To the Virginia Geological Survey with the compliments of the author,
Dave Larrabee

LANDSLIDES IN A PART OF FAIRFAX COUNTY, VIRGINIA, AND THEIR RELATIONS TO THE POTOMAC GROUP OF SEDIMENTARY FORMATIONS-- A GUIDE TO THESE RELATIONS IN THE METROPOLITAN WASHINGTON AREA

By

David M. Larrabee, Geologist

April, 1972

SUMMARY

This map indicates the approximate distribution of the Potomac Group of sedimentary formations,--and the close relations of landslides to members within the Group in the east-central part of Fairfax County,--the only place where landslides had been shown on a map available to me at the time of compilation in 1971.

The purpose of the map is to clearly indicate any possible correlation between the Potomac Group and landslides, past, present, and future--and if any are found, to serve as a warning in future land use decisions, highway planning, and subsurface development.

Such a correlation definitely has been established, as evidenced in the southwestern part of the map, where landslide "control" data had been established in 1966, and in other areas since that time.

* * *

The project, done as a voluntary contribution to the Engineering Geology of the area, was suggested by Charles F. Withington, as Secretary of the Baltimore-Washington Section of the Association of Engineering Geologists, and a member of the United States Geological Survey, who has observed many active landslides in Metropolitan Washington over a period of 10 years. The study also was encouraged by Henry W. Coulter, of the Engineering Geology Branch of the U. S. Geological Survey, who also has observed landslides in the area.

The compilation was made in 1971, following my retirement from the U. S. Geological Survey. Progress has been slow and the results incomplete as a result of my health.

The project was assisted materially by C. S. Coleman, Soil Scientist for Fairfax County, Virginia, who enthusiastically discussed the project with me, and kindly furnished a copy of his "Map showing present known limits of soils having clay subsoils that have a high shrink swell potential." This map was released in January, 1966.

His map, showing approximate areas of known landslides at that time, prepared on a planimetric base with a scale of 1 inch equals 4,000 feet, was compiled chiefly from aerial photographs having a scale of 1 inch equals 400 feet, and later field-checked. Mr. Coleman has since observed many landslides, past, present, and areas of potential future landslides not shown on his map. All are within the Potomac Group of formations. He graciously drove me to many sites of

past and presently active landslides on March 21, 1972. All of these have seriously affected the planning or development of apartment complexes, a major motel, proposed shopping districts, and major highways. A recent slide, for instance, was being removed from such a highway at the time of our visit. This slide had completely blocked the highway the day before. I am deeply indebted to Mr. Coleman for his interest, encouragement, and assistance.

* * *

The Potomac Group, of Upper Cretaceous age, (deposited about 70 million years ago) includes deposits of sand, gravel, silt, and clay. Two formations of prime importance in the development of landslides are the Patapsco and Arundel clays. When water-saturated weight of these and overlying sediments, where present land slopes exceed 15 per cent (about 22 per cent in parts of the Metropolitan Washington area, as reported orally by Withington), where gravel deposits have been removed to expose these clays to saturation at higher elevations, or where the "toes" of natural slopes composed of the Potomac Group have been removed by road cuts or for building foundations, etc., such areas are particularly susceptible to landslides.

My map was prepared by compiling the outlines of the Potomac Group, on paper topographic maps (in contrast with a stable-base material such as Cronaflex), as presented on the map of "Sedimentary Formations of Washington, D. C., and Vicinity," by N. H. Darton of the U. S. Geological Survey, in 1947. His map was printed at a scale of 1 inch equals 2,640 feet, on a topographic base map prepared in 1913-1915, revised in 1941 and 1942, without benefit of Aerial photography.

It was necessary for me to rescale the geology in order to show it on the newer topographic maps of the U. S. Geological Survey, scale 1 inch equals 2,000 feet, and which had the benefits of aerial photography in 1955, revised in 1965. Such maps are not only more accurate in details of original topography, but also show many highways and building developments since the time of Darton's base map, all of which have changed much local topography. Of course, many more such developments and highways have been built since 1965, (now shown on new topographic quadrangles revised with 1971 photography, published in 1972), and these changes are not included on my map. The changes between 1947 and 1965, alone, have resulted in my map being considered only approximate in some places.

The accompanying map includes all of the Potomac Group and a little of the Raritan Formation (as shown by Darton) in the Annandale, Falls Church, Alexandria, and the southeastern and southwestern parts of the Washington West topographic quadrangles. No geology in the District of Columbia north of the Anacostia River and east of the Potomac River has been included. Thus, the map is primarily concerned with parts of Fairfax and Arlington Counties, and the City of Alexandria, Virginia.

