



WATER-RIGHT DOCKET

Virgin Islands National Park

Docket No: 6

WELL #6, CINNAMON BAY

Supporting Hydro Data

00-00-0000: table 1: summary of water supply at cinnamon bay

Table 1.—Summary of water supply at Cinnamon Bay, St. John, V. I.

Source	Estimated safe yield gpm	Field chloride ppm	Possible use	Proposed type pump
NPS-6	2,000	400	Discharge to cistern	Submersible
NPS-9	3,000 to 5,000	290	Discharge to cistern	Submersible
NPS-11	500 to 1,000	240	Drinking water	Deep well cylinder hand pump
NPS-12	500 to 3,000	350-5,000	Sanitary purposes	Shallow well centrifugal
*Spring	0 to 2,000	400	Discharge to cistern	Gravity flow
**Well points	500 to 1,000 ea.	500-5,000	Sanitary purposes	Shallow well centrifugal

*Present supply.

**Not in existence at present.

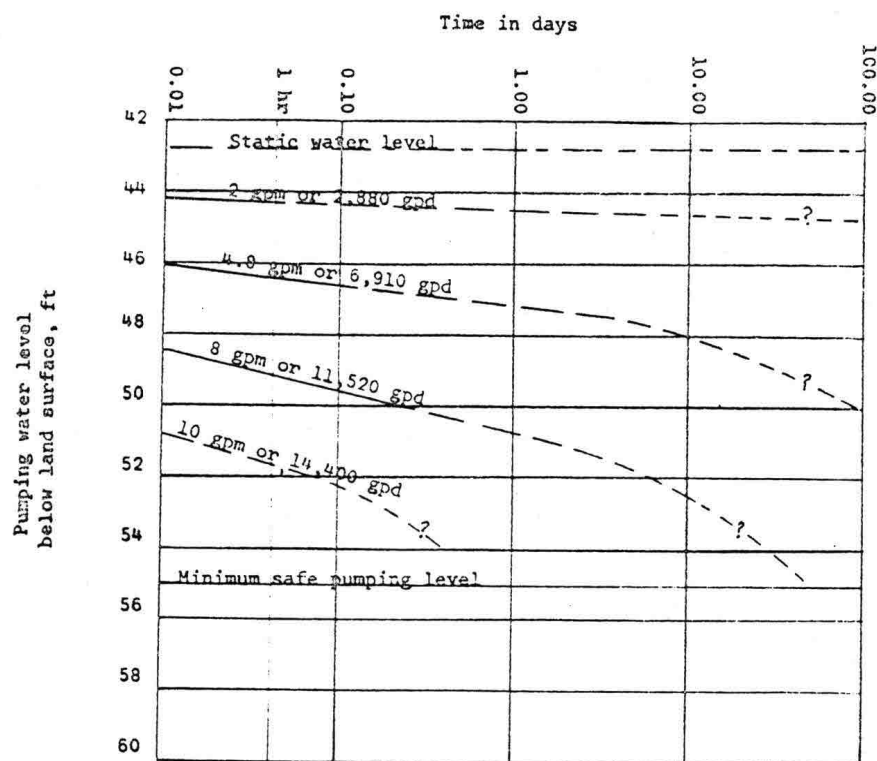


Figure 1.--Actual and projected pumping water levels at various pumping rates in well NPS-9 Cinnamon Bay, St. John, Virgin Islands.

Solid lines represent test data; dashed lines are projections. The degree of reliability is proportional to the length of the dashes, the longest indicating greatest reliability.

