2.5 HYDROLOGY

2.5.1 INTRODUCTION AND SUMMARY

This section of the report presents the results of the surface and ground water hydrology phase of the environmental study performed by Dames & Moore. Research for this phase included a review of available pertinent hydrologic literature (References 1 through 5) and interviews with representatives of government agencies and other individuals possessing knowledge of the local area (References 6 through 10).

A study of the hydrologic features of the site and the surrounding area was conducted. This study included an inventory of water wells, an inspection of surface drainage features, a study of aquifers, measurement of ground water levels in exploratory borings, and an analysis of the depth, direction, and rate of ground water movement.

The site is well drained and not susceptible to flooding. Surface runoff is moderately high and accounts for about 35% of the total annual precipitation. Average annual precipitation in the region ranges from about 40.6" at the Patuxent NATC to about 44" at Prince Frederick. A drainage divide extends across the site in a general north-south direction. The area east of the divide (20% of the site) drains into the Chesapeake Bay, whereas the area to the west drains into local tributaries and eventually into the Patuxent River. The plant is located east of the divide where surface drainage is toward the Chesapeake Bay.

The plant area is underlain by over 200' of relatively impermeable deposits which effectively confines the underlying artesian aquifers and minimizes their possible contamination by the downward percolation of an accidentally discharged contaminated liquid. The vertical component of ground water movement through the Chesapeake Group is upward. This precludes the possibility of contamination of the aquifers due to downward percolation of a contaminant.

Most of the potable water used in the region is obtained from the artesian aquifers underlying the Chesapeake Group. The aquifers are composed of glauconitic sand and silt of the Piney Point, Nanjemoy, and Aquia formations. The piezometric surfaces of these water-bearing formations slope to the southeast at about 2' per mile. Based upon this hydraulic gradient and coefficients of permeability for these formations, the estimated average rate of natural ground water movement is less than 1" per day.

A limited quantity of potable water is obtained from shallow wells completed in the surficial Pleistocene deposits which overlie the Chesapeake Group throughout most of the area surrounding the site. The areas in which these materials are utilized as a source of water are up-gradient from the plant and cannot be affected by the accidental release of contaminated liquids at or below the ground surface in the plant area.

The possibility of adversely affecting the available ground water resources or existing wells in the area, by the construction and operation of a nuclear facility, is remote. The hydrologic characteristics of the site are favorable for the construction and operation of a nuclear power plant.

2.5.2 SURFACE HYDROLOGY

2.5.2.1 General

Calvert County is a peninsula bounded on the east by the Chesapeake Bay and on the west by the Patuxent River. The area is characterized by gently rolling terrain with a dendritic drainage pattern. A drainage divide extends longitudinally across the county. The county is well drained by a relatively large number of streams, although most are less than seven miles long. Many streams have moderately

steep valley walls, while others form estuaries to the Patuxent River. Swampy areas and tidal flats are common along the coastal areas.

Stream flow in Calvert County is measured at two gauging stations maintained by the U.S. Geological Survey. Their locations are shown on Figure 2.5-1, Map of Area Showing Surface Hydrology. The gauge on St. Leonard Creek is a continuous recording station, while the Hellen Creek station is a partial recording site. Average monthly discharges at the continuous recording station are presented in Table 2-31, Average Monthly Discharge at Gauging Station on St. Leonard Creek (1958-1964).

The average runoff measured at the St. Leonard gauge from 1958 to 1964 was 15-1/2"/year. The average annual precipitation for the same period as measured at Prince Frederick, about 10-1/2 miles north of the site, was about 44". Thus, runoff accounts for about 35% of the total precipitation. Evapotranspiration also accounts for a large portion of the annual precipitation. Relatively little precipitation percolates into the surficial materials to recharge the phreatic surface.

The reason for the high runoff and low infiltration probably can be attributed to the impermeable nature of the Miocene subsoils which retard downward percolation of water. The surficial soils are Pleistocene or Recent deposits which are relatively pervious. Rainfall absorbed by them is soon discharged as stream runoff or lost through evapotranspiration. Many lowland areas of the county are not mantled by Pleistocene deposits and the relatively impermeable Miocene deposits are exposed. Precipitation falling on these areas is discharged almost immediately as surface runoff.

