Plate 1: Map Showing the Distribution and Sources of Geologic Data
Plates 2A-O: Geologic Cross Sections
City of Alexandria and Vicinity—Expanded Explanation
By Anthony H. Fleming, 2015

Introduction

Geologic data from a variety of sources were utilized to prepare the Geologic Atlas of Alexandria. These sources are broadly grouped into two types: surface exposures and subsurface data. Observations were made at numerous surface exposures, which included natural *outcrops*, excavations of various sizes, and other disturbed areas where soil, sediment, or bedrock were exposed. Most of the large natural outcrops in the city are found in the valleys of modern streams, though some exposures are also present on steep bluffs in the uplands. Several major excavations for large buildings and numerous minor ones for utility trenches, roads, foundations, gravel pits, and other infrastructure were also available for examination on an opportunistic basis during the course of this study and yielded valuable geologic information. In many places, *landforms* and the *vegetation communities* growing on them also gave important insights into the underlying geology, especially in parks, natural areas, and other places where historical disturbance of the landscape is less.

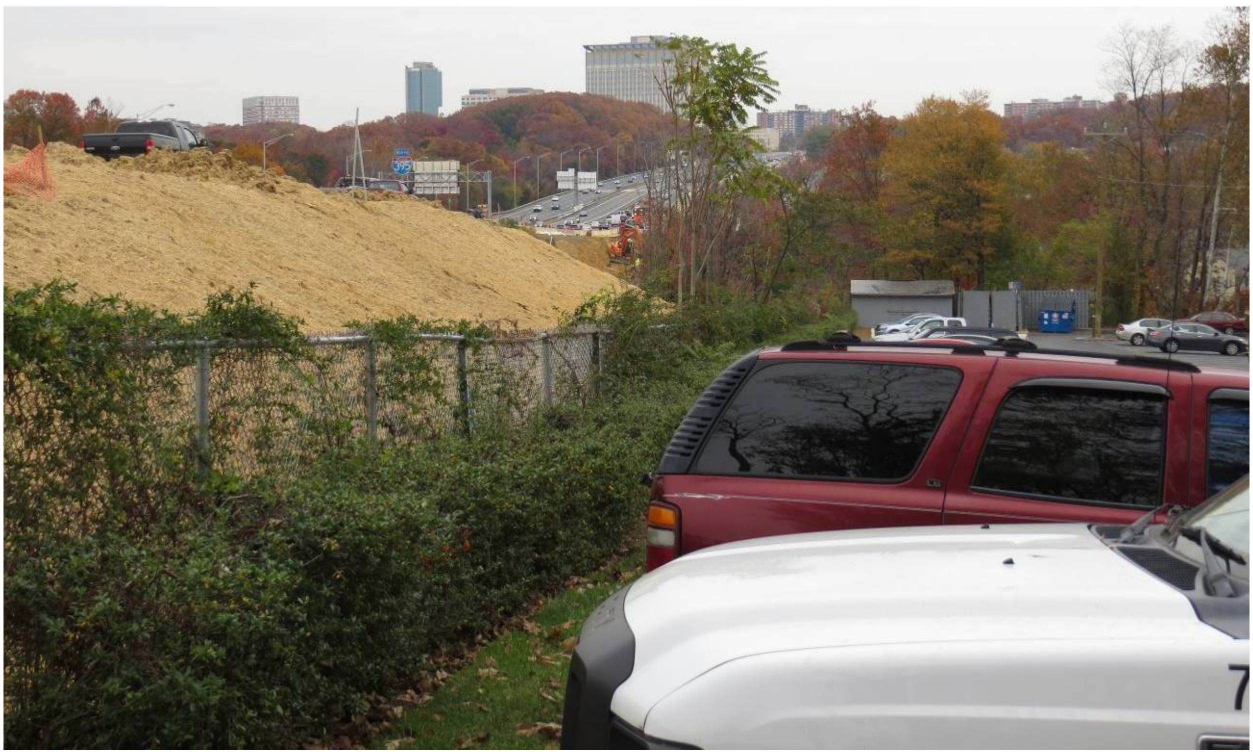

Figure 1-1. Geologic information in an urbanized area comes in a variety of forms and often appears on an opportunistic basis, such as the construction project along Shirley Highway pictured above. Other sources of geologic information represented in this image include geotechnical reports and foundation excavations for the major buildings on the horizon, records of old water wells at several nearby homes, and extensive outcrops and natural landscapes along Holmes Run, which occupies the forested valley in the foreground. The beds containing the microfossils described by ***Hueber (1982)****, which provided a definitive age for the Potomac Formation in Alexandria, were exposed during an earlier road construction project along this same stretch of Shirley Highway. Photo by Tony Fleming.*

These traditional sources of geological information were augmented by subsurface data from hundreds of sites, consisting chiefly of old water wells catalogued by previous investigators, and *geotechnical* (engineering) borings made during the past 25 years or so for buildings and roads and on file with the City of Alexandria and VDOT. As outlined below, the sources of the subsurface data are varied, and the data are presented in disparate formats that range from rudimentary summaries of well construction data in decades-old maps and tables (e.g., **Johnston, 1961**; **Darton, 1950**), to electronic, GIS-based borehole databases for specific large projects (e.g., **VDOT's** reconstruction of the Capital Beltway from Woodrow Wilson Bridge to Telegraph Road).

Because no two data sources are alike, an attempt was made to synthesize the key geologic aspects of all the data into a series of MS-Excel spreadsheets in order to: 1) facilitate consistency and comparability; 2) create a means by which specific types of data can be visualized and electronically linked to other parts of the atlas; and 3) consolidate and organize far-flung data and metadata in a single, compact archive so that they are readily available to others. Each location of a surface exposure or subsurface data set is tagged with a unique master ID number to enable unambiguous identification of the source and to facilitate future reconstruction of data points.

Description of Data by Source

Surface Exposures: More than 300 numbered surface exposures in and near the city were visited in the course of this project. Each locality is shown on plate 1 and summarized in the accompanying spreadsheet entitled "**Alexandria Exposures**". Each exposure is marked by two identifiers: the unique master ID number mentioned above, and a "field number" that was generated during the fieldwork portion of the study. In many cases, the two identifiers are the same, but they differ in the case of a few large parks and similar tracts, where the field number incorporates a prefix to identify the tract, e.g., DK-1, DK-2, etc. identify exposures 1, 2, etc. in Dora Kelley Park; likewise, CP-21 and CP-22 are exposures 21 and 22 in Chinquapin Park. Master ID numbers 1-500 were reserved for surface exposures; there currently are 312 of such numbered exposures. Their numerical order largely represents the sequence in which exposures at various locations throughout the city were visited during the project.