With the evidence presented in the southwestern part of the map, and other slides observed by Coleman and Coulter, I personally predict landslides elsewhere in that County, in Alexandria, and in Arlington County wherever the Potomac Group is present,--and conditions conducive to slides such as mentioned elsewhere are present or become so; in fact, I suspect such slides already have occurred in Alexandria and in Arlington County.

* * *

Xerox copies on vellum of my map, from which Ozalid copies may be made, are being distributed to Mr. Clarence S. Coleman, Soils Scientist for Fairfax County, Mr. P. B. Hall, Director of Public Works for the City of Alexandria, and Mr. William L. Hughes, Director, Department of Environmental Affairs, Arlington County. Of course, I also have such a copy, should prints be desired. The original compilation and a vellum copy have been given to Mr. Walter A. Schreiber, Executive Director of the Metropolitan Washington Council of Governments, by whom the original study was approved for the use of the Council.

* * *

My original plan was to recompile the Potomac Group, and other clay-bearing formations as the Raritan, Nanjemoy, and Calvert Formations, which crop out in southeastern Washington and Prince Georges County, Maryland (for all are potentially hazardous as to landslides) for the entire area of the Metropolitan Washington Council of Governments (COG), and plot up-to-date reported landslides on this map. I am unable to complete the map of such a large area--necessary as such a map is for the total area--with all the associated new housing developments, highways , and the underground transportation routes of Metro, which probably will encounter some of the landslide--susceptible formations.

* * *

The preparation and use of such a map of the Metropolitan Washington area could do much to avoid the future tragic loss of private homes and yards, even human life during trenching operations for private and public buildings, by the failure of foundations of private enterprises, and the unexpected tax load resulting from bridge failures, highway slides, and in the failure of foundations for public buildings, among other things. It is hoped that such a map will be prepared in the near future by some organization or persons, including geologists and soil scientists. Until such a map is available, I encourage study and use of Darton's map, and the Geologic Map of Prince Georges County, published by the Maryland Geological Survey at John Hopkins University in Baltimore.

Note to users: This map has not been technically reviewed by the U. S. Geological Survey, and the text is most definitely not designed to fit the "normal pattern" of publications of the U.S.G.S.

REFERENCES USED

Coleman, C. S., 1966, Map showing present known limits of soils having clay subsoils that have a high shrink-swell potential: Fairfax County, Va.; scale 1 inch equals 4,000 feet.

Darton, N. H., 1947, sedimentary formation of Washington, D. C. and Vicinity, U. S. Geological Survey Map; scale 1:31,680 (or 2,640 feet to the inch).

ADDITIONAL REFERENCES

Cooke, C. Wythe, and Cloos, Ernst, 1951, Geologic Map of Prince Georges County and the District of Columbia: Maryland Department of Geology, Mines and Water Resources; scale 1:62,500 (approximately 1 inch equals 1 mile).

Johnson, Paul M., 1964, Geology and ground water resources of Washington, D. C. and Vicinity: U. S. Geological Survey Water Supply Paper 1776; 97 p., 2 maps, scale 1:62,500, (1 inch equals approximately 1 mile).

United States Department of Agriculture, Soil Conservation Service, in cooperation with Maryland Agricultural Experimental Station, 1967: Soil Survey, Prince Georges County, Maryland.

VIRGINIA DIVISION OF
RECEIVED
MAY 4 1972
MINERAL RESOURCES

5406 Surrey St.
Chevy Chase, MD 20015
May 2, 1972

Dr. James L. Calver
State Geologist
Dept. of Conservation and Economic Development
Box 3667
Charlottesville, Va. 22903

Dear Jim:

Thanks for your note of April 14, and the offer to have it reviewed for possible publication.

The delay in my reply is caused by the fact that, having done the job for "C.O.G." at my own suggestion, I felt I needed their permission to have you publish it if you so decide.

Their reply came only this morning, so go ahead if you wish. You may be interested to know that Martin's 1947 map is the ~~only~~ latest published map of the geology of the Nation's Capital!

Incidentally, you might wish to get a copy of Calomiris' fact map — the one I used — as he

shows other landslides (1966) outside of Dartan's map to the south, especially Fort Belvoir and farther south; I have no detailed geologic control for the area but you may have. He says all the slides appear to be in the same conditions, etc.

I enclose copy of the C.O.G. letter for your interest. The change in scale (1" = 800') referred to what now is shown to be a typographical error. As soon as I received his letter I warned him about this.

If you wish to go ahead, have ozalid copies made up from your Xerox, color same, and I'll be glad to proof the job - some of my lines didn't come out too well!

Good luck, and I hope you decide to show the U.S.G.S. that Va. has more up-to-date landslide correlations than they have or have published!