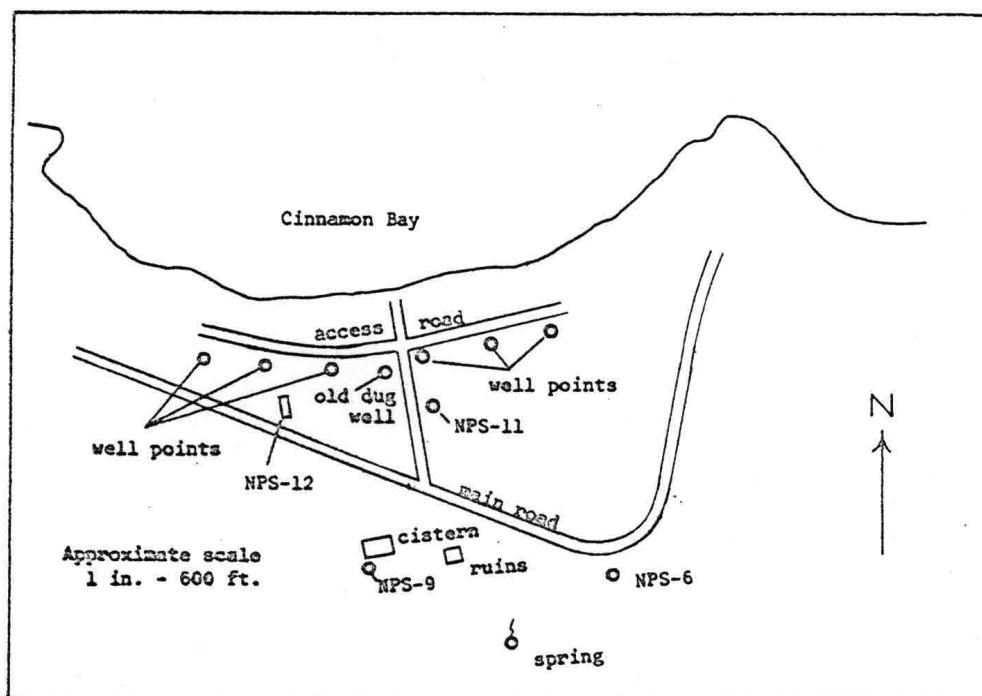


Figure 2.--Sketch of the Cinnamon Bay area showing locations of wells

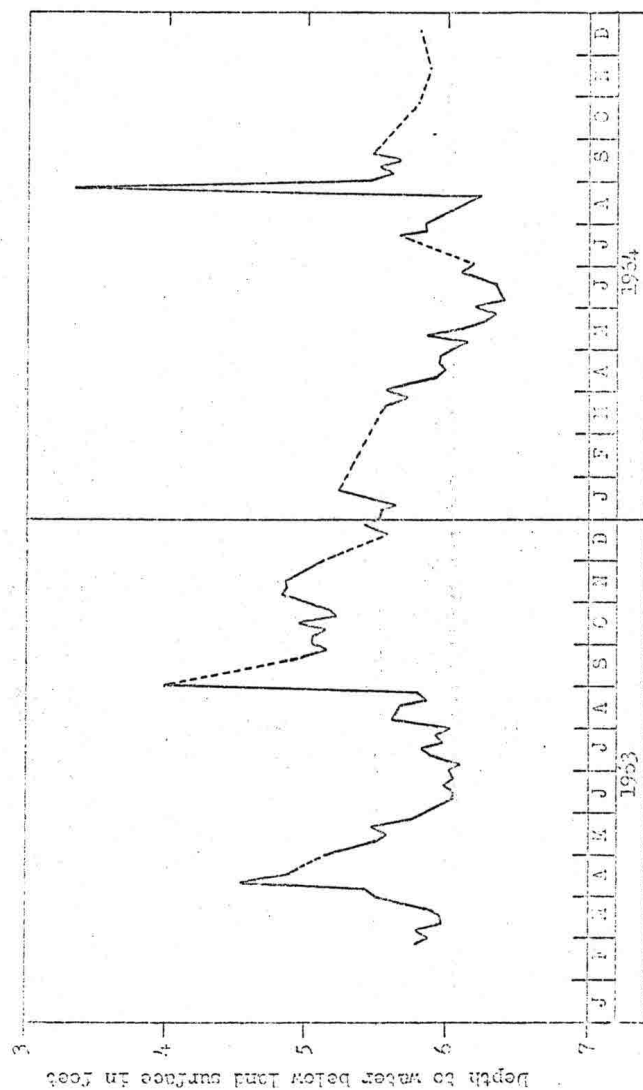


Figure 1.-- Highest daily water level below land surface, dug well 112.
Clifton Bay, St. John, V. I.