Figure 1-2. Natural outcrops abound along streams in Alexandria. Some of the largest are represented by bedrock exposures along the fall zone of Holmes Run (left), but many ravines in the map area also display respectable outcrops of unconsolidated sediment, such as the large exposure (right) of Cameron Valley sand (Potomac Formation) at its type locality along Backlick Run. Photos by R.H. Simmons (left) and Tony Fleming (right).

Figure 1-3. Excavations of various sizes can yield extremely valuable information about both local and regional geology, but they tend to be rather short lived, so timing is everything. The foundation excavations pictured above represent "holes of fortune" encountered during this project: a high-rise on King Street (left) and a much smaller house foundation in Del Ray (right). Unfortunately, thousands of other excavations made over the years in the City were never documented by a geologist or geotechnical engineer, so any useful information they might have yielded is lost. Photos by Tony Fleming (left) and R.H. Simmons (right).

In addition to the ID numbers, the spreadsheet also gives the location, altitude, date visited, geologic unit(s) present, and a brief description of the geologic features at each site. The nature of the exposure (size, natural outcrop vs. excavation, etc) is indicated in the spreadsheet; through the use of different symbols and patterns, plate 1 also visually differentiates natural outcrops, excavations, and sites where the landscape or landform is the primary feature of geologic interest. Exposures shown on plate 1 are identified by their master ID numbers.

Figure 1-4. A former outcrop in a bank along Beauregard Street was still reasonably well exposed as recently as a decade ago, but has now largely slumped over and become overgrown with vegetation (left). An astute geologist can still obtain useful information at such places, and even from small areas of bare soil, such as the bluff above Goat Hill Park pictured on the right. Such features are numerous in urban areas. Photos by Tony Fleming.

Outcrops may change or become obscured through time, especially in an urban setting. Natural processes like weathering, sedimentation, and slumping can obliterate outcrops over periods ranging from months to years to decades, depending on the size and location of the exposure. Likewise, excavations are, by definition, temporary exposures. Finally, there are numerous forces uniquely associated with the urban environment that can either degrade exposures or produce new ones: site grading, road widening, establishment of vegetation, building construction, and excessive pedestrian traffic in sensitive areas are just a few examples of numerous changes in land use commonly found in an urban setting.

Figure 1-5. Even in the absence of outcrops, a variety of landscape characteristics yield valuable clues about the underlying geology. Here, the sharply leaning trees and walls in parts of Beverley Hills (left) indicate strong soil creep and potential slope instability, and suggest that sediment containing appreciable amounts of plastic silt and clay underlies the slopes. Solitary bees (right) exhibit a strong preference for nesting in sandy but cohesive sediments, and are frequently found in the clayey sands of the Potomac Formation. Photos by Tony Fleming (left) and Alonso Abugattas (right).

<u>Subsurface Data-Water Wells</u>: The subsurface data compiled for this project falls into two categories: water well construction data, and geotechnical engineering borings. Water well data were obtained from three main sources, all from the US Geological Survey (USGS), hence they are catalogued in the Excel spreadsheet entitled "**Alexandria USGS Wells**", which contains three pages of data, each corresponding to one of the three sources described below. Like the surface exposures, each well location was tagged with a unique master ID number. Master numbers 501-800 were reserved for water wells; there are currently 108 such wells in the database (#'s 501-580, 601-629). On plate 1, wells are identified by a consecutive, second order "map ID" number (e.g., 1, 2, 3, …) within each particular source, as illustrated in figure 1-6 below.

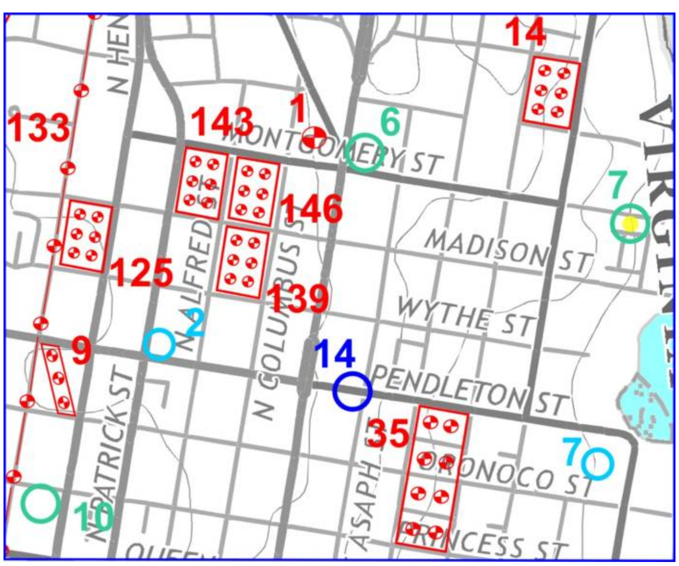

Figure 1-6. This example shows how wells and geotechnical boring sites are identified on Plate 1. One well (#14) documented by ***Darton (1950)*** *appears as the dark blue circle and map ID number; two boreholes (#2 and #7) described by* ***Froelich (1985)*** *are in light blue; and three wells (# 6, 7, 10) documented by* ***Johnston (1961)*** *are in teal green; the well with the yellow center (#7) was further interpreted by Froelich (1985). Geotechnical boring sites appear in red. Each of these data sets has its own series of consecutive map ID numbers: Johnston (1961): 1-80; Froelich (1985): 1-12; Darton (1950): 14-29; and geotechnical boring sites: 1-190.*

About 100 other wells documented in these same USGS reports lie just outside of the map area in nearby parts of Fairfax and Arlington Counties, VA, and the District of Columbia. These more distant wells were useful for interpreting the regional topography of the *bedrock* surface and other features that extend beyond the map area, but do not appear in the spreadsheet or on plate 1.

Each source of water well data is summarized in the sections below.

Johnston (1961, 1964): While compiling his seminal publication *The Geology and Ground-Water Resources of Washington, DC, and Vicinity*, Johnston (1961, 1964) systematically documented the locations and characteristics of more than 1,000 water wells and springs throughout the greater Washington DC area, hence, this is one of the single largest and historically important sets of subsurface data available (figure 1-7). **Johnston (1961)** presents data on 80 wells in the map area and another 75 or so in adjacent areas. Some of the wells are deep industrial or public supply wells, while many others are shallow residential wells. The vast majority of the wells no longer exist, hence, the maps and tables compiled by Johnston represent a valuable, archival data set.

