



Sheetlines

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problem solved?”

Richard Oliver

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The Society publishes a wide range of books and booklets on historic OS map series and its journal, *Sheetlines*, is recognised internationally for its specialist articles on Ordnance Survey-related topics.

Sheet lines, sizes and style: a Scottish problem solved?

Richard Oliver

A commonly-asked question, albeit more in conversation than in print, concerns the sheet size of the original one-inch map of Scotland, on which work began in 1852. Whereas the one-inch (1:63,360) maps of northern England and of Ireland were based on a full-sheet size of 36 × 24 inches (91.48 × 60.98 cm) within the neat line, but were engraved and at first published as quarter sheets 18 × 12 inches (45.74 × 30.49 cm), those of Scotland used a standard size of 24 × 18 inches (60.98 × 45.74 cm) and always bore individual numbers. This is all the more striking, as the Irish and the Scottish maps were authorised in April and December 1851 respectively, and have geodetic and stylistic similarities: the use of the Bonne projection, the naming of hills in ‘Egyptian’, the naming of railways and canals in sloping Egyptian capitals, a simplified border, and diagrams showing adjoining one-inch sheets and constituent six-inch sheets. All these set them apart from contemporary English sheets. Less often remarked on are two aspects of design of most of the earlier Scottish sheets, and a few later ones. One, the use of reverse-sloping lettering for watercourses, has a parallel on two Irish sheets, and no English ones; the other, the use of an ‘engrossing’ style for naming water bodies and most coastal features, is unique to the Scottish mapping. Whilst sheet size and style of lettering might appear to be separate problems, the answers suggested here to them are closely related. Also discussed here is the episode of the ‘full sheet series’ phase of numbering the one-inch New Series mapping of England and Wales of *circa* 1869–73. Considerations applicable to sheet size questions are also applicable to this problem.

Sheet sizes in Britain and elsewhere

The Scottish sheets were occasionally referred to by contemporaries as ‘half-sheets’.¹ It is useful at this point to consider what the practical justifications might be for ‘half sheets’, and whether there are parallels elsewhere in Britain or Europe.

One justification might be that a sheet size of around 24 × 18 inches is a more convenient one to handle than is a ‘full sheet’ of 36 × 24 inches although, because the OS printed the maps on paper with a wide margin (about 3 inches or 7.5 cm) to left and right, this theoretical advantage is not as great as it might first appear. A similar consideration applies to quarter sheets in relation to ‘half sheets’. Quarter sheets were first introduced in 1829 in order that four engravers could work at once on the equivalent of a full sheet, but at the expense of sheets that were comparatively small compared either with OS practice hitherto or with contemporary commercial rivals such as the Greenwoods.² The quarter sheets were thus in effect conceived of as ‘cells’, and the lack of inner margins on early states of the first three sheets to be ‘quartered’ (43, 54, 55) supports this view. ‘Cell’ or ‘section’ construction of copper-engraved mapping seems to have been little used in Britain, though it was extensively

¹ *Report of the Departmental Committee... to inquire into... the Ordnance Survey* [the ‘Dorington Committee’], British Parliamentary Papers (House of Commons series) [BPP (HC)] 1893–94 [c.6895], LXXII, 305, evidence, q.600.

² The size of plates used by the Greenwoods varied, according to how a particular county was to be divided up. The plates for their first map of Yorkshire (1817–18) measured about 29.5 × 25.5 inches, giving a ‘map area’ of about 28 × 24 inches, which would include an outer border on ‘outside’ sheets. Rather smaller plates were used for other map areas measured (Somerset (1822), 24 × 25.75 inches; Worcestershire (1822), 23 × 21 inches; Surrey (1823), 23.5 × 19.5 inches), but this does not invalidate the general point.

used for drawing photo-lithographed maps, such as the one-inch Fifth Edition and Seventh Series.³ With ‘half sheets’ it was still possible for two engravers to work at once on the equivalent of a 36 × 24 inch full sheet, and so this might be a compromise solution. That said, quarter sheets were used in Ireland because the geologists liked the size though, as John Andrews has pointed out, there was nothing to stop them cutting up full sheets for ease of handling in the field.⁴

There are two obvious parallels with Europe. One is the use of the Bonne projection. John Andrews has suggested that this was adopted for the Irish one-inch on the advice of Captain William Yolland, who was Executive Officer (*i.e.* second-in-command) of the OS until October 1852.⁵ As Yolland had been sought for the OS in 1838 on account of his mathematical abilities, this seems highly likely.⁶ It seems much less likely that it was the idea of Lt-Col Lewis Alexander Hall, the Superintendent of the OS, who was appointed in 1847 as an outsider, and who had to rely on Yolland and other subordinates for technical advice. Yolland may have been influenced by the popularity of the Bonne projection elsewhere at this time: it was used for the 1:80,000 *Carte de l'Etat Major* of France, begun in 1832, and the 1:100,000 *Carte Dufour* of Switzerland, begun in 1842. The mapping of England and Wales used the Cassini projection, which was easy to construct but distorted angles and areas. The theoretical advantage of the Bonne projection was that it was equal-area, but in practice that was, as Brigadier Winterbotham remarked in 1936, ‘for what that is worth. For the 1-inch of Scotland it is worth little.’⁷ The area of Ireland is similar to Scotland and the comment applies equally there: Brian Adams had some difficulty in confirming that the one-inch of Ireland really did use Bonne rather than Cassini.⁸

The other parallel is the sheet sizes of these two series. The French 1:80,000 was in sheets measuring 80 × 50 cm (31.48 × 19.67 inches) within the neat line; the Swiss 1:100,000 sheets measured 70 × 47 cm (27.53 × 18.50 inches). The French 1:80,000 was designed to replace the 1:86,400 Cassini *Carte de France*, the sheets of which covered an area of 40,000 × 25,000 toises, a map area of about 90.23 × 56.39 cm (about 35.51 × 22.19 inches), *i.e.* very similar to the 36 × 24 inch ‘full sheet’ standard for Ireland and northern England.

Mathematical considerations: smaller sheets an illusory advantage

At first sight a small sheet size appears more flexible, and it is certainly the case that there is less mapped area. 205 quarter sheets covered Ireland; had all four quarters of the notional 59 full sheets been produced, then 236 quarter sheets would have been necessary, 31 of which would have been effectively blank. Similarly, the familiar small sheet series of the New Series was numbered from 1 to 360 (though some combinations resulted in only 348 plates), but it was originally laid out as 104 full sheets, *i.e.* equal to 416 quarter sheets.⁹

³ One-inch Seventh Series sheets covered an area of 40 × 45 kilometres, but were usually drawn in ‘sections’ covering 10 × 10 km, which were assembled for photography.

