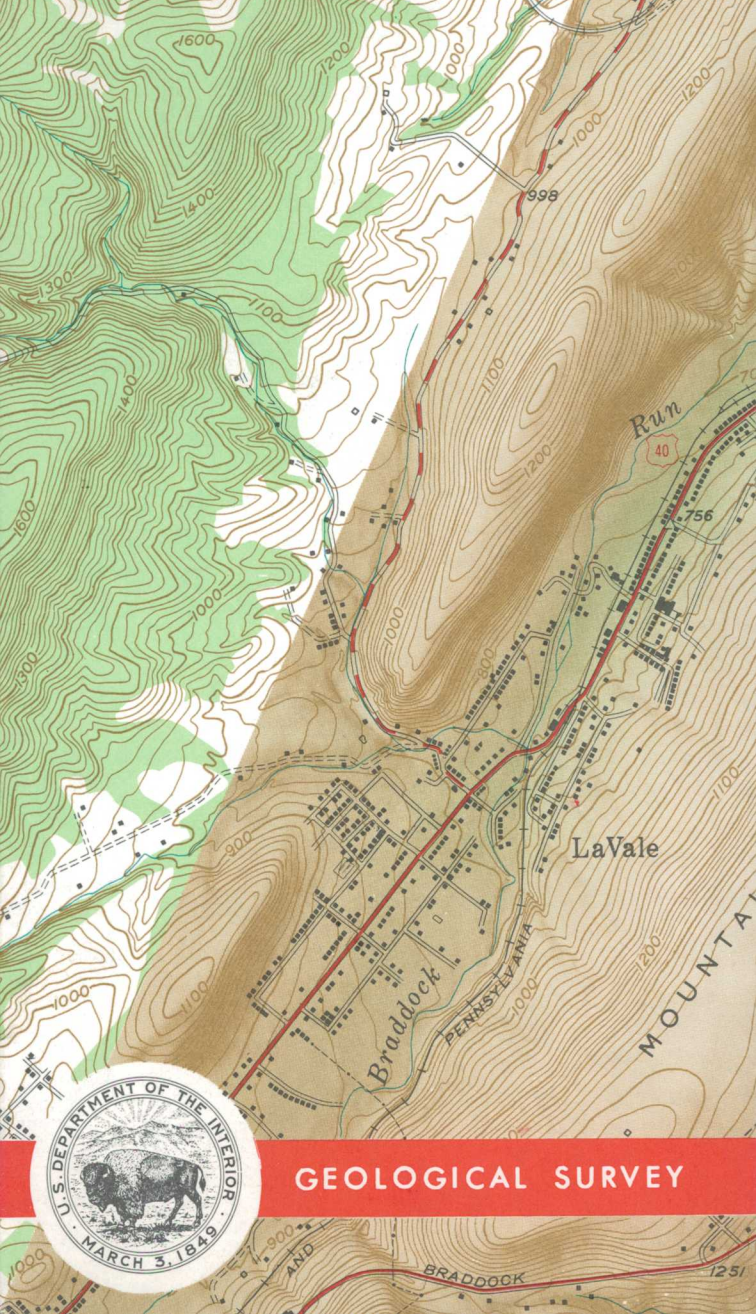
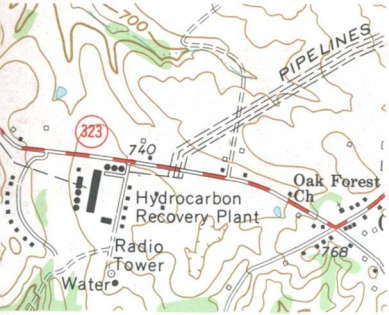
TOPOGRAPHIC MAPS



U.S. DEPARTMENT OF THE INTERIOR · MARCH 3, 1849

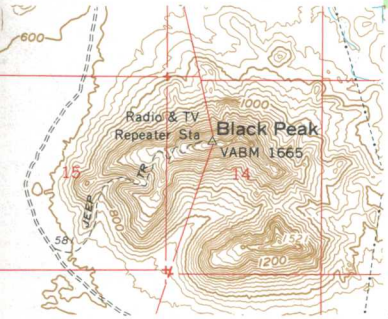
GEOLOGICAL SURVEY

TOPOGRAPHIC MAPS FOR DEVELOPMENT



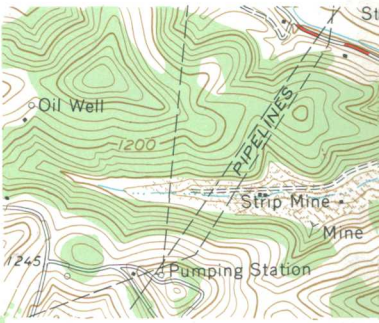
SELECTING INDUSTRIAL SITES

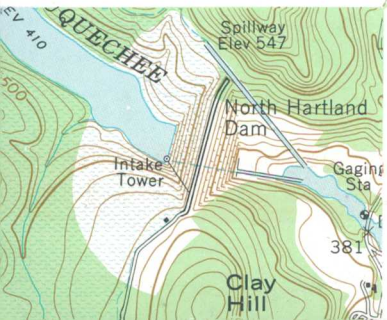
PLANNING HIGHWAYS



LOCATING COMMUNICATION FACILITIES

ROUTING PIPELINES





SELECTING DAM SITES

What is a TOPOGRAPHIC MAP?

A topographic map is a graphic representation of selected manmade and natural features of a part of the earth's surface plotted to a definite scale. The distinguishing characteristic of a topographic map is the portrayal of the shape and elevation of the terrain.