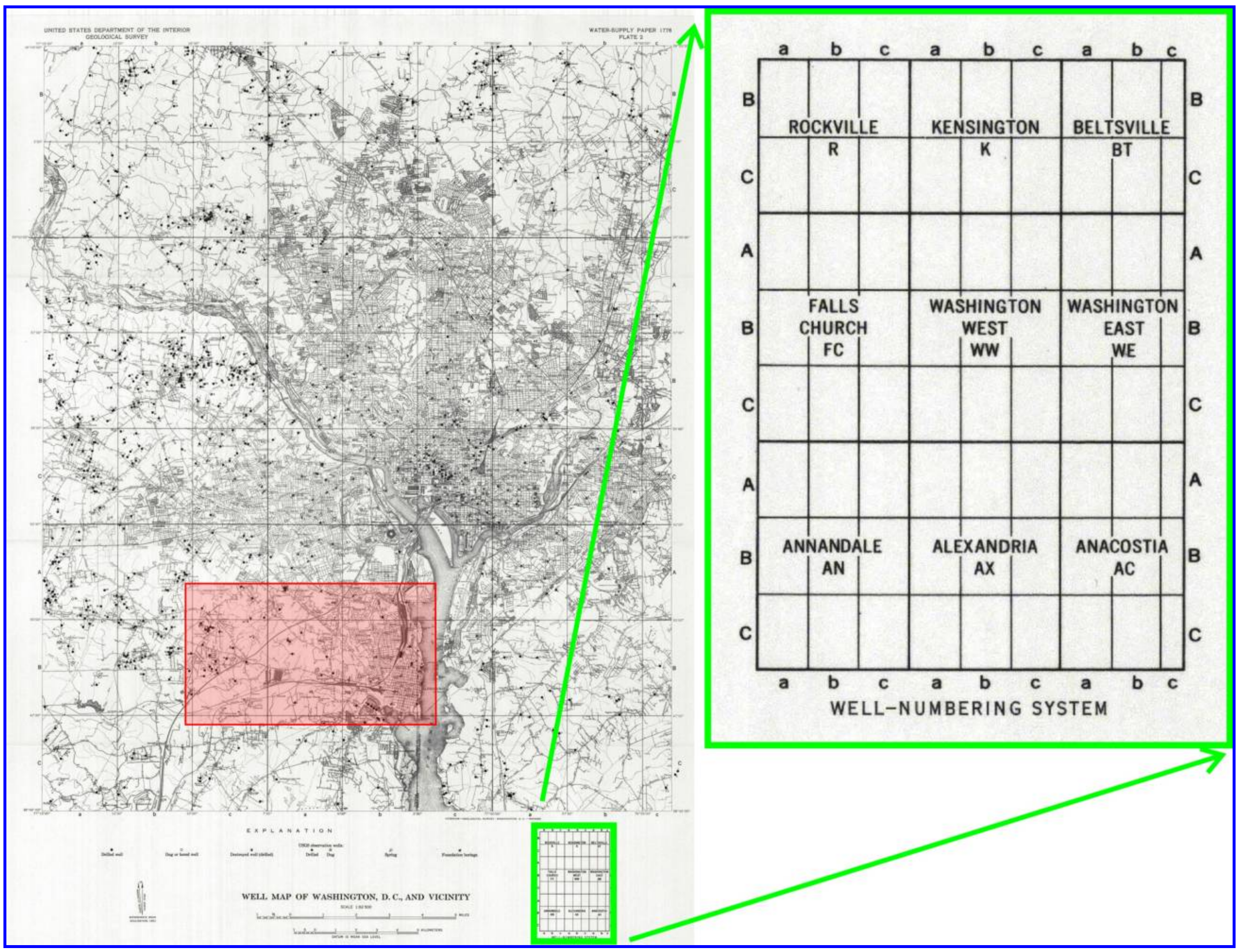

*Figure 1-7. **Johnston's (1964)** original map showing the locations of the historical wells and springs he documented in the Washington, DC area. Each dot on the map represents a well or spring described in the tables in his 1961 open-file report. The part of the map corresponding to the Geologic Atlas of Alexandria is highlighted in red. Johnson's diagram illustrating his method of numbering wells across the entire region of his map is enlarged, on the right.*

The published water-supply report (**Johnston, 1964**) depicts the locations of the wells on a 1:62,500 map (figure 1-7), but otherwise contains no systematic descriptions of individual wells. Such descriptions are found in a set of typewritten tables that form the bulk of an obscure open-file report (**Johnston, 1961)**. All of the water-well data contained in these tables and located within the map area of the Alexandria geologic atlas were recreated electronically in the page called "Johnston 1961" in the "**Alexandria USGS Wells**" spreadsheet, and the well locations are identified on **plate 1**.

To more easily manage the large number of wells he described, Johnston (1964) devised a well-numbering scheme (figure 1-7) in which each 7.5-minute topographic quadrangle within his study area was divided into 9 equal-sized rectangles by drawing north-south and east-west lines through each 2 ½-minute tic mark on the quadrangle, and then numbering the wells consecutively within each rectangle. For example, AX-AA-1 refers to well #1 in rectangle AA of the Alexandria (AX) topographic quadrangle. For the current study, this system was simplified by renumbering the wells in the map area to a consecutive sequence of basic map ID numbers (1-80) to produce a unique ID for each well shown on plate 1 and listed in the "Johnston 1961" page of the USGS wells spreadsheet. Johnston's original ID's (e.g., AX-AA-1) are also retained in the spreadsheet for cross reference purposes.

Figure 1-8. Some of the historical water wells in Alexandria. A deep drilled well that extends to bedrock and was formerly used for public water supply appears in the background of the upper left photo. The other images depict bored or dug residential wells, characterized by their large diameters and concrete or brick linings. Many of the wells documented by Johnston (1964) in Alexandria and elsewhere are of the latter variety, which once were very common on the upland gravel terraces. Photos by Rod Simmons.