⁴ J H Andrews, *A paper landscape: the Ordnance Survey in nineteenth-century Ireland*, Oxford University Press, 1975, 231.

⁵ Andrews, *A paper landscape*, 230.

⁶ ‘Statement’ accompanying Colby to Inspector-General of Fortifications, 9 December 1846, in The National Archives (Public Record Office) [TNA/PRO] WO 55/963.

⁷ H S L Winterbotham, *A key to maps*, London and Glasgow: Blackie, second edition, 1939, 43.

⁸ Brian Adams, ‘The projection of the original one-inch map of Ireland (and of Scotland)’, *Sheetlines* 30 (1991), 12-15, reprinted in Brian Adams, *Projections and origins*, London: Charles Close Society, 2006, 22-25.

⁹ Counting is complicated by the 348 including the Isle of Man sheet, which was always published as a ‘full’ sheet, though numbered as five small sheets (36, 45, 46, 56, 57): thus the calculations which follow tend to put the small sheet series at a slight advantage to the full sheet series.

However, what is gained over a full sheet series in not preparing quarter sheets wholly blank within their neat lines tends to be lost in the margins. The reason for this is that it is usual to provide a border, latitude and longitude values, sheet number, scale bar, and explanatory matter, and in series mapping, such as the one inches of England and Wales, Scotland and Ireland, it is usual to repeat all this matter for each sheet. It therefore follows that these details would occur 104 times on the New Series 'Full Sheet Series' (FSS), but 348 times on the small sheet series (SSS).¹⁰ (The statistics introduced here are tabulated in the Appendix.) The standard plates used for the one-inch for much of the nineteenth century extended an average of 1.5 inches (about 3.8 cm) beyond the neat line (usually somewhat less in the upper margin and somewhat more in the lower margin), so that, for example, a plate for a Scottish 'half sheet' (HSS) of 24 × 18 inches would be 27 × 21 inches; one for a 18 × 12 inch 'small sheet' or 'quarter sheet' would be 21 × 18 inches, and one for a 36 × 24 inch 'full sheet' would be 39 × 27 inches. Thus although the use of a larger basic sheet size would produce a significant increase in redundant map area and copper *within* the neat line, it would result in a reduction in total plate area *outside* the neat line. Thus for England and Wales 348 SSS on 21 × 15 inch plates would occupy 109,620 square inches of copper, whereas 104 FSS on 39 × 27 inch plates would occupy 109,512 square inches. (It is worth noting here that in the second quarter of the nineteenth century the actual standard sizes of plate being used by the OS were quoted officially as 21.25 × 15.25 inches and 38.5 × 26.5 inches.¹¹) By the mid 1890s, with the coming of the Revised New Series, the standard plate size was enlarged to 23 × 17 inches for the SSS; so 348 such plates would occupy 136,068 square inches, whereas 104 FSS on 41 × 29 inch plates would occupy 123,656 square inches.¹² For Ireland, 205 SSS on 21 × 15 inch plates would occupy 64,575 square inches of copper; 59 FSS on 39 × 27 inch plates would occupy 62,127 square inches.

A possible alternative to the familiar 132-sheet HSS layout for Scotland (sheets 1-131 plus 57A: a total plate area of 74,844 square inches) would be a FSS. Using the same starting-point near Ben Lawers as was actually used late in 1852 for the HSS, 80 FSS plates (84,240 square inches) would be necessary to cover Scotland, including Orkney and Shetland, following contemporary practice of using butt-jointed landscape-shaped sheets throughout. The FSS represents an increase of 131 *per cent* in map area, but only about 113 *per cent* in plate area. The increase for the FSS is due to the relative irregularity of the area to be mapped: Scotland is not quite so compact a shape as are England and Wales or Ireland. A SSS would need about 243 sheets to cover Scotland, or about 76,545 square inches of copper. A HSS would need about 190 sheets and 107,730 square inches of copper to cover England and Wales and 84 sheets and 60,102 square inches to cover Ireland.

¹⁰ I have used 'FSS' in order to avoid confusion with the Third Edition 'Large Sheet Series' (LSS). Both terms are relative: the map area of a standard modern single-sided 1:25,000 *Explorer* sheet is 120 × 80 cm, *i.e.* 47.22 × 31.48 inches, and a map area of 1486 square inches, *i.e.* 172 per cent of the map area of a New Series FSS.

¹¹ TNA PRO OS 3/279, *passim*. Measurements of printed copies are affected by paper shrinkage, which may be of the order of 1 in 100 to 1 in 50.

¹² I am concerned here, strange as it may seem from the results, to try to make the calculations seem to favour the decision actually taken to use SSS and HSS rather than FSS. The nearest approach to a published FSS sheet was that for the Isle of Man, which was notionally composed of parts of sheets 14 and 20; had a single sheet been used for the Isles of Scilly, as in the SSS, then FSS sheets 100 and 104 would have been combined, and only 102 FSS plates would have been needed, reducing the total area to 107,407 square inches. It is worth noting that the enlargement in plate size for the SSS seems to have been prompted by the fitting in of a legend: on the Scottish HSS it was possible to avoid enlargement, as there was already sufficient space, and this would apply with still greater force to a FSS.

Both SSS and HSS formats involved engraving significantly more border, including divisions for graticule dicing, than would the FSS: excluding the corners, each SSS sheet had 60 inches of border, *i.e.* a total of 20,880 inches for 348 plates, each HSS sheet had 84 inches, *i.e.* a total of 11,088 inches for the 132 plates for the original map of Scotland, and each FSS sheet had 120 inches, *i.e.* 12,480 inches for 104 plates of England and Wales and 9,600 inches for the 80 FSS plates considered necessary to cover Scotland.

Another method of evaluating the ‘efficiency’ of a particular sheet size in a map series is to calculate the percentage of the plate which is occupied by the map. For the SSS on 21×15 inch plates it is 68.5 *per cent*; for HSS on 27×21 inch plates it is 76.2 *per cent*; and for FSS on 39×27 inch plates it is 82.1 *per cent*.¹³ (As a comparison, a standard 1:50,000 *Landranger*, with a map area 80×80 cm printed on 100.0×89.0 cm paper, scores 71.9 *per cent*.)

Thus the benefits of a SSS or HSS over a FSS are not all they may seem: practically, unless the coast or other border is very irregular, they seem to be ‘cell’ construction and user-convenience.