Topographic maps record in convenient, readable form the physical characteristics of the terrain as determined by precise engineering surveys and measurements. They show the location and shape of the mountains, valleys, and plains; the network of streams and rivers, and the principal works of man.

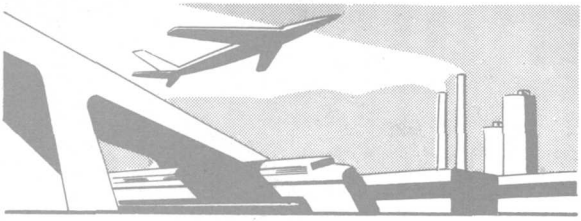
APRIL, 1969


U.S. DEPARTMENT OF THE INTERIOR
MARCH 3, 1849

THE UNITED STATES GEOLOGICAL SURVEY

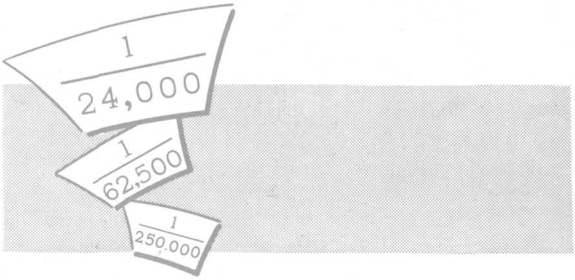
was established by Congress in 1879 to consolidate four earlier organizations that had been engaged in topographic and geologic mapping and the collection of information regarding the public lands. From the beginning of this work it was evident that no adequate classification of lands or conclusive geologic determinations could be made without suitable base maps. A general plan was adopted in 1882 for the production of a standard series of topographic maps. Under this plan each map covers a quadrangle area bounded by meridians of longitude and parallels of latitude. Maps with these standard boundaries are called quadrangle maps.

The plan of 1882 has been expanded to meet the needs of a growing Nation and to satisfy numerous civil and military needs not contemplated in the 1879 Act. One of the principal objectives of the Geological Survey today is to provide general-purpose maps of appropriate scale and accuracy for all of the country. Several series of topographic maps are needed to satisfy modern requirements.



TOPOGRAPHIC MAPS have many uses as fundamental tools for planning and executing projects that are necessary to our modern way of life. They are of prime importance in planning airports, highways, dams, pipelines, transmission lines, industrial plants, and countless other types of construction. Topographic maps are an essential part of geologic and hydrologic research, of mineral investigations, and of studies on the quantity and quality of water. They greatly facilitate the study and application of flood control, soil conservation, and reforestation. Intelligent and efficient development of our natural resources depends on the availability of adequate topographic maps.

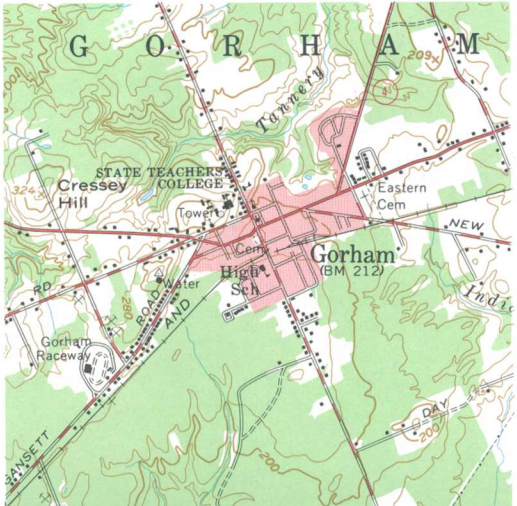
In addition, the rapidly growing list of map users now includes many who have discovered the advantages of topographic maps in the pursuit of outdoor activities such as hunting, fishing, and vacationing. Reliable maps showing relief features, woods, clearings, and watercourses are of inestimable value to the serious hiker. There is, in fact, very little of our outdoors that cannot be better understood and appreciated with the aid of topographic maps.



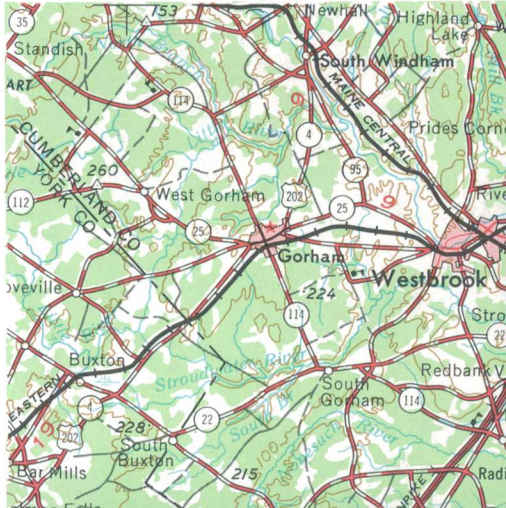
MAP SCALE expresses the size relationship between the features shown on the map and the same features on the earth's surface. This is generally expressed as a ratio or fraction—1:24,000 or 1/24,000. The numerator, usually 1, represents map distance; the denominator, a large number, represents ground distance. Thus the scale 1:24,000 states that any unit such as 1 inch or 1 foot on the

1:24,000 scale,
1 inch = 2000 feet.
Area shown,
1 square mile.

1:62,500 scale,
1 inch = nearly 1 mile.
Area shown,
6¾ square miles.



1:250,000 scale,
1 inch = nearly 4 miles.
Area shown,
107 square miles.