Of the wells documented by Johnston in the map area, 5 include **formation logs** (figure 1-9) from the driller describing the geologic strata encountered during well construction. All of the entries are summarized by well depth, casing length, aquifer the well was finished in, water level, and other features useful for geological interpretation. The principal uses of this data set in the present project were for determining the depth to bedrock and ascertaining water levels in selected aquifers; the formation logs were also invaluable for interpreting the *lithofacies* relations of the Potomac Formation at depth below the Old Town terrace.

Table 11. Logs of Wells in Alexandria Quadrangle, cont.

Fairfax, Bb-10, Fairfax Hydraulics, Inc.
Altitude, 5 ft.

0-17 ft	Sand, gravel, and rock
17-23	Clay, hard, red
23-27	Clay, hard, gray, white
27-30	Clay, red
30-37	Clay, red, and gray, interbedded
37-50	Clay, red
50-73	Clay, softer, gray, brown
73-73.8	Sand, fine-grained, dirty
73.8-118	Clay, blue-green
118-125	Sand, fine-grained, dirty
125-137	Sand, coarser-grained, with clay, interbedded
137-137.2	Sand, hard
137.2-150	Clay, hard, blue
150-163	Sand, medium, coarse-grained, with clay beds
163-166	Sand, finer-grained, and clay
166-172	Clay, smooth, blue
172-189	Clay, blue, harder with hard sand beds
189-190	Clay, gummy, blue
190-193	Clay, medium hard, blue
193-195	Clay, sandy, blue
195-205	Sand, medium-hard
205-208	Sand and clay, interbedded
208-210	Sand, medium, coarse-grained
210-214	Clay, blue
214-226	Sand
226-231	Clay, blue
231-237	Clay, gummy blue
237-242	Clay, medium hard, brown
242-257	Clay, gummy, blue
257-263	Clay, tri-color
263-269	Clay, hard, tri-color
269-269.5	Hard sand lens
269.5-274	Clay, hard, tri-color
274-289	Clay, soft, gummy, tri-color
289-289.5	Hard sand lens
289.5-305	Clay, sandy, blue
305-307	Sand and clay, interbedded
307-312	Clay, blue, with thin sand layers
312-318	Sand, with thin clay layers
318-328	Clay, blue, with sand layers
328-331	Sand
331-334	Clay
334-359.3	Sand, medium hard
359.3-	Granite

Figure 1-9. One of the well logs recorded by ***Johnston (1961)*** *in the map area. This log is for well J-15, one of four, deep, public water supply wells located in Huntington, Fairfax Co.*

Froelich (1985): This report focuses chiefly on Fairfax County and consists of a series of small scale (1:100,000) maps highlighting various features of the Potomac Formation, as interpreted from surface and borehole data. Wells and boreholes are represented by a series of unnumbered dots on the maps, of which about 30 are in the Alexandria map area. Some of the maps were compiled from a series of open file reports—generated during the USGS Fairfax County mapping program of the 1970's—that present the same data at a scale of 1:24,000; however, only a portion of these reports are still available. Therefore, the locations of some of Froelich's data points had to be interpolated from his small-scale maps, a process hindered by the wide spacing of geographic reference features.

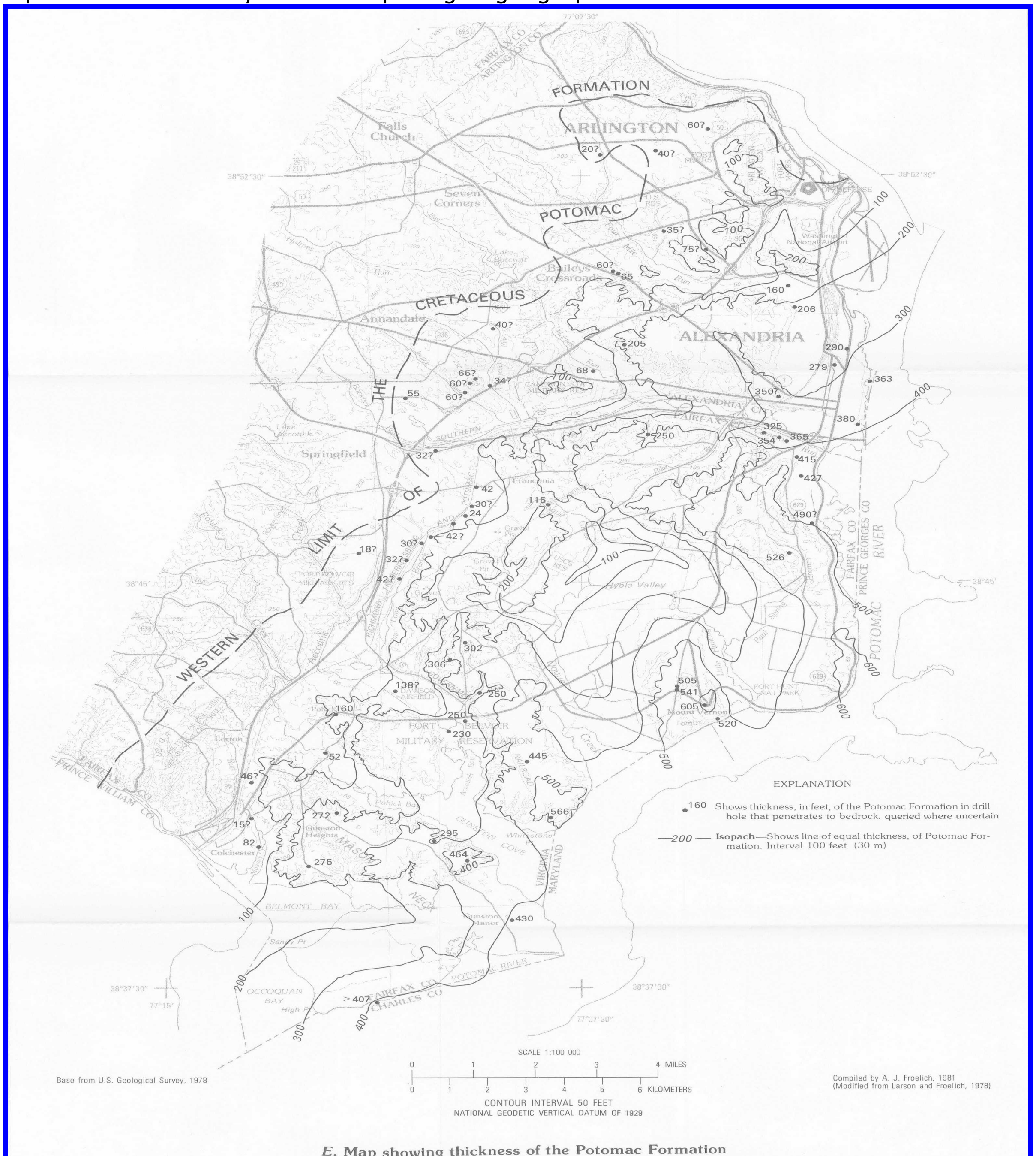

Figure 1-10. One of more than a dozen small-scale maps of the Potomac Formation by ***Froelich (1985)****. Each dot represents a drillhole, some of which correspond to* ***Johnston's (1964)*** *wells. Other maps in the folio show additional drillholes.*