(It is to be noted that these considerations apply to monochrome mapping, in which the sea areas are blank; they do not necessarily apply to gridded or colour-printed mapping where the sea area is occupied by grid or tint, which is the invariable modern practice, though they would apply to early OS colour-printed mapping, which used water-lining or vignetting, but no grid or equivalent. A further complication affecting modern mapping is that sheet layouts are often not butt-jointed, especially in the vicinity of the coast, but are laid out in a more sophisticated way to suit users, and often with the use of insets, and sometimes with the marine content of coastal sheets minimised by putting the legend in the sea area: these characteristics are well demonstrated on the OS 1:25,000 *Explorer*, and the current French 1:100,000.¹⁴)

The problems of sheet layouts

It is possible that a series of calculations along the lines of those given above were carried out at Southampton in 1852 and pointed to a HSS being a better option for Scotland than a FSS or SSS. This by itself suggests that efficient use of copper could have been the determining factor. It is to be noted that all the calculations set out here have the advantage of working with precise mapping of the Scottish coast, such as was not available in the early 1850s. This is demonstrated by the earliest known index for the Scottish HSS, in which, for example, the sheets we know as 32 to 34 are numbered 35 to 37 and what we know as sheets 117 and 118 are 127 and 128: the mainland proved to be not quite so extended to the north as had been anticipated.¹⁵ Conversely, what appears on this index as sheet 61 was evidently thought unnecessary when the definitive numbering was decided on, but had to be revived later as 57A. The seven sheets covering Lewis (originally 102, 103, 109-111, 116 and 117) were first published in 1858 with an independent numbering system: they only received their definitive numbers (98, 99, 104-106, 111, 112) in 1862. All this demonstrates the difficulty of allocating sheet numbers when the position of the coast is insufficiently known.

¹³ The plates used for the six-inch in Great Britain in the mid-1840s were 38×26 inches, but the ‘border’ was little more than a narrow band of graticule dicing: this gave a map area of 87.45 *per cent*.

¹⁴ Such non-butt-jointed sheet lines are sometimes referred to as ‘arbitrary’, which seems a pretty *arbitrary* use of language. The *systematic* use of butt-jointed sheet lines *systematically* reduced OS 1:25,000 sales for decades; with the introduction of the more flexible sheet lines of the *Explorers* sales shot up.

¹⁵ This index is in TNA PRO OS 2/649.

This immediately begs a question. The Appendix shows that an Irish HSS would show a small but definite saving of copper over both SSS and FSS, and the shape of the country was reliably known by 1851, in a way that it was not in Scotland: so why, if a HSS was an efficient use of copper for Scotland, was it not equally efficient for Ireland? This is implicitly answered by the next section, and a careful attention to chronology.

Scottish half sheets: who was responsible?

The earliest reference to the use of 24 × 18 inch sheets for Scotland is on 4 December 1852, in a memorandum from Captain John Cameron, who was in charge of the computations, to Captain William Driscoll Gosset, who succeeded Yolland as Executive Officer: this refers to ‘the arrangement of the sheets decided on by Lieut Colonel Hall’, and goes on to describe precisely the geodetic basis, with an origin at 57°30′ North, 4° West.¹⁶ The one-inch of Scotland was effectively authorised some twelve months earlier, as a result of the Treasury adopting recommendations by the Select Committee on the Ordnance Survey of Scotland, which had sat earlier in 1851, that the six-inch (1:10,560) scale be dropped in favour of survey at two-inch (1:31,680) and publication at one-inch. Two-inch survey began almost immediately, but in September 1852 resumption of six-inch survey was authorised and further two-inch survey was abandoned. Such two-inch survey as was made had as its first priority a tract of country around Edinburgh; this may have been for ‘political’ as well as for ‘operational’ reasons, as much of the pressure which led to the appointment of the Select Committee came from that city.¹⁷ That there would have been no point in surveying at two-inch areas already surveyed at six-inch is neatly exemplified by Haddingtonshire [East Lothian], much of which had been surveyed at six-inch when the two-inch was ordered, and which was completed at the smaller scale; after six-inch work was resumed the county was completed at that scale, and the two-inch work went unused. By late 1851 the whole of Edinburghshire [Midlothian] had been surveyed at six-inch, and this would have provided material for reduction to one-inch. (We shall return to this later in discussing the ‘style problem’.)

One of the more remarkable pieces of evidence to the Select Committee of 1851 was given by Yolland on 27 June when, in answer to a question by the Chairman, the Hon. Francis Charteris, he said that a one-inch map of Scotland, selling at the same price as that of England and Wales (2s, [£0.10] per sheet), and in full sheets of 36 × 24 inches representing 864 square miles (2237.6 square kilometres), would cost £3.10s [£3.50], *i.e.* (though it was not explicitly stated thus) there would be 35 sheets.¹⁸ The only way of reconciling this with the 80 FSS sheets of 864 square miles extent suggested by the writer’s experiments is that an estimated figure for the total area of the Scottish mainland in square miles was divided by 864. Previously, Yolland had said that a composite six-inch map of Scotland would occupy 126 × 216 feet (38.4 × 65.8 metres), *i.e.* would cover an area of 252 × 432 miles, which is approximately correct.¹⁹ At this time no one-inch of Scotland was authorised, and it is

¹⁶ TNA PRO OS 2/649, 7.

¹⁷ Richard Oliver, ‘Unfinished business: the lost Ordnance Survey two-inch mapping of Scotland, 1819-1828 and 1852’, *Sheetlines* 78 (2007), 9-31, esp.25-27.

¹⁸ *Report from the Select Committee on Ordnance Survey (Scotland)...*, BPP (HC) 1851 (519), XX, 359, evidence, qq 1660-2.

¹⁹ *Report from the Select Committee on Ordnance Survey (Scotland)...*, BPP (HC) 1851 (519), XX, 359, evidence, qq 1647, 1655. The idea of a composite of this size was not as outlandish as it may seem, as the Select Committee was sitting at the same time as the OS was exhibiting some large composite maps of counties at the Great Exhibition, the largest being one of Lancashire some forty feet high: see Richard Oliver, ‘The Ordnance Survey and the Great Exhibition of 1851’, *The Map Collector*, 50 (1990), 24-28.

understandable that Yolland should have made what proved to be a wildly inaccurate estimate, but the important point is that he seemed to be thinking in terms of 36 × 24 inch sheets; 24 × 18 inch sheets were evidently not yet thought of.