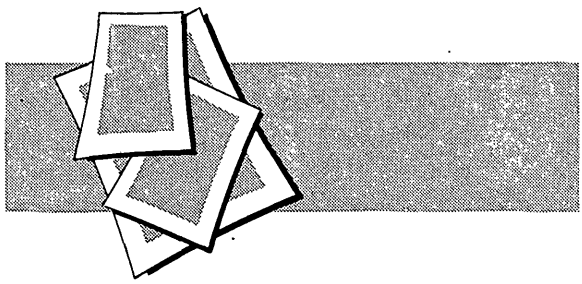
map represents 24,000 of the same units on the ground. This could also be expressed as 1 inch represents 24,000 inches or 2,000 feet.

Maps are classified generally according to publication scale, and each scale series is intended to fulfill a specific type of map need. The illustrations show the contrast between large-, medium-, and small-scale maps. To select a map of proper scale for a particular use, remember that large-scale maps show more detail and small-scale maps show less detail. Thus—

Large-scale maps, such as 1:24,000, are especially useful for highly developed areas or rural areas where detailed information is needed for engineering planning or similar purposes.

Medium-scale maps, for example 1:62,500, may be adequate for rural areas where less detailed planning is contemplated.

Small-scale maps, 1:250,000 and smaller, cover very large areas on a single sheet and are useful in the study of extensive projects or regional planning.



THE NATIONAL TOPOGRAPHIC MAP SERIES includes the several quadrangle and other map series published by the Geological Survey. A map series is a family of maps conforming generally to the same specifications or having some common unifying characteristic such as scale. Adjacent maps of the same quadrangle series can generally be combined to form a single large map.

The principal map series and their essential characteristics are given in the following table.

The National Topographic Map Series also includes other special-purpose maps which are prepared from standard quadrangles but do not follow the standard quadrangle format.

NATIONAL TOPOGRAPHIC MAPS

Series	Scale	1 inch represents	Standard quadrangle size (latitude-longitude)	Quadrangle area (square miles)	Paper size E-W width N-S length (inches)
7½-minute	1:24,000	2,000 feet	7½×7½ min.	49 to 70	[1] 22×27
Puerto Rico 7½-minute	1:20,000	about 1,667 feet	7½×7½ min.	71	29½×32½
15-minute	1:62,500	nearly 1 mile	15×15 min.	197 to 282	[1] 17×21
Alaska 1:63,360	1:63,360	1 mile	15×20 to 36 min.	207 to 281	[2] 18×21
U.S. 1:250,000	1:250,000	nearly 4 miles	[3] 1°×2°	4,580 to 8,669	[4] 34×22
U.S. 1:1,000,000	1:1,000,000	nearly 16 miles	[3] 4°×6°	73,734 to 102,759	27×27

[1] South of latitude 31° 7½-minute sheets are 23 × 27 inches; 15-minute sheets are 18 × 21 inches.
[2] South of latitude 62° sheets are 17 × 21 inches.
[3] Maps of Alaska and Hawaii vary from these standards.
[4] North of latitude 42° sheets are 29 × 22 inches. Alaska sheets are 30 × 23 inches.

Metropolitan Area Maps, at 1:24,000 scale, have been prepared for many cities and published in one or more sheets, according to the size of the area shown.

The National Park Series, at various scales, covers national parks, monuments, and historic sites. Many of these maps are available with shaded-relief overprinting on which the topography is made to appear three dimensional by the use of shadow effects. An example of this map treatment is shown on the lower right side of the front cover.

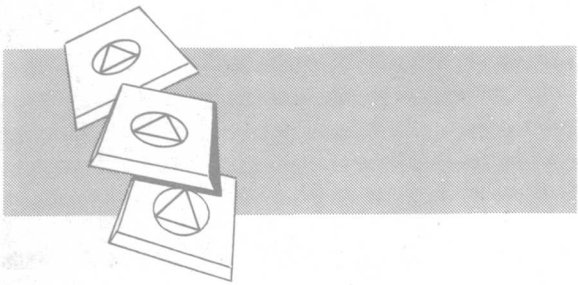
State base maps at scales of 1:500,000 (1 inch represents approximately 8 miles) and 1:1,000,000 (1 inch represents approximately 16 miles) are available for all States except Alaska and Hawaii, which are covered by maps at other scales. For some States, topographic and shaded-relief editions are also available.

Maps of the United States are available in sizes and scales ranging from letter size, 1:16,500,000 scale, to a two-sheet wall map, 1,2,500,000 scale.
In addition, topographic maps of special format are produced for many principal rivers and their flood plains.

The Geological Survey is also engaged in a mapping program in Antarctica. These maps are published at several scales, principally 1:250,000, with shaded relief.

Although most of the maps of the National Topographic Map Series are produced by the Geological Survey, other Federal agencies—the Army Map Service, Coast and Geodetic Survey, Tennessee Valley Authority, Forest Service, and the Mississippi River Commission—also prepare topographic maps in connection with their regular activities that are incorporated in the National Topographic Map Series and published by the Geological Survey.

For some mapping projects, State or local agencies share the cost of mapping equally with the Federal Government. These cooperative projects expedite the mapping of areas of particular interest to the cooperating agency, and help to complete the National Topographic Map Series.

