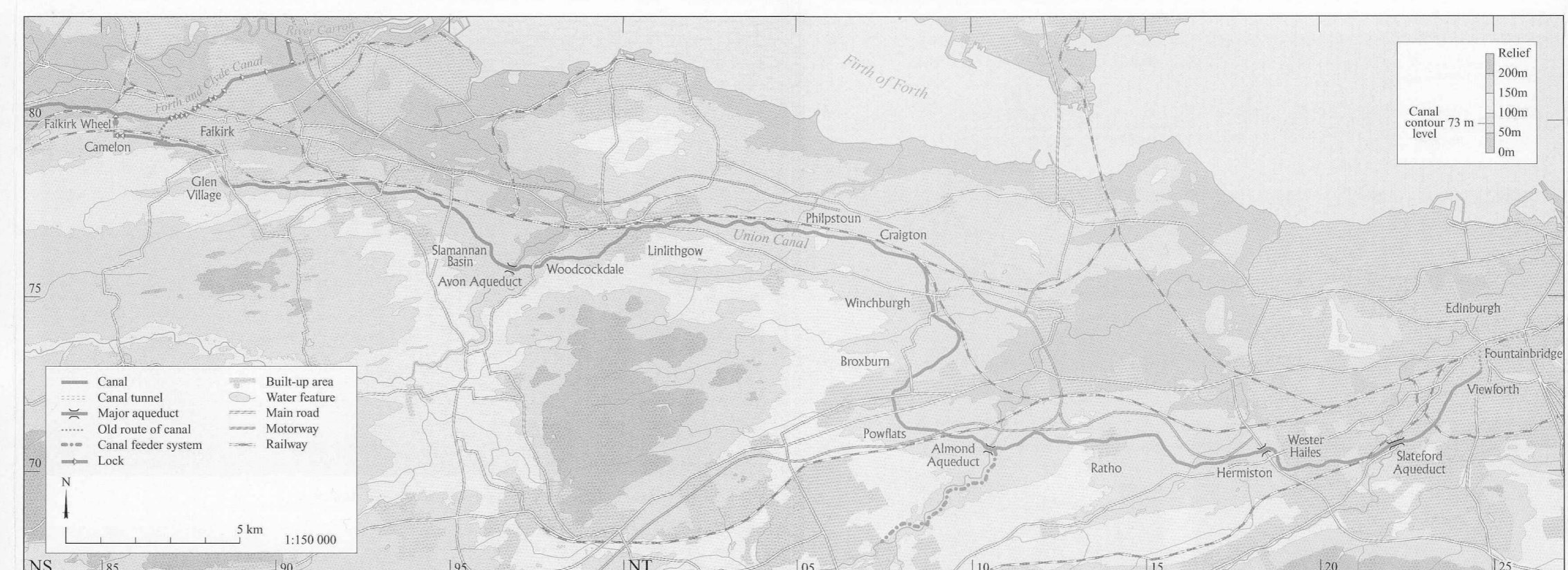
Edinburgh, Slateford Aqueduct (SC700208); view from south of easternmost arch over the Water of Leith and the railway viaduct beyond, and (inset (SC707339)) mason's marks on east abutment.



Falkirk Tunnel; masonry arch over eastern entrance and towpath. (SC678627)