Although the one-inch of Ireland was authorised by the Treasury in April 1851, it was only authorised by the Board of Ordnance on 28 January 1852. The necessary computations for the sheet lines began under Yolland's direction in Southampton a few weeks later, though the mapping was drawn and engraved in Dublin.²⁰ Calculations of positions and convergences in Scotland with reference to the 57°30' North, 4° West origin were being undertaken in March 1852, but these appear to be concerned with general principles rather than the minutiae of sheet lines.²¹ By early December, and the first reference to 24 × 18 inch sheets, Yolland and Hall had fallen out, Gosset was Executive Officer, and the computations were under the charge of Cameron, who had until October been in charge in Dublin.²²

Gosset may be a man who has not had his due, because of the patchy survival of OS records. In 1852 he would have been aged about thirty, or a little over.²³ Hall's successor, Colonel Henry James, credited Gosset with having suggested that photography be used to aid map reduction, though it was only under James that this came about.²⁴ As Yolland had resisted publishing a version of the one-inch with contours in 1851, it would seem that the imaginative leap of dual format publication for the one-inch map – with hills, or in outline with contours – was probably Gosset's rather than Hall's.²⁵ It would therefore be in keeping for Gosset to suggest a rethinking of the sheet size for the one-inch of Scotland. Timing is crucial: by mid-November Yolland had left Southampton, yet computation only began a few weeks later. Had Yolland thought of 24 × 18 inch sheets for Scotland he might surely have thought of them a few months earlier when the computing for Ireland was being put in hand. Similarly, as Cameron had previously been in charge in Dublin, if he had felt that a change in sheet size was desirable he might surely have raised the point, and if it was acceptable to Hall by late 1852 it would surely have been acceptable less than a year earlier. It may also be germane that at some time during 1852 Gosset visited Paris and the Depot de la Guerre in order to study French methods of relief depiction, in the course of which he would have been

²⁰ Treasury minute, 17 April 1851, on papers 4945 and 6713 in group 26071 in TNA PRO T1/5720B; Ordnance minute, 28 January 1852, TNA PRO WO 47/2282, 1045-6; Andrews, *A paper landscape*, 230 (n.4 cites Yolland to Cameron, 20 February 1852).

²¹ TNA PRO OS 2/647, pp 100-2, 110-6, 120-5: these make sense of the otherwise puzzling reference in pencil to Lewis calculations in May 1852 in TNA PRO OS 1/649, 24.

²² The falling-out is documented in detail in a file, 'Hall & Yolland – original correspondence', apparently still in OS library (item 4690): there are quotations in W A Seymour, *A history of the Ordnance Survey*, Folkestone: Dawson, 1980, 124-5.

²³ The following details are recorded in T W J Connolly, ed. R F Edwards, *Roll of Officers of the Corps of Royal Engineers from 1660 to 1898*, Chatham: Royal Engineers Institute, 1898 [annotated photocopy in TNA PRO library, 358.2 ROL oversize]: commissioned in Royal Engineers as Second Lieutenant 20 June 1840, Lieutenant 27 May 1843, Second Captain 11 November 1850, Captain 13 January 1855, Lt Col 3 August 1863, Colonel 3 August 1872; commissioned in Army as Major 9 November 1862, Colonel 3 August 1868, Major-General 24 September 1873, when retired on full pay; died in London 18 May 1899. Gosset joined the OS on 13 March 1842, and the various stations recorded for him in 1842-5 suggest that he was on geodetic work: from 1845 he was one of the officers in charge of survey parties in south-west Scotland (TNA PRO WO 17/2756: monthly returns, 1809-50), and footnotes to published maps suggest that he continued on this work until the turn of 1851-2. It is unclear when he left the OS, though it was evidently shortly after Henry James became its head in 1854: the two may well be related.

²⁴ Ian Mumford, 'Lithography, photography and photozincography in English map production before 1870', *Cartographic Journal*, 9 (1972), 30-36, especially page 33.

²⁵ *Report from the Select Committee on Ordnance Survey (Scotland)...*, BPP (HC) 1851 (519), XX, 359, evidence, qq 1570-1; *Report from the Select Committee on the Map of Ireland*, BPP (HC) 1852-3 (921), XXIV, 393, evidence, qq 251, 277, 280.

bound to encounter French 1:80,000 sheets.²⁶ However, a series nearer home was Cary's half-inch map of England, Wales and southern Scotland, completed in 1832, and by 1852 being published by Cruchley: its standard sheet size was about 24 × 19.5 inches within the neat line.²⁷ In the early 1850s this was the only 'series mapping' on a relatively large topographic scale covering southern Scotland, and as such it might have been used by the OS as a makeshift for administrative purposes.

I suggest, therefore, that the idea of the 24 × 18 inch sheet size was Gosset's, and that he may have got the idea from either the French 1:80,000, the Swiss 1:100,000, or the Cary-Cruchley half-inch.

The style problem

The earliest one-inch mapping of Scotland falls into three geographical groups: a 'Galloway' group, of Wigtown and Kirkcudbright shires; an 'Edinburgh' group, of Edinburgh and adjoining areas; and a Lewis group, of the Island of Lewis. The borders and marginalia of these sheets differ from contemporary English practice, but are consistent with that on later Scottish one-inch mapping, and need not be considered further here. The 'Edinburgh group' differs from contemporary English one-inch mapping in that hills are named in lower-case 'Egyptian', and railways and canals are named in forward-sloping Egyptian capitals. Otherwise the basic principles are those of the English mapping: for example, lighthouses are named in ordinary italic 'stump'. I will call this the 'standard style'. The Galloway and Lewis groups are similar in style to each other, but differ in other respects from the 'Edinburgh group': lower-case Egyptian is used to name lighthouses, reverse-sloping lettering is used to name watercourses, and a distinctive 'Engrossing' style is used to name water bodies and all but the largest coastal features. I will call this the 'ornate' style.

Most of the Galloway mapping was published in 1856-7; the Lewis sheets are all dated July 1858; the Edinburgh sheet was published in February 1857.²⁸ Later sheets mostly followed the style of the 'Edinburgh' group: Wigtown and Kirkcudbright shires were completed in the 'ornate' style, and the remainder of the Outer Hebrides were completed in the early 1880s in 'ornate' style. Consequently sheets straddling county boundaries were sometimes a mixture of 'standard' and 'ornate' styles. Whilst it is evident that the 'ornate' style was decided against in principle at some time, its retention for the Galloway group can be explained by the policy of using electrotypes of the series mapping, suitably cut and reassembled, for indexes to the six-inch mapping of counties. Stopping the 'ornate' style at the county boundary at least ensured consistency by county. No one-inch index is known for Lewis. The 'ornate' style was presumably revived in the early 1880s so as to give consistency to the mapping of the Outer Hebrides, an area of relative cartographic as well as geographical isolation.²⁹

²⁶ *Report from the Select Committee on the Map of Ireland*, BPP (HC) 1852-3 (921), XXIV, 393, evidence, qq 272-4.