No metadata (i.e., a basic list and descriptions of the sources, locations, and characteristics of the drillholes) are available in the main report or its precursor open-file reports, hence little is known about the nature of these drillholes and the data upon which the interpretations presented on the maps are based. More than half of the data points clearly coincide, both spatially and in gross character (e.g., borehole depth, bedrock elevation) to wells listed by **Johnston (1961)**, but 12 others are "drillholes" of unknown origin and geology; possibly, they are test holes drilled during the USGS mapping program or other "holes of fortune" available at that time.

This data set was useful both for interpreting the elevation of the bedrock surface and for characterizing the lithofacies of the Potomac Formation. The geologic data for all of Froelich's boreholes were taken at face value, *except* in several cases where a gross conflict exists between the interpretation shown by Froelich and the well construction data presented by Johnston, or where Froelich's interpretations are internally inconsistent. The data from Froelich's maps are compiled onto the page "Froelich 1985" in the spreadsheet, which differentiates between wells also contained in Johnston (1961) versus the other 12 drillholes whose source is not stated by Froelich, and lists any issues with the data.

Darton (1950): **Darton** compiled data on the elevation and geology of the bedrock surface throughout the greater DC area, derived from his first-hand observations of hundreds of wells, tunnels, shafts, and excavations over several decades. Using a variety of sites as examples, he compiled detailed maps of the topography of the bedrock surface in local areas, such as the Pentagon, as well as a more generalized bedrock topography map of the entire region at a scale of 1:31,680 (1 inch = one half mile). The raw information collected by Darton is presented in a series of tables, accompanied by a topographic map showing the locations of wells and other data points. The majority of Darton's data are from the District of Columbia and Maryland; although only a handful of wells are shown within Alexandria, the information they provide is singularly important because several of the wells are located on the Seminary terrace, where few other reliable bedrock data are available. Darton's data in that area reveal a tantalizing example of what appears to be a high-local-relief bedrock surface. Data for the 16 of Darton's wells located in the map area are presented in the page entitled "Darton 1950" in the **Alexandria USGS Wells spreadsheet**.

Subsurface Data-Geotechnical Borings: Records of geotechnical borings were obtained from the City for numerous building sites, schools, and other city-regulated construction activities, as well as from VDOT for two major roadways: Shirley Highway and the Capital Beltway. All of the geotechnical boring records can be reliably located and contain detailed information about surface elevation, the strata penetrated in the borings (typically described in terms of the Unified Soil Classification system used in engineering studies), ground-water levels, and other features of interest. Every boring site was given a unique master ID number as well as a map ID number; the map ID # appears next to each geotechnical boring site on plate 1 (figure 1-6), while both ID numbers appear in the spreadsheet entitled "**Alexandria Geotechnical Borings**". Master numbers 801 and higher were reserved for geotechnical boring sites; there are currently 191 such numbers in the database (801-991, corresponding to map ID's 1-191), representing more than 2500 individual borings. In nearly every case, a boring "site" identified in the spreadsheet and on plate 1 includes more than one test boring; in fact, some of the larger sites have dozens of borings. The number of borings at each site is listed in the spreadsheet; however, no attempt was made during this project to provide exact locations for individual borings on either plate 1 or in the database. Instead, the coordinates in the database represent a central location at each site. It is necessary to consult the individual boring plans to determine the number and identities of individual borings at each site and their respective locations within the site (figure 1-11).

