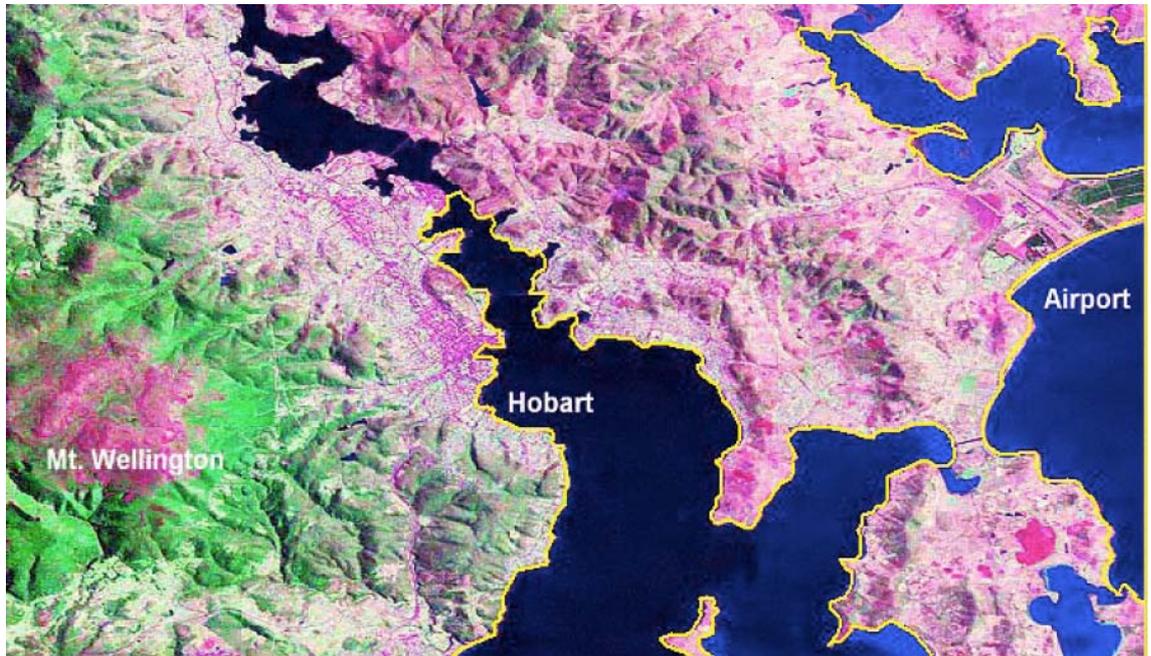


The New GPINFO Coastline



An example of the new GPINFO 5 high resolution coastline in the vicinity of Hobart, Tasmania. The coast (in yellow) is superimposed on a Landsat image.

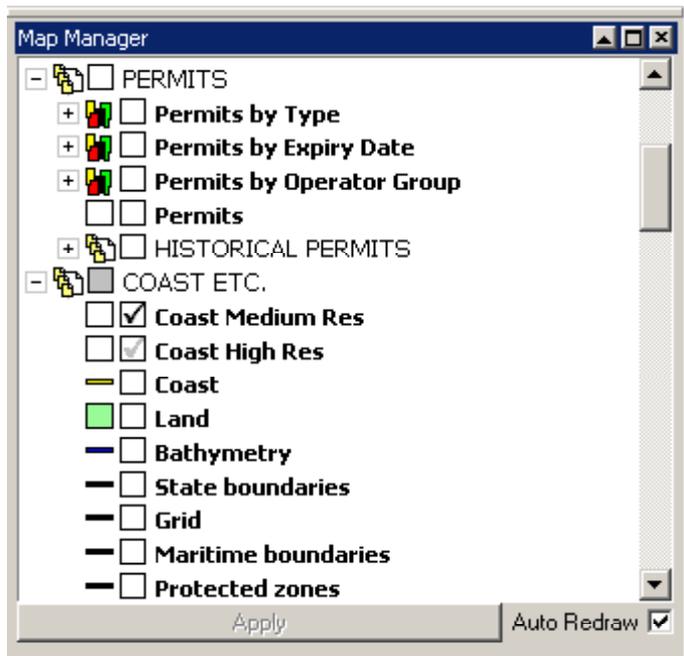
Getting started

From August 2003, two additional coast layers (*Coast High Res* and *Coast Medium Res*) will appear in the GPINFO 5 Map Manager.

