GOVERNMENT OF GUAM
OFFICE OF THE GOVERNOR
AGANA, GUAM

EXECUTIVE ORDER NO. 75-37

AMENDMENT TO EXECUTIVE ORDER NO. 75-16:

UNIFORM GRID SYSTEM

WHEREAS, the Uniform Grid System as provided for in Executive Order No. 75-16 dated March 27, 1975 is by its nature related to, and interdependent on, the graphical presentation of such grid data; and

WHEREAS, it is more efficient to assimilate and present such uniform grid data on a uniform series of maps rather than on unrelated maps; and

WHEREAS, a uniform series of maps is dependent on a common scale for each series;

NOW, THEREFORE, I, RICARDO J. BORDALLO, Governor of Guam, by virtue of the authority vested in me by the Organic Act of Guam, as amended, do hereby amend Executive Order No. 75-16 to read as follows:

1. The Uniform Mapping System recently adopted by the Bureau of Planning shall henceforth be the standard mapping system for the Territory of Guam:

    (a) The map series of said system shall be those as provided for in the "Manual of Specifications and Procedures" for the Guam Uniform Grid System as prepared by the Bureau of Planning, dated August 14, 1975, and any amendments thereto.

2. This Order shall be effective immediately.

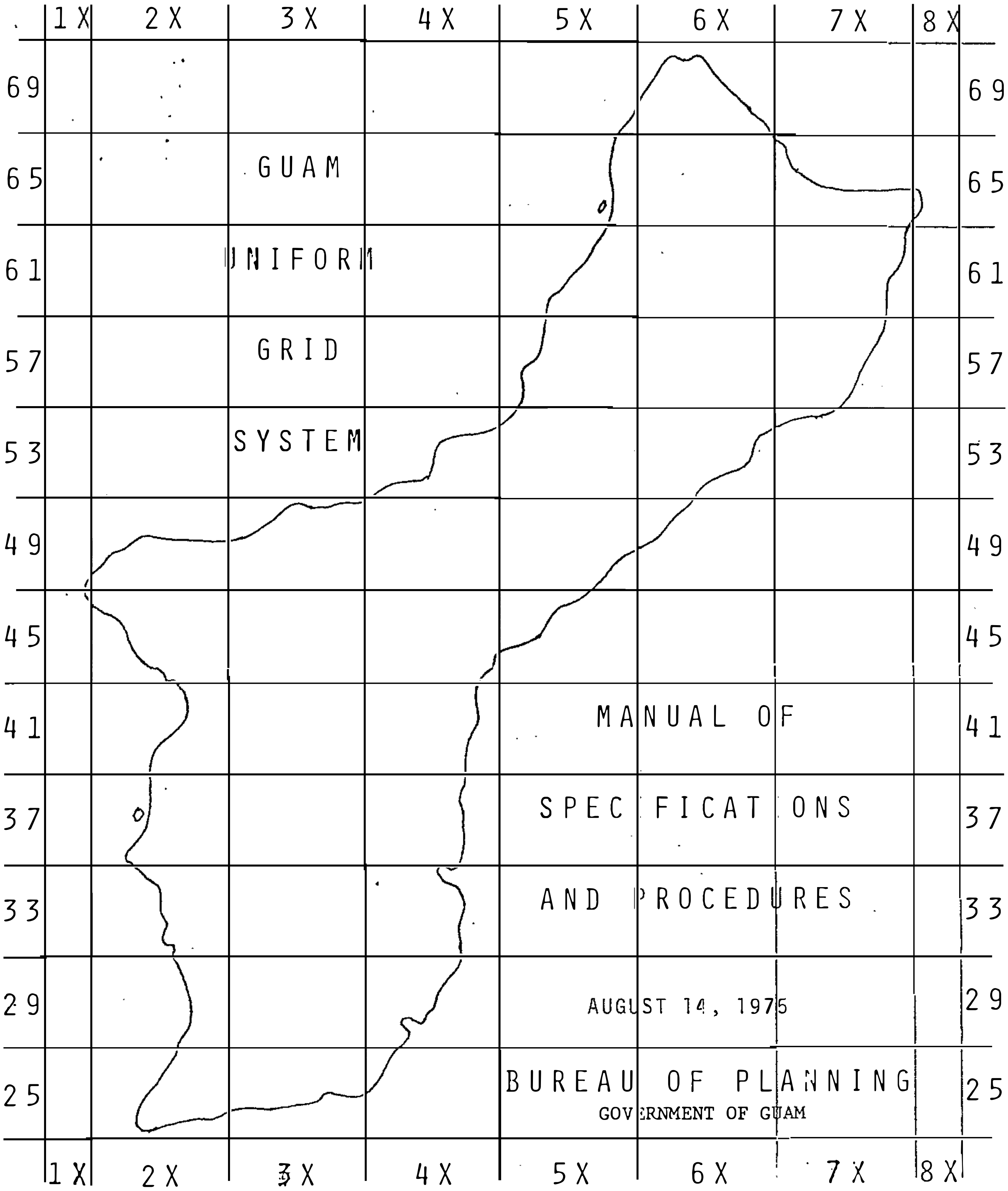
SIGNED AND PROMULGATED IN THE CITY OF AGANA on this 15th day of August, 1975.

RICARDO J. BORDALLO
Governor of Guam

COUNTERSIGNED:

RUDOLPH G. SABLAN
Lieutenant Governor

TERRITORY OF GUAM



GUAM UNIFORM GRID SYSTEM

MANUAL OF SPECIFICATIONS AND PROCEDURES

AUGUST 14, 1975

BUREAU OF PLANNING
GOVERNMENT OF GUAM

PREFACE

The concept of a locator system based on a grid is not something new to Guam. As early as 1913 the "Land Square" grid system was introduced and has been extensively used in land records and surveys. The logic of the Land Square grid followed the best concepts of the time period in which it was developed and served well for many years. Other grid systems and variations of the Land Square grid were tried from time to time but were little used. During the years of slow progress and relatively few changes, these grid systems were sufficient. With the rapid growth in the late 1960's and early 1970's serious problems were encountered in attempting to collect and correlate data due to the diverse grids used by the various government agencies.

With the passage and approval of Public Law 12-200, Comprehensive Development Planning, the requirements for an information system and data bank in the newly created Bureau of Planning focused renewed attention on the grid system problem. A study was made of existing systems and found that none of them could be made compatible with the modes of modern computerized data systems without complicated revisions. Further studies with input from interested agencies resulted in agreement on a standard grid which is closely related to past grids and also computer compatible. This standard grid system, named the "Uniform Grid System," was officially adopted for all government agencies by Executive Order No. 75-16 dated March 27, 1975. The Bureau of Planning was assigned the responsibility of coordinating system development and providing standard specifications and procedures for the guidance of all users.

Parallel to a grid system is the need for a means of graphic display to portray the relative location of data for visual inspection and interpretation. A standard grid could be overlayed on existing maps; however, a series of maps at common scales provides a more efficient means of collecting and correlating data. A standard mapping system has been developed to complement the Uniform Grid System. This system, known as the "Uniform Mapping System," standardizes base maps to facilitate collection and display of data concerning the numerous activities affecting Comprehensive Development Planning for Guam.

This first edition of a "Manual of Specifications and Procedures" is intended as an introduction to the Uniform Grid System and Uniform Mapping System. As these systems progress, additions to this manual and, where necessary, amendments will be prepared. Comments and users' suggestions are invited and should be addressed to the Director, Bureau of Planning.