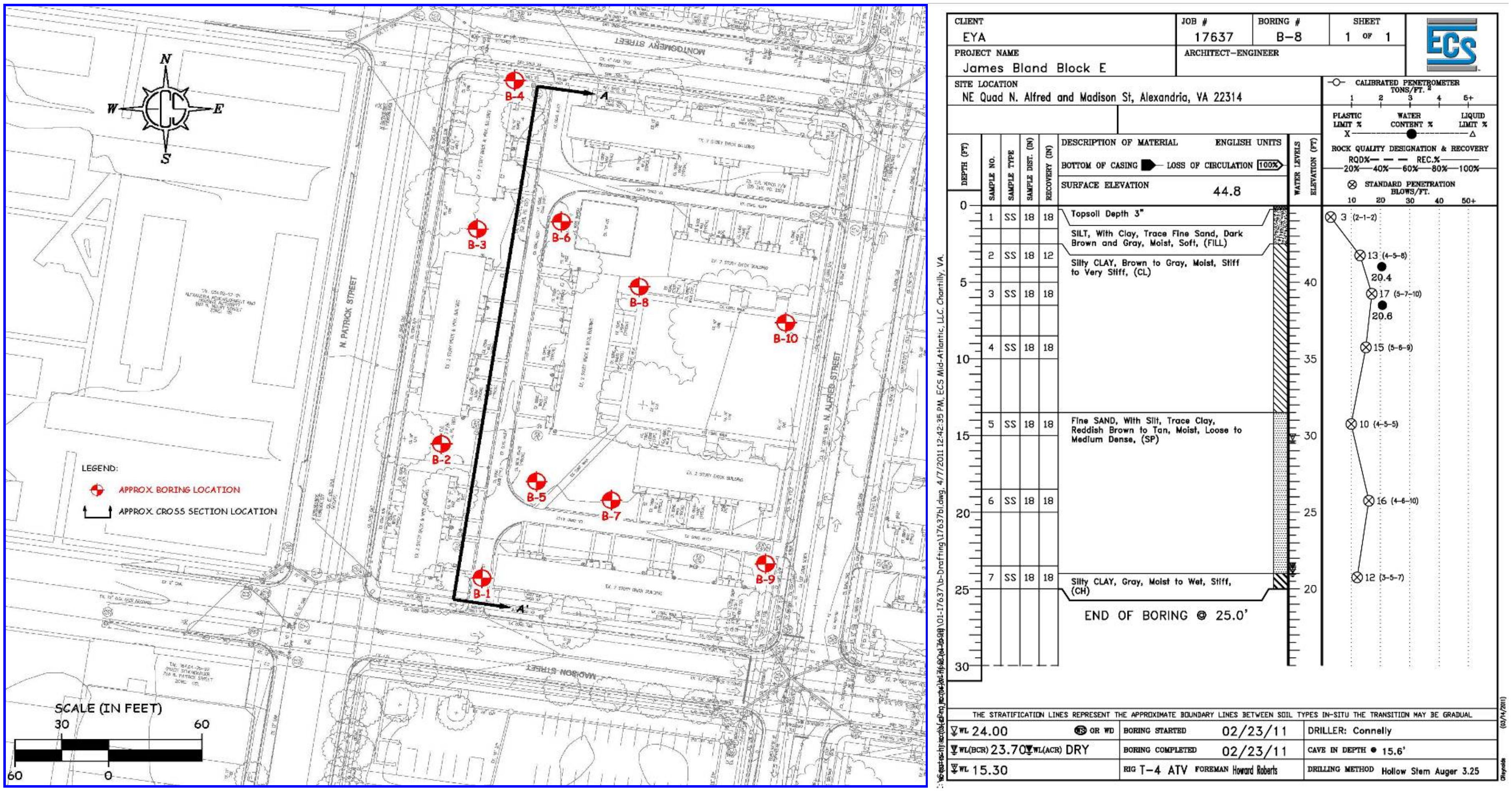

Figure 1-11. Site plan and boring location map (left), and representative boring log (right) for geotechnical boring site 143, whose location appears in figure 1-6. This site is typical in that the individual borings are not uniformly distributed within the site and are concentrated in foundation footprints and other key project areas. The log is from boring B-8, located just above the center of the site. Detailed site maps and boring logs like these are found in most of the geotechnical reports. The log gives the precise surface elevation of the boring—an important piece of information for relating the geology below the site to other sites and areas. Most sites provide boring elevations, though some do not and a few use an internal datum. Credit: ECS Mid Atlantic, 2011, Report of Subsurface Exploration and Geotechnical Engineering Analysis for James Bland Redevelopment, Block E, City of Alexandria, Virginia.

Figure 1-12. These images illustrate a typical geotechnical boring operation using hollow-stem augers. The rig pictured here is on the large side, capable of drilling to depths of 100 feet or more. A) a 140-lb hammer, represented by the cylinder on the drill rod above the operator's hand, falls 30 inches, driving a split spoon coring device into the sediment. The number of blows required to advance the split spoon one foot is a standard measure of hardness ("N" value, or blow count) recorded for every borehole; B) the business end of the sampling barrel, which can range from 18 inches to 5 feet in length, and 1 to 4 inches in diameter, depending on the objectives of the project and the level of detail needed. For routine geotechnical investigations, one 18-inch sample is typically taken in every 5-foot depth interval. More complex geotechnical investigations and environmental sites often require more frequent sampling; C) once the sampler has been retrieved from the hole, the augers are used to drill through the just-sampled interval. The process then repeats; D) the split spoon is separated, revealing a continuous core of sediment from the sampled interval, at least under ideal conditions. A number of problematic geologic conditions, such as large stones, heavy gravel, and runny, wet sand can lead to incomplete sample recovery. Photos by Tony Fleming.

To provide a consistent format for the geotechnical data, and to simplify the interpretation of geotechnical sites with large numbers of borings, the geologic information from individual borings at every site was summarized into one or more interpretive site schematics, or cross sections, presented as a **separate PDF file** to accompany the databases. Figure 1-13 shows several examples of site schematics and their utility for interpretation.