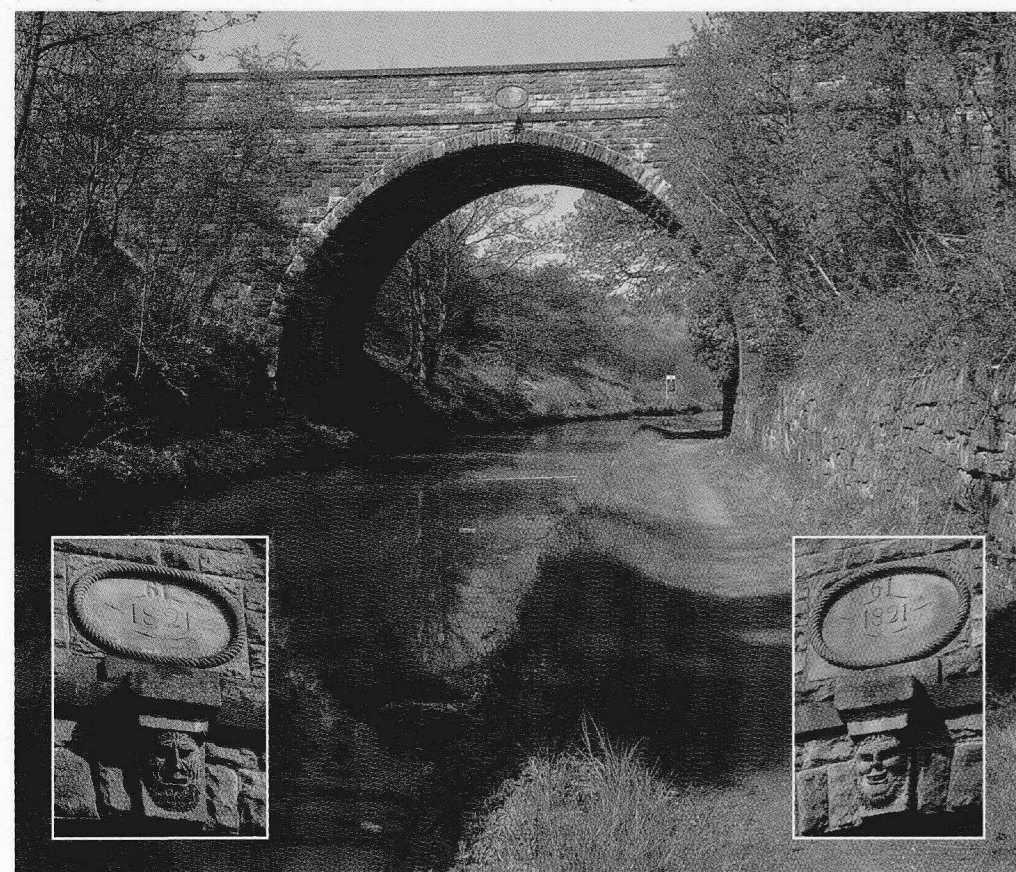


Falkirk Tunnel; rock-cut interior from eastern entrance. (SC678625)

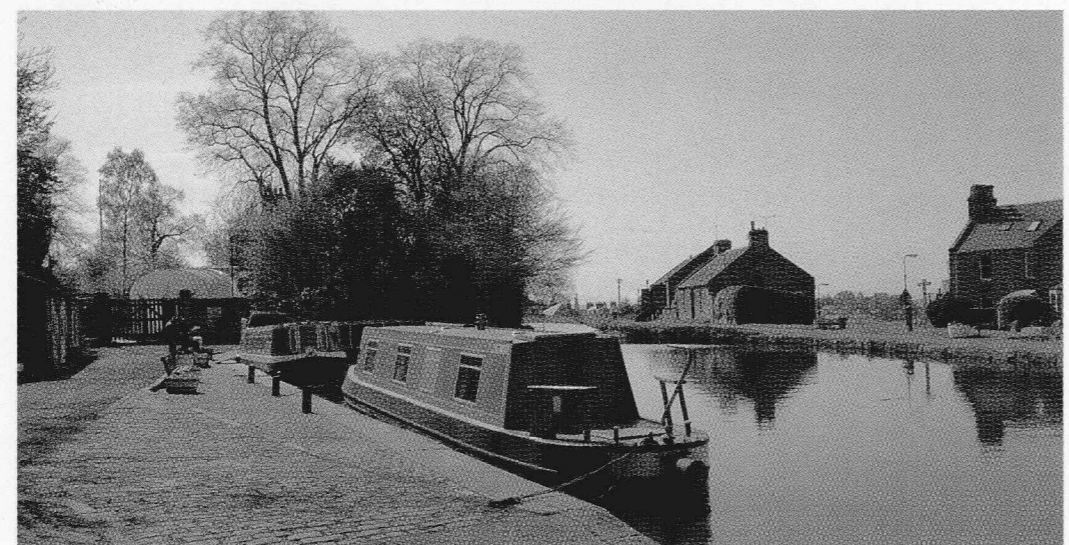


Map at 1:150,000 scale showing line of Union Canal and its principal features.