The coast files attached to these layers are a major improvement over the existing GPINFO coast. They are more accurate and more detailed and the two coasts are internally consistent.

The new coasts are set to non-visible when they are first installed in GPINFO. To see them you have to check their visibility boxes in the Map Manager (these are the boxes immediately to the left of the layer title). At the same time, you should uncheck the *Coast*, *Land* and *State Boundaries* layers. This will have the effect of turning off the old coastline, land and state boundary layers and turning on the new ones.

You will note that at any one time, only one of the *Coast High Res* and *Coast Medium Res* visibility boxes contains a black tick (the other being grey). The reason for this is the fact that these two layers operate in concert with one another. Depending on the scale at which you are displaying your GPINFO data, one or other of these files will be more appropriate. For example, if you are viewing the whole of Australasia, then *Coast Medium Res* will be visible. As you zoom in there will come a point (at a scale of 1:400,000) that GPINFO will turn off *Coast Medium Res* and turn on *Coast High Res* instead.



Map Manager showing the new High Res and Medium Res coasts turned on and the old Coast, Land and State boundaries turned off.

Note: The Coast layer is still linked to the old GPINFO coast file. This will be changed later this year when the old coast will be removed and the new medium resolution coast will be linked to the Coast layer.

Background

When the GPINFO service was first established over 12 years ago the quality of the coastline data was relatively unimportant. GPINFO was first and foremost a service which provided a graphical view of permit changes.

PCs at that time ran at a fraction of the speed they do today so, in order to provide a responsive system, compromises had to be made. For this reason a decision was made to provide 3 GPINFO coastlines: a low resolution one consisting of approximately 2,800 line segments; a medium resolution one with 18,000 segments and a high resolution one with 132,000 segments.

The low resolution coast was only used when the graphical window within GPINFO covered the whole area of Australasia. If the user zoomed in at all it was immediately replaced by the medium resolution coast.

In order to use the high resolution coast a user had select it from the layer list. This let GPINFO know to turn off the medium resolution coast. It also told it to turn on a higher resolution version of the permit boundaries (see *The problem of coastal permits* below).

The original GPINFO coastline

In the mid '80s, Encom was contracted by Jacksons Limited, a prominent Sydney stockbroking company to produce a wall map of Australasian permits. At this time, National Mapping (the Federal Government predecessor to AUSLIG) supplied a coastline of Australia for a nominal fee. This was an old coastline (probably from the early '60s) which had been converted to AGD66. Coastline datasets for New Zealand and Papua New Guinea were not available in digital form so these coasts were digitized from naval hydrographic charts.

These data were combined into a single coastline file and the low, medium and high resolution coasts were created from this file by compressing the original coast at three different collinear tolerances (ie. if, in a set of vertices, all vertices between the endpoints of the set lay within a specified tolerance of a line joining the endpoints, these internal vertices were removed).

The problem of coastal permits

By creating multiple coasts we solved one problem but introduced another.

Where a permit abuts the coast, part of the permit boundary is formed by the coast. The decision then has to be made as to which coast should be used in creating the permit outlines. This is a problem that has multiple solutions none of which is ideal.

The solution that was adopted in GPINFO 4 was to create and maintain two graphical permit layers – one which matched the medium resolution coast and one which matched the high resolution coast. Users could then elect which coast/permit combination was most suitable to the task at hand.

This was an acceptable solution for users but it did introduce a significant overhead in terms of GPINFO data preparation. Two permit layers in which the only differences were the coastal segments had to be maintained and distributed.

The GPINFO 5 coastline

When GPINFO 5 was released 18 months ago we were faced with a technical issue with the high resolution coastline – the data preparation tools that we were using only allowed us to create filled polygons with 500 vertices or less even though GPINFO 5 itself could store polygons with up to 16,000 vertices (this has now been increased to 32,000).

