

LLIW VALLEY RESERVOIRS

FLOODED VALLEYS AND OLD MINES

Discover geology and landscape: walking trails in rural Swansea

SCRATCHING THE SURFACE

CRAFU'R WYNEB

CRONFEYDD DŴR DYFFRYN LLIW

DYFFRYNNOEDD DAN DDŴR A HEN LOFEYDD

Darganfod daeareg a thirwedd:
llwybrau cerdded yn ardal Abertawe

7 KM
3 HOURS
GPS COMPATIBLE



**START
GRID REF.
SN 64974 03375**

at the free car park at the Lower Lliw reservoir. Buses go to Felindre, a pleasant 1.6 km (1 mile) walk from the dam.

PATH CONDITIONS

The trail follows a level, surfaced track that is wheelchair and pushchair accessible.

MAPS



Ordnance Survey 1:50,000 map 159 (Swansea & Gower)
1:25,000 Explorer map 165 (Swansea)
Geological Survey 1:50,000 Sheet 230 (Ammanford)



REFRESHMENTS

Lower Lliw Cafe
in the car park

SAFETY

Grid references are for guidance only. Follow the Countryside Code (<http://naturalresourceswales.gov.uk>) and the Geological Fieldwork Code (www.rockwatch.org.uk/geological_code). Respect people, protect the environment and stay safe. Wear sensible clothing and footwear.

FURTHER INFORMATION

Local walking groups www.swansea.gov.uk/walking
Local geology www.swga.org.uk
For junior geologists www.rockwatch.org.uk
Geology and geological maps www.bgs.ac.uk
Coal mining heritage www.welshcoalmines.co.uk
Gower Society www.thegowersociety.org.uk
Wildlife Trust www.welshwildlife.org

The Geology of South Wales: A field guide
by Gareth T. George (gareth@geoserv.co.uk, 2008)

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Design: iconcreatedesign.com

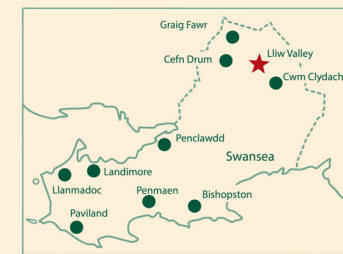
7 KM
3 AWR
YN CYDWEDDU
Â GPS

The Lliw Valley reservoirs are in an area of old quarries and coal mines. This easy trail explores the relationship between the landscape and the underlying rocks and discovers how the extraction of resources has changed the landscape. The trail is 7 km (4½ miles); allow 3 hours.

Mae cronfeydd dŵr Dyffryn Lliw mewn ardal o hen chwareli a glofeydd. Mae'r daith hawdd hon yn archwilio'r berthynas rhwng y dirwedd a'r creigiau sy'n sail iddi ac yn darganfod sut mae'r gwaith o gloddio glo a cherrig wedi newid y dirwedd. Mae'r daith yn 7 km (4½ milltir) o hyd ac mae'n cymryd tua 3 awr.



Look for
other trails
in this series!