2.5.2.2 Site Conditions

The topography at the site is gently rolling with steeper slopes along stream courses. Local relief ranges up to about 130'. The site is well drained by short, intermittent streams. A drainage divide, which is generally parallel to the coastline, extends across the site as shown on Figure 2.5-1. The area to the east of the divide comprises about 20% of the site and includes the plant area. This area drains into the Chesapeake Bay. The western area is drained by tributaries of Johns Creek and Woodland Branch, which flow into St. Leonard Creek and subsequently into the Patuxent River. Grading performed during construction has not substantially altered the present drainage system.

The average Elevation of the site is about 100' above mean sea level. The site occupies the head-water area of several small drainage basins, and is not subject to flooding. It is possible that high intensity rain storms may cause water to back up in some valleys due to local constrictions in the stream beds, but this would be a temporary situation. The plant area has an Elevation of about +45' and has a storm drain system to handle runoff. High water levels in the bay due to storm conditions are discussed in Section 2.8.3.

Site grading in the vicinity of the Diesel Generator Buildings provides a system of swales that direct overland flow of the probable maximum precipitation runoff without producing drainage or flooding problems for the buildings. The system of swales direct runoff to the Chesapeake Bay without any dependence on the site's storm drain system. The results of the runoff and backwater analyses indicate that during the probable maximum precipitation storm the swale system at the Diesel Generator Building site will convey the surface runoff with a maximum water level of 44.8' above sea level near the Diesel Generator Buildings. This water level is below the floor grade of the Diesel Generator Buildings, which is 45.5' above sea

level, and thus precludes the potential for flooding of the Diesel Generator Buildings during the probable maximum precipitation.

2.5.3 GROUND WATER HYDROLOGY

2.5.3.1 Regional Conditions

Ground water occurs in the surficial soils and is tapped by many shallow dug and driven wells. Ground water in deeper aquifers occurs under artesian conditions. These aquifers, the Piney Point, Nanjemoy, and Aquia formations, are separated from the surficial deposits by an aquiclude averaging about 270' in thickness. Recharge to these aquifers occurs in their outcrop areas about 15 to 30 miles west of the site. The geologic position of these aquifers relative to other formations in Calvert County is presented in Table 2-32, Geologic Units in Calvert County.

The hydrologic characteristics of the Piney Point, Nanjemoy, and Aquia formations are discussed in greater detail in the following subsections.

2.5.3.1.1 Piney Point Formation

The Piney Point formation consists of glauconitic sand interspersed with shell beds and a little clay. Well cuttings and particle-size analyses indicate that the aquifer is composed mainly of medium to fine sand. The formation occurs as a wedge-shaped geologic unit and is known only in Southern Maryland. It is about 30' thick in the vicinity of the site and increases in thickness to the southeast.

The Piney Point formation is widely utilized as a source of ground water in Calvert County and adjoining St. Mary's County. It is estimated that more than 500 domestic wells in these two counties tap the Piney Point and the underlying Nanjemoy formations. These two aquifers are hydrologically connected. The yields of domestic wells generally range from about 3 to 20 GPM. At the Patuxent NATC, located about 10 miles south of the site, large-capacity wells tap the Piney Point aquifer and the upper part of the Nanjemoy formation. These wells each yield as much as 190 GPM. The specific capacities of 25 selected wells in these formations range from 0.1 to 3.3, and average 1.2 GPM/ft of drawdown.

2.5.3.1.2 Nanjemoy Formation

The lower part of the Nanjemoy formation consists of an impermeable red clay known as the Marlboro Clay. The remainder of the formation consists chiefly of greensand, but contains some clayey greensand. A limited number of particle-size analyses indicate that the sand is predominantly medium- to fine-grained.

The Nanjemoy formation is an important aquifer in Calvert County where it is tapped by several hundred wells. Most wells are completed in the permeable water bearing sands occurring in the uppermost 80' of the formation and yield less than 10 GPM. The specific capacities of 11 wells in Calvert County tapping this aquifer range from 0.2 to 2.4, and average 0.8 GPM/ft of drawdown. On the basis of water level recovery measurements made during a pumping test, a coefficient of transmissibility of approximately 2,000 GPD/ft has been computed. The field coefficient of permeability was 66 GPD/ft^2. The results of a similar test in Prince George's County indicate coefficients of transmissibility ranging from 260 to 840 GPD/ft.

2.5.3.1.3 Aquia Formation

The Aquia formation is characterized by an abundance of glauconitic sand with some quartz sand and clay. The thickness of permeable sandy beds in the formation ranges up to slightly more than 40' in parts of Calvert County. Particle-size analyses of nine samples at the Aquia formation show that the sand is medium- to fine-grained.