Because of the 500 vertex limitation we had to break any large areas (such as the Australian continent) up into multiple adjacent polygons in order to colour fill it. This task was relatively easy with the medium resolution coast but not with the high resolution one. So the decision was made to release the product with just the medium resolution coast and medium resolution permits. This has been the situation with GPINFO 5 until the latest (July 2003) data release.

There are several reasons why we decided to perform the effort necessary to produce new coastlines:

1. The detail in the coast released with GPINFO 5 was adequate for scales of 1:4,000,000 or smaller but became very 'blocky' at larger scales.
2. The detail in the high resolution GPINFO 4 coast was adequate for most purposes in GPINFO 5 but its history was such that its accuracy varied widely throughout the region.
3. The only quality statement that we could make about the old GPINFO 4 coast was that the high resolution version was 'better' than the medium resolution one which was, in turn 'better' than the low resolution one.
4. None of the coasts were detailed or accurate enough to be used for cartographic quality maps at scales larger than 1:1,000,000 or so.

Points to consider

In creating a new coast for GPINFO we had to take into account the needs of a wide range of subscribers.

Some GPINFO users routinely download data into 3rd party mapping, interpretation or CAD programs (Petroseis, Landmark, Microstation etc.) and combine the GPINFO data with other data for display at large scales (1:250,000 and larger).

At the other end of the scale are users who primarily use GPINFO as a way of finding information about permits, companies etc. For these users, the detail in auxiliary datasets such as coastlines, pipelines etc. is largely irrelevant.

We also had to take into account the desirability of being able to state the provenance of the coast (where it came from and what processes we had applied) and a statement of quality and accuracy.

A third consideration is the speed with which the coast can be displayed in GPINFO. Whilst most GPINFO users now sit at Pentium 4 PCs running at speeds in excess of 2 Ghz, some people still use much slower PCs. Clearly for this latter group (many of whom are not interested in coastline detail or accuracy) we need to provide a coast which is 'reasonable' but can be displayed quickly.

A final consideration was the desire to produce a coast (or coasts) which are consistent in detail and accuracy as we move between Australia, New Zealand and Papua New Guinea (and Indonesia).

Creating a new coast for GPINFO

An impediment to our providing a more detailed coastline until a year or so ago was the licensing regime that applied to providing data sourced from government mapping authorities.

Fortunately in the last year there has been a major shift in policy in Australia whereby mapping products available through Geoscience Australia and other government agencies can now be obtained either free of charge via web downloads or at nominal cost if supplied on media. Also these agencies are now allowing companies such as Encom to value add to their products and redistribute them with less onerous licensing conditions than were previously the case.

The GPINFO 5 coast has been created from data obtained from 3 principal sources:

Australia – GEODATA 1:100,000 Coastline

This coastline is primarily sourced from the 1:100,000 scale National Topographic Map Series produced by Geoscience Australia and the Royal Australian Survey Corps. Line segments are limited in length to be longer than 20 metres and shorter than 50 metres (the exception being small islands which can have segments less than 20 metres).

Comprehensive quality and other details relating to this coast are included in the GEODATA Coast 100K 1992 User Guide which can be downloaded from the Geoscience Australia web site at:

http://www.agso.gov.au/data_download/docs/coast1992_userguide.pdf

Note: This coast was released in 1992 and therefore does not match recent man-made coastal features (eg. the second runway at Sydney airport). There will also be differences relating to recent erosion and deposition at various locations on the coast.

New Zealand – NZTOPO 1:50,000 Coastline

This coastline forms part of the NZTopo GIS dataset produced by Land Information New Zealand. It is primarily sourced from the 1:50,000 National Topographic Map Series and has evolved progressively since 1973 when the photogrammetric acquisition of the base data was first started. The digital capture of data occurred between 1989 and 1998 and since then, Land Information New Zealand has carried on a program of progressive maintenance.