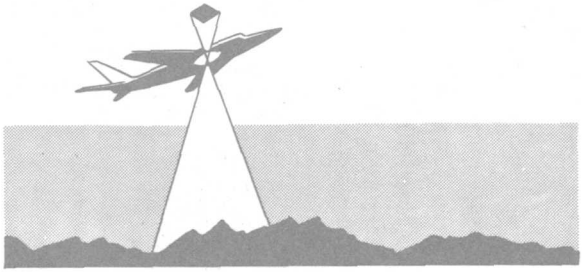


CONTROL SURVEYS are required to present map features in correct relationship to each other and to the earth's surface. Two kinds of control are required: horizontal and vertical. Horizontal control is needed to develop and maintain correct scale, position, and orientation of the map. For this purpose, latitude and longitude of selected points within the area to be mapped must be determined by field surveys. Similarly, vertical control is needed to determine the correct position of the contours which show the shape and elevation of the terrain. To obtain this, the elevation of selected points must also be determined in the field. Control points so located become the framework on which map detail is assembled. This framework determines the accuracy with which the positions and elevations of map features can be shown. Maps of abutting quadrangles join without a break in the continuity of map detail.

Permanent control points are usually marked on the ground by metal tablets 3¾ inches in diameter set in

rock or masonry, and many are shown on the maps by appropriate symbols. Some marks serve for both horizontal and vertical control.

Because such data is useful for many other purposes, the results of control surveys are published for sale in tabulated lists, each covering a 15-minute quadrangle.



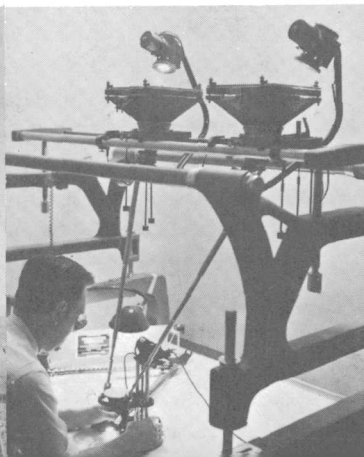
MAPPING PROCEDURES have changed considerably since the time when all topographic maps were sketched by hand in the field, using an alidade and a planetable. Today, most maps are compiled in the office by photogrammetric methods, using stereoscopic plotting instruments and aerial photographs. These complex instruments provide three-dimensional optical models of the terrain from which the compiler makes precise measurements for accurate delineation of contours, drainage, woodland, and culture.

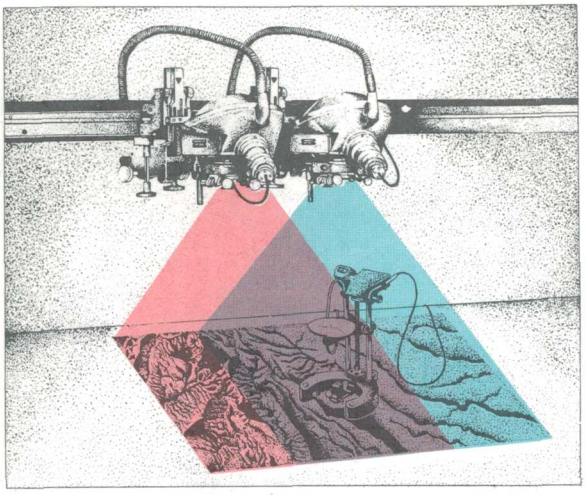
Nevertheless, field surveys are still required to establish the geodetic framework on which aerial photographs are assembled and to add detail not obtainable from photographs. In areas obscured by dense foliage or heavy shadows, map features are plotted by planetable methods. Place names and political boundaries are determined, and roads, water features, and buildings are classified in the field. These field surveys may be done either before or after the map manuscript is compiled from aerial photographs.

Before publication, each quadrangle map is edited for content, legibility, accuracy, and spelling and placement of names.

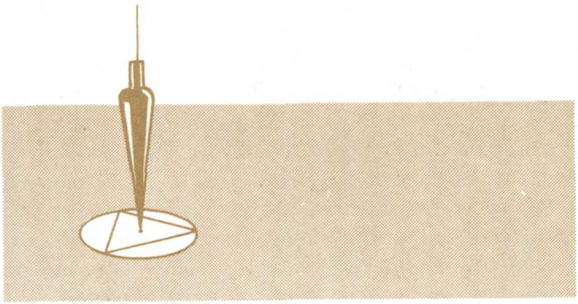
Electronic distance-measuring device

Stereoplotting instrument



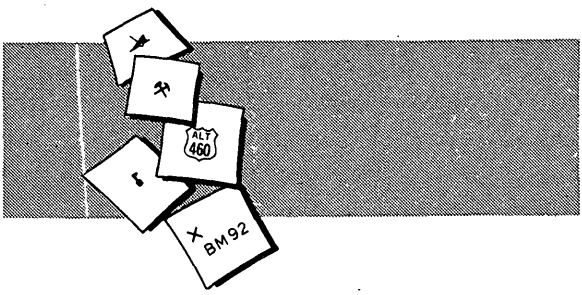


This stereoplotting instrument is used to compile topographic map detail from a pair of overlapping aerial photographs. To provide a three-dimensional model of a portion of the earth's surface, one photograph is projected through a red filter, the overlapping photograph through a blue filter. The compiler wears special eyeglasses of corresponding colors.



NATIONAL STANDARDS

for the horizontal and vertical accuracy of topographic maps were adopted in 1941, and maps that meet these standards carry a statement to that effect in the lower margin. The standards for horizontal accuracy require that at least 90 percent of the well-defined map points shall be plotted correctly within one-fiftieth of an inch on the published map. This tolerance corresponds to 40 feet on the ground for 1:24,000-scale maps and about 100 feet on the ground for 1:62,500-scale maps. The standards for vertical accuracy require that at least 90 percent of the elevations interpolated from the contour lines shall be correct within one-half the contour interval.