Billy G. Huckaby
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Uniform Grid System Coordinator

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Director, Bureau of Planning

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PRINCIPLES OF THE UNIFORM GRID SYSTEM

The Uniform Grid System follows the principles of Cartesian coordinates from geometry as these are applied in the plane coordinate systems of surveying and mapping. From geometry we begin with the basic idea of locating a point or points in relation to two mutually perpendicular lines. This is modified by the conditions imposed by fitting a plane surface to the round earth. Further, to avoid the use of negative signs in computations, an origin other than the intersection of the zero axis is selected and positive coordinate values assigned to this point. The application of these principles as they have been used on Guam is first reviewed to provide a basic background for users of the Uniform Grid System. None of the mathematical formulas are given as these are not necessary to understanding the grid and making full use of it.

CARTESIAN COORDINATES

Cartesian coordinates were invented for geometry to deal with the mathematical relationship of objects on a plane surface or in three dimensional space. For the present we are only concerned with two dimensions on a plane surface. Location of a point is determined by its distance in two directions from a pair of mutually perpendicular axes. (See Diagram 1)

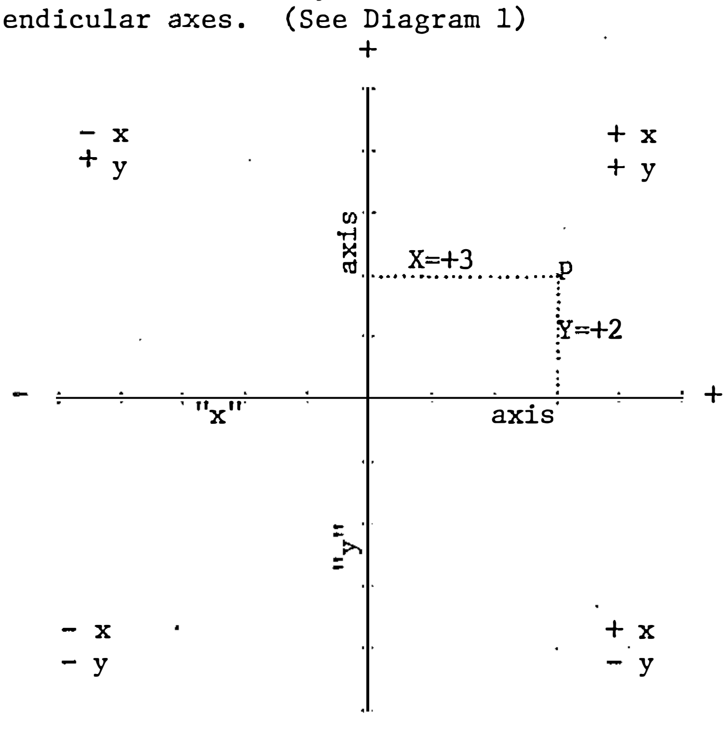


Diagram 1

Point "p" is located by its distance of 3 units in the "X" direction from the vertical axis and 2 units in the "Y" direction from the horizontal axis. In analytic geometry the location of "p" is defined by the terms X=+3 and Y=+2 or simply by (+3,+2). By common usage it is understood that the "X" distance is expressed first, followed by the "Y" distance. The unit of measure may vary depending on requirements, but it is usually expressed in decimal form for convenience.

PLANE COORDINATES

When applying the principles of Cartesian coordinates to location of points on the earth's surface minor modifications are introduced. First, the vertical (y) axis is oriented to a north-south direction and the horizontal (x) axis is oriented east-west. Next, a point is selected near the center of the area to be grided and referenced to the geographic latitude and longitude at that point. For an area as small as Guam, the plane coordinate system is assumed to be tangent to the earth's surface at this one point. The y-axis parallels the true meridian at the point of tangency or "origin." This origin is assigned a plane coordinate value large enough that only the first quadrant of the Cartesian system is used. This assures that all X and Y points have positive values and do not need a positive or a negative algebraic sign. (See Diagram 2)

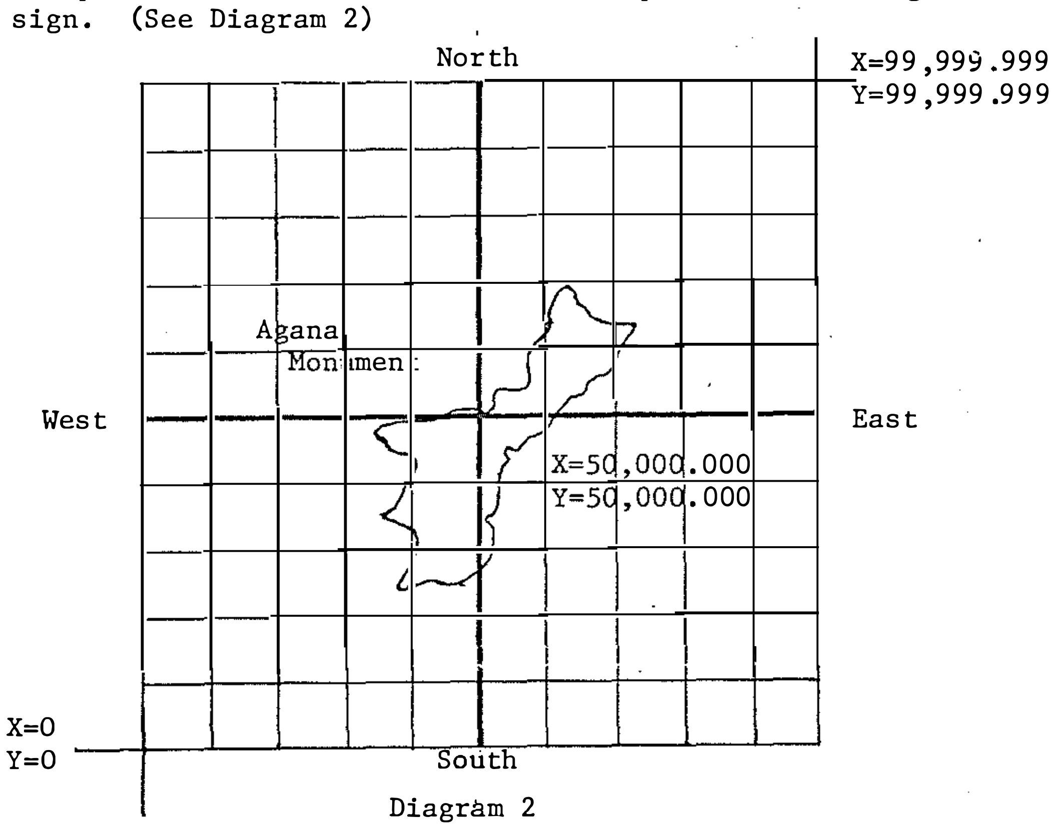


Diagram 2

GUAM PLANE COORDINATES

The plane coordinate system for Guam is defined in Publication 62-4 of the U. S. Department of Commerce, Environmental Science Services Administration, Coast and Geodetic Survey. It was officially adopted by Guam under Chapter 9, Title XIV of the Government Code and is referred to locally as the "Guam Geodetic Triangulation Net." The origin is Agana Monument at latitude 13° 28' 20".87887 North and longitude 144° 44' 55".50254 East. The assigned plane coordinate values of the origin are X = 50,000 meters and Y = 50,000 meters. The Guam plane coordinate values can be applied to a square area 100 kilometers by 100 kilometers centered at the Agana Monument using positive values only. Any point within this area can be identified by its "X" and "Y" value expressed in meters or decimal parts of a meter with from 2 to 16 digits.