²⁷ The series was advertised as 'half the scale and half the price'. It was eventually taken over by Gall and Inglis (by which time it was being printed from lithographic transfers), and was apparently abandoned *circa* 1914: the plates reputedly went for scrap during World War I. The measurements are based on an engraved example and a lithographed example from the writer's collection.

²⁸ These are the dates of publication in outline-with-contours form: the versions 'with hills' followed somewhat later. They may not be wholly reliable, particularly for Lewis, for the National Library of Scotland has a copy of Lewis sheet 6 (later sheet 98), printed in October 1858, which still lacks contours and a publication date. The British Library's 'legal deposit' copy of sheet 32 was printed on 22 April 1857. [These dates have been elucidated by Roger Hellyer.]

²⁹ For this reason, most of sheet 90, containing the northern part of Skye, is in the 'standard' style but a fragment in the north-west, part of Harris, is in the 'ornate' style.

It is immediately obvious that there is no neat chronological progression from the ‘ornate’ to the ‘standard’ style. A possible explanation, purely on the evidence of the maps, would be that the Edinburgh area was a high priority for publication for political or public relations reasons, and that it ‘jumped the queue’: it includes a substantial part of Linlithgowshire, surveyed at 1:2500, and therefore later than Galloway or Lewis. On this thesis, the ‘ornate’ style was that decided on originally for the Scottish one-inch, but was decided against when the Galloway and Lewis groups were part complete and the ‘standard’ style decided on.

In fact, the documentary evidence is at odds with this. A Parliamentary return prepared in late May 1857 gives the following sequence for beginning the one-inch engraving: Edinburghshire, January 1853; Wigtownshire, June 1853; Kirkcudbrightshire, July 1853; Lewis, February 1854; Haddingtonshire, November 1854; Fife and Kinross, December 1854; Linlithgowshire, November 1855.³⁰ Thus the sequence of development would appear to be: (1) adoption before January 1853 of the ‘standard’ style for the Edinburghshire mapping; (2) substitution of the ‘ornate’ style by June 1853; (3) a reversion later to the ‘standard’ style.

Assuming this to be the case, what is the explanation? It has already been hinted at above: the replacement of Yolland by Gosset in the autumn of 1852. An essential preliminary to engraving was the preparation of a manuscript drawing at the one-inch scale, and where the scale of survey was the six-inch, as in Edinburghshire, it would be sensible to prepare the drawings by six-inch sheet lines. (An early printing of Lewis sheet 4 (later sheet 105) in the British Library retains some faint six-inch sheet lines in places, evidently engraved to guide the fitting of the manuscript to the plate, though the primary control was by the trigonometrical points pricked into the plate and also appearing on the drawing.³¹) As the six-inch sheet lines were on the Cassini projection and various county origins, it would be necessary to re-compute the sheet corner positions in terms of the Bonne projection and one-inch sheet lines. This computation work, however, need not delay the preparation of the one-inch drawings, and it would be possible to begin the drawing as soon as draughtsmen were available: I suggest that this was some time during 1852, before Yolland was replaced by Gosset, and that the differences of the ‘standard’ style from that used in northern England can be explained by ideas of Yolland’s. Once Gosset had taken over, he was in a position to argue for his ideas, and it is noticeable that the ‘ornate’ style only starts to appear on the Galloway sheets, of which the engraving started about eight months after Gosset became Executive Officer, thereby giving time for him to suggest the style, have it approved by Hall, and have it incorporated in the one-inch drawings.³² In August 1854 Hall was succeeded by Major (soon to be Lt-Col) Henry James, shortly afterwards Gosset left the survey and Cameron became Executive Officer. With these changes, it seems relevant that the one-inch

³⁰ *Return, with regard to the Ordnance Survey in each County of Scotland...*, BPP (HC) 1857 (63-Sess.2), XXVII, 413. It should be noted that this gives March 1857 for commencing the engraving of Ayrshire (although a small portion had been included on sheet 3, nominally published in outline a year earlier), and describes both Lanark (a tiny portion on sheet 32) and Peebles (a considerably larger portion on sheet 32) as ‘Not commenced’: the ‘answer’ is perhaps that this refers to the start of engraving of sheets containing a substantial portion of these counties. Thus the date of November 1854 for Haddingtonshire perhaps refers to the start of sheet 33, rather than the portion of that county in sheet 32, and similarly that of December 1854 for Fife to the start of sheet 41.

³¹ This is the copy in the open-access set of the outline format in the British Library Map Library: the faintly visible sheet lines are the vertical one dividing sheets 26 and 32 from 27 and 33, and the horizontal dividing sheets 20 and 21 from 27 and 28.

³² It is perhaps stretching imagination a little to suggest that another reason might be that a few years earlier Gosset had been the officer in charge of some of the field survey in Galloway.

engraving of the next county, Haddingtonshire, was started in November 1854, at about the time that James told the OS office in Dublin that he wanted the one-inch of the United Kingdom to be in as uniform a style as possible.³³ By that time it may have been too late to do anything about the simplified borders adopted in Scotland and Ireland (it is possible that Cameron had a hand in this, as preparation of the Irish map was in hand before he left Dublin in October 1852), and the use of Egyptian for hills and railways, but the distinctive features of the ‘ornate’ style were evidently to be curtailed as soon as the counties for which the style was being used were complete. In Ireland the reverse-sloping style was used for watercourse names on sheets 121 and 148: it is possible that there was a verbal order to adopt this, before James’s appointment, and that, as there were no one-inch county indexes in prospect in Ireland to complicate matters, that the style was confined by sheet lines rather than by counties.³⁴ The ‘ornate’ style proved to be an episode rather than a standardised style. It symbolises the change from Hall and Gosset to James and Cameron.

