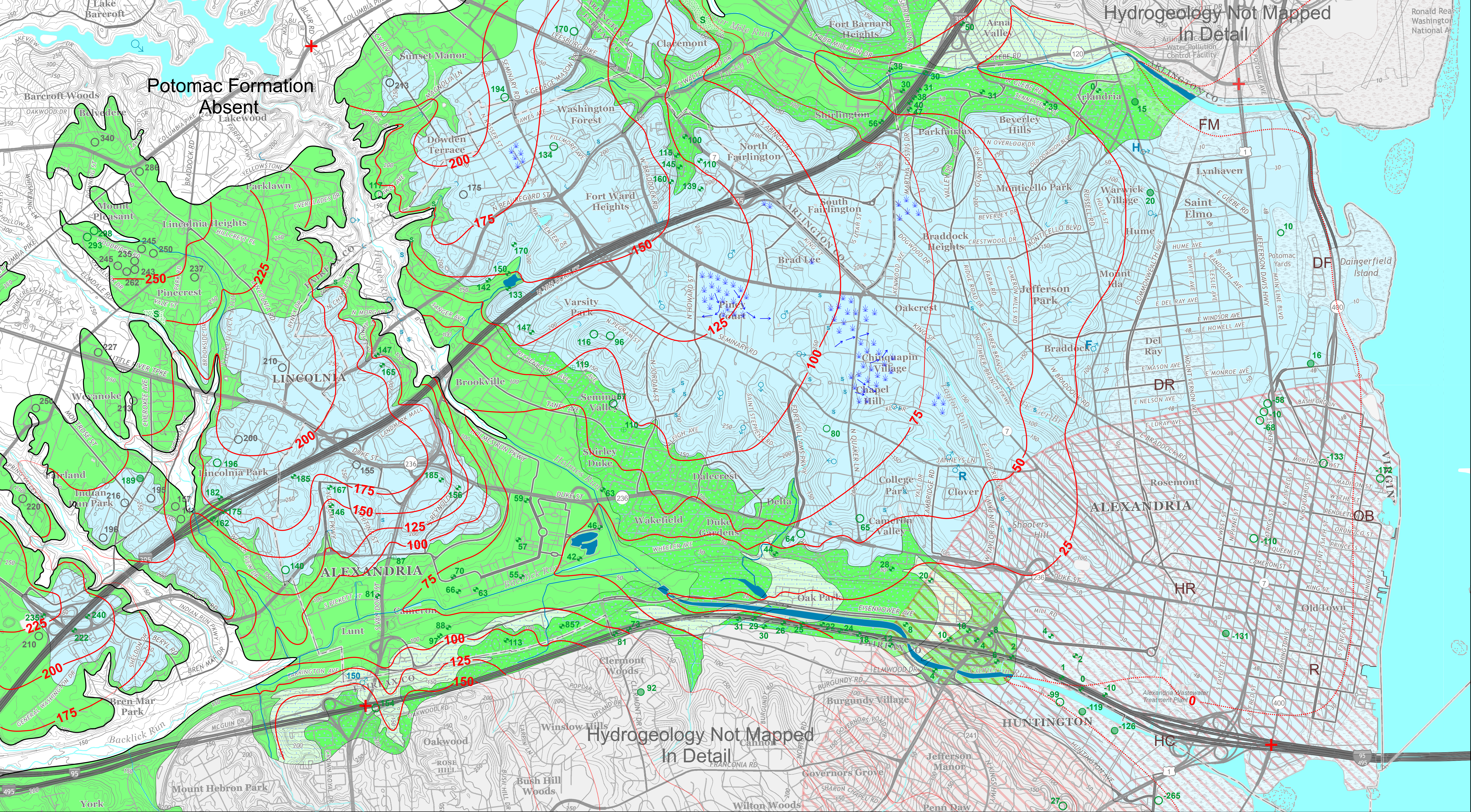




BASE MAP ADAPTED FROM U.S. GEOLOGICAL SURVEY NATIONAL MAP, 2013: TOPOGRAPHIC MAPS OF THE ALEXANDRIA, VA-DC-MD AND ANNANDALE, VA 7.5-MINUTE QUADRANGLES, NAD 1983