A comprehensive document describing NZTopo can be downloaded from the Land Information New Zealand website at:

http://www.linz.govt.nz/staticpages/datadictionary/Version3_2/document/nztopo_guide.pdf

Papua New Guinea and Indonesia – World Vector Shoreline 1:250,000

This coastline was extracted from the World Vector Shoreline (WVS) which is a standard product of the US Defense Mapping Agency that contains shorelines, international boundaries and country names at a nominal scale of 1:250,000.

The web page below contains details of the World Vector Shoreline:

<http://rimmer.ngdc.noaa.gov/coast/wvs.html>

Preparing the combined coastline

In order to prepare a single coastline of the region we took the three coast datasets and merged them into one as follows:

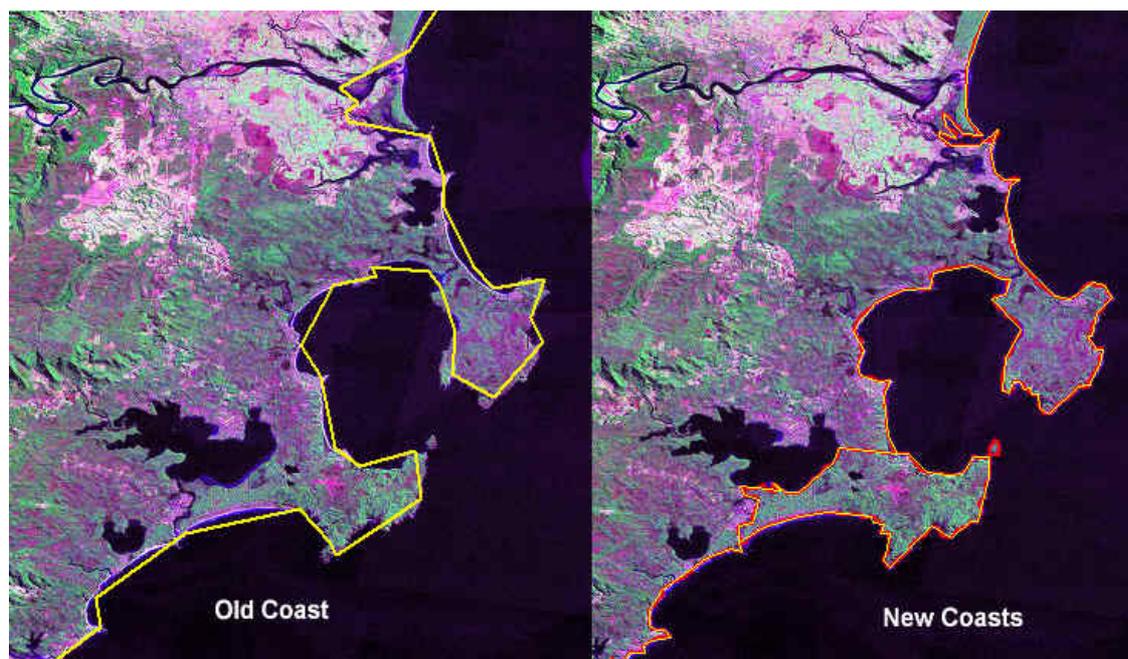
1. All three coasts were converted to a common datum (WGS84).
2. A high resolution coast (High Res) was produced by compressing the data to a collinear tolerance of 50 metres.
3. Polygons were created for the major landmasses and islands (Australia was divided up on a state by state basis and Irian Jaya and Papua New Guinea were also separated) and islands less than 0.5 sq. km in size were removed.
4. A medium resolution coast (Medium Res) was produced by further compressing the coast created in steps 2 and 3 to a collinear tolerance of 250 metres and by removing islands less than 2 sq. km in size.
5. All data were converted to AGD66, the geodetic datum currently used by GPINFO (see *Conversion to a geocentric datum* below).
6. The coasts for Australia and New Zealand were superimposed on Landsat images to verify their overall accuracy and to check for any significant differences.

The GPINFO 5 High Res coast contains approximately 325,500 line segments. At a scale of 1:250,000, the discrepancy between the source coastal data and the GPINFO 5 coast is of the order of 0.1 mm.