AREA VERSUS POINT LOCATION

Fundamentally, Cartesian coordinates were designed to deal with the location of infinitely small points rather than with areas. However, in practical planning situations we rarely deal with points but rather with areas of various shapes and sizes. By proper expansion of the principles of Cartesian coordinates, we can accommodate both regular square areas and irregular shaped areas. We will define first the location of regular square areas and then the location of irregular shaped areas.

For ease in locating objects and for statistical analysis of the spatial distribution of such objects, it is convenient to use a square as a basic unit. Consistent size and shape simplifies in the mind of the user the relative location of each unit in respect to other units. Of many possible regular shapes the square fits ideally within a plane coordinate system. The Cartesian coordinates can be interpreted as applying not only to the point identified but also to all the square following up to the next point one unit larger in both X and Y value. (See Diagram 3)

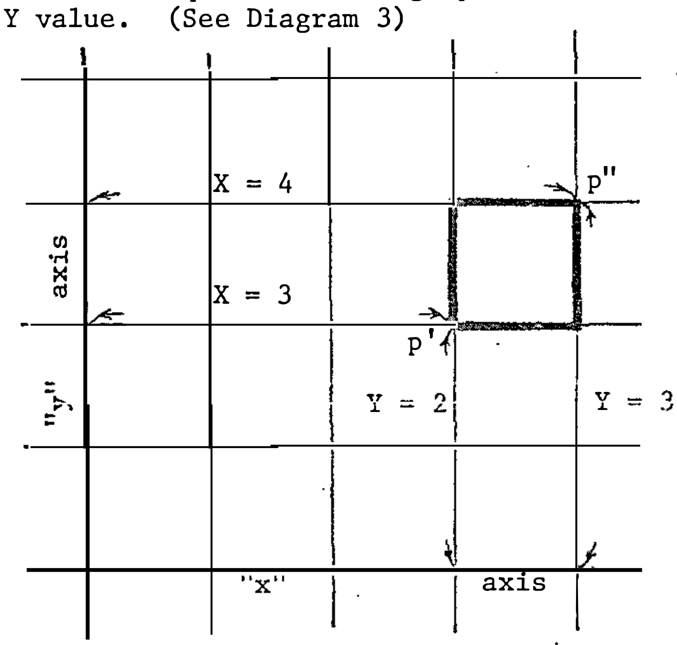


Diagram 3

The square area can be identified by X=3, Y=2 (point p') and is understood to extend to X=4, Y=3 (point p"). This sets the bounds of a square measuring one unit on each side. Square size can be varied depending upon the unit of measurement and increased or decreased by a factor of ten by altering the number of significant digits used.

This system of adjoining squares provides a means to collect data common to each square. This assimilation of data into identical blocks, squares, or "cells" can then be correlated and manipulated by digital computers. Spatial relationships and the distribution and density of objects within any combination of cells can be studied and analyzed. Using computer programs already developed, data assimilated into cells can be automatically plotted for bar graph or schematic map displays.

The location and identification of individual irregular shaped objects can also be accomplished by use of Cartesian coordinates. For precise location it is sometimes desirable to define each irregular shaped object by a series of points defining the perimeter of the object. However, the requirements of location only without precise description can be accomplished by identification of one critical point only. The specifics of the perimeter may be stored in auxiliary data files. The "para-centroid" of an object has been chosen for use in the Uniform Grid System as the critical point used to identify and locate irregular shaped objects. The "para-centroid" is generally defined as the approximate (visual) center. A specific means of determining the para-centroid will be covered in detail later in this manual.

One of the most common irregular shaped objects pertinent to planning is a parcel of land. (See Diagram 4)

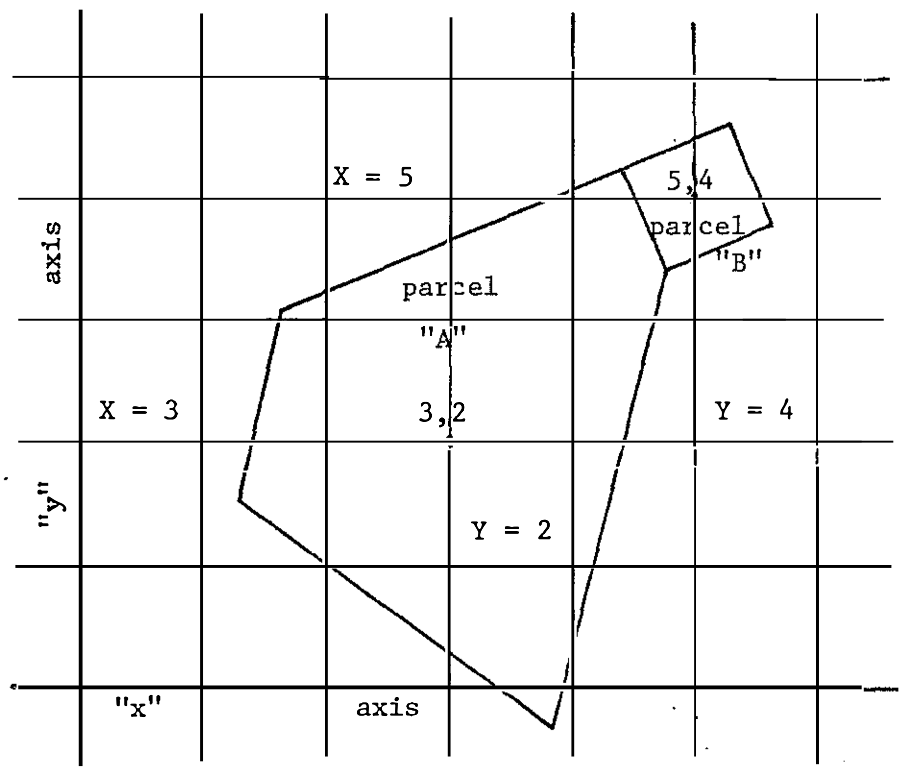


Diagram 4

For any parcel of land, regardless of shape, the identifier is determined by the coordinates of its para-centroid. The coordinates of the para-centroid are unique for each parcel and provide an identification which is unique to that one specific parcel. The shape of the object and the size has no effect on the identifier. Parcel "A" is idenfified by X=3, Y-2 while Parcel "B" is identified by X=5, Y=4.