The most productive wells tapping this formation are at the Patuxent NATC. Yields of individual wells range from 125 to 350 GPM. The specific capacities of eight of these wells range from 0.8 to 4.2 and average 2.5 GPM/ft of drawdown. The results of six pumping tests indicate field coefficients of permeability ranging from 130 to 1,340 GPD/ft^2. Coefficients of transmissibility determined from the tests range from 5,500 to 33,000 GPD/ft^2.

Plant wells tap this formation.

2.5.3.1.4 Water Levels

The artesian head of the three principal aquifers in Calvert County is generally above sea level. The effect of tidal fluctuations on water levels is noticeable in two observation wells, completed in the Nanjemoy and Piney Point formations, at Solomons Island about 7 miles south of the site. Recorder charts from these wells, which are 248 and 493' deep, respectively, show semi-diurnal fluctuations of about 1/2'.

The approximate configurations of the piezometric surfaces of the Aquia and Nanjemoy formations are shown on Figure 2.5-2, Piezometric Surfaces in Calvert County. The regional hydraulic gradient in the vicinity of the proposed plant site is to the southeast. However, local minor variations occur. The cone of depression at the southern end of Calvert County is the result of ground-water extraction at the Patuxent NATC. Records of observation wells maintained by the U.S. Geological Survey indicate that water levels in the area have remained essentially unchanged since 1963. If the future rate and amount of ground-water extraction in the area is not significantly changed, it is likely that the cone of depression will remain constant and the existing hydraulic gradient in the vicinity of the site will be maintained.

2.5.3.2 <u>Water Use</u>

2.5.3.2.1 General

Nearly all potable water used in Calvert County is from subsurface sources. Since little industry is located in this area, the major use of water is for domestic and agricultural purposes.

2.5.3.2.2 Public Water Supplies

In 1967, there were 12 towns in Calvert County with public water supplies. The output from these systems is relatively small, but increases substantially in the summer to accommodate the seasonal population increase. Data concerning the public water supplies are presented in Table 2-33, Public Supply Wells in Calvert County. The locations of these supplies are shown on Figure 2.5-3, Public Water Supplies in Calvert County.

2.5.3.2.3 Private Wells

Most domestic water supplies in Calvert County are obtained from private wells greater than 300' in depth. In some instances, other wells are less than 50' deep and are of limited capacity. The locations of the deep wells, in the vicinity of the site, are shown on Figure 2.5-4, Map of Area, Showing Known Water Wells. Information pertaining to these wells is presented in Table 2-34, Known Water Wells, Vicinity of Site.

Shallow dug or driven wells are not tabulated or shown on Figure 2.5-4. The shallow wells will not be affected by changes in the ground water regimen at the site since they are at a higher elevation than the proposed plant grade.

Wells numbered 2 & 10 are located on BG&E property and were previously owned by YMCA. One is in use supplying water to our recreational pool facility for authorized personnel including BGE employees and the Red Cross. The same aquifer supplies water to this well and three others located close to the reactors on the plant site. Output from the three onsite wells referred to in Section 2.5.3.3 is pumped to two storage tanks from the well water treatment building.

There is no comprehensive source of public information on dug wells in Calvert County. The Calvert County Health Department records and retains dug-well records for only five years. Permits are not required by the Maryland Department of Water Resources nor by the Maryland Department of Health. Several dug wells are listed in Reference 2 and Section 2.5.4.2; however, accurate public information is not available for most of them. It is believed that dug wells in the area are upgradient from the plant site or are across drainage area boundaries.

2.5.3.3 Site Conditions

The depth of ground water at the site was measured in piezometers installed in seven of the Dames & Moore exploratory borings. The piezometers consisted of small-diameter steel pipe equipped with a well point, or perforated PVC pipe. They were installed in borings DM-1, DM-2, DM-3, DM-5, DM-7, DM-8, and DM-9 immediately after completion of the drilling operations. The locations of the borings are shown on Figure 2.4-7, Plot Plan. The water level recorded in each piezometer is shown on the Log of Borings, Figures 2.4-9A through 2.4-9J in Section 2.4, Geology.

An in-situ soil percolation test was performed at the site in Miocene soils typical of those underlying the proposed plant. The test was conducted in a one-foot square hole in accordance with the procedure used for the Corps of Engineers Soil Absorption Test (Reference 5). Results of this test indicate a permeability of less than 1 GPD/ft^2. The location of the test is shown on Figure 2.4-7.