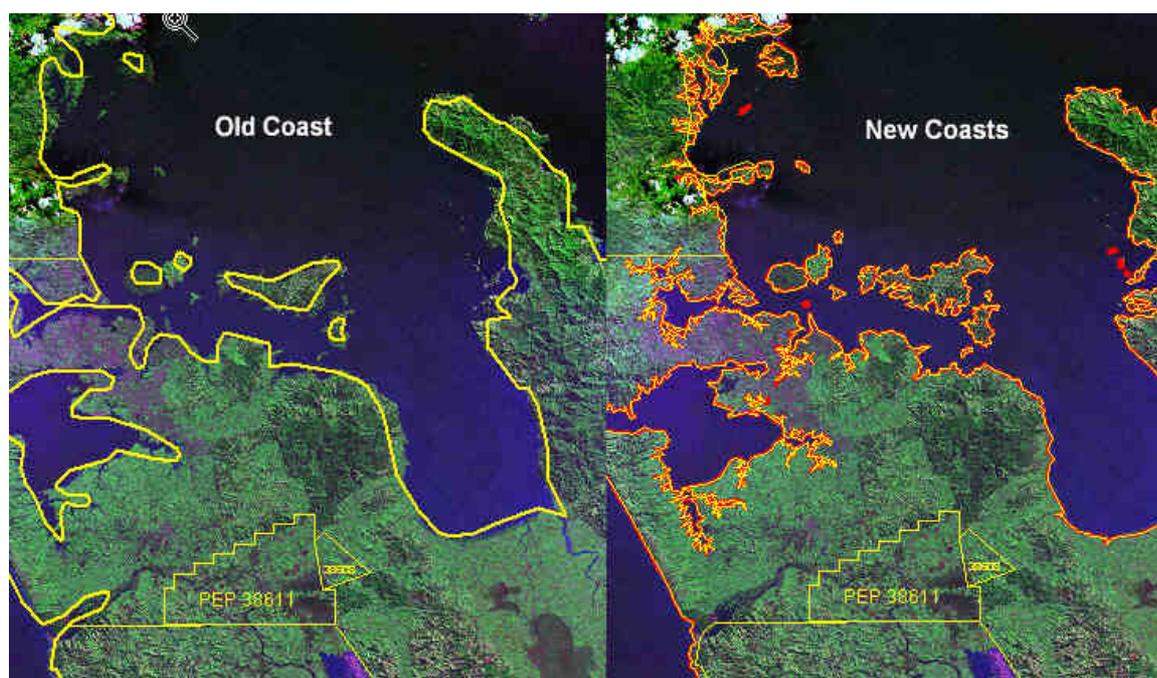
The GPINFO 5 Medium Res coast contains approximately 87,500 line segments. At a scale of 1:250,000 it differs from the source coastal data by less than 0.5 mm.

The GPINFO 5 High Res and Medium Res coasts are compatible with the source coasts and contain a subset of the points contained in the original datasets.

Some comparisons between old and new



The old GPINFO 5 coast compared with the new high and medium resolution coasts. The area shown is in the vicinity of Jervis Bay, NSW and the backdrop is a Landsat image.



Another comparison from the northwestern corner of the North Island of New Zealand.

Ongoing adjustments

In the course of producing these new coasts we have noted several discrepancies between the satellite imagery and the coasts. These differences are obvious where there are new man-made objects (breakwaters etc.) but less obvious in other cases. It is our intention to progressively modify the coast as we find and understand these discrepancies.

We also plan in the future to obtain satellite imagery of Papua New Guinea in order that we can further assess the accuracy of the World Vector Shoreline data used for that part of the GPINFO 5 coast file.



An example showing the discrepancy between the GEODATA 100K coast and a more recent satellite image of Sydney airport. Note the changes to the first runway, the addition of the second runway and the build up of the area to the east of the airport.

The problem of estuaries

If you look at the image of Hobart at the start of this document you will note that the coastline is truncated approximately 5 km up river from the centre of Hobart. In addition truncations occur in two of the larger bays to the north of Hobart.

