



WATER-RIGHT DOCKET

Shenandoah National Park

Docket No: 3

WELL. BIG MEADOWS WATER SYSTEM

State Water Rights Documentation

09-01-1965: water well completion report for big meadows test hole #1, (site #2)

COMMONWEALTH OF VIRGINIA		VDMR - 1347
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT		WWCR - 39
DIVISION OF MINERAL RESOURCES		OFFICE ADDRESS:
JAMES L. CALVER, COMMISSIONER		McCormick Road
WATER WELL COMPLETION REPORT		Charlottesville, Virginia
MAILING ADDRESS: Box 3667, University Sta. Charlottesville, Virginia	OWNER: <u>National Park Service (Shenandoah)</u> Mailing Address: <u>Luray, Virginia 22835</u>	
TENANT: <u>Big Meadows Test Hole #1, (Site #2)</u> Mailing Address: <u>Luray, Virginia 22835</u>		
H. L. Singhas, President		
DRILLER: <u>Valley Drilling Corporation</u> Mailing Address: <u>Middleburg, Virginia</u>		
WELL LOCATION: County <u>Madison</u> Approx. <u>6-1/2</u> miles <u>West</u> (direction) of <u>Syria, Virginia</u> and <u>1/2</u> miles <u>East</u> (direction) of <u>Skyline Drive</u>		
(GIVE DIRECTION AND DISTANCE IN FEET OR MILES FROM TWO REFERENCE POINTS - ROADS, TOWNS, RIVERS, ETC. - ON COUNTY HIGHWAY OR OTHER MAP)		
DATE STARTED: <u>July 28, 1965</u> DATE COMPLETED: <u>August 20, 1965</u>		
TYPE OF DRILL RIG USED: <u>Air Rotary</u> TOTAL DEPTH <u>265</u> feet		
WATER LEVEL: Stands <u>52</u> feet below surface OR		
has <u>NATURAL</u> flow of _____ gallons per minute.		
YIELD TEST: Method <u>Submersible (test)</u>		HOLE SIZE: <u>10</u> inches from <u>0</u> to <u>52</u> feet
Drawdown <u>151.1</u> feet		<u>6-1/4</u> inches from <u>52</u> to <u>265</u> feet
Rate <u>60</u> gal. per min.		_____ inches from _____ to _____ feet
Duration <u>*36</u> hrs., <u>15</u> min.		SCREEN SIZE: _____ inches from _____ to _____ feet
WATER ZONES: from <u>200</u> to <u>205</u> feet		_____ inches from _____ to _____ feet
from <u>215</u> to <u>220</u> feet		_____ inches from _____ to _____ feet
from _____ to _____ feet		CASE SIZE: <u>6-1/4</u> inches from <u>+2</u> to <u>52</u> feet
WATER: Color <u>Clear</u> Taste <u>Good</u>		_____ inches from _____ to _____ feet
Odor <u>None</u> Temp. <u>50</u> °F		_____ inches from _____ to _____ feet
WELL TO SUPPLY: (check one) Home _____		GROUTING: Method <u>Poured</u>
Farm _____ Town _____ School _____		Material <u>Concrete</u> Depth <u>52</u> feet
Industry _____ Other <u>Government facility</u>		PUMP: Type <u>10 HP Submersible pump</u>
WATER ANALYSIS AVAILABLE: Yes <u>X</u> No _____		Capacity <u>50</u> gal per min
DRILL CUTTINGS SAVED: Yes <u>X</u> No _____		Depth of intake <u>215</u> feet
(DRILL CUTTINGS SHOULD BE COLLECTED AT 10 FOOT INTERVALS. THESE SAMPLES MAY BE SHIPPED TO THIS OFFICE EXPRESS COLLECT SAMPLE BAGS ARE FURNISHED FREE OF CHARGE UPON REQUEST.)		
REMARKS: <u>* 14-hour test after leak in air line was repaired.</u>		
(LOG OF WELL) OVER		