Representative samples extracted from the exploratory borings were subjected to a laboratory testing program in order to evaluate the permeability characteristics of the natural soils and the physical properties of the material for correlation purposes. The laboratory program included the following tests:

a. moisture and density determinations;
b. particle-size analyses;
c. permeability tests; and
d. cation exchange and X-ray diffraction analyses.

The moisture and density determinations were performed on undisturbed samples for correlation purposes. The results of these determinations are shown on the Log of Borings in Section 2.4, Geology.

Selected soil samples were tested in order to measure their grain-size distribution. The results of these analyses were used in evaluating soil permeability and for classification purposes. The results are presented on Figures 2.5-5A and 2.5-5B, Particle Size Analyses.

Two permeability tests were performed on materials typical of those underlying the plant. The results of these tests, which were performed in accordance with the American Society for Testing and Materials (ASTM) procedures, are presented in Table 2-35, Laboratory Permeability Tests.

The clay mineral content and the total cation exchange capacity of seven selected soil samples was analyzed. The results of these tests are presented in Table 2-36, Cation Exchange and X-ray Diffraction Analyses.

Data obtained from the geologic exploratory borings indicate that a large portion of the site is mantled by relatively permeable Pleistocene soils. These soils have been eroded from a portion of the site exposing the Chesapeake Group which includes the St. Mary's, Choptank, and Calvert formations. The Chesapeake Group consists of about 270' of impervious sandy and clayey silts of Miocene age. Underlying this material are the Piney Point, Nanjemoy, and Aquia formations of Eocene age.

The Pleistocene deposits consist mainly of silts and sands which have fairly good infiltration characteristics. A few domestic wells in the area obtain water from this material, but are up-gradient from the plant and cannot be affected by a change in the ground water regimen at the site. Grain-size analyses of the surficial soil samples indicate a maximum permeability coefficient of about 400 GPD/ft^2. The elevation of the phreatic surface changes with the surface topography and can be expected to fluctuate slightly as a result of climatic changes. The water table occurs generally within 30' of the ground surface. East of the topographic divide, the direction of ground water movement is toward the Chesapeake Bay. The direction of ground water flow west of the divide is toward the existing stream valleys. Piezometers installed in the borings show that the ground water gradient at the site is generally less than 1%. The average rate of ground water flow probably does not exceed a few feet per day.

The underlying impervious sandy and clayey silts of the Chesapeake group extend to about 200' below mean sea level. A percolation test conducted near the plant indicates a permeability of less than 1 GPD/ft^2. Particle-size analyses indicate that the permeability of the Chesapeake Group averages about 3 GPD/ft^2. The rate of ground water movement is extremely low (much less than 1" per day). The formation is an aquiclude which effectively confines the underlying artesian aquifers. Regional studies by the U.S. Geological Survey have shown that the head in the artesian aquifers is above sea level. The result is vertical upward leakage through the Chesapeake Group. The rate of leakage is extremely low because of the low permeability of the Miocene sediments.

At the site, the combined thickness of the aquifers within the Piney Point and Nanjemoy formations is about 80'. They occur at Elevations ranging between 200' and 300' below mean sea level and are separated from the deeper Aquia formation by a layer of clay (Lower Nanjemoy) about 150' thick. The general

direction of ground water movement in the Aquia formation is toward the southeast with a piezometric gradient of about 2' per mile.

Grain-size analyses of samples of the Piney Point formation collected at the site indicate a permeability of about 150 GPD/ft^2. This value is probably typical of both the Piney Point and Nanjemoy aquifers. It is estimated that the permeability coefficient of the Aquia formation may be on the order of 1,000 GPD/ft^2. The computed rate of flow of ground water through these aquifers ranges from about .07 to .004' per day. The possibility of accidental contamination of the Eocene aquifers beneath the site is remote because; (a) the aquifers are covered by over 200' of relatively impervious soils and, (b) the vertical component of ground water movement is upward.

Cation exchange and X-ray diffraction analyses were performed on seven samples ranging in depth from 5 to 115' in order to evaluate the cation retention characteristics in the vicinity of the site. The cation exchange capacity of these soils is relatively high and would effectively absorb radioactive cations.

Three wells have been developed for plant use. They extend to a depth of approximately 640' and are each capable of producing 300 GPM from the Aquia formation. Casings for the three plant wells are continuous and sealed with grout to the top of the screens. The effect of pumping these wells will be to create a cone of depression in the Aquia formation such that the direction of groundwater flow will be toward the site rather than away from it. This will further minimize the possibility of lateral migration of any possible release of contaminated liquids beyond the site boundary. For other aquifers, the upward component of groundwater movement and the overlying aquiclude prevent contamination due to downward percolation.