CELL SIZE FOR GUAM

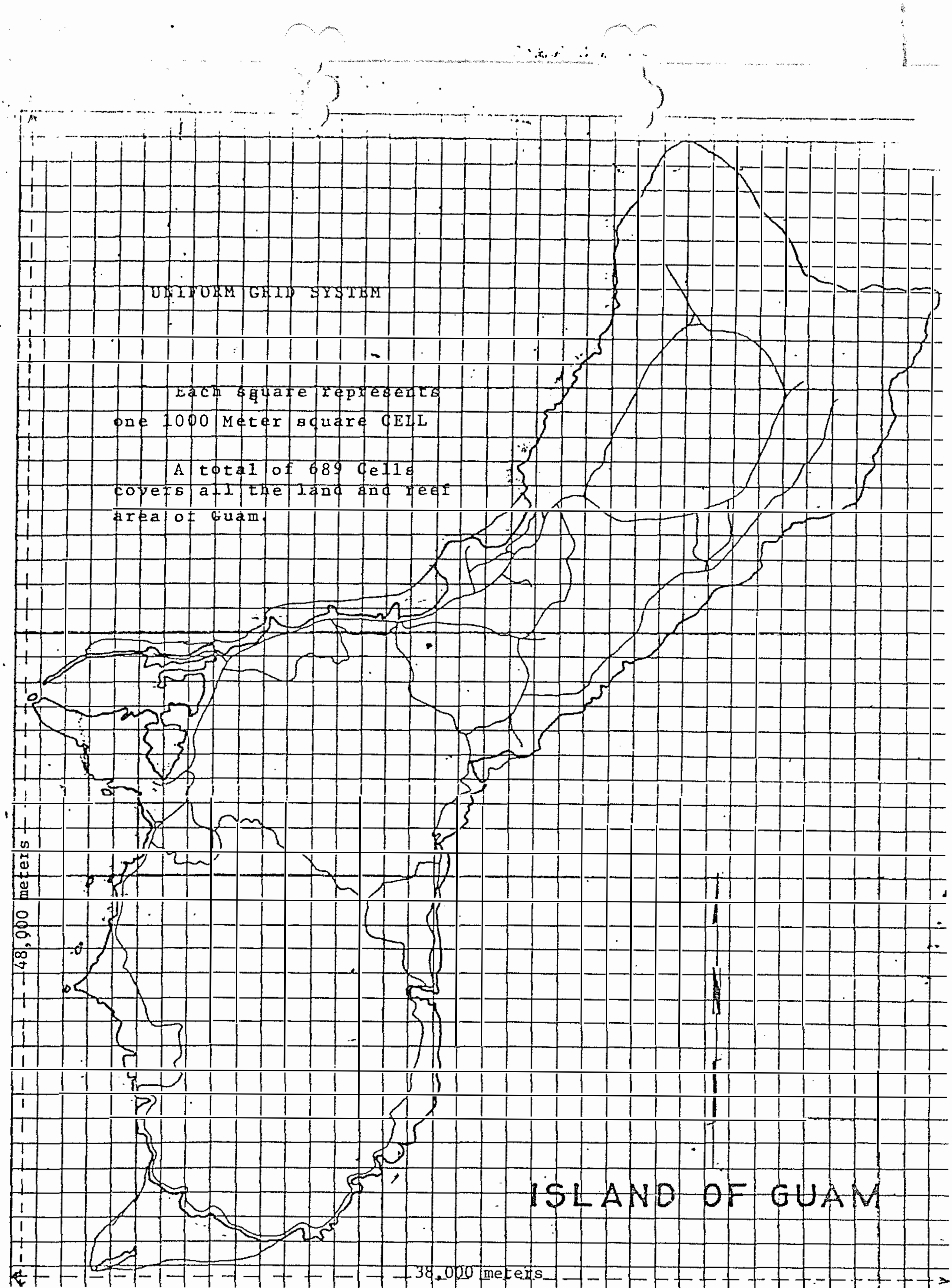
In selection of appropriate cell size for Guam a few considerations are paramount. To begin with the Guam plane coordinate system uses meters as the basic unit of measurement. In examining the position of Guam on the plane coordinate grid, the island occupies a rectangular area extending 38,000 meters in an east/west direction and 48,000 meters in a north/south direction. This covers the total land and surrounding reefs of Guam. Using a cell with 1,000 meter sides, we are considering 38 units in the X direction and 48 units in the Y direction. Such a cell having sides of 1,000 meters is ideal for collecting most general planning data and has been selected as the primary cell for the Uniform Grid System.

(See Diagram 5 on Page 6)

The 1,000 meter cell serves well in counting such things as houses, streets and other objects of similar size. For smaller objects more densely congregated, a cell only 100 meters square would be better. Such a cell size provides a more specific location for each object and on the ground covers an area which an individual's senses can entirely perceive. It is useful in statistical analysis in differentiating more distinctly the characteristics of an area under study. These two cell sizes, 1,000 meters square and 100 meters square, will in most cases be sufficient for location and for an information system and data bank.

CELL COMBINATIONS

In planning a system of standard base maps, it is not always possible to maintain strict adherence to the primary 1,000 meter cells or to the 100 meter cells. The optimum area to be covered by each map of a series depends on several factors, such as scale, sheet size and supplemental data to be included in a legend. Map sheet coverage for each series is often more satisfactorily achieved by combinations of the 1,000 meter or 100 meter cells into larger groups. These combinations for the major map series are described in detail as each map series is defined. Where special maps for areas not fitting into the standard series are needed, combinations can be made to cover the situation.


UNIFORM GRID SYSTEM
Each square represents one 1000 Meter square CELL
A total of 689 Cells covers all the land and reef area of Guam.
48,000 meters
ISLAND OF GUAM
38,000 meters
Diagram 5

IDENTIFIERS OF THE UNIFORM GRID SYSTEM

NUMERICAL VALUES AS IDENTIFIERS

For digital computers the use of numerical values only as identifiers is ideal and the Uniform Grid System was designed with this primary application intended. In a two-dimensional spatial system identifiers may be divided into three cases: (1) points, (2) regular shapes, and (3) irregular shapes. As mentioned earlier in this manual, each case can be accommodated in the plane coordinate system.

POINT IDENTIFIERS

In the case of points we are usually involved with very small objects, such as property corners, power poles, fire hydrants, street signs, manholes, etc. Such objects are most often less than one meter square in area or less. In certain objects, such as survey control monuments or property corners, we are theoretically attempting to define an infinitely small point. From a practical viewpoint the smallest object identifiable is about one millimeter square. Considering this limit we can "point identify" small objects by their X and Y coordinate values given to the nearest millimeter. Within the limits of Guam this will require an X value to 8 digits and a Y value to 8 digits or a total of 16 digits. An example is Agana Monument which is identified as X = 50,000.000 and Y = 50,000.000. For an object such as a fire hydrant, the 16 digits would refer to the approximate center of the object and no other identifier would be possible within the area actually occupied by the fire hydrant.

REGULAR SHAPE IDENTIFIERS

In the case of regular shapes we are concerned with the two cells used in the Uniform Grid System. The primary 1,000 meter square cell requires a 4 digit identifier - 2 digits for the X value and 2 digits for the Y value. The X value is always given first followed by the Y value. Thus, for a 1,000 meter cell identified as 6552, it would mean X = 65,000 and Y = 52,000. For the smaller cell size of 100 meters by 100 meters, a 6 digit identifier would be needed. A subdivision of the 1,000 meter cell 6552 may be 653527. This would identify the 100 meter cell at X = 65,300 and Y = 52,700. This same principle could be continued down to a 10 meter cell or even a one meter cell. However, such small cells would rarely be useful and are not included as a common part of the Uniform Grid System, but could be used in special situations without disrupting the system.

IRREGULAR SHAPE IDENTIFIERS

For the identifier of irregular shaped objects, the plane coordinates of the para-centroid are employed. For physical planning purposes, we are concerned most of the time with objects having an area greater than one square meter. These are objects large enough to be occupied by people, such as houses, sections of streets, parcels of land, etc. which usually

THE UNIFORM MAPPING SYSTEM

SCOPE OF UNIFORM MAPPING SYSTEM

The purpose of the Uniform Mapping System is to standardize general mapping used by all agencies of the Government of Guam. Standards are intended to apply to all mapping at scales of 1:2,000 and smaller. Surveying maps, engineering maps and mapping for similar special projects at scales of 1:1,200 (1" = 100') and larger are not covered within the standard map series. However, the Uniform Grid System shall be included on all such large scale maps for the purpose of identification.