VDMR - 1348
WWCR - 95

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF MINERAL RESOURCES
JAMES L. CALVER, COMMISSIONER

MAILING ADDRESS: Box 3667, University Sta.
Charlottesville, Virginia

OFFICE ADDRESS: McCormick Road
Charlottesville, Virginia

WATER WELL COMPLETION REPORT

OWNER: National Park Service (Shenandoah) Mailing Address: Luray, Virginia 22835

TENANT: Big Meadows Test Hole #2 (Site #4) Mailing Address: Luray, Virginia 22835

DRILLER: H. L. Singhas, President
Valley Drilling Corporation Mailing Address: Middleburg, Virginia

WELL LOCATION: County Page Approx. 3 ^{miles} ~~feet~~ southeast (direction) of Mauck and 1500 ^{feet} ~~miles~~ northwest (direction) of Skyline Drive

(GIVE DIRECTION AND DISTANCE IN FEET OR MILES FROM TWO REFERENCE POINTS - ROADS, TOWNS, RIVERS, ETC. - ON COUNTY HIGHWAY OR OTHER MAP.)

DATE STARTED: August 2, 1965 DATE COMPLETED: August 6, 1965

TYPE OF DRILL RIG USED: Air Rotary TOTAL DEPTH 500 feet

WATER LEVEL: Stands none * feet below surface OR
has NATURAL flow of _____ gallons per minute.

YIELD TEST: Method none conducted

Drawdown _____ feet

Rate 0 gal. per min.

Duration _____ hrs., _____ min.

WATER ZONES: from none encountered feet

from _____ to _____ feet

from _____ to _____ feet

WATER: Color no water obtained

Odor _____ Temp _____ °F

WELL TO SUPPLY: (check one) Home _____

Farm _____ Town _____ School _____

Industry _____ Other Government facility

WATER ANALYSIS AVAILABLE: Yes _____ No X

DRILL CUTTINGS SAVED: Yes X No _____

(DRILL CUTTINGS SHOULD BE COLLECTED AT 10 FOOT INTERVALS. THESE SAMPLES MAY BE SHIPPED TO THIS OFFICE EXPRESS COLLECT. SAMPLE BAGS ARE FURNISHED FREE OF CHARGE UPON REQUEST.)

REMARKS: * August 6, 1965 - at completion of drilling

(LOG OF WELL) OVER

LOG

FURNISHED BY: Valley Drilling Corporation DATE: September 1, 1965

DEPTH (feet)		TYPE OF ROCK OR SOIL PENETRATED (gravel, clay, etc., hardness, color, etc.)	REMARKS (water, caving, shot, screen, sample, etc.)
FROM	TO		
0	70	Soft materials encountered, consisting of dirt, shale and mud seams No water encountered	
70	500		

(Use additional forms if necessary)

COMMONWEALTH OF VIRGINIA		VDMR - 1701 WWCR - 45
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT		
MAILING ADDRESS: Box 3667, University Sta. Charlottesville, Virginia	DIVISION OF MINERAL RESOURCES JAMES L. CALVER, COMMISSIONER	OFFICE ADDRESS: McCormick Road Charlottesville, Virginia

WATER WELL COMPLETION REPORT

OWNER: National Park Service (Shenandoah) Mailing Address: Luray, Virginia 22835

TENANT: Big Meadows Test Hole #3 (Exploratory Hole #1) Mailing Address: Luray, Virginia 22835

DRILLER: Frank W. Martin Drilling Co., Inc. Mailing Address: 5163 Starkey Rd. Roanoke, Va 240-14

WELL LOCATION: County Madison Approx. 600 ~~1000~~ northeast (direction) of Big Meadows Maintenance Area and 1600 ~~1000~~ north (direction) of Skyline Drive

(GIVE DIRECTION AND DISTANCE IN FEET OR MILES FROM TWO REFERENCE POINTS - ROADS, TOWNS, RIVERS, ETC. - ON COUNTY HIGHWAY OR OTHER MAP)

DATE STARTED: June 27, 1966 DATE COMPLETED: June 27, 1966

TYPE OF DRILL RIG USED: Air Rotary TOTAL DEPTH 100 feet

WATER LEVEL: Stands 18 feet below surface OR

has NATURAL flow of _____ gallons per minute.