There was a ‘battle of the scales’: perhaps there was a miniature ‘battle of the styles’.³⁵

The New Series Full Sheet Series

Whilst the Scottish ‘half sheets’ were numbered individually from the start, and individual sheet numbering replaced quarter-sheet numbering in Ireland in November 1858, numbering by quarters lasted for much longer in England and Wales. In July 1872 a replacement of all the pre-1847 one-inch mapping of southern Britain – what we know as the ‘Old Series’ – was authorised by the Treasury: this is familiar to us as the New Series, numbered individually as (nominally) 360 ‘small’ sheets. However, the earliest known New Series sheet, prepared before the project was formally authorised, is that published as 272, but bearing the number ‘76 SE’.³⁶ It was the discovery of this in the winter of 1983-4 that solved a mystery pertaining to the Isle of Man sheet, notionally Old Series sheet 100. On the Hills version, in early states, ‘*Sheet 14*’ and ‘*Sheet 20*’, divided by a line, appeared adjacent to the eastern neat line: this did not fit any hitherto known numbering system for six-inch or one-inch maps. Extrapolating back from 76 SE/272 demonstrated that this was a symptom of an early intention to treat the New Series as a quarter-sheet series, which would have involved renumbering Old Series full sheets 91-110 as sheets 1-24, and this was unexpectedly confirmed when a quarter-inch index of south-east England, dateable to the early 1870s and showing both six-inch and New Series FSS sheet lines, came to light in 1990 in Alan Godfrey’s collection.³⁷ Recently further indexes of this type, in more fragmentary form, have been found.³⁸ The appearance of the familiar New Series numbers, ironically on the outline

³³ James to Leach, 28 November 1854, OSLR 1429: OS of Ireland records, National Archives of Ireland.

³⁴ That said, the Irish reverse-sloping episode is still not neatly explained. The Egyptian style for hill-names was adopted in Ireland, but apparently only in 1856.

³⁵ Not an original phrase: it was applied by contemporaries to the mid-nineteenth century rivalry between classical and gothic in architecture.

³⁶ The number ‘76 S.E.’ was engraved, forward-reading, on the bottom left of the plate, so it is reverse-reading bottom right when printed.

³⁷ This copy was formerly in the hands of John Bartholomew and Son, and was from that part of the firm’s map collection which was sold off in the early 1980s.

³⁸ The earlier discoveries were reported in Richard Oliver, ‘New light on the New Series’, *Sheetlines* 12 (1985), n.p. [7-11] [the accompanying index to the FSS was omitted from this as first published, but was added to the combined reprint of *Sheetlines* in 1991], and ‘New cartographic discoveries’ [*sic*; what is an ‘old’ discovery?], *Sheetlines* 29 (1991), 27. The fragmentary indexes are in TNA PRO OS 3/420, and cover parts of Cheshire, North Wales and Cambridgeshire: this volume was only transferred to the PRO relatively recently, having formerly been in the OS Library at Southampton.

edition of the non-standard Isle of Man sheet, dated November 1873, demonstrates that the FSS scheme was abandoned by then.³⁹

Whilst it is nice to have conjecture confirmed, nonetheless the question remains as to why, when it had been abandoned in Ireland in 1858, was numbering as quarter sheets revived in England over a decade later? One answer might be habit and continuity, a more durable example of which was the design of border, used on most of the sheets of northern England which were to be renumbered in the ‘new series’, and itself a modification of that used for earlier ‘old series’ sheets. Another explanation might be that it was intended to provide for the possibility of treating the quarter sheets in the long term as ‘cells’, which could eventually be combined into full sheets by electrotyping. As we have seen, it would be possible to demonstrate by calculation that the extra sea area of a FSS would be largely offset by a reduced area of marginalia. A reliable ten-mile (1:633,600) map was available for southern Britain in 1870, in contrast to the position in Scotland twenty years earlier, and it would have been easy to calculate accurately sheet lines and sizes and quantities of copper.

And there were precedents for joining quarter sheets into full sheets. In 1862 what had been the four quarters of Ireland sheet 31 were combined to form a Dublin district sheet, and in 1863-4 two of the first English Old Series sheets to be published in quarters, 43 and 55, were republished as full sheets made up from joined electrotypes duplicate plates. It might be objected that the Dublin sheet was a logical follow-up to the London district sheet, produced in 1857 by combining electrotypes of seven plates, and reissued in 1861, but sheets 43 and 55 are less easy to explain away.

The timing of the origins of the ‘New Series’

From the early 1860s Old Series sheets 1-90 have to be seen in the context of the ‘cadastral’ 1:2500 resurvey of southern Britain, studied by a Select Committee of the House of Commons in 1861-2 and authorised by the Cabinet on 14 March 1863. One of the arguments for the resurvey put forward by James was that the alternative was to revise the one-inch, at a cost of £500,000: between the report of the Committee and the Cabinet decision there was a correspondence in *The Times* which (fortuitously?) made the point about one-inch outdatedness.⁴⁰ In the short term, there was less one-inch revision rather than more: whereas since the 1840s some urban expansion and various incidental changes had been noted in the course of adding railways, now revision was confined to railways, and to the addition of spot-heights along the lines of primary levelling. The values for these were published in book form in 1861: their rather restricted spatial distribution suggests that they were more to illustrate the text than to provide information supplementing the hachuring.⁴¹ On the other hand, between 1867 and 1873 there was a programme of refurbishing the worn hachures on

³⁹ The earliest known complete index to the New Series is ‘Index no. 2A’ accompanying the *Report of the ... Ordnance Survey... 1873*, BPP (HC) 1874 [C.952], LII, 681, and therefore dateable to early 1874: this shows the familiar 360-sheet numbering, including sheets 243 and 260 [FSS 68 SE and 77 NE].

⁴⁰ Correspondence and leaders in *The Times*: 17 Sept 1862, p.6, c.5; 20 Sept 1862, p.12, c.2; 22 Sept 1862, p.6, c.4 and p.7, c.3; 23 Sept 1862, p.10, c.6; 24 Sept 1862, p.6, c.4, p.7, c.3; 25 Sept 1862, p.11, c.2; 26 Sept 1862, p.5, c.6; 27 Sept 1862, p.7, c.5. For the £500,000 figure see James’s evidence in *Report from the Select Committee on the Cadastral Survey*, BPP (HC) 1861 (475), XIV, 93, evidence, qq 86, 207-16, esp. q.212; for authorisation, see papers in group 17170 in TNA PRO T1/6451B, especially Gladstone to Hamilton, 14 March 1863.

⁴¹ There was some limited addition later of spot heights supplied by detailed levelling in the course of 1:2500 survey: a notable example is sheet 10, where later states (1870s onwards, exemplified by the copy used for the David & Charles facsimile) have a relatively dense net of altitudes on the Isle of Wight.