The primary unit of measurement in the Uniform Mapping System is the meter. Metric ratio scales are used on all maps at the scale of 1:5,000 and smaller. Until full metric conversion is possible, maps at scales of 1:4,800 (1" = 400') and larger will remain in the foot system. In all maps the scale is expressed as a representative fraction with a numerator of one, and on foot system maps the ratio of inches to feet is provided as secondary information. The Uniform Grid System shall be shown on all maps with a secondary foot system grid added as applicable.

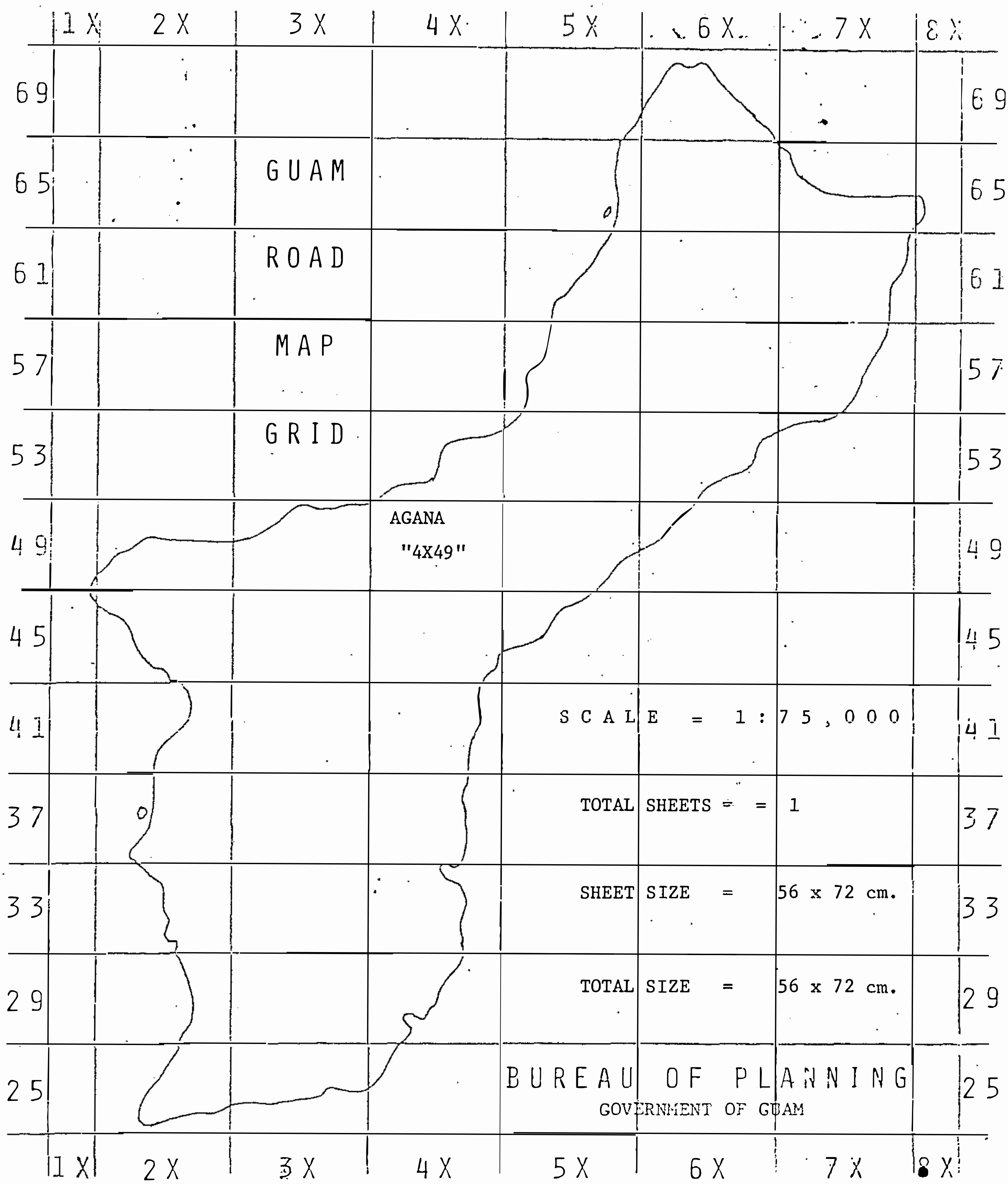
UNIFORM MAPPING SYSTEM SCALES

A set of scales has been selected for the Uniform Mapping System with a series of maps designed around each scale selected. Each scale and map series is intended to provide a graphic tool applicable to planning, public and special needs. The selected map series are as follows:

Series Name	Scale
Index Maps	1:100,000 and smaller
Road Map	1:75,000
Outline Map	1:50,000
Wall Map	1:25,000
Street Atlas	1:12,500
General Planning	1:5,000 (1:4,800)
Urban Planning	1:2,000

Each of these map series are explained on the following pages. As each map series is covered, the related alpha-numeric identification system of the Uniform Grid System is included with an explanation of its use.

TERRITORY OF GUAM



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OUTLINE MAP

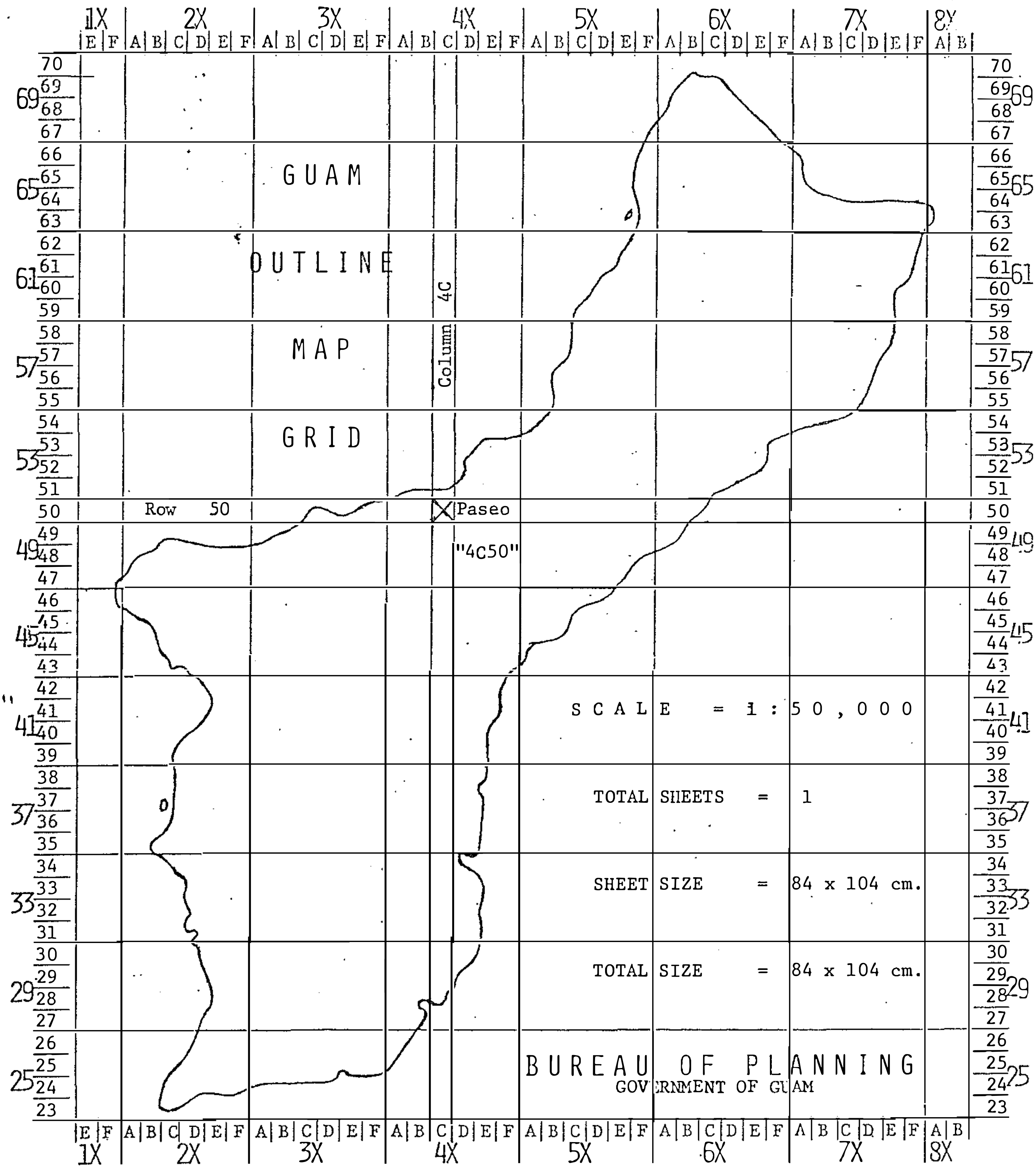
The outline map at a scale of 1:50,000 is designed primarily as a base map on which to collect general planning data and provide a graphical display of island conditions. As an "outline map" only major roads, streets, rivers, villages and important names will be shown. This map is not intended to be used in its original form but only as a base on which other information can be properly located for study and planning purposes. Sheet size is 84 x 104 centimeters (34" x 42") which can be reproduced on most osalid process machines.