Table 3.--Chloride content, as determined from
field analyses, of water from well NPS-9 Cinnamon Bay, St. John

Date	Meter reading, gallons	Temperature, °F	Chloride, ppm
11-18-64	5,560	80	270
11-20-64	-	80	280
11-23-64	12,940	80	270
11-24-64	14,150	82	280
11-25-64	15,590	81	280
11-27-64	18,110	84	270
12-3-64	27,410	80	290
12-4-64	29,160	82	290
12-11-64	45,130	79	290
12-17-64	-	-	330

Table 1.--Records of drilled test wells, Virgin Islands

DESIGNATION		CONSTRUCTION DATA						HYDROLOGIC DATA				SUPPLEMENTARY DATA			
Well number	Location	Date com- pleted (year)	Depth (feet)	Casing record		Finish Depth (feet)	Type of lift	Surface altitude (feet)	Depth below land used (feet)	Date meas- ured (yr.)	Water- bearing material	Yield (gpm)	Use	Temp. °F	Remarks
				Diam- eter (inches)	From To										
NFS-2	Cruz Bay	Drilled	1964	99	4	0	20	0	20	99	None				
NFS-3	Cruz Bay	do	1964	54	6	0	25	0	25	54	None				
NFS-4	Lind Point	do	1964	200	6	-	-	0	0	200	None				
NFS-5	Trunk Bay	do	1964	60	6	0	12	0	12	60	None				
NFS-6	Cinnamon Bay	do	1964	70	6	0	50.7	0	50.7	70	None				
NFS-7	Hawksnest Bay	do	1964	36	6	0	27	0	27	36	None				
NFS-8	Cinnamon Bay	do	1964	50	6	-	-	0	0	50	None				
NFS-9	Cinnamon Bay	do	1964	60	6	0	39				Sub-				
					4	0	60	S	50	60	meral-				
											ble				
NFS-10	Lameshur	do	1964	66	6	0	52								
					4	0	67	S	47	67	None				
National Park, St. John, V. I.															
DESIGNATION		CONSTRUCTION DATA						HYDROLOGIC DATA				SUPPLEMENTARY DATA			
Well number	Location	Date com- pleted (year)	Depth (feet)	Casing record		Finish Depth (feet)	Type of lift	Surface altitude (feet)	Depth below land used (feet)	Date meas- ured (yr.)	Water- bearing material	Yield (gpm)	Use	Temp. °F	Remarks
				Diam- eter (inches)	From To										
NFS-2	Cruz Bay	Drilled	1964	99	4	0	20	0	20	99	None				
NFS-3	Cruz Bay	do	1964	54	6	0	25	0	25	54	None				
NFS-4	Lind Point	do	1964	200	6	-	-	0	0	200	None				
NFS-5	Trunk Bay	do	1964	60	6	0	12	0	12	60	None				
NFS-6	Cinnamon Bay	do	1964	70	6	0	50.7	0	50.7	70	None				
NFS-7	Hawksnest Bay	do	1964	36	6	0	27	0	27	36	None				
NFS-8	Cinnamon Bay	do	1964	50	6	-	-	0	0	50	None				
NFS-9	Cinnamon Bay	do	1964	60	6	0	39				Sub-				
					4	0	60	S	50	60	meral-				
											ble				
NFS-10	Lameshur	do	1964	66	6	0	52								
					4	0	67	S	47	67	None				

Finish: O - open hole, S - slotted.

Water-bearing material: Vb, volcanic breccia; Vt, volcanic tuff; V, volcanic undifferentiated.

Use: T, test; O, observation; P, public supply.

National Park, St. John, V. I.