In the Data Dictionary section of the GEODATA Coast 100K User Guide, there is a comment thus:

Closing lines: the mouths of narrow inlets and rivers are generally closed off when they are less than 500m wide. The overall intent in considering the placement of closing lines was to preserve the general shape of the coastline.

Whilst this seems to be a somewhat arbitrary decision and leads to what seem to be unwarranted truncations (as in the case described above) the reason that

this decision was adopted can be seen in the example below which shows the Victorian coastline in the vicinity of the Gippsland Lakes.

In this case, a large complex of coastal lakes drains into the ocean through a very small estuary. It is arguable whether or not the coast should pass back through the estuary and trace the outline of the major lakes or whether the inland lakes should be part of a lakes and rivers data set separate from the coast.



The Gippsland lakes in south-eastern Victoria showing the GEODATA 100K coast (in yellow) superimposed on a Landsat image.

In our opinion, there are places where we believe it is appropriate to extend the GPINFO coast inland beyond the truncations that are present in the GEODATA 100K coast. It is our intention therefore, over time to provide an updated coast which extends further inland in estuaries, harbours etc.

Do the permit boundaries match both coasts?

The answer to this question is no – we only distribute one permit layer with GPINFO 5 and it now matches the high resolution coast.

This means that when you are zoomed out beyond a scale of 1:400,000 GPINFO will display two slightly different coasts in the vicinity of coastal permits – the medium resolution coast from the Coast Medium Res layer and the high resolution coast from the Permits layer.

At this scale the difference between the two coasts is close to the resolution of your screen so it is unlikely that you will notice any discrepancy between them.

We looked at various alternatives – maintaining high and medium resolution permit layers, incorporating high resolution coastline data into the medium resolution coast where permits abut it, creating the medium resolution version on the fly by performing compression within GPINFO.

In the end we felt the best compromise is the one we have adopted.

Conversion to a geocentric datum

GPINFO provides its data to you in latitude/longitude coordinate pairs. The data for the Australian component of GPINFO are still based on the AGD66 geodetic datum. This is a non-geocentric (earth centred) datum which was designed specifically to fit the Australian continent. Satellite measurements which are received by GPS receivers are based on the WGS84 geodetic datum. The same latitude/longitude pair in AGD66 and WGS84 represent points which are separated by approximately 200 metres on the earth's surface.

A similar problem exists between WGS84 and NZGD49. NZGD49 was, until recently, used as the basis for locations within New Zealand. It is a non-geocentric datum and the shift between it and WGS84 is approximately the same magnitude and in the same sense as the shift between WGS84 and AGD66.

Australia has now converted to GDA94 (Geodetic Datum of Australia 1994) and New Zealand has converted to NZGD2000 (New Zealand Geodetic Datum 2000) both of these being compatible (for all practical purposes) with WGS84.

The current geodetic datum gazetted for Papua New Guinea is PNG94, a geocentric datum also compatible with WGS84. This supersedes AGD66 which was previously used in PNG.

All 3 datums have an epochal component to them – ie. their definitions recognise the fact that over time, continental drift affects relative positioning and therefore the basic parameters used to define them must be refined/redefined at some point in the future.

Now that all 3 countries covered by GPINFO have adopted WGS84 compatible datums it is our intention to reproject GPINFO data during the latter part of this year in preparation for a WGS84 compatible release in early 2004.

Summary

In producing this new coast we have listened and responded to the requests of our users.

We recognise, however, that for some of you, our solution may not be optimal. Perhaps you may be working in a relatively small coastal area and would have preferred to have access to the original GEODATA 100K coast rather than our compressed version. You might also have an offshore permit that includes a number of islands and would prefer to see islands less than 0.5 sq km in size.

If you need uncompressed versions of the various coastal components in GPINFO 5 compatible format then we can supply these at a nominal charge.

If in the course of your working with these new data you note discrepancies in the coast then please bring these to our attention and we will investigate them for you.

We hope you are pleased with these new coast files and welcome any feedback.