Old Series plates, sometimes with dramatic results.⁴² It is interesting that Old Series hachure-repair apparently came to an end shortly after the authorisation of the New Series. Nor need the conversion of sheets 43 and 55 to full-sheet format need necessarily be interpreted as a ‘long-term’ measure: the electrotype plates from which sales copies of Old Series sheets were printed were replaced periodically as they showed signs of wear, and for a period sheet 33 was published as a landscape-shaped rather than portrait-shaped sheet. Thus the repair of hachures and combining of quarters did not necessarily indicate that the Old Series had much of a long-term future after 1863: this work seems to have been regarded as maintenance, chargeable to publishing, rather than a capital cost chargeable to the Parliamentary vote.⁴³

The ostensible reason for authorising the New Series was the realisation by the War Office that the Old Series was out of date, and that a replacement was desirable. This can be traced to a report on aspects of the Franco-Prussian war by Captain Charles Wilson, who had had OS experience and would be its head from 1886 to 1894, in which he noted the out-datedness of the maps used by the defeated French.⁴⁴ It would have been easy to connect out-dated French mapping and military disadvantage with similarly out-dated mapping in England, and draw an uncomfortable conclusion: at any rate, in May 1871 the War Office asked the OS for an updated one-inch.⁴⁵

When James had the engraving of 76 SE put in hand is unclear, but there are two pieces of evidence from 1869 that indicate that by then he was determined on complete replacement of Old Series sheets 1-90 by mapping on a single national, Delamere, projection, and that he was only waiting his chance to obtain formal authorisation. One is an inelegant sentence in the OS annual report: ‘A new edition has also been commenced to be engraved of those sheets in the South of England of which the Cadastral Survey has been completed.’⁴⁶ The other is some quarter-inch index maps of Cheshire, evidently designed for internal use to illustrate monthly progress returns, which are dated ‘186_’, and carry the New Series FSS quarter-sheet lines and numbers.⁴⁷ This might suggest that James had a change of mind in the late 1860s, away from patching up the existing mapping, in favour of a new, re-engraved series.

Or was James biding his time? Had he had replacement in mind for much longer, perhaps even before the Select Committee of 1861-2 examined the case for the 1:2500 resurvey? The aborted re-engraving in the later 1850s of the re-surveyed Old Series sheet 10, covering the Isle of Wight, was perhaps a victim in the first instance of the decision in 1859 to resurvey the island and some other areas at 1:2500 for defence purposes, but these limited defence surveys opened the way to the 1:2500 resurvey authorised in 1863, with its implications for an updated one-inch.⁴⁸ It may be that work on sheet 10 was abandoned as much because of

⁴² Compare, for example, the two [‘Red Label’] copies of Old Series sheet 65 in the British Library [open access] collection of 1863 and c.1867. This work is referred to in OS annual reports for 1867 to 1873: see especially *Report of the ... Ordnance Survey... 1867*, BPP (HC) 1867-68 [4008], XLII, 727, 9.

⁴³ For an indication of how such work was paid for see *Report of the Departmental Committee... to inquire into... the Ordnance Survey*, BPP (HC) 1893-94 [c.6895], LXXII, 305, evidence, q.542.

⁴⁴ C W Wilson, ‘Notes on a visit to Metz and Strasbourg in November 1870’, in TNA PRO WO 33/22.

⁴⁵ *Report of the ... Ordnance Survey... 1892*, BPP (HC) 1893-94 [C.7001], LXXII, 649, 8.

⁴⁶ *Report of the ... Ordnance Survey... 1869*, BPP (HC) 1870 [C.61], XLIII, 623, 9. This point has apparently not been noticed before. The only sheets for which resurvey data was fairly complete in 1869 were New Series 271, 272, 330, 331, 344 and 345 (FSS 76 SW and SE, 90 SW and SE, and 99 NW and NE).

⁴⁷ These are in TNA PRO OS 3/420.

⁴⁸ See Richard Oliver and Roger Hellyer, ‘The one inch Old Series: more discoveries – yet more questions’, *Sheetlines* 80 (2007), 26-39, esp. 34-37.

developing a longer-term strategy of replacing sheets 1-90 by a completely re-engraved map on a single meridian with a standard sheet-size, as of the shorter-term consideration that the Isle of Wight was about to be resurveyed. The amount of extra or changed detail affecting the recently resurveyed sheet 10 likely to be generated by 1:2500 re-survey would surely have been modest. It may be germane that in 1859 the OS began work on a quarter-inch map of England and Wales, which was projected using the Delamere origin, and the sheet lines of which did not coincide with those of the one-inch, unlike an earlier quarter-inch geological map, constructed by grouping one-inch sheets.⁴⁹ Another pointer towards a re-engraved map was that the pre-1852 Old Series sheets were only available hachured, whereas all later one-inches derived from six-inch and larger-scale material were also available in outline-and-contours form. It would be anomalous to have dual-format one-inch mapping in northern Britain and in Ireland, but to retain single-format mapping in the south.

The inception of the new map in 1869, yet its only being formally authorised some three years later, is probably to be explained by political considerations. In 1870 the OS was transferred from the superintendence of the War Office to that of the Office of Works. This meant that any new 'military' map would be paid for from the Works vote, yet at this time the First Commissioner of Works was Acton Smee Ayrton, who seems to have been a fanatical opponent of any sort of public expenditure, and who would hardly welcome the addition of the OS to his department's financial burden.⁵⁰

1871: full sheets in Britain and in Ireland

Whatever the precise timing of its conception, the new one-inch map derived from the resurvey might in the first instance be prepared in quarter sheets, but might in due course be reissued in electrotypically-joined full sheets. An interest in a FSS might be set off in the late 1860s by the starting of the engraving of the Isle of Man sheet.⁵¹

There was another consideration affecting a FSS scheme. Up to November 1866 quarter or 'small' sheets were priced at a quarter of the price of full sheets: then a revision of prices to reflect more closely the costs of printing resulted in one-inch quarter sheets or equivalent being priced at 1s (£0.05) and full sheets at 2s.6d (£0.125). For those buying a complete set, or an extensive area, there would be a definite advantage in a FSS over a SSS. On the other hand, someone of more modest aspiration whose area of interest came at the junction of four FSS sheets would have to pay 250 *per cent* more for four FSS than for four SSS.

In 1871 there was another flurry of interest in combined sheets in Ireland, recorded in an exchange of correspondence between Dublin and Southampton. On 18 February Cameron wrote to Major Wilkinson, in charge in Dublin:

I have spoken to Sir H. James to ascertain his wishes about the joining of the quarter plates. There is no doubt the large plates look the best, but if we have to keep up two sets of plates and revise from time to time, it makes a serious difference of expense, and if we cancel the quarters, the Public would have some cause to complain in having to buy the more expensive article.