Table 2.--Chemical quality of water from drilled test wells, Virgin Islands National Park, St. John, V. I.

Well Number	Location	Date of collection	PARTS PER MILLION										Dis-charge (gpm)					
			Silica (SiO ₂)	Iron (Fe)	Cal-ium (Ca)	Mag-nesium (Mg)	Sodium (Na)	Po-tas-sium (K)	Bicar-bonate (HCO ₃)	Sul-fate (SO ₄)	Chlo-ride (Cl)	Fluo-ride (F)		Ni-trate (NO ₃)	Dissolved solids	Hardness as CaCO ₃ , mg/l	Specific conductance at 25° C	pH
NPS-2	Cruz Bay	5-18-64	31	0.00	66	67	320	-	664	46	470	0.6	4.9	1,400	440	0	2,490	7.9
NPS-3	Cruz Bay	6-3-64	34	.00	94	77	377	-	632	45	480	.5	4.4	1,420	551	33	2,270	7.8
NPS-4	Cruz Bay housing	Dry hole																
NPS-5	Trunk Bay	7-17-64	38	.05	80	61	188	-	482	39	300	.0	.0	988	450	55	1,670	7.9
NPS-6	Cinnamon Bay	8-2-64	34	.00	46	81	224	-	390	47	400	.3	.4	1,060	448	128	1,900	8.2
NPS-7	Hawtnest Bay	8-8-64 ^{1/}	35	.00	68	88	214	-	372	57	505	.1	2.2	1,260	534	308	2,090	7.9
NPS-7	Hawtnest Bay	8-8-64 ^{2/}	38	.05	106	577	628	-	350	276	2,425	.0	.4	5,640	2,637	2,342	7,440	7.5
NPS-8	Cinnamon Bay	Dry hole																
NPS-9	Cinnamon Bay		36	.00	58	71	183	-	504	30	275	.5	.0	964	436	23	1,610	8.4
NPS-10	Lameshur Bay		23	.04	70	111	-	-	544	-	1,003	.3	.9	2,380	631	185	4,090	7.8

1/ Sample taken at beginning of test, 5 minutes pumping.

2/ Sample taken at end of test, 12 hours pumping.

WATER SYSTEM DATA

- AREA Virgin Island DATE _____
COLLECTED _____ COLLECTED BY U.S.G.S.
1. Name of System: Cinnamon Bay
2. Location: State _____ County _____ General Area _____
Reference to permanent landmark _____
3. Source of Supply: Well No. 6 Capacity Safe Yield 2000 gpd
(Well, Spring, Stream, Impoundment, etc.)
4. Type of System: Gravity
(Pumped, Gravity, etc.)
5. Treatment: Chlorination
(Filtration, Chlorination, Aeration, etc.)
6. Distribution Mains: Size _____ Length _____; Size _____ Length _____
Size _____ Length _____; Size _____ Length _____
Size _____ Length _____; Size _____ Length _____
7. Pump Unit: Make _____; Type _____; Model No. _____
Serial No: _____; Outlet _____ in.; Inlet _____ in.
(Size) (Size)
8. Power Source: Electric Motor: Make _____; HP _____;
(Elec., Gas, Generator)
Serial No. _____; Voltage _____; Amps _____;
RPM _____; Type _____; Phase _____;
Cycles _____; Others _____; Stages _____
9. Control: Automatic _____; Manual _____;
(Float, Electrobe, Pressure, Time)
Other _____
(Explain)

10. Pump Design: Capacity _____ gpm _____ gpm
 (Actual) (Design)
 Head _____ ft. _____ ft.
 (Actual) (Design)
11. Pump Housing: Type Const. _____; _____; Size _____
 (Walls) (Roof)
12. Storage: Ground Level; Type Const. Concrete
 (Pneumatic, Elevated, Underground, etc.) (Concrete, Wood, Steel)
 Size _____; Capacity _____; Inlet _____ ft. 1" P.V.C. in.
 (Elev.) (Size)
 Outlet _____ ft. _____ in.; Pressure Setting _____
 (Elev.) (Size) (If pneumatic)
13. Distribution: Water Closets X; Lavatory X; Urinal X;
 Drinking Fountain X; Hose Bids X; Residences _____;
 Other _____; _____; _____;
14. Metered or Nonmetered: _____; No. _____; Size _____
 No. _____; Size _____
 No. _____; Size _____
15. Fire Protection: Fire Hydrants _____; Yard Hydrants _____
16. Water Analysis: Chloride 400 ppm