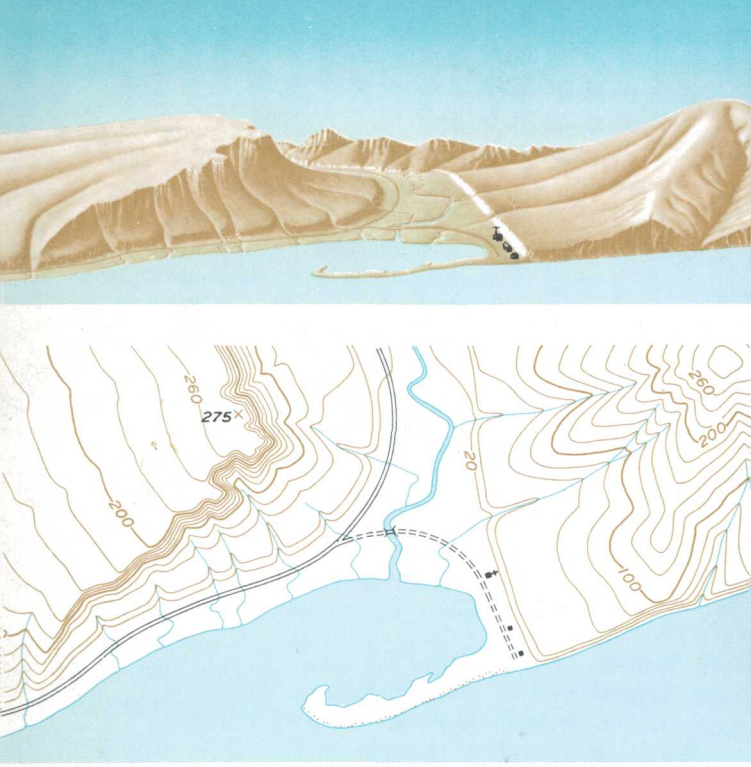


SYMBOLS are the graphic language of maps—their shape, size, location, and color all have special significance.

On topographic maps published by the Geological Survey the colors in which symbols are printed indicate the general classes of map features they represent. Symbols for water features are printed in blue; manmade objects—roads, railroads, buildings, transmission lines, and many others—are shown in black; and green is used to distinguish wooded areas from clearings. The symbols that show the shape and elevation of the land surface—the distinguishing characteristic of topographic maps—are printed in brown.

Some map symbols are pictographs, which resemble the objects they represent, but the brown contour lines are abstractions that have no counterpart in nature; they are an effective device for representing the third dimension on flat paper. Practice and imagination are required to visualize hills and valleys from the contours of a topographic map; but once this ability is acquired, the topographic map presents a third dimension that is useful in many ways.

Some of the features depicted on a topographic map are illustrated in the accompanying bird's-eye view of a river valley and the adjoining hills. The river flows into a bay which is partly enclosed by a hooked sandspit. On both sides of the valley are terraces through which streams have cut gullies. The hill on the right has a smoothly eroded form and gradual slopes above a wave-cut cliff, whereas the one on the left rises to a steep slope from which it falls off gently and forms an inclined tableland crossed by a few shallow gullies. An unimproved dirt road and bridge provide access to a church and two houses situated across the river from an improved light-duty road which follows the seacoast and curves up the river valley.



The lower illustration shows the same features represented by symbols on a topographic map. Elevations are represented by contour lines; the vertical difference between contours in this illustration is 20 feet.

To understand the contour symbol, think of it as an imaginary line on the ground which takes any shape necessary to maintain a constant elevation above sea level. The shoreline shown on the map illustration is, in effect, a contour representing zero elevation or sea level. If the sea should rise and cover the land, the shoreline would trace out, in turn, each of the contour lines shown on the map. Since the vertical difference in elevation between contours in this example is 20 feet, the shoreline would coincide with a new contour each time sea level rose 20 feet.

For easier reading, index contours (every fourth or fifth contour, depending on the contour interval) are accentuated by making the lines heavier. Supplementary contours, used to depict features which the basic contours do not adequately portray, are shown as dashed or dotted lines. Figures in brown at intervals along contour lines give the elevations of the lines above sea level. The elevation of any point can be read directly, or interpolated between contours. Map users who are concerned with quantitative measurement of terrain features can determine this basic data from map contours.

To the map user who is not concerned with exact ground elevations but only with the general appearance and shape of the land, maps with relief shading are useful. The pictorial effect of contoured topographic features is emphasized by simulating the appearance of sunlight and shadows. By overprinting the conventional map with shading, the illusion of solid, three-dimensional land surface is given. The maps for which shaded-relief editions are available are listed in the Indexes to Topographic Mapping for each State. Usually they are selected for areas of special topographic or recreational interest.

Water features are printed in blue and are generally classified as either perennial or intermittent. Perennial water features contain water most of the year (except for infrequent and extended periods of drought), and are shown by solid lines. Intermittent water features contain water only part of the year and are indicated by broken lines. Single lines represent rivers, streams, canals, and ditches less than 40 feet wide on 7½-minute quadrangle maps, or less than 80 feet wide on 15-minute maps. Larger streams and rivers are shown to scale, with double lines. Large bodies of water usually are shown with a light blue tint.