⁴⁹ Richard Oliver, 'The origins of Ordnance Survey quarter-inch mapping in Great Britain, 1837-72', *Sheetlines* 15, 9-14.

⁵⁰ For the transfer of the OS to 'Works' and for a feel for Ayrton's views see papers in group 22049 in TNA PRO T1/7021B; for the authorisation of the New Series see papers in group 1160 in TNA PRO T1/7200B. These show that the mid-Victorian Treasury, whilst careful of national funds, was by no means an unintelligent 'Scrooge' department.

⁵¹ *Report of the ... Ordnance Survey... 1869*, BPP (HC) 1870 [C.61], XLIII, 623, Index no.2; *Report of the ... Ordnance Survey... 1870*, BPP (HC) 1871 [C.301], LVI, 729, p.6.

On the whole Sir Henry thinks you had better not join any more except the four quarters containing Dublin.

Wilkinson replied:

I will abandon the idea of joining any more. The Belfast composite sheet is just ready and if Sir Henry would permit it I should like to be allowed to join the four sheets embracing Galway, the four taking in the City of Cork & the four which will shew the whole of the Lakes of Killarney: this last will be a very interesting tract of country.

Sir Henry permitted it, but so far no evidence has been found that the Cork, Galway and Killarney sheets were prepared: it is possible that this is because no hill-plates were available for these areas in the early 1870s.⁵² However, composites of Inishowen and Drogheda *were* prepared at about this time. Though seemingly not documented, the plates are extant, and they are listed in an Ordnance Survey catalogue of February 1873, which also lists a composite for the Coleraine-Ballymena area: hill-plates were available for all these areas. All the Irish combined sheets were still being advertised in January 1901. These do not fit the original FSS combinations of the 1850s – each is the southern half of one and the northern half of that below it - but by themselves they suggest the ghost of a butt-jointed arrangement, contradicted however by the Belfast sheet, which has at its centre the meeting-point of four erstwhile FSS sheets. A second Dublin sheet was made in 1890, butt-jointed to the Drogheda sheet; the earlier Dublin sheet was kept in print.⁵³

It may be that it was the problem of the considerable price increase for those with a limited area of geographical interest which led to the demise of the New Series FSS, and it may be that the number '76 NE' on the future SSS 272 was already obsolescent in concept, if not in operation, in the summer of 1872. Within eighteen months the FSS was dead, and individual numbers were allocated to 'new series' sheets.

Acknowledgements

This is one of a number of papers which have been preliminaries to writing an 'introductory essay' to accompany a cartobibliography by Roger Hellyer of the engraved one-inch mapping of the United Kingdom produced between 1847 and 1914. Much of the detail description and arguing here takes advantage of Roger's work, and he has made some valuable suggestions and corrections, though of course all deficiencies, eccentricities and weaknesses remain mine.

⁵² Correspondence of February-March 1871 in National Archives of Ireland OS 5/3603: I am grateful to Roger Hellyer for extracting it, and we are both grateful to Professor John Andrews for guidance on this material.

⁵³ The Drogheda and Inishowen plates are in National Archives of Ireland OS 106/21: for this reference and for those in the 1873 catalogue I am indebted to Roger Hellyer. Irish SSS combinations are: Inishowen: 1, 2, 5, 6; Coleraine, 13, 14, 19, 20; Belfast, 28, 29, 36, 37; Drogheda, 91, 92, 101, 102; Dublin [1862], 101, 102, 111, 112; Dublin [1890], 111, 112, 120, 121. All six combinations are still listed in the 1901 Irish catalogue; that the other three sheets were not listed might be taken as indicating that they were not prepared. Galway might have combined 105, 106, 113, 114, Killarney 172, 173, 183, 184, and Cork 186, 187, 195 and 196, though it is to be noted that all three are 'off-centre', whatever combinations of undivided SSS are used: could this be another reason why these were not proceeded with?

Appendix 1

Comparative statistics for various basic sheet sizes

All measurements are in inches or square inches.

England and Wales

	SSS	HSS	FSS
Sheet size within neat line	18 × 12	24 × 18	36 × 24
Area within neat line	216	432	864
Total number of sheets needed	348	190	104
Total map area (square inches)	75,168	82,080	89,856
Increase in map area compared with SSS (%)	0	109.5	119.9
Length of border per sheet	60	84	120
Total length of border for series	20,880	15,960	12,480
Size of plate	21 × 15	27 × 21	39 × 27
Area of plate	315	567	1053
Total area of copper for series	109,620	107,730	109,512
Area within neat line as percentage of copper	68.6	76.2	82.1
Percentage of copper needed compared with SSS	100	98.3	99.9
Percentage of copper needed compared with HSS	101.7	100	101.7
Percentage of copper needed compared with FSS	100.1	98.4	100

Ireland

	SSS	HSS	FSS
Sheet size within neat line	18 × 12	24 × 18	36 × 24
Area within neat line	216	432	864
Total number of sheets needed	205	106	59
Total map area (square inches)	44,280	45,792	50,976
Increase in map area compared with SSS (%)	0	103.4	115.1
Length of border per sheet	60	84	120
Total length of border for series	12,300	8,904	7,080
Size of plate	21 × 15	27 × 21	39 × 27
Area of plate	315	567	1053
Total area of copper for series	64,575	60,102	62,127
Area within neat line as percentage of copper	68.6	76.2	82.1
Percentage of copper needed compared with SSS	100	93.1	96.2
Percentage of copper needed compared with HSS	107.5	100	103.4
Percentage of copper needed compared with FSS	103.9	96.7	100

Scotland

	SSS	HSS	FSS
Sheet size within neat line	18 × 12	24 × 18	36 × 24
Area within neat line	216	432	864
Total number of sheets needed	243	132	80
Total map area (square inches)	52,488	57,024	69,120
Increase in map area compared with SSS (%)	0	108.6	131.7
Length of border per sheet	60	84	120
Total length of border for series	14,580	11,088	9,600
Size of plate	21 × 15	27 × 21	39 × 27
Area of plate	315	567	1053
Total area of copper for series	76,545	74,844	84,240
Area within neat line as percentage of copper	68.6	76.2	82.1
Percentage of copper needed compared with SSS	100	97.8	110.1
Percentage of copper needed compared with HSS	102.3	100	112.6
Percentage of copper needed compared with FSS	90.9	88.8	100