2.5.4 REFERENCES

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6. U.S. Geological Survey Water Resources Division; Towson, MD; Mr. James Weigle, Mr. Wayne E. Webb
7. Maryland State Department of Health; Baltimore, MD; Mr. Charles Gross
8. Maryland Department of Geology Mines and Water Resources; Baltimore, MD; Mr. H. Hansen
9. Maryland Division of Water Resources; Annapolis, MD; Dr. Bruce Martin
10. Numerous local residents; Vicinity of Site

TABLE 2-31

AVERAGE MONTHLY DISCHARGE AT GAUGING STATION ON ST. LEONARD CREEK (1958-64)[a]

January	1.74"	May	1.35"	September	0.48"
February	1.92"	June	0.88"	October	0.56"
March	2.46"	July	1.00"	November	1.23"
April	2.04"	August	0.83"	December	0.99"

(a) Expressed in inches of runoff.

TABLE 2-32

GEOLOGIC UNITS IN CALVERT COUNTY

GEOLOGIC UNIT	APPROXIMATE RANGE IN THICKNESS (ft)	PHYSICAL CHARACTERISTICS	WATER BEARING PROPERTIES
Pleistocene surficial deposits	0-150	Silt and sand with some clay gravel	Yields small quantities of water to relatively shallow dug or driven wells.
Chesapeake Group: St. Mary's, Choptank, and Calvert Formations	30-325	Sandy and clayey silt with inter-bedded sand and fossiliferous layers	An aquiclude. Yields small supplies of water to a few dug wells.
Piney Point Formation	0-60	Glauconitic sand	Yields up to 200 GPM are reported from drilled wells. An important aquifer in Calvert County.
Nanjemoy Formation	40-240	Glauconitic sand with clayey layers. Basal part is red or gray clay	Yields of individual wells reported up to 60 GPM. An important aquifer in Calvert County.
Aquia Formation	30-200	Green to brown glauconitic sand	Yields up to 300 GPM reported from wells. An important aquifer in Southern Maryland.
Brightseat Formation	0-40	Gray to dark gray micaceous silty and sandy clay	Not known to be an aquifer in Southern Maryland.
Monmouth and Matawan Formations	20-135	Sandy clay and sand, dark gray to black, with some glauconite	Not a major aquifer in Southern Maryland, but yields up to 50 GPM have been reported.
Magothy Formation	0-40	Light-gray to white sand and gravel with interbedded clay layers	A few wells reportedly yield up to 1,000 GPM but average yields are considerably less. This aquifer is not used in Calvert County because of its depth.
Raritan Formation	100	Interbedded sand and clay with iron-stone nodules	Yields up to a few hundred GPM reported. Not utilized in Calvert County due to depth.
Patapsco Formation	100-650	Interbedded sand, clay, and sandy clay	Large-diameter wells yield up to 1,000 GPM. Not used in Calvert County because of depth.
Arundel Clay Formation	25-200	Red, brown, and gray clay	Not generally a water-bearing formation.

TABLE 2-32

GEOLOGIC UNITS IN CALVERT COUNTY

GEOLOGIC UNIT	APPROXIMATE RANGE IN THICKNESS (ft)	PHYSICAL CHARACTERISTICS	WATER BEARING PROPERTIES
Patuxent Formation	100-450+	Chiefly gray and yellow sand with interbedded clay	Yields of several hundred GPM reported. Not used in Calvert County due to great depth.
Precambrian	Unknown	Gneiss, granite, gabbro, meta-gabbro, quartz diorite, and granitized schist	Yields moderate supplies of ground water, generally not more than 50 GPM. Not used in Calvert County because of its great depth.

TABLE 2-33

PUBLIC SUPPLY WELLS IN CALVERT COUNTY (1967)

TOWN	POPULATION SERVED[a]	NUMBER OF CONNECTIONS	AVERAGE OUTPUT (mgd)	WELL	TOTAL DEPTH (ft)	DIA (in)
Calvert Beach	60	15	.006	1	475	5
Chesapeake Beach	500	155	.05	1[b]	400	8
				2	400	8
				3	400	6
				4[b]	400	2
				5	400	2
Chesapeake Ranch Estates	150			1	400	4
				2	750	4
				3	750	4
Dares Beach	600	175	.05	1[b]	217	1 1/2
				2	210	2 1/2
Hunting Hills	30	8	.003	1		4
Kenwood Beach	250	62	.025	1	365	1 ½
Long Beach	720	180	.07	1	525	3
				2	500	4
				3	475	4
				4	500	4
Prince Frederick	125	35	.02	1	552	8
St. Leonard	60	14	.006	1	550	5
Scientists Cliffs	120	185	.025	1	240	6
Western Shores				1	325	3
White Sands[c]	160 (approx.)	40	.012	1	402	6
	Comm.	2	.015	2	315	2 1/2

[a] Does not include seasonal increases, with the exception of Chesapeake Ranch.