SCALE 1:12,000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

UTM GRID AND 2013 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

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DESCRIPTION

The lower 100 - 200 feet of the Potomac Formation in Alexandria contains abundant large bodies of hydraulically interconnected sand deposited in the thalwegs of early Cretaceous river channels. This sandy, lower interval is given the informal name of "Cameron Valley sand" in this atlas (plate 4) to distinguish it from other parts of the formation that originated in different sedimentary environments and possess different lithological and hydrogeological properties. The Cameron Valley sand constitutes the principal aquifer system in the Potomac Formation and is broadly synonymous with the term "lower aquifer" used by previous workers, such as Froelich (1985) and Johnston and Larson (1977). Up until the early to mid 1970's, the aquifer system was a major source of water for high-capacity industrial and public supply wells in the greater Old Town area; water levels in the southeastern part of the map area were moderately to severely depressed by these withdrawals, but had partially recovered by 1976 with the cessation of most pumping. Water levels have likely rebounded even further in the decades since then, but a lack of modern water-level data in the affected part of the aquifer system precludes a quantitative determination. Recovery of water levels is probably incomplete, however, because of ongoing high-capacity pumping and dewatering of the aquifer system in Indian Head, Maryland and other wellfields just southeast of the map area.

The piezometric contours depict water levels in the Cameron Valley sand, as interpreted in 2015 from a variety of data, including visible ground-water discharge from outcrops along the banks of streams, indicating that those parts of the aquifer system are currently saturated and interacting with the streams. Water levels measured at widely disparate times in the past, in wells that are largely no longer extant (Johnston, 1961; Johnston and Larson, 1977), along with water levels reported much more recently from numerous geotechnical borings and several ground-water monitoring wells that terminate in the Cameron Valley sand, were also crucial to mapping the piezometric surface.

Because of the widely divergent times and conditions under which these water-level data were collected, the contours should be regarded as a general guide to the configuration of the piezometric surface, rather than a precise indication of water levels at any specific point. In general, the contours are likely to be most accurate in the western half of the map area, where the aquifer system is under water table conditions and visibly discharging ground water to several perennial streams. The stratigraphically higher parts of the aquifer system that crop out further to the east commonly contain bodies of silty clay that likely act as local confining units, thereby inhibiting hydraulic communication between the upper and lower portions of the system and potentially creating vertical hydraulic gradients and locally perched water-table conditions. Despite these limitations, the map pattern clearly shows that regional ground-water flow in the Cameron Valley sand is east-southeast towards the Potomac River, with local deflections around the larger streams. Observed water levels indicate the aquifer system is under water table conditions in some places, and artesian conditions in others.

The map also shows extant and historical springs, wetlands, and other aspects of urban hydrology, many of which are associated with geologic units other than the Cameron Valley sand. A more complete account of the hydrogeology of Alexandria, this map, and how it was compiled can be found in the expanded explanation of Plate 6.

REFERENCES AND DATA SOURCES

Froelich, A.J., 1985. Folio of geologic and hydrologic maps for land-use planning in the Coastal Plain of Fairfax County, Virginia, and vicinity: U.S. Geological Survey Miscellaneous Investigations Series Map I-1423. Scale 1:100,000.

Johnston, P.M., 1961. Geology and ground-water resources of Washington, D.C. and vicinity: well records and data tables. U.S. Geological Survey Open-File Report 61-79.

Johnston, R.H., and Larson, J.D., 1977. Potentiometric surface maps and water-level change map, 1960-76, for the lower aquifer of the Potomac Group in Fairfax County, Virginia. U.S. Geological Survey Open-File Report 77-284.