The blue line marking the limits of the coastal waters represents mean high water, always at a higher level than the contour reference datum, mean sea level. Quadrangle maps that include seacoasts and tidal waters sometimes show depth curves, soundings, some obstructions to navigation, and other marine detail of interest. These maps, however, should not be used for navigation.

Two classes of buildings are distinguished by symbols on quadrangle maps. Buildings intended to shelter human activities are shown by a solid or a cross-hatched symbol; those intended for the protection of machinery, animals, or materials are shown with an open-outline or a hatched symbol. Buildings such as sheds, smaller than the average dwelling, are not shown.

Heavily built-up city areas, larger than approximately three-fourths of a square mile, are shown with a red-tint overprint. Within the tinted area only the streets and landmark buildings are shown, such as schools, churches, public buildings, and other structures that are prominent because of their outstanding size, design, or historic associations. The limits of the tinted area usually do not coincide with the legal boundary of the municipality.

On recent maps, red is used to represent or emphasize certain map features, such as the more important roads, fence lines, and the boundary lines of townships, ranges, sections, and land grants in the States subdivided by public-land surveys. Public-land lines and civil boundaries (the latter shown in black) are mapped as accurately as possible using information obtained from documentary records and field investigations. The lines shown on the map are not intended to show conclusive evidence of land ownership or of boundary locations.

Maps published by the Geological Survey are intended to give a picture of the terrain that is as complete as can be legibly reproduced at the selected publication scale. The standards for map content have been developed over many years, and changes are adopted only after careful consideration of their effect on the needs of map users, as well as the cost and operational problems involved. Relatively unimportant features are sometimes omitted, and many small but important features are exaggerated in size to make them readable. Some features are mapped because of their relative importance on a regional basis, such as wells and springs in the arid Western States; other features, such as windmills and fence lines, are mapped for their value as landmarks.

The symbols most commonly used on topographic maps are illustrated on pages 16 and 17.

Geographic names are recognized as an integral and important part of a quadrangle map. Much effort is made to establish correct map nomenclature, which is based primarily on present-day local usage. Name controversies are referred to the Board on Geographic Names, an interdepartmental agency established by law to determine choice, spelling, and application of geographic names for Federal usage.

TOPOGRAPHIC MAP SYMBOLS

Hard surface, heavy-duty road

Hard surface, medium-duty road

Improved light-duty road

Unimproved dirt road

Trail

Railroad: single track

Railroad: multiple track

Bridge

Drawbridge

Tunnel

Footbridge

Overpass—Underpass

Power transmission line with located tower

Landmark line (labeled as to type) TELEPHONE

Dam with lock

Canal with lock

Large dam

Small dam: masonry — earth

Buildings (dwelling, place of employment, etc.)

School—Church—Cemeteries Cem

Buildings (barn, warehouse, etc.)

Tanks; oil, water, etc. (labeled only if water) Water Tank

Wells other than water (labeled as to type) Oil Gas

U.S. mineral or location monument — Prospect

Quarry — Gravel pit

Mine shaft—Tunnel or cave entrance

Campsite — Picnic area

Located or landmark object—Windmill

Exposed wreck

Rock or coral reef

Foreshore flat

Rock: bare or awash

Horizontal control station

Vertical control station BM 671 672

Road fork — Section corner with elevation 429 58

Checked spot elevation 5970

Unchecked spot elevation 5970

VARIATIONS WILL BE FOUND ON OLDER MAPS

Boundary: national

State

county, parish, municipio

civil township, precinct, town, barrio

incorporated city, village, town, hamlet

reservation, national or state

small park, cemetery, airport, etc.

land grant

Township or range line, U.S. land survey

Section line, U.S. land survey

Township line, not U.S. land survey

Section line, not U.S. land survey

Fence line or field line

Section corner: found—indicated

Boundary monument: land grant—other

Index contour

Supplementary cont.

Cut — Fill

Mine dump

Dune area

Sand area

Tailings

Intermediate contour

Depression contours

Levee

Large wash

Tailings pond

Distorted surface

Gravel beach

Glacier

Perennial streams

Water well—Spring

Rapids

Channel

Sounding—Depth curve

Dry lake bed

Intermittent streams

Aqueduct tunnel

Falls

Intermittent lake

Small wash

Marsh (swamp)

Inundated area

Woodland

Submerged marsh

Orchard

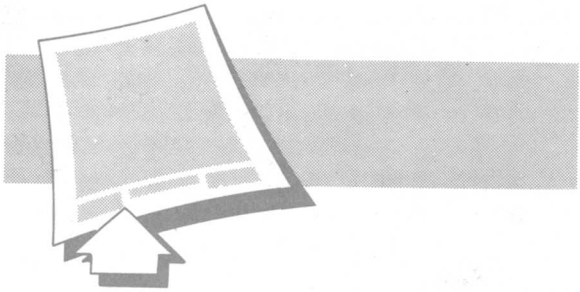
Vineyard

Mangrove

Scrub

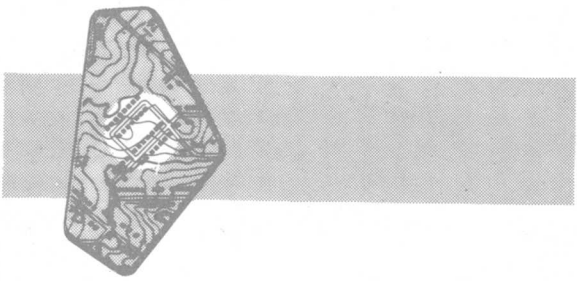
Wooded marsh

Bldg. omission area



MAP MARGIN, the space outside the projection lines on published maps, is used to identify and explain the map. The marginal information corresponds somewhat to the table of contents and introduction of a book, telling briefly how the map was made, where it is located, what agency prepared it, and other information to make the map more useful.