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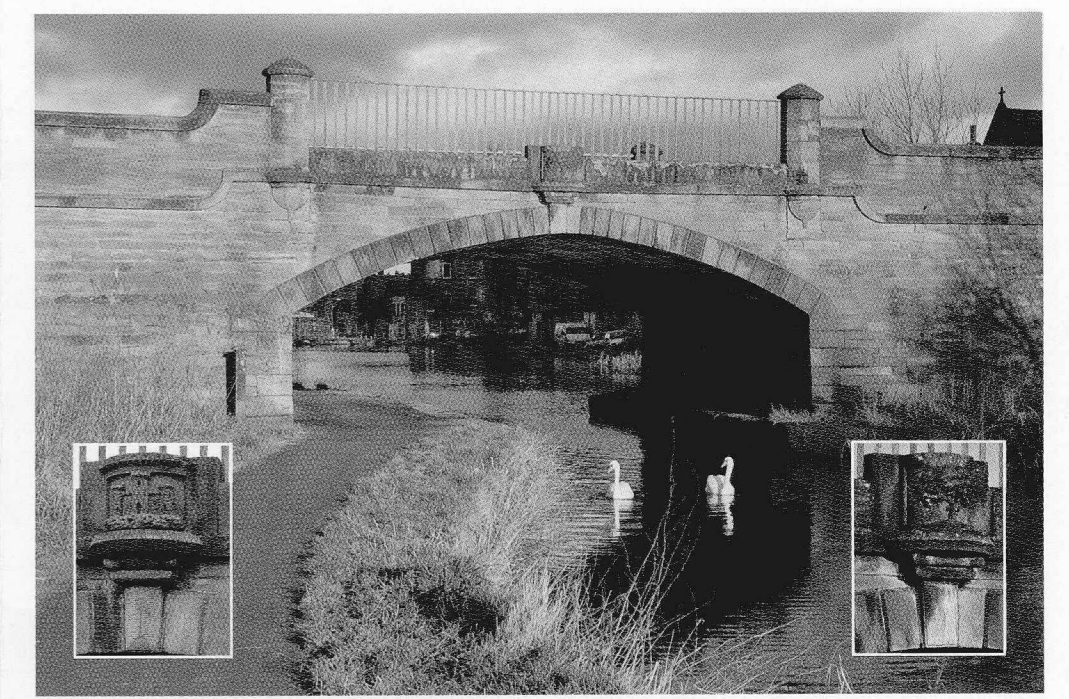
Glen village, Falkirk, Bridge No 61 ('The Laughin' and Greetin' Bridge'), from east (SC678608). Carved keystones and panels (inset left (SC678633) west, right (SC678631) east).



Linlithgow; Manse Road Basin and Canal Centre from south-east. (SC678602)



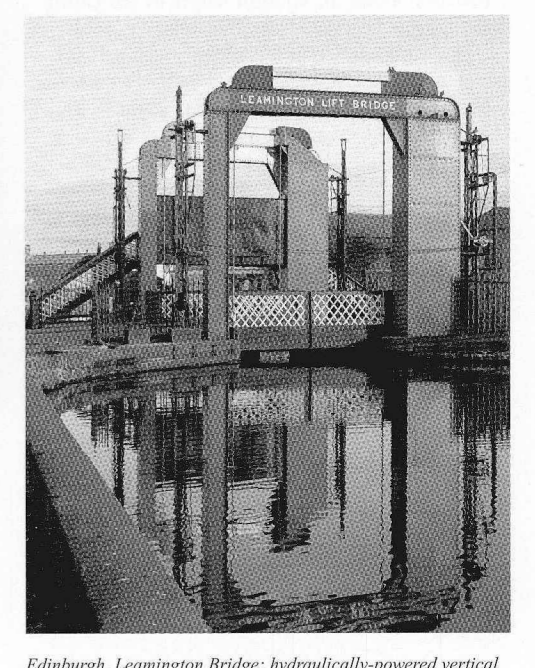
Powflats, Bridge No 23; bridge and associated building from south-east. (SC678606)



Edinburgh, Viewforth, Bridge No 1, from west (SC700205), and symbols of (inset left (SC701776)) Edinburgh and (right (SC701775)) Glasgow carved on the central brackets of the east and west faces of the bridge.



Ratho; first stage post (left) and milestone. (SC691365)



Edinburgh, Leamington Bridge; hydraulically-powered vertical lift bridge of from west. (Originally at Fountainbridge c.1908) (SC361770)