- EXPLANATION**
- Map Units and Symbols Related to the Cameron Valley Sand**
- Base of the Potomac Formation
 - Boundary of hydrostratigraphic units, approximately located
 - Updip region where the lower unit of the Cameron Valley sand crops out or subcrops beneath younger surficial deposits of alluvium, colluvium, and stream terraces. This unit commonly ranges between 50 and 100 feet thick and consists almost entirely of sand. Hydraulic head is likely to be well integrated throughout. Acts as the regional recharge area for the lower aquifer of the Potomac Formation. The aquifer discharges to streams in low parts of the landscape, however, yielding a substantial amount of base flow
 - Area where the upper part of the Cameron Valley sand crops out or subcrops beneath alluvium, colluvium, and stream terraces. In this unit, localized bodies of silt and clay become increasingly numerous higher in the section and may act as local confining units that disrupt the continuity of hydraulic head at places, creating vertical gradients and perched conditions with water levels that are higher than those in the lower part of the aquifer system. Acts as a regional recharge area for the lower aquifer of the Potomac Formation, as well as a local ground-water discharge area along several streams in contact with the unit
 - Large bodies composed mostly of fine-grained sediment and much lesser sand. Probably act as low-flow boundaries within the aquifer system
 - Areas where the aquifer system is confined or capped by extensive bodies of silty clay and other low-yielding units higher in the Potomac Formation that impede ground-water recharge
 - Contour representing line of equal water level elevation (piezometric surface) in the Cameron Valley sand. Contour interval 25 feet
 - Projected or speculative water level contour. The sea level (0) contour shown in Old Town is speculative and assumes that water levels in this part of the aquifer system have largely recovered from historical high-capacity pumping and are influenced by river level. Contour interval 25 feet
 - Approximate location of cone of depression in the lower Potomac aquifer in 1976. The boundary of the cone of depression generally follows the zero (sea level) contour shown in plate 2 of Johnston and Larson (1977), south and east of which, water levels were substantially depressed by decades of high-capacity pumping prior to the mid 1970's, with water levels in some wells indicating 200-300 feet of long-term water-level decline. The degree to which water levels within this area have recovered since 1976 is unquantified and the actual boundary of the cone of depression today may be much different from what existed in 1976
 - Location of water well developed in Cameron valley sand, showing water level elevation measured in 1961 or earlier. Data from Johnston, 1961.
 - Location of water well developed in Cameron Valley sand, showing water level elevation measured in 1976. Data from Johnston and Larson, 1977

Location of water well open in bedrock immediately beneath the Cameron valley sand, showing water level elevation measured in 1961 or earlier. Data from Johnston, 1961. Water levels are expected to be similar to or slightly less than those in the Cameron Valley sand. Shown for comparison only

Location of geotechnical boring that terminates in Cameron Valley sand, showing water level elevation measured between 1999 and 2011. Nearly all of these are reported to be cased borings with stabilized water levels measured at least 24 hours after completion of the boring

Location of ground-water monitoring well screened in Cameron Valley sand, showing water level elevation measured between 1999 and 2004

Ground-Water Discharge Areas

Stream segment in contact with the Cameron Valley sand. Ground-water discharge is readily visible along these streams, commonly in the form of springs and seepage faces emanating from outcrops of Cameron Valley sand

Seepage face developed on Cameron valley sand. Typically marked by remnant hydric vegetation, including several ground-water slope wetlands

Seepage face developed on ground-water sources other than the Cameron Valley sand. Wetland hydrology at these places is supported by ground-water discharge, and is commonly accompanied by hydric soil profiles and locally by relict seepage vegetation

Spring. Some springs are destroyed or obscured by urbanization and may not be shown in their original, pre-settlement locations. Named historical springs include: F-Federal Spring; H-Hume Spring; R-Rixby Spring. Some springs are ephemeral and flow only during periods of high ground-water levels, while others are strong perennial springs

Other Hydrogeological Features

Outfall of urbanized ravine or other drainage. Above the outfalls, these drainages typically are partially to entirely filled and the source springs are usually destroyed or obscured

Wetland hydrology resulting from ponded surface water and/or shallow water table perched on fine-grained terrace sediment and clayey Potomac Formation units. Typically occurs on level to slightly depressional upland surfaces. Soil profile commonly with fragipan, may be gleyed or mottled in the wettest areas. Remnant swamp forest and other hydrophytic vegetation occurs locally

Wet swales on upland terraces, showing drainage direction

Approximate extent of several large, mostly filled, historical wetlands in and adjacent to the Old Town terrace: DF-Daingerfield Island estuary; DR-Del Ray swamp; FM-Four Mile Run estuary; HC-Hunting Creek estuary; HR-Hoeff Run-Commonwealth swale; OB-Oronoco Bay estuary; R-Royal Street estuary. Substantial parts of the Old Town terrace consisted of low-lying, poorly drained swamps and tidally-influenced estuarine wetlands, and the ones shown here represent only the largest and best documented. Many smaller streams, swamps, and riparian wetlands were also destroyed when the city was settled, but the historical record of these is obscure. The bottomlands of Cameron Run and Four Mile Run also contain large areas of filled floodplains, backswamps, seepage swamps, and other wetlands