SCRATCHING THE SURFACE



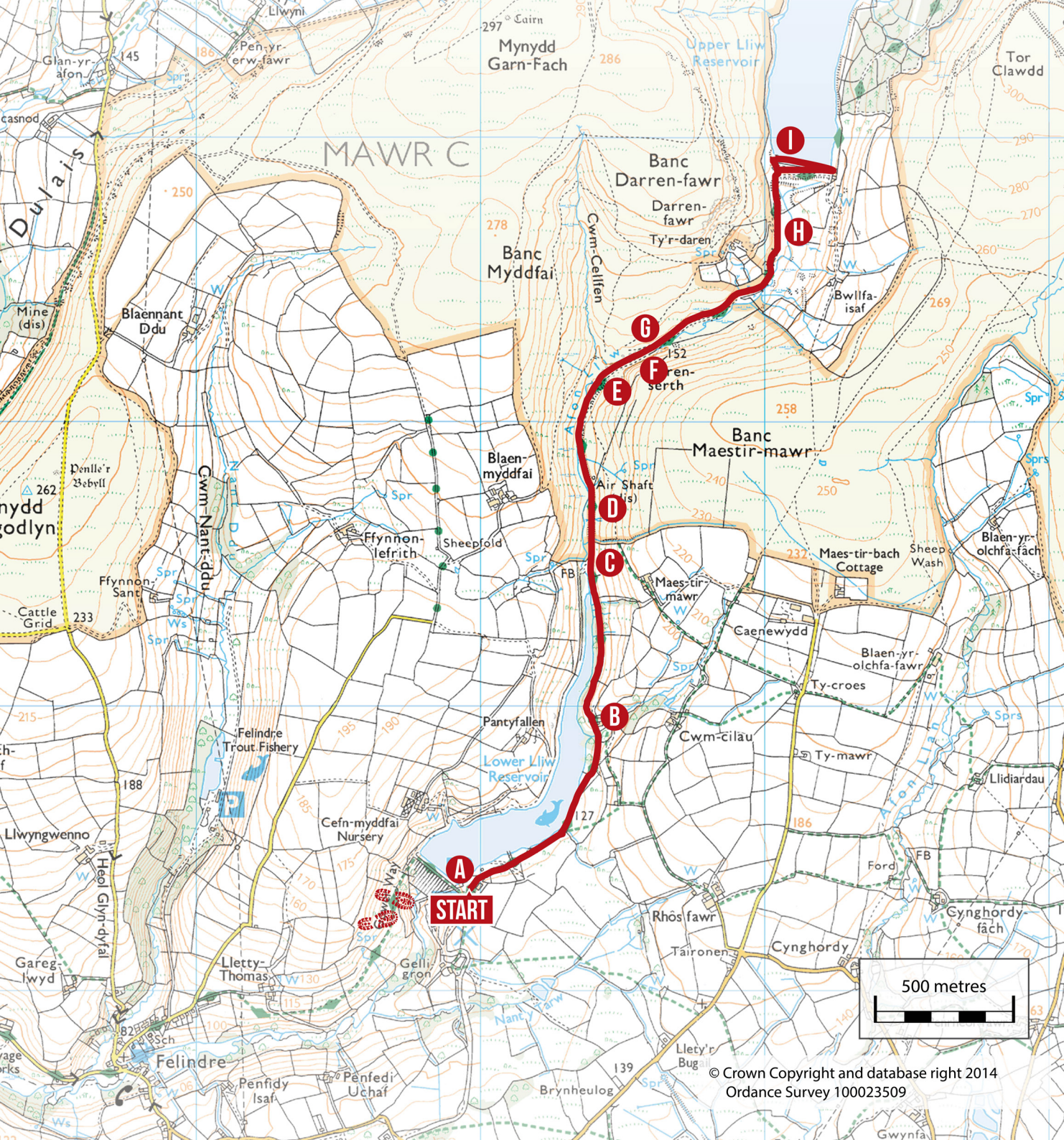
CRAFU'R WYNEB

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Darganfod daeareg a thirwedd:
llwybrau cerdded yn ardal
Abertawe

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email: g.owen@swansea.ac.uk #scratchingthesurface
<http://geography.swan.ac.uk/scratchingthesurface/>





Look at the display boards in the car park. [SN 64973 03366]

A Two dams form reservoirs on the Afon Lliw as it flows south off Mynydd y Gwair. They were built in the nineteenth century to provide clean drinking water for Swansea. At that time several mines extracted coal from the rocks beneath the surface near here.

With the reservoir on your left, go through the car park and follow the surfaced lane for 900 metres to a building on the right. [0.9 km; SN 65410 03940]

B The rocks beneath the surface are mainly sandstone, part of a thick succession called the Pennant Sandstones, which includes intervals of mudstone and seams of coal. Miners extracted coal either by following seams into the hillside (drift mines or adits) or by sinking shafts tens to hundreds of metres deep. Deep mines were kept dry by pumping. The building was constructed in 1879 to house steam pumps for Felindre Colliery. It is built of Pennant Sandstone. In a small quarry just beyond the house you can see beds of sandstone with a gentle tilt (dip) to the south.