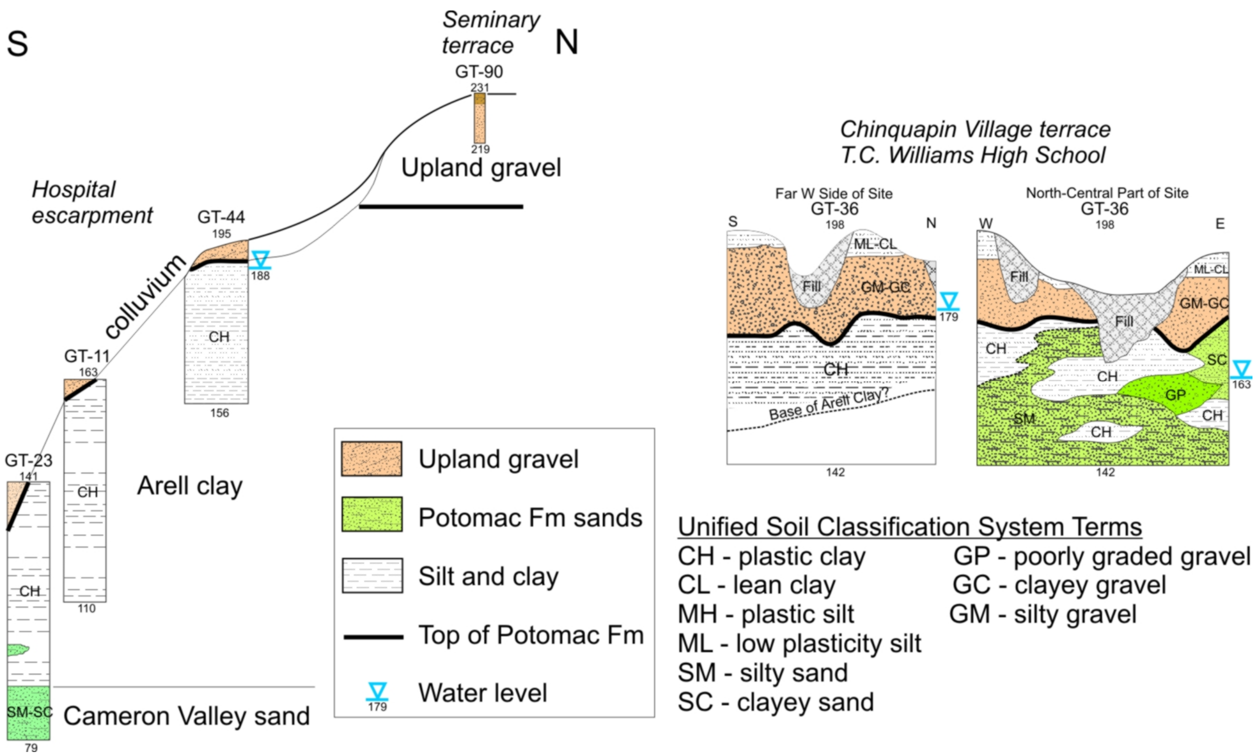

Figure 1-13. Schematic diagrams of geotechnical boring sites of various sizes. The header above each diagram identifies the site number (e.g., GT-23) and the surface elevation (in feet) of the highest boring at the site (e.g., 141). The number at the bottom is the lowest elevation reached by the deepest boring at the site (e.g., 79). The relative widths of the diagrams are proportional to the sizes of the sites. Sediment characteristics are identified by colors, patterns, and the Unified Soil Classification System. The diagrams on the left are from four small to medium sized sites located within about 2,500 feet of each other along a north-south line just west of Quaker Lane between Duke Street and Janneys Lane. Individually, each site shows only a part of the geologic section underlying the Hospital escarpment, but collectively they encompass nearly all of it. The two diagrams on the right are from a very large site with dozens of borings, and are oriented perpendicular to one another.

City of Alexandria Geotechnical Borings: Several city departments review geotechnical borings in advance of various kinds of construction projects. The boring records are typically submitted to the city as part of a geotechnical report in support of each project; the reports are filed in the plan review section of Transportation and Environmental Services (T&ES). In the case of city schools, they also are filed in the school facilities office. Geotechnical reports and boring logs for 163 discrete sites were obtained and reviewed for this project. The number and depths of borings at a given site range widely, depending on the scope of the building project. Small projects typically consist of between 1 and 6 borings that range from 10 to perhaps 35 feet deep, whereas some major projects include dozens of borings that range up to 50-100 feet deep.

VDOT-Shirley Highway: Bridge borings were made at every interchange when Shirley Highway was expanded into a modern interstate (I-395) in the 1960's. The borings at each interchange are depicted on large-format bridge plans, which are archived on microfilm at VDOT's northern Virginia office in Chantilly. For this project, full-size prints were made off of the film for all interchanges from Edsall Road northward to Glebe Road (figure 1-14). As with the city boring sets, each site was given a unique master ID number, and contains multiple borings, which are summarized on a site schematic prepared during the course of this project. Some large sites were divided into two or more smaller sites under the same site ID number, for example, the borings for the Quaker Lane interchange are divided into 4 smaller sites labeled on plate 1 as 69-A, 69-B, 69-C, and 69-D.

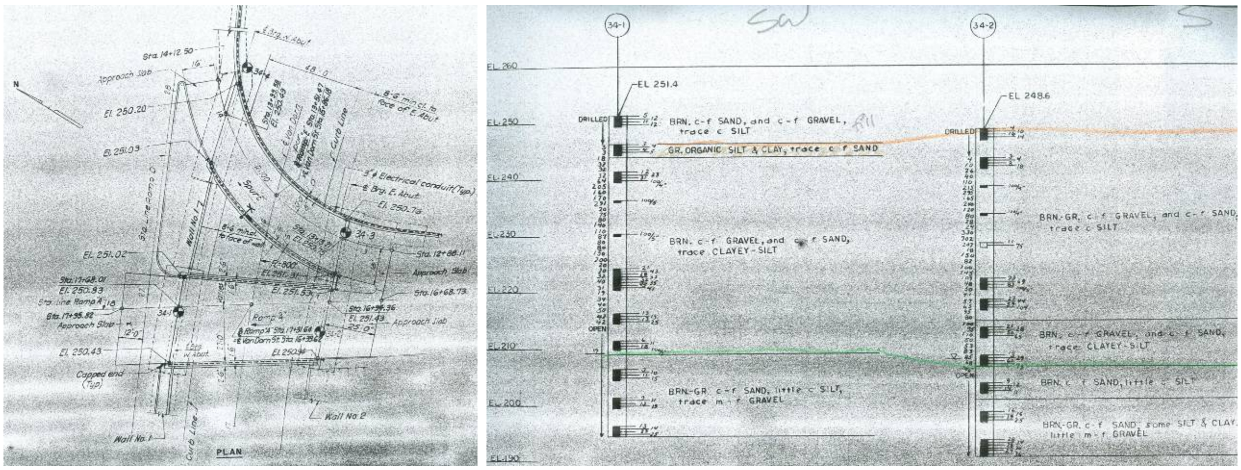

Figure 1-14. Example of a site map (left) and bridge boring logs (right) from the VDOT Shirley Highway archive, for site 74-A at the Shirley Highway x Seminary Road interchange. The colored lines are stratigraphic picks made by the author: orange-top of upland gravel (Dowden terrace); green: top of Potomac Formation (Winkler sand member).

VDOT-Capital Beltway: The replacement of Woodrow Wilson Bridge (WWB) and reconstruction of adjacent sections of the Capital Beltway was a major, long-term project that was ongoing at the time of this study. Several hundred individual test borings were drilled just for the section of the beltway in Alexandria between Route 1 and the city limits two miles west of Telegraph Road. Because the subsurface database for the WWB project is so vast, it was made available during the life of the project at the VDOT website, through a pilot project involving on-line GIS (formerly http://gis.virginiadot.org/GDBMS_menu.asp).

Although it would have been possible to generate images of individual borings, such a task would have been prohibitively time consuming. Instead, the site allowed a remote user to generate "fence diagrams" (similar to geological cross sections) by selecting up to ten borings; the website then generated a cross section, or "fence", with each boring in its proper spatial location and elevation, and showing the strata and other engineering features of each boring (figure 1-15). By reviewing the on-line borings on the VDOT site, a series of 16 fence diagrams were generated for this project, using the deepest and most descriptive geotechnical borings in the project area from Route 1 westward to the city limits. This approach simplified the VDOT data, and instead of having hundreds of boring sites, each of the 16 fence diagrams acts as a "site" for purposes of the database.

When placed end to end, 14 of the fence diagrams essentially act like one continuous geological cross section that follows the Beltway and Cameron Run through the city. The individual **fence diagrams** are included with the database part of this atlas as PDF files, and their locations are depicted on plate 1 by the violet-colored "swaths" along the beltway. The names of the fence diagrams are referenced to the Telegraph Road interchange: 1-west, 2-west, etc. refer to fence diagrams located west of Telegraph Road; 1-east, 2-east, and so forth refer to those located east of the interchange. Two additional fence diagrams run north-south across the Cameron Valley, one paralleling Route 1, the other parallel to Telegraph Road, for a total of 16 such diagrams, identified as map numbers 96-111 in the "**Alexandria Geotechnical Borings**" spreadsheet.