Sincerely yours
Dave Larrabee

see refreshed

Coleman's address:

C.S. Coleman, Civil Litigator
County of Fairfax
Civil Attorney Office
3945 Chain Bridge Rd.
Fairfax, VA. 22030

Also
Please add the two spots shown in orange on the attached overlay, which I somehow missed in the original map. I had since added it to my colored copied (yellow) and my "original" as well as the to the C.O.G. master sheets.

Thanks a lot!

Jane

This has been added to map
JH

metropolitan washington
COUNCIL OF GOVERNMENTS
1225 Connecticut Avenue, N.W., Washington, D. C. 20036 223-6800

April 28, 1972

Mr. David Larrabee
5406 Surrey Street
Chevy Chase, Maryland 20015

Dear Mr. Larrabee,

In response to your letter of the 16th, let me assure you that we do not intend to magnify the scale of your landslide correlation. In fact, by transferring it to 1"=8000' (not 1"=800') we will reduce the margin for erroneous interpretation in your information as you point out in your letter.

As to possible publication by the State of Virginia, please be assured that we have no objection. We are adding your landslide correlation to our regional overlay series, and until such time as the entire region is so mapped, I do not foresee publication by COG. However, we would intend to use it as a working map resource, making it available to those who would have need of it (again, only at 1"=2000' or at a reduced scale).

To answer your third question, the Council of Governments qualifies as a non-profit organization under Section 501(c)3 of the Internal Revenue Code. I would suggest contacting the Internal Revenue Service regarding income tax deduction for the value of your personal expense in preparing the maps.

Again, let me thank you for your generous and skilled contribution to our regional planning effort.

Sincerely,

Walter A. Scheiber
Executive Director

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DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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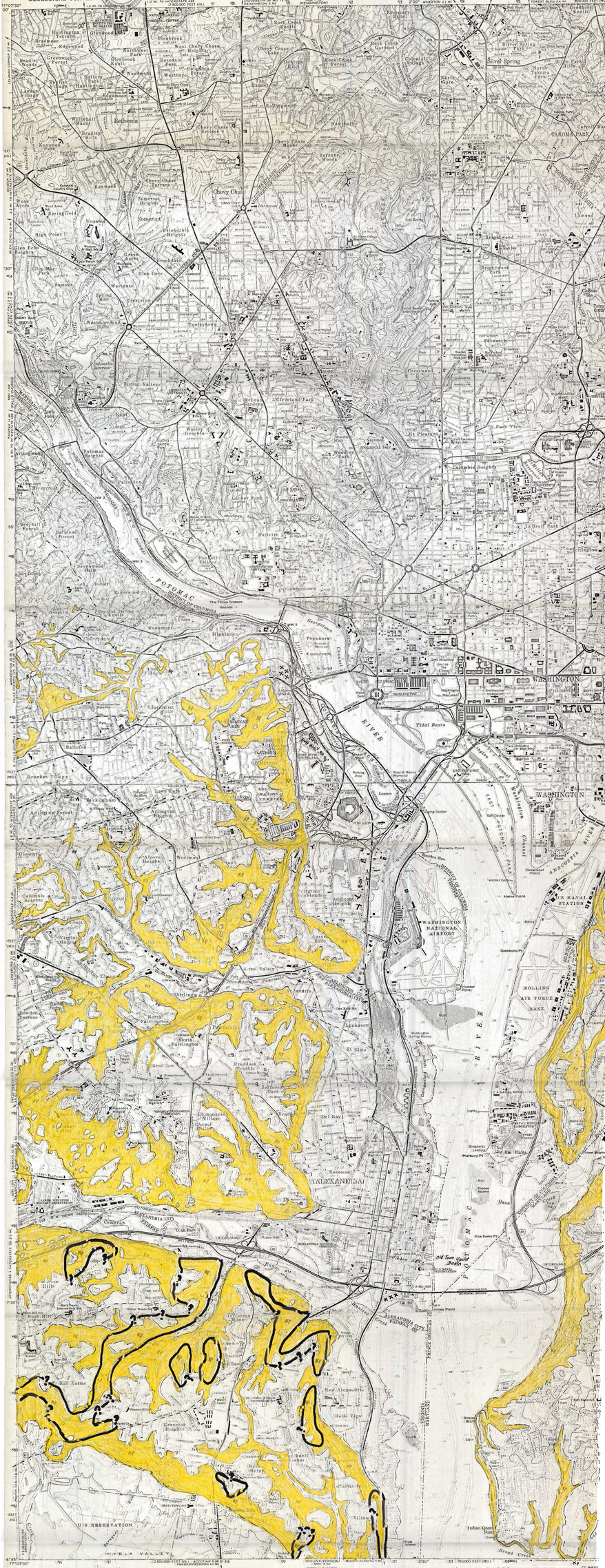