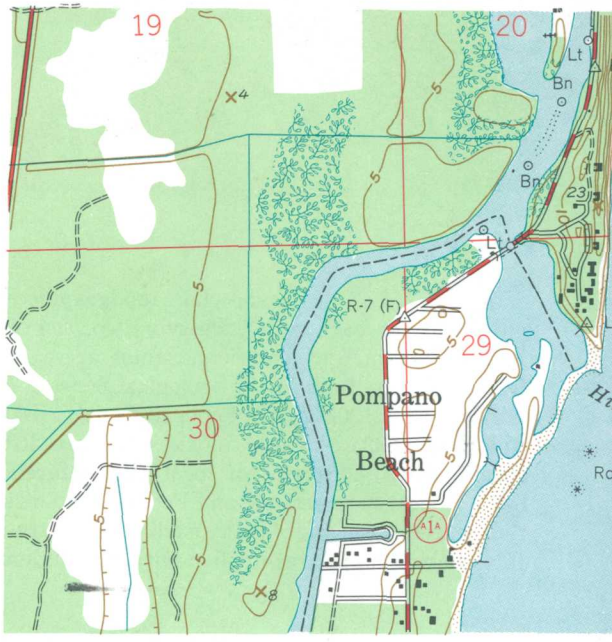
The year in which the map was field inspected or last revised is shown in the lower right corner, under the map name. Only features existing at this date are shown on the map.



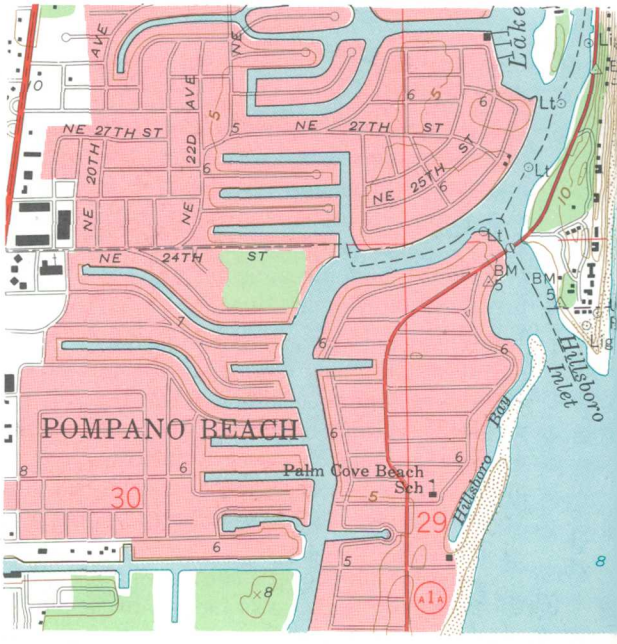
MAP REVISION is needed to show changes in manmade features, such as new roads, buildings and reservoirs, and changes in the shape of the terrain. The rate and amount of change varies greatly from urban to remote areas, therefore maps are not all revised at definite intervals and to the same extent. The needs of map users for up-to-date maps that meet modern standards are considered in selecting maps for revision.

Revision methods vary, but usually are a combination of photogrammetric, field, and cartographic procedures designed to bring the map content up to date and to maintain or improve the original accuracy of the map.

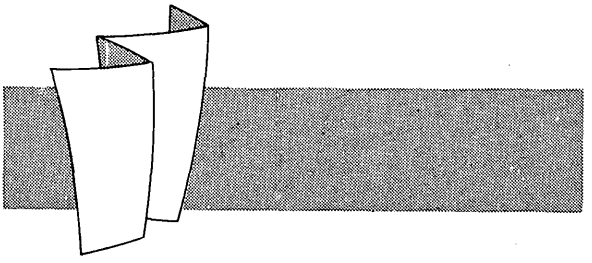
WHY MAPS MUST BE REVISED



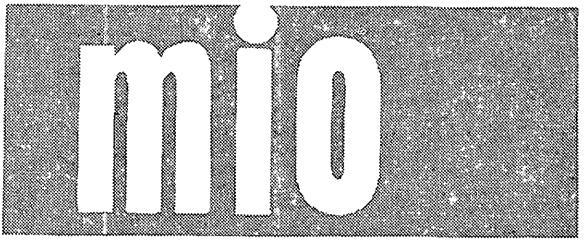
Mapped in 1946



Revised in 1962



INDEXES showing topographic maps published for each State, Puerto Rico, the Virgin Islands, Guam, and American Samoa are available free on request to the U. S. Geological Survey, Washington, D. C. 20242, or Federal Center, Denver, Colorado 80225. These indexes contain lists of special maps, addresses of local map reference libraries, local map dealers, and Federal map distribution centers. An order blank and detailed instructions for ordering maps are supplied with each index.



THE MAP INFORMATION OFFICE, maintained by the Geological Survey, collects, organizes, and distributes, free on request, information about the availability of map coverage, aerial photography, and geodetic control in the United States, and information about the activities of Federal mapping agencies and some State and private organizations.

Index maps are published periodically to show the status of aerial photography, including aerial photomosaics, and the agencies which hold the photographs. Aerial photographs obtained by the Geological Survey, except those subject to security restrictions, are generally for sale to the public. Requests for prints from negatives held by other agencies are referred to those agencies.