(See Map on Page 13)

The major grid across the map will be the same as on the 1:75,000 road map. In addition to this, the single 1,000 meter grid will be shown along the edges of the map sheet with alpha-numeric labels. When these grid marks are joined, a location within a 1,000 meter cell is possible.

For 1,000 meter location, the columns 1X through 8X are divided into six parts labeled A through F. The column identifier for a 1,000 meter column is then a number-letter combination, such as 4A, 4B, 4C, 4D, 4E or 4F. The rows are identified by the 1,000 meter grid line at the south limit of the 1,000 meter cell and numbered from 23 to 70, corresponding to the equivalent 1,000 meter "Y" value of the Uniform Grid System. An example would be the Paseo located in column 4C and row 50 identified as "4C50."

GUAM UNIFORM GRID SYSTEM



WALL MAP.

The wall map at a scale of 1:25,000 is intended as a general location map for use in operational supervision and planning. Drafted on four sheets, it may be assembled into one map with a total size of 164 x 204 centimeters (65" x 80"). This size can be accommodated on one wall of an office or staff room and properly oriented to facilitate understanding and location by 1,000 meter cell identifiers.

(See Map on Page 15)

The grid on the map will be shown at 1,000 meter intervals with the 6,000 meter column lines and 4,000 meter row lines heavier. This grid relates the map to the smaller scale road map and also relates to the sheets of the larger scale maps described below.

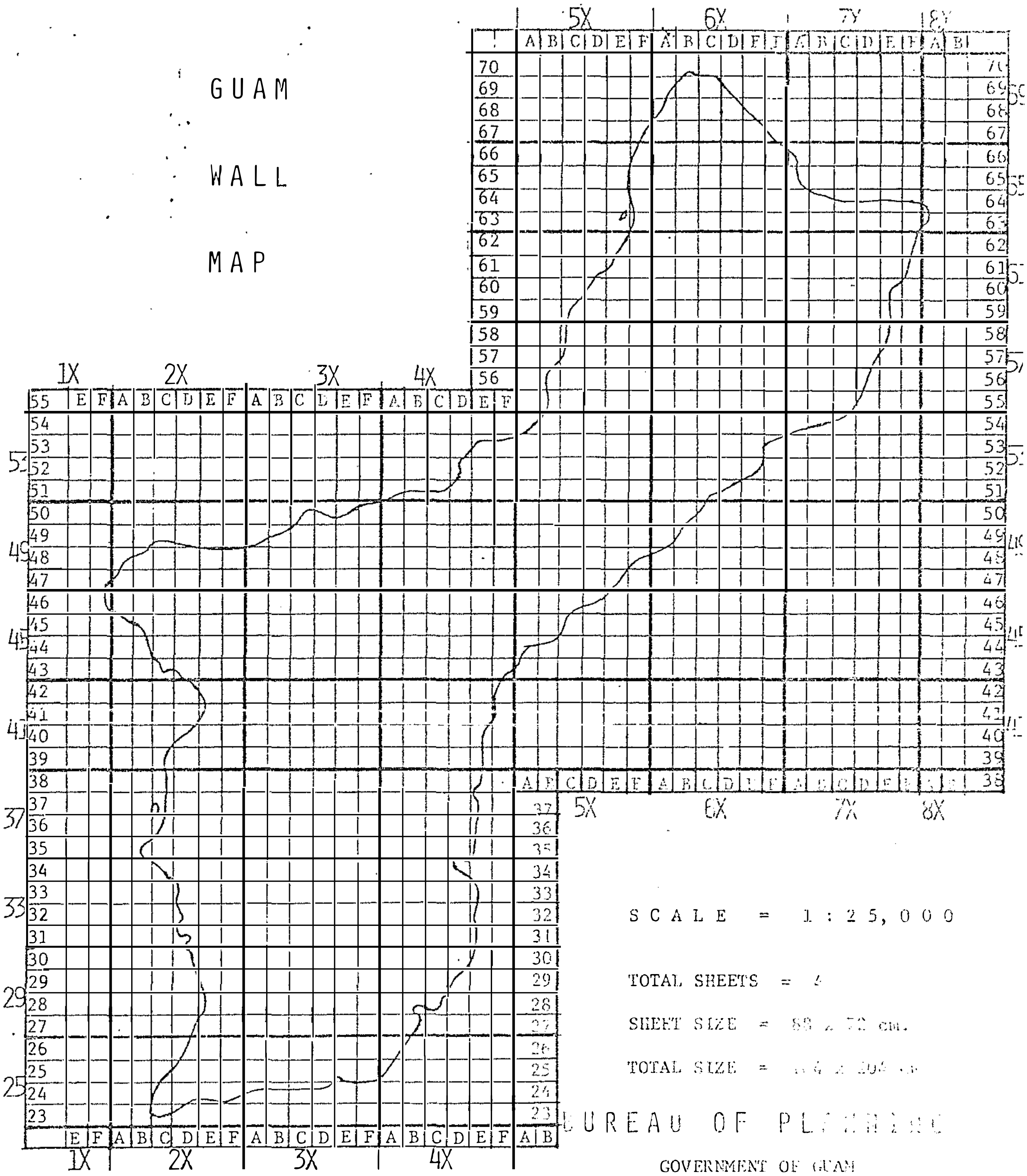
The map will be prepared in two forms which may be combined into a third product. The first form will be an orthophoto map giving a complete picture of the island. The second form will be a line map with name data and the grid with identifier labels. These two forms may be used separately and each has its own uses. Also, the line map can be reproduced as a transparent overlay to the orthophoto map. This will provide the detail of the orthophoto with the added information of names and location.