Felindre Colliery pumping house

Most of the oak woodland here has developed since mining ended. In the spring it comes alive with birds such as pied flycatchers, redstarts and chiffchaffs. The industrial landscape is slowly returning to a more natural state.

Just after the reservoir ends, look down on the left to a bridge and picnic table (accessible by steps). [1.5 km; SN 65396 04481]

C The Afon Lliw drains the moorland surrounding the reservoirs. The size of cobbles and boulders in the channel shows how fast the river can flow in such a deep, narrow valley after heavy rain. The dams help smooth out the flow by holding water in the reservoirs.

Continue 150 metres beyond a cattle-grid to a mass of boulders on the right behind a row of wooden posts. [1.8 km; SN 65402 04727]



Landslide scar and debris

D This is a landslide, where rock slipped across the road. Wet ground and steep slopes generate instability and small landslides are common. You pass a larger, older landslide 100 metres further on.

Most of the blocks of rock are sandstone. If you look very closely you can see sand grains cemented firmly together. The brown colour is due to iron compounds in the rock which oxidise - or rust - in wet conditions. Small black patches are pieces of fossil plants. They are very common, although most are not well enough preserved to identify the species.



Fossil plant debris

The rocks formed 320 million years ago, in the late Carboniferous period, from deposits of sand carried by large rivers eroding newly formed mountains to the south. The climate was tropical - hot and wet - and the floodplains were covered with trees. As they died, their remains formed organic-rich deposits of peat in swamps. Over millions of years, deposits over 2000 metres thick built up, burying older layers. Sand grains were cemented together to form sandstone, mud was hardened into mudstone, and peat was compressed into coal.

The conditions were similar to those in the Amazon Basin today. None of the hills and valleys you can see today existed. Major changes to the climate and landscape have been caused by plate tectonics moving continents at about the speed your fingernails grow. Over millions of years, the effects are dramatic!

About 300 million years ago, the mountains spread north and the rocks here were squeezed, bent, broken and pushed upwards, forming high mountains. These have since been worn down by erosion, so that tilted beds of rock lie beneath today's ground surface, although in most places they are covered by plants, water, soil and other deposits.

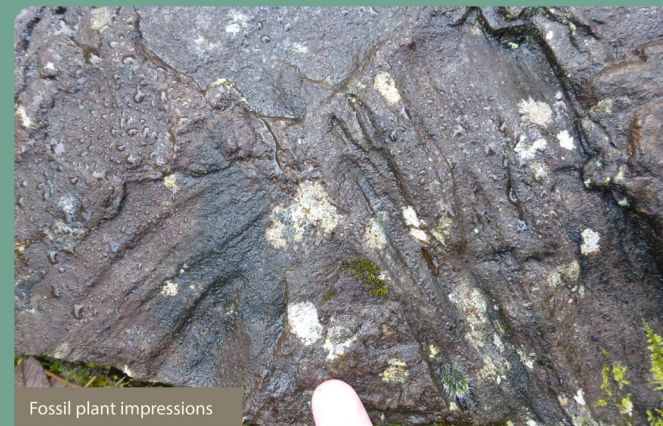
Continue to where Cwm Cellfen joins the Lliw valley. The valley is more open and there is an old boundary marker post next to a bench on the left of the road. [2.2 km; SN 65453 05168]

E The valley between D and E is very straight. The river follows a fault - a fracture across which rocks slipped while they were buried. Rocks close to a fault break, rendering them more susceptible to erosion, which is why the valley is here. The deep valley of Cwm Cellfen follows the same fault. Movements on active faults generate earthquakes, like those along the San Andreas Fault in California. The fault here was active hundreds of millions of years ago, although small earth tremors are occasionally generated along old, inactive faults in Wales.

An old quarry on the right provided sandstone for the lower dam. If you enter the quarried area, be careful and keep away from rock faces. You can clearly see the bedding, tilted gently to the south. Many of the fallen blocks are full of plant fossils.