Lists describing geodetic control established by the Geological Survey are also for sale to the public provided there are no security restrictions. Further information can be obtained without charge on request to the Map Information Office, U.S. Geological Survey, Washington, D. C. 20242.

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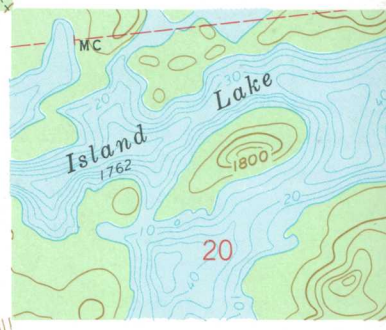
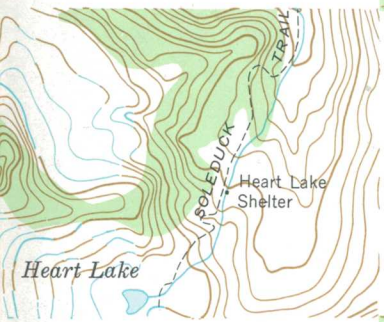
TOPOGRAPHIC MAPS FOR RECREATION

HUNTING



FISHING



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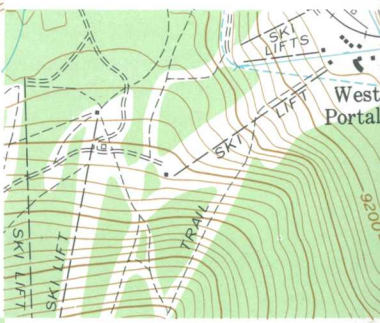
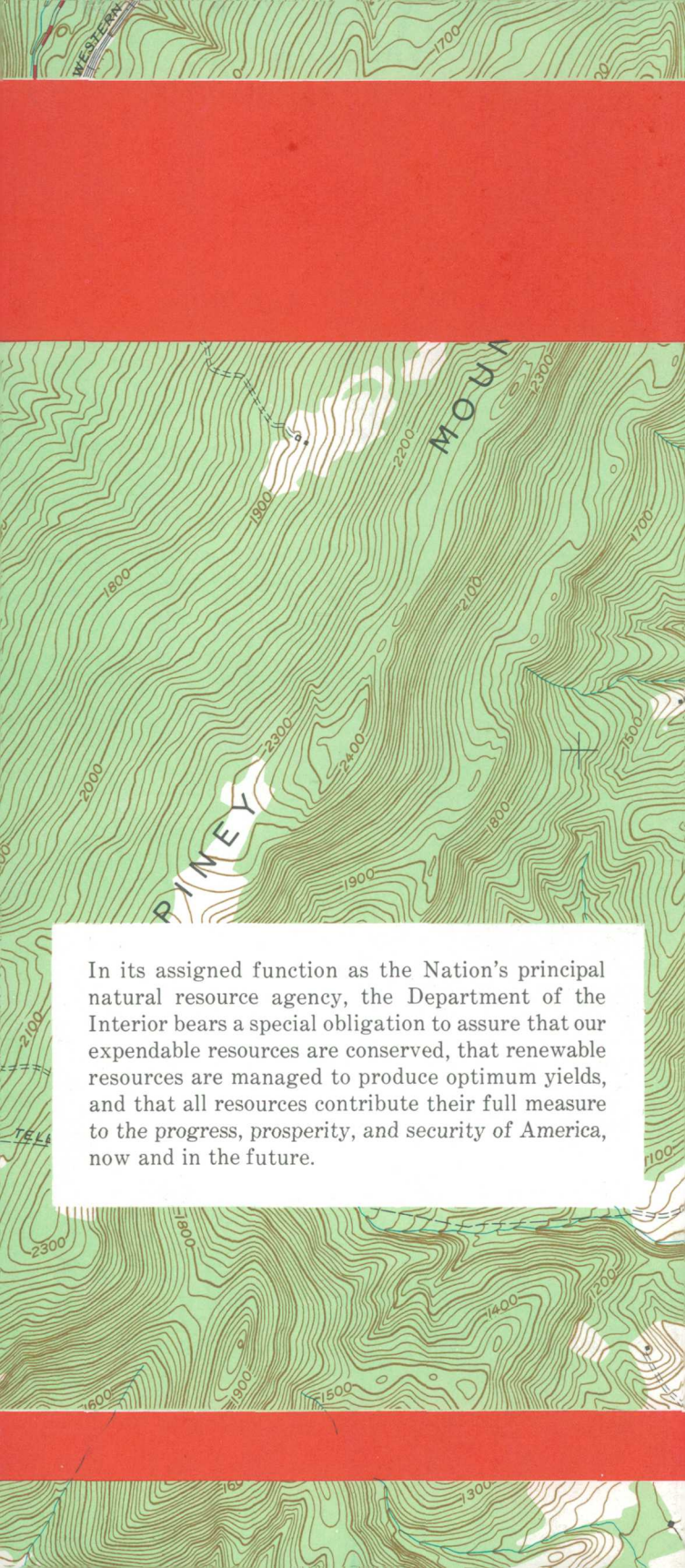


SKIING

CAMPING



In its assigned function as the Nation's principal natural resource agency, the Department of the Interior bears a special obligation to assure that our expendable resources are conserved, that renewable resources are managed to produce optimum yields, and that all resources contribute their full measure to the progress, prosperity, and security of America, now and in the future.