[b] Not in use.

[c] Appropriate permits data per Maryland Department Natural Resources ground water.

NOTES:

1) Information based on 1963 data from United States Public Health Service and Maryland Department of Health.

2) Total population of a community is not necessarily served by the public water supply.

TABLE 2-34

KNOWN WATER WELLS, VICINITY OF SITE

OWNER	WELL NUMBER	WELL DEPTH (ft)	WELL DIAMETER (in)	AMOUNT OF CASING (ft)	YIELD (GPM)
K. C. Gerard	1	365	4	280	22
BGE	2	585	6	560	60
Yacht Club	3	315	2 1/2	189	25
H. Krellen	4	285	2	180	15
E. Zinn	5	384	4	237	25
B. Foot	6	399	2 1/2	252	20
H. C. Wilder	7	399	2 1/2	273	20
H. J. Mishou	8	404	2 1/2	277	*
D. Wood	9	315	2	273	5
BGE	10	540	6	520	10
R. C. Hall	11	274	2 1/2	*	50
G. D. Wait	12	252	2	*	3
D. Adams	13	300	2 1/2	*	*
William Rekar	14	461	3	*	*
E. Bowen	15	525	3	*	*
E. Daniels	16	450	*	*	*
W. Jenkin	17	435	*	140	*
Knotty Pine Bar & Grill	18	*	*	*	*
Bay Breeze Camp	19	340	*	*	*
Mrs. Faron	20	*	*	*	*
Mrs. Moran	21	*	*	*	*
*	22	365	2 1/2	*	*
Mr. McQueen	23	300	*	*	*
Mr. Street	24	375	*	*	*
P. Andjiano	25	360	*	*	*
Mr. Bancroft	26	*	*	*	*
Mr. Wohlgenmuth	27	*	*	*	*
Mrs. Mansfield	28	*	*	*	*
*	29	*	*	*	*
*	30	*	*	*	*
*	31	*	*	*	*

* Information not available.

NOTE: Well locations are shown on Figure 2.5-4.

TABLE 2-35

LABORATORY PERMEABILITY TESTS

BORING	DEPTH (ft)	SOIL TYPE	DRY DENSITY (lbs/ft^3)	COEFFICIENT OF PERMEABILITY (ft/day)
DM-6	45	Sandy silt with shells	93	3.18
DM-8	75	Sandy silt	82	0.86

TABLE 2-36

CATION EXCHANGE AND X-RAY DIFFRACTION ANALYSES

BORING	DEPTH (ft)	SOIL TYPE	GRADATION IN % FINER[a] (in millimeters)				% OF TOTAL CLAY MINERALS[b]			TOTAL CATION EXCHANGE CAPACITY[c]	
			.074	.048	.005	.002	Illite	Montmorillonite and Mixed Clay Minerals	Chlorite	Test 1	Test 2
DM-1	45	Gray Silty Clay	98	44	23	17	30	50	20	23.8	24.5
DM-6	43 1/2	Green Silty Sand	28	25	21	15	40	60	-	10.0	11.0
DM-6	115	Green Clayey Silt	98	91	44	31	30	50	20	24.3	27.3
DM-8	30	Green Silty Sand	28	25	22	15	35	65	-	13.8	12.8
DM-8	45	Green Clayey Silt	90	80	45	35	20	60	20	25.0	30.6
DM-9	5	Reddish-Brown Sandy Clay	80	65	38	34	-	-	100	10.0	10.3
DM-10	47	Gray Sandy Silt	59	22	16	11	20	80	-	14.4	10.0

(a) Soil samples soaked for 24 hours in 0.4% hours in 0.4% sodium hexametaphosphate before hydrometer analysis.

(b) X-ray diffraction analyses of minus 2 micron material.

(c) Because of the $CaCO_3$ in some of the samples, the ammonium acetate method was used. Total Cation Exchange was determined on the minus 40 micron material.

NOTE: Swell observed in samples DM-1 (45'), DM-6 (115'), and DM-8 (45').