GUAM UNIFORM GRID SYSTEM

GUAM

WALL

MAP



SCALE = 1 : 25,000

TOTAL SHEETS = 4

SHEET SIZE = 88 x 72 cm.

TOTAL SIZE = [illegible]

BUREAU OF PLANNING

GOVERNMENT OF GUAM

STREET ATLAS

The Guam Street Atlas at a scale of 1:12,500 is designed for field use of government agencies to locate major facilities, roads, streets and structures. Each sheet of the Street Atlas covers one of the 6,000 meter by 4,000 meter areas shown on the smaller scale maps. On this format each 1,000 meter grid line is shown and the alpha-numeric grid identifier for each 1,000 meter cell is given so that location by column and row is possible.

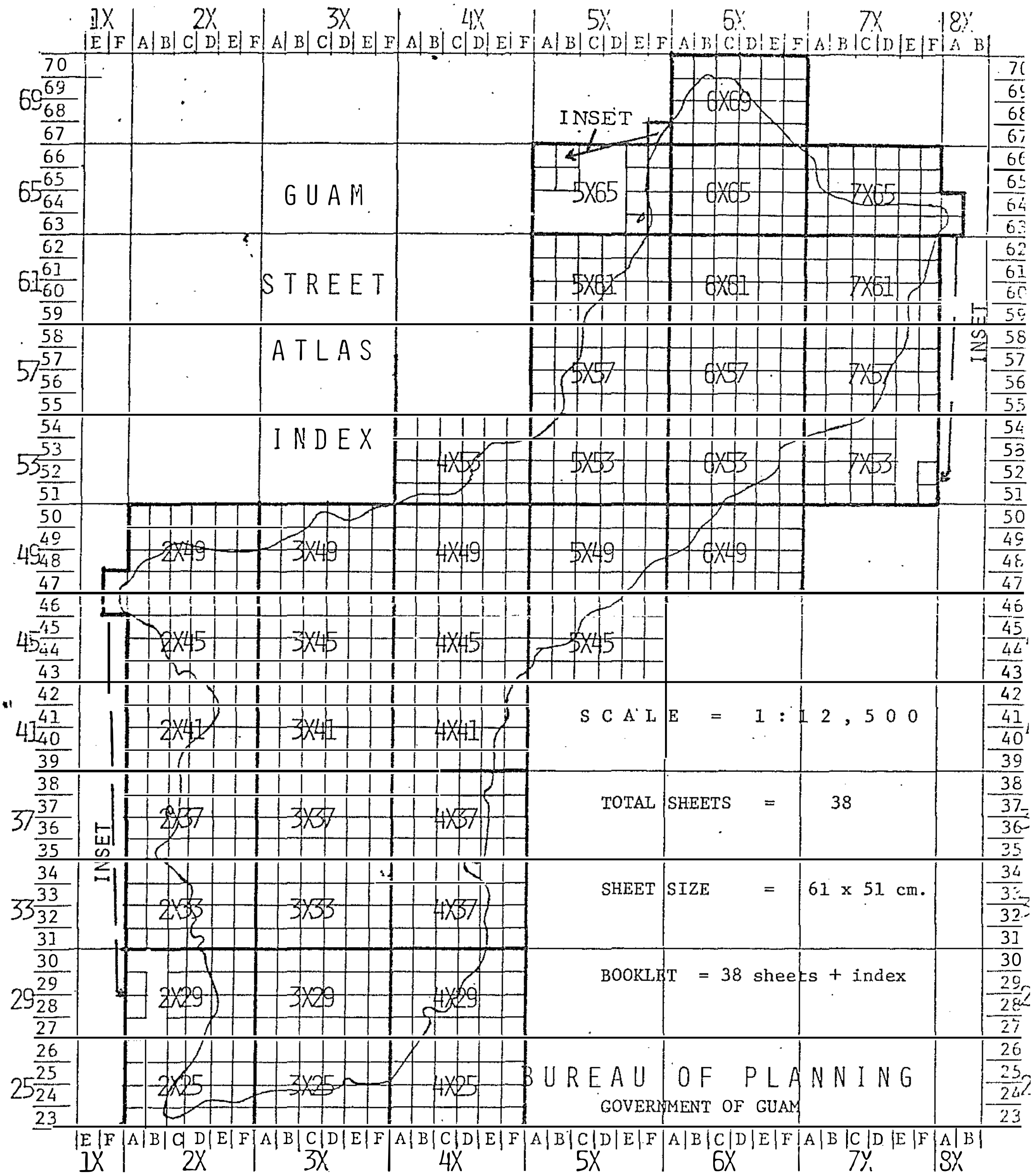
(See Index Map on Page 17)

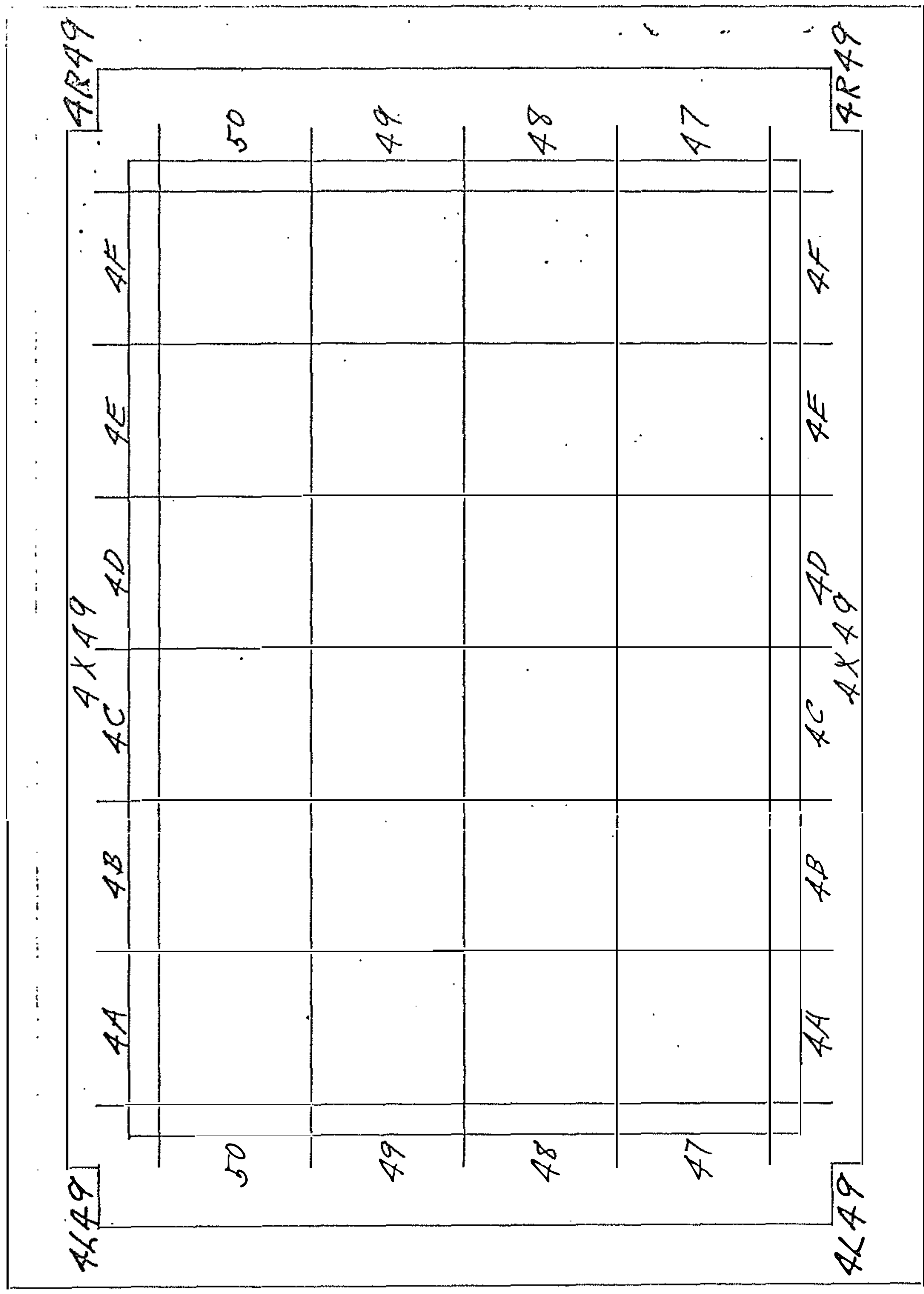
(See Sample Sheet on Page 18)