17. Condition of System: _____
 (Repairs needed itemize)

Other Supporting Information

Virgin Islands Cooperative Water-Resources Investigations

Water Resources Division
U. S. Geological Survey

INFORMATION RELEASE VI-17
St. John, Virgin Islands

Ground Water, V. I. National Park
St. John, V. I.

Annual Summary

The Virgin Islands National Park and the Virgin Islands in general have been experiencing a drouth since late in 1963. Ground-water levels reached a high in September 1963 and since generally have been declining as shown by hydrographs of selected wells, figures 1 and 2. Hydrographs of other wells show similar trends.

Table 1 summarizes well information and table 2 gives data on chemical quality of water from the test wells. Detailed well information on test wells completed in the National Park is given in previous Information Releases and Monthly Reports.

In general, the information gained from the test drilling has been very encouraging. Ground water of fair chemical quality and in significant quantities is available in most areas of the National Park and should be considered as a source of supply for all future development. It is the least expensive and the most reliable of all natural sources in the National Park.

During December 1964, field chloride determinations (table 3) of water samples from NPS-9 at Cinnamon Bay, which was recently placed in operation, show a slight increase in chloride content. The chloride content may stabilize, but if periodic analyses of the water continues to show increasing chloride it will be necessary to rest the well for longer periods and to pump for shorter intervals. In conjunction with this, it would be advisable to put into operation NPS-6 and NPS-12 as noted in Information Release VI-15.

Cinnamon Bay Spring has been dry since February 1964 except for short periods after rains that cause some surface runoff. The flow from the spring at these times is essentially surface flow and near-surface runoff, and not ground water in the true sense. Before ground-water flow is re-established it will be necessary for the ground water reservoir to be recharged from rainfall. Water levels must rise several feet, perhaps as much as 4 feet, judging from ground-water levels in similar areas in the Islands.

During the coming months the program of measuring water levels and stream flow will continue on St. John, and periodic reports summarizing the results will be made.

2

INFORMATION RELEASE VI-17

The information contained in this release is preliminary and is subject to revision. It may be used internally by the cooperating agencies and their representatives, but may not be published.