Fossil plant stem



Fossil plant impressions

Plants are steadily reclaiming these old workings. The first to colonise rocky ground are lichens and mosses. Thin soils develop from their decay, allowing ferns and hardy flowering plants to grow. With more soil development, slower growing shrubs and trees take over. In time, the area will return to oak woodland, the natural vegetation in the mild, wet climate of South Wales. But these conditions may never be reached because of disturbance by grazing, human activity, fire, disease, pests or the spread of non-native species such as rhododendron or Japanese knotweed.



Quarry at E

Continue 100 metres beyond the quarry to cliffs on the right that are undercut at their base. [2.3 km; SN 65500 05203]

F The overhang shows that the sandstone in the quarry is underlain by a more easily eroded rock. This is mudstone, made from the compression of mud that built up on the river floodplains. Its dark colour is due to the abundance of fossil plant material. Plant debris alone, without any mud, forms coal. Like wood and peat, coal releases heat on burning, but one seam of coal accumulates plant remains from thousands of years of growth and turns into coal over millions of years. The fuel is “concentrated” but it is a fossil fuel, meaning that it is not replenished at the rate people use it: its use is unsustainable.



Roof of Graigola coal seam

The mudstone here is at the top of a coal seam, although the coal is covered by soil. There are over 40 coal seams in the Pennant Sandstones and more in the underlying South Wales Coal Measures. Seams are typically about 1 metre thick, so coal makes up only a small part of the rock pile. The seam here is the Graigola, or Swansea Three Feet seam. Because the rock layers dip gently to the south, the Graigola seam continues beneath the ground to the south, where it has been extracted in deep mines. To the north, it was exposed along the hillsides and worked from adits. A Scratching the Surface trail at Cefn Drum explores the legacy of mining, which continued until the late 1970s.

Cross a bridge over the Afon Lliw. [2.5 km; SN 65668 05295]

G The bridge is made of shaped blocks of Pennant Sandstone. Look at the lower slopes across the river. A series of scrapes have been cut into the hillside, spaced every 20-30 metres. These are old adits, or coal “levels”, that were extracting coal from the Graigola seam. Each scrape marks a tunnel into the seam, and the series of tunnels ensured good drainage. This type of mining pre-dates deep mines and may be as much as 200 years old. The tunnels have now collapsed and no coal is visible. You can trace the line of workings northwards on both sides of the valley, rising gently up the valley sides as they follow the dip of the coal seam.



Coal workings visible from G



Coal workings in Cwm Cellfen

Continue along the road. Shortly after the upper dam comes fully into view, stop at a junction on the left. [3.1 km; SN 66045 05676]



Landslide scar and quarry

H The prominent scar on the hillside above is the quarry that supplied stone for the upper dam. But there was probably a cliff here before the rock was quarried, because this hillside - Darren-fawr - is an old landslide, much larger than the ones you saw at D. In the last 2 million years, the Earth's climate has repeatedly fluctuated between interglacial episodes, like we live in today, and colder glacial episodes. The most recent glacial episode was 20,000 years ago, when all the landscape you can see was buried beneath hundreds of metres of ice. Glaciers of ice flow from colder, higher ground to warmer, lower ground, wearing the rock down to form broad valleys with steep sides. When the ice melts, the valley sides are unstable and landslides occur. The lane and the house are on the slipped debris at the foot of the landslide. A Scratching the Surface trail at Cwm Clydach discovers more large landslides near here.

To reach the reservoir, either climb steps up the left side of the dam or follow the road across the dam and return along the crest. [3.4 km; SN 66038 05920]



Upper Lliw dam

I The Upper Lliw Reservoir was built about 30 years after the lower reservoir. The core of the dam is a massive pile of earth and rock. For protection, this is covered with blocks of sandstone, and the downstream face of the dam has been grassed. The domed building is made of a tough, pale sandstone that is not from this area. Old adits are clearly visible on the hillside above you; you can reach them by a strenuous climb from the junction at H.



Coal workings above I

Retrace your steps to the cafe and car park, enjoying the open landscape, the water and the woodland. An alternative, unsurfaced path crosses the river at C and returns along the other side of the reservoir, crossing the lower dam to the parking area.

FINISH