The basic Street Atlas Map will be a street line map only. The reef line and shoreline will be shown to outline the island; and in the undeveloped areas with no roads, important rivers and streams will be shown. All traveled ways will be shown for emergency access to any area with names of streets and roads provided wherever possible. The boundaries of municipalities and of military areas with names will also be shown.

The street atlas sheets measure 61 x 51 centimeters (24" x 20") and can be reproduced by photographic contact printing in order to maintain accurate scale. For ozalid reproduction processes, a sheet size of 61 x 46 centimeters (24" x 18") is adequate. The base sheets are also designed so that each may be divided into a left-half and right-half to be assembled into booklet form approximately 35 x 42 centimeters (14" x 17").

GUAM UNIFORM GRID SYSTEM




4RA9
50
49
48
47
4F
4E
4D
4XA9
4C
4B
4A
4LA9

GENERAL PLANNING

Maps for general planning are at the scale of 1:5,000 or 1:4,800 (1" = 400'). The foot system scale will be used in initial mapping until a firmer commitment to total metric conversion has been established. This series is designed as the largest practical scale at which entire island coverage can be obtained within economic limits. Complete orthophotographic mapping providing the most detail possible will be used. This will be supplemented by contours at 10' intervals combined with the orthophotography.

(See Map on Page 20)

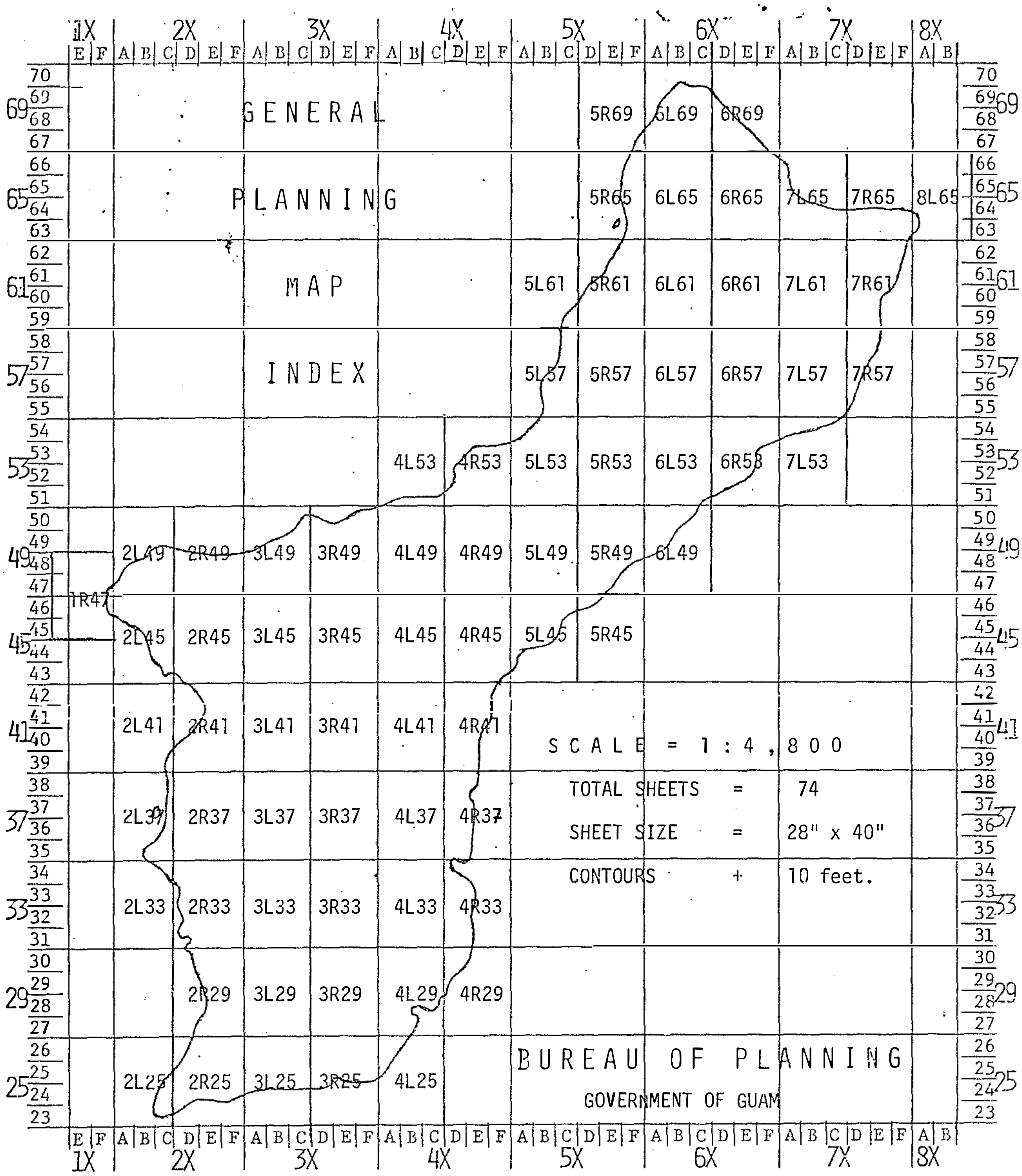
The sheet layout for the general planning maps is identical to the left-half and right-half sheets of the 1:12,500 scale Street Atlas series described above. A total of 74 sheets provides total island coverage.

In addition to the basic orthophotographic/contour maps, overlays are to be prepared for such data as property lines, road right-of-ways, utility structures, etc. Each sheet is standardized at 28" x 40" and both metric grid lines and foot grid lines will be shown on the base maps.

URBAN PLANNING

Maps for Urban Planning are at a scale of 1:2,000. A complete series for the entire island is not necessary at this scale and therefore only selected areas will be mapped as needed and as funds are available. Normally, each map sheet will cover a single 1,000 meter cell but exceptions may be made to more economically cover an area of study. In any case, sheet limits shall be in increments of 100 meters and sheets shall be oriented in a normal north-south and east-west direction in either square or rectangular cell combinations.

GUAM UNIFORM GRID SYSTEM



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