January 15, 1965

San Juan, Puerto Rico

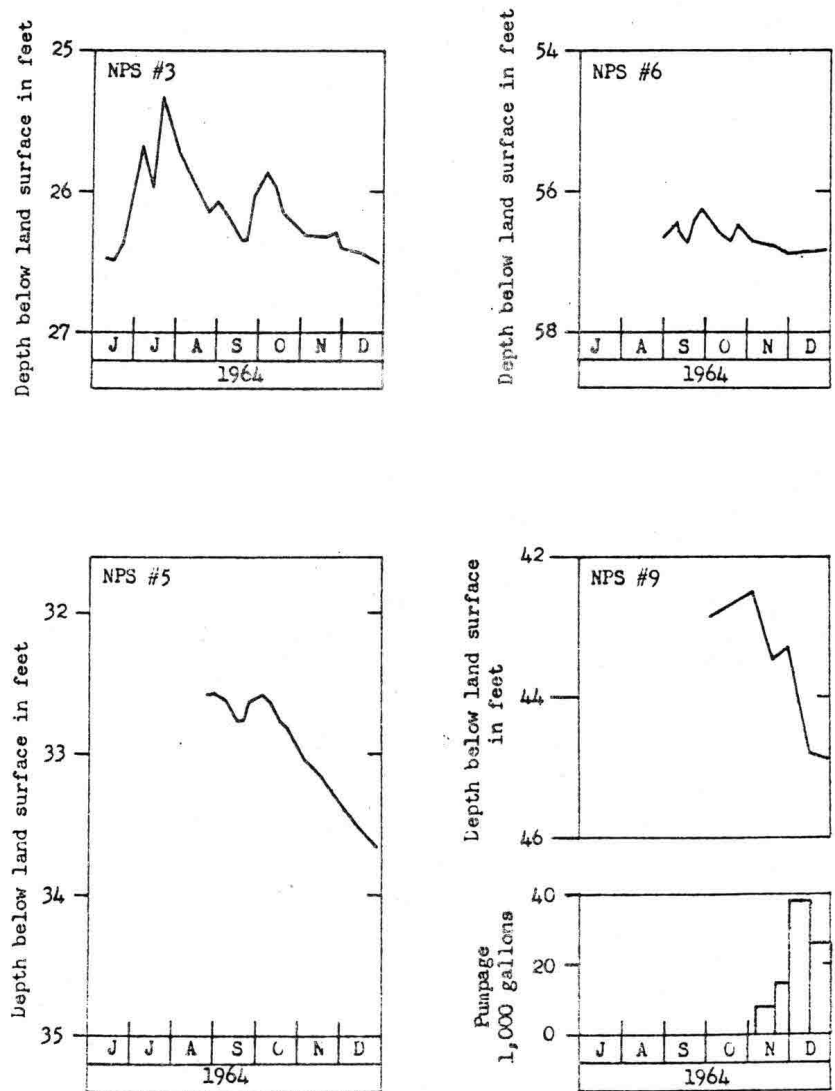


Figure 2.-- Water levels in selected wells, St. John, V. I.

12 Arroyo Street
Hato Rey, Puerto Rico 00918

January 12, 1965

Mr. Frank R. Givens, Superintendent
National Park Service
Virgin Islands National Park
P. O. Box 1707 Charlotte Amalie
St. Thomas, V. I. 00802

Dear Mr. Givens:

A tabulation is enclosed of funds spent on test-well drilling for the National Park Service in St. John, Virgin Islands. The funds were assigned in FY-1964, but the drilling contract carried over into FY-1965.

If you have any questions about the data shown, Mr. Donald C. Jordan, our resident engineer in St. Thomas, is in the best position to provide answers. Sufficient copies of the tabulation have been provided for your possible transmittal to appropriate other NPS offices.

Exploring for and finding water for some of your needs was an interesting technical problem. The second phase of observing how the well supplies stand up under regular use also will be interesting. Pivotal in this phase is knowing how much water is pumped. I believe Mr. Jordan has made recommendations on what information is needed.

Cordially yours,

DBB
Dean B. Bogart
Chief, Caribbean District, WRD

In triplicate

cc: D. C. Jordan, St. Thomas, V. I.

Area Hydrologist, Arlington, Va.

DBB/gmp

Water-Supply Project for National Park Service
in Virgin Islands National Park, St. John

Summary of costs of test-well drilling, FY-1964 funds

Funds assigned to drilling	\$15,000
Less: 12 3/4% Washington Office Technical Service Charge	<u>1,912</u>
Net funds available for drilling	<u>\$13,088</u>

Well number	Depth drilled, ft 14.75/ft	Casing installed, ft 5.00/ft	Casing pulled, ft 1.25/ft	Experimental time, hr \$11.00/hr	Pumping and bailing tests, hr \$11.00/hr	Cost
NPS-2	98	-	18	-	2 1/2	\$ 1,495.50
3	54	25	-	-	13 1/2	1,070.00
4	200	-	13	-	0	2,966.25
5	60	13	-	-	17	1,137.00
6	70	54	-	-	10 1/2	1,418.00
7	36	28	-	-	15 1/2	841.50
8	50	-	21	-	0	763.75
9	60	45 1/	-	1	9	1,220.00
10	<u>66</u>	<u>53 1/</u>	<u>-</u>	<u>-</u>	<u>8</u>	<u>1,326.50</u>
Total	694	218	52	1	78	\$12,238.50
Bulldozing 2/						<u>810.00</u>
						<u>\$13,048.50</u>

1/ 4-inch diameter plastic liner was installed, in addition to steel casing.