Mapped, edited, and published by the Geological Survey

Control by USGS, USC&GS, USCE, NCPC, and WSSC

Topography by photogrammetric methods from aerial photographs taken 1955. Field checked 1956. Revised 1965

Selected hydrographic data compiled from USC&GS Chart 560 (1965)

This information is not intended for navigational purposes

Polyconic projection. 1927 North American datum
10,000-foot grids based on Virginia coordinate system, north zone, and Maryland coordinate system
1000-meter Universal Transverse Mercator grid ticks, zone 18.
Shown in blue

Red tint indicates areas in which only landmark buildings are shown

Fine red dashed lines indicate selected fence and field lines where generally visible on aerial photographs. This information is unchecked

UTM GRID AND 1965 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 1.8 FEET

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, WASHINGTON, D. C. 20242
AND VIRGINIA DIVISION OF MINERAL RESOURCES, CHARLOTTESVILLE, VIRGINIA
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved
Interstate Route — U.S. Route

GEOGRAPHIC LOCATION

ALEXANDRIA, VA.—
N3845—W7700/
1965
AMS 5561 I SE—SERIES

MAP OF LANDSLIDES IN A PART OF FAIRFAX COUNTY VIRGINIA, AND THEIR RELATION TO THE POTOMAC GROUP OF SEDIMENTARY FORMATIONS - A guide to these relations in the Metropolitan Washington area.

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(Done for the Metropolitan Washington Council of Governments, April, 1972)

EAST SHEET

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FALLS CHURCH QUADRANGLE
VIRGINIA-MARYLAND
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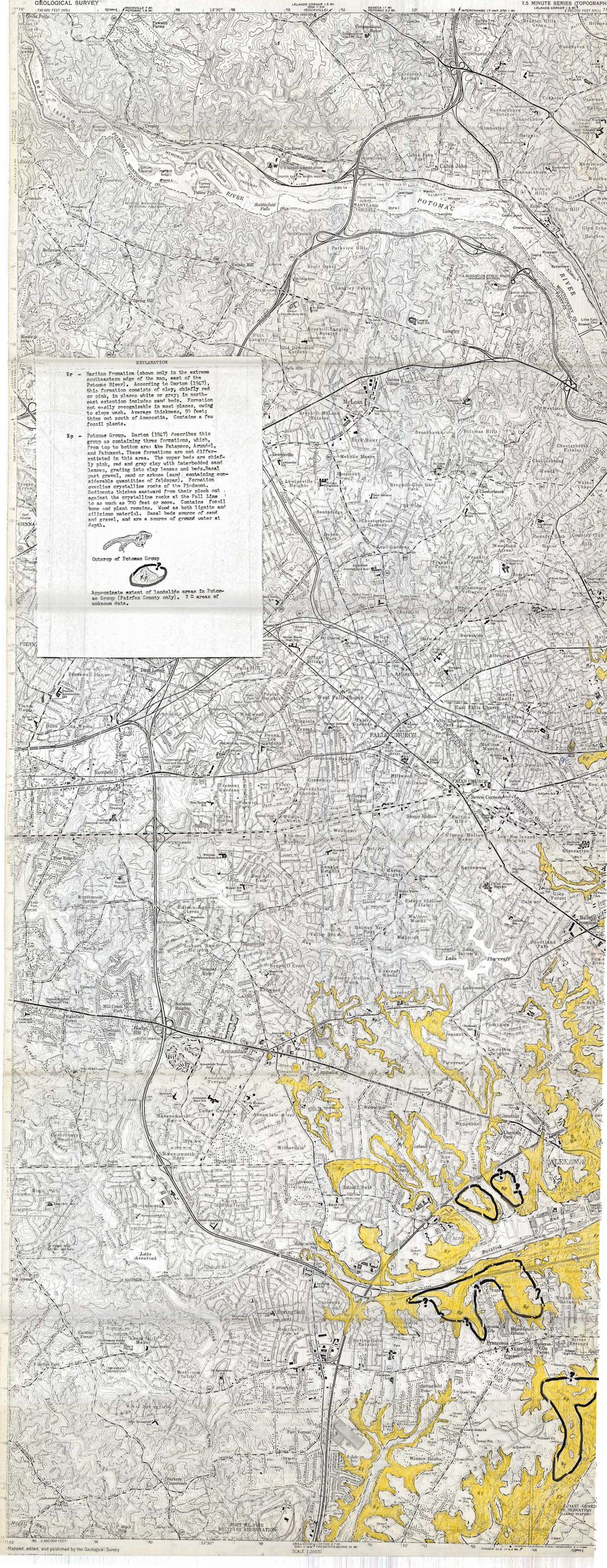

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SCALE 1:24000