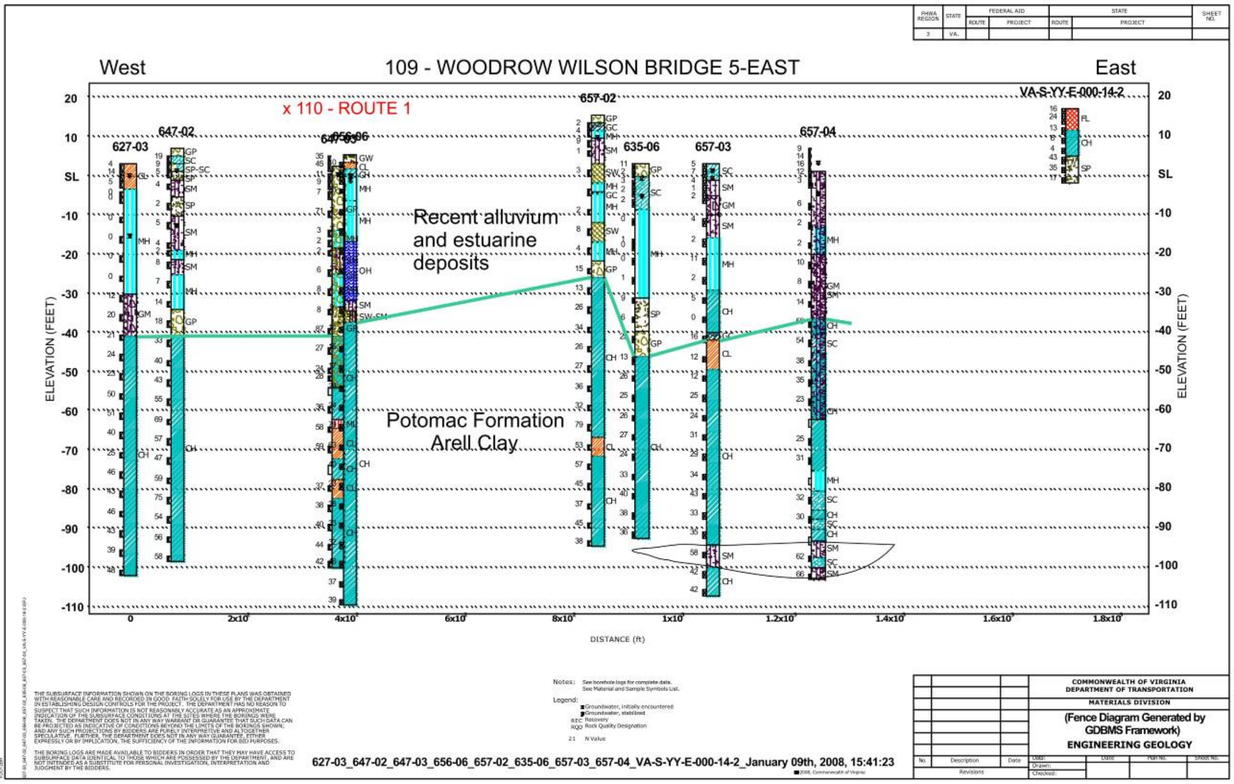

Figure 1-15. Fence diagram for site 110, generated by VDOT's Woodrow Wilson Bridge Project website. Geologic interpretations are the author's.

Other Data: The USGS collected a variety of regional geophysical data, much of which is unpublished. Regional aeromagnetic data, compiled at a 1:24,000 scale and depicted in **figure 3-4** of the expanded explanation of plate 3, were essential to the interpretation of bedrock geology and structure in the large majority of the city where the bedrock is buried beneath Coastal Plain deposits, and thus not visible. **Daniels (1980)** used the aeromagnetic data and other kinds of geophysical information to make a similar interpretation of the bedrock geology for all of Fairfax County (including Arlington and Alexandria); his interpretations were extremely helpful and form the basis for the bedrock geology shown on plate 3. Published 1:24,000 geologic maps for the adjacent Washington West (**Fleming and others, 1994**), Annandale (**Drake and Froelich, 1986**), and Falls Church (**Drake and Froelich, 1997**) quadrangles were also extremely useful for constraining map units, contacts, and structures. In particular, the combination of the regional aeromagnetic data and the author's familiarity with the Washington West Quadrangle enabled the bedrock structure to be extended southward beneath the Coastal Plain section of Alexandria with a reasonable amount of confidence.

Cross Sections

Fifteen geologic cross sections (**plates 2A-O**) were constructed using the surface and subsurface data described above. Some of the cross sections parallel major urban corridors such as King Street and Shirley Highway, while others encompass significant environmental sites, such as Rynex and Dora Kelley Natural Areas, Cameron Valley, and Chinquapin Hollow. Most of the cross sections are oriented to either broadly parallel the regional southeastward dip of the bedrock surface and Potomac Formation, or to cut across it at nearly right angles.

The cross sections can be thought of as vertical slices extending downward from the modern land surface to the maximum depth to which data are available, which is generally the bedrock surface in most of the city. They depict the vertical profile of rocks, sediments, and ground water levels encountered in wells, borings, and exposures in relation to the landscapes they occur with, and so represent the crucial third dimension needed for geologic and ground-water interpretations. The individual lines of cross section are depicted on **plate 1** using a series of colors to distinguish one section line from another at places where they intersect on the map. As noted earlier, the series of fence diagrams generated from the VDOT WWB website constitute an additional defacto cross section following the Capital Beltway, when placed end to end.

Geologic units shown on the cross sections are depicted in the same colors and patterns as on plates 3, 4, and 5. A complete explanation of the units appears on plate 5, except for a few bedrock units that are present only in the subsurface; the latter are included in the Plate 3 explanation. Each cross section contains a brief discussion highlighting the dominant landforms and geologic features visible along the section line.

Ideally, the cross sections should be used in conjunction with plate 5 and the other maps to illustrate the third dimension of the map units and their relations to landforms and water resources. Used this way, the cross sections are helpful for visualizing the vertical sequence of geologic units and their relations to the Alexandria landscape at a variety of scales, ranging from individual landforms to neighborhoods to watersheds.

References

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