2/ Bulldozing drilling sites.

December 31, 1964

U. S. Geological Survey
San Juan, Puerto Rico

Virgin Islands Cooperative Water Resources Investigation

Water Resources Division
U. S. Geological Survey

MONTHLY REPORT NO. 6

Summary of Activities for National Park Service
July 1963

A 5-foot diameter test hole has been completed at Cinnamon Bay, St. John (see figure 1). The test hole penetrated very dry, reddish-brown alluvial rubble to a depth of 24 feet. The materials range from clay to boulders and have been deposited in layers ranging in thickness from one to three feet. The layers have a graded appearance with coarser material at the bottom grading upward to finer material. At a depth of 24 feet the color of the material changed to gray and numerous roots were observed. This represents the top of the capillary fringe over the water table. The material became progressively wetter below 24 feet and at 26 feet the first free water was observed. The test hole was completed at a depth of 24 ft. With the equipment and personnel available it was not possible to deepen the hole.

A short duration step drawdown pumping test was conducted on July 31. The results of this test are as follows:

<u>Pumping Rate</u> <u>(Gallons per Minute)</u>	<u>Duration of Pumping</u> <u>(Minutes)</u>	<u>Water Level</u> <u>(Feet below land surface)</u>
0	0	26.20
0.57	101	26.38
1.0	40	26.40

The data indicates that the well will produce 1 gpm with about 0.2 foot drawdown. The water has a chloride content of about 200 ppm, based on field tests. In view of the fact that the step drawdown test shows favorable results the test hole could be converted to a production well, as suggested in Figure 2. It is recommended that the hole be deepened two feet to a depth of 29 ft. and that an 18-inch concrete culvert be used as the casing. A gravel envelope should be placed around the casing below the water table. The bottom joint of casing should be perforated with say, 1/2-inch holes.

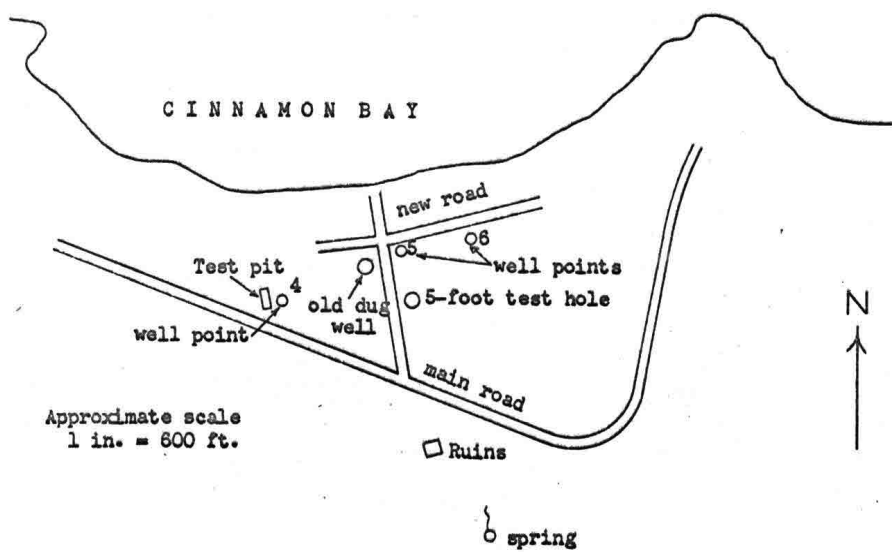
The hydrologic data obtained to date from the investigation at St. John indicate that wells of various types are feasible in the beach areas. Properly constructed wells can be installed to furnish potable water, but of course all water for drinking should be chlorinated. In addition, it is possible to obtain supplies of slightly brackish water suitable for such things as laundries, showers, and toilets.

The following table shows the chlorides of the water at various installations at Cinnamon and Trunk Bays.

Field chloride of water at various installations in Cinnamon and Trunk Bays, St. John, V. I.				
Source of sample	Date	Chloride (ppm)	Water Temp. (°F)	Remarks
Cistern at Cinnamon Bay	7-11-63	375		Water pumped from converted test pit.
47. Converted test pit (Figure 1)	7-11-63	350	88	Pit had been pumped 4 times on alternate days with a maximum drawdown of 0.5 ft.
6. Well point #6 (figure 1)	7-23-63	1,680		Pumped 1/2 gpm from a depth of 7.7 to 8.7 ft.
5 foot test hole (figure 1)	7-31-63	185		After pumping at 1 gpm for 40 min.
5. Dug well Trunk Bay	7-11-63	400		After well was cleaned.

It is suggested that the water needs be determined in the various beach areas so that recommendations can be made as to the type, number, and location of well installations in each area.

The investigation of the north-shore beach areas will continue as time allows. Pumping tests are planned for wells at Cinnamon Bay, Trunk Bay, and Adrian Estate.



Water source	Chloride (ppm)
Test pit	400
Spring	236
Well point no. 4	225-245
Well point no. 5	490-530

Figure 1.— Sketch of the Cinnamon Bay area.

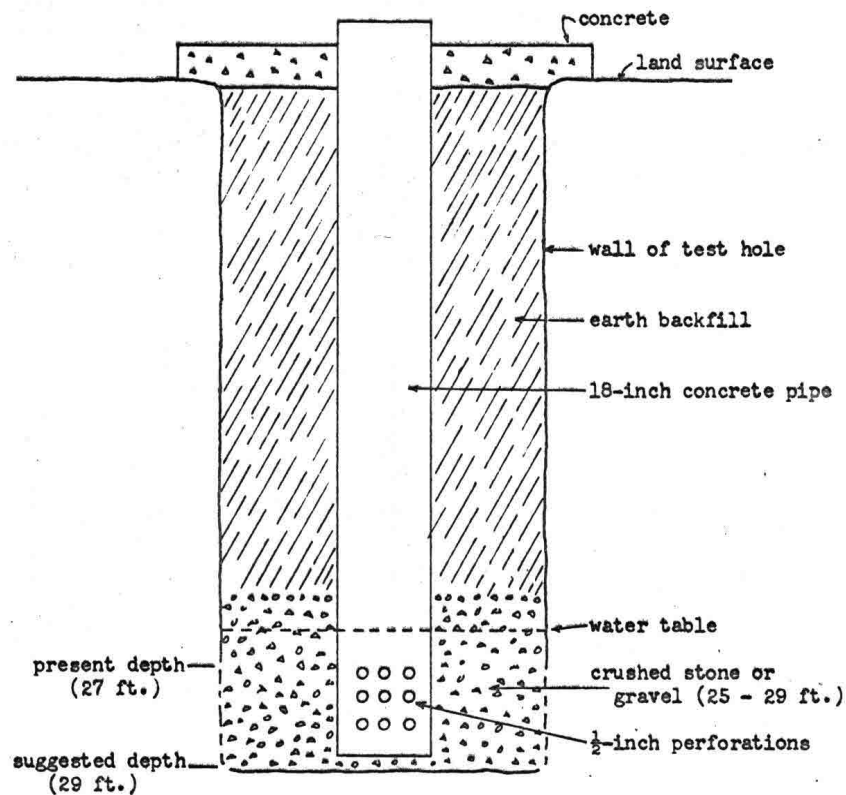


Figure 2.- Suggested construction for converting dug test hole to a production well at Cinnamon Bay, St. John.

Docket Information

Number of Documents in Docket 18

Documents Dated from 7/15/1963 to 1/15/1965

Docket Compiled: 7/28/2011