YIELD TEST: Method <u>Pump</u> Drawdown <u>6 3/4</u> feet Rate <u>92</u> gal. per min Duration <u>24</u> hrs., <u>0</u> min WATER ZONES: from <u>35</u> to <u>40</u> feet from <u>70</u> to <u>80</u> feet from _____ to _____ feet WATER: Color <u>clear</u> Taste _____ Odor _____ Temp. <u>50</u> °F WELL TO SUPPLY: (check one) Home _____ Farm _____ Town _____ School _____ Industry _____ Other <u>Government facility</u> WATER ANALYSIS AVAILABLE: Yes <u>X</u> No _____ DRILL CUTTINGS SAVED: Yes <u>X</u> No _____ (DRILL CUTTINGS SHOULD BE COLLECTED AT 10 FOOT INTERVALS. THESE SAMPLES MAY BE SHIPPED TO THIS OFFICE EXPRESS COLLECT. SAMPLE BAGS ARE FURNISHED FREE OF CHARGE UPON REQUEST) REMARKS: <u>Flow by air test estimated by driller to be 500 gpm.</u> _____ _____ _____	HOLE SIZE: <u>10</u> inches from <u>0</u> to <u>68</u> feet <u>6</u> inches from <u>68</u> to <u>100</u> feet _____ inches from _____ to _____ feet SCREEN SIZE: _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet CASE SIZE: <u>6</u> inches from <u>0</u> to <u>68</u> feet _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet GROUTING: Method <u>Poured</u> Material <u>Cement</u> Depth <u>66</u> feet PUMP: Type <u>Elect. Sub.</u> Capacity <u>92</u> gal per min. Depth of intake <u>68</u> feet
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(LOG OF WELL) OVER

COMMONWEALTH OF VIRGINIA DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT DIVISION OF MINERAL RESOURCES JAMES L. CALVER, COMMISSIONER		VDMR - 1702 WWCR - 44 OFFICE ADDRESS: McCormick Road Charlottesville, Virginia
WATER WELL COMPLETION REPORT		
MAILING ADDRESS: <u>Box 3667, University Sta. Charlottesville, Virginia</u>		Mailing Address: <u>Luray, Virginia 22835</u>
OWNER: <u>National Park Service (Shenandoah)</u>		Mailing Address: <u>Luray, Virginia 22835</u>
TENANT: <u>Big Meadows Test Hole #4. Site #5</u>		Mailing Address: <u>Luray, Virginia 22835</u>
DRILLER: <u>Frank W. Martin Drilling Co., Inc.</u>		Mailing Address: <u>5163 Starkey Road, Roanoke, Va 24014</u>
WELL LOCATION: County <u>Madison</u> Approx. <u>1/2</u> miles <u>east-southeast</u> (direction) of <u>entrance to Big Meadows Area</u> and <u>1600</u> feet <u>southeast</u> (direction) of <u>Skyline Drive</u>		
(GIVE DIRECTION AND DISTANCE IN FEET OR MILES FROM TWO REFERENCE POINTS - ROADS, TOWNS, RIVERS, ETC. - ON COUNTY HIGHWAY OR OTHER MAP.)		
DATE STARTED: <u>June 28, 1966</u>		DATE COMPLETED: <u>July 11, 1966</u>
TYPE OF DRILL RIG USED: <u>Air Rotary</u>		TOTAL DEPTH <u>350</u> feet
WATER LEVEL: Stands <u>111</u> feet below surface OR has <u>NATURAL</u> flow of _____ gallons per minute.		
YIELD TEST: Method <u>Pump</u> Drawdown <u>212.5</u> feet Rate <u>2</u> gal. per min. Duration <u>24</u> hrs., <u>0</u> min.		HOLE SIZE: <u>10</u> inches from <u>0</u> to <u>36</u> feet <u>6</u> inches from <u>36</u> to <u>350</u> feet _____ inches from _____ to _____ feet
WATER ZONES: from <u>160</u> to <u>165</u> feet from _____ to _____ feet from _____ to _____ feet		SCREEN SIZE: _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet
WATER: Color <u>Clear</u> Taste _____ Odor _____ Temp. _____ °F		CASE SIZE: <u>6</u> inches from <u>0</u> to <u>36</u> feet _____ inches from _____ to _____ feet _____ inches from _____ to _____ feet
WELL TO SUPPLY: (check one) Home _____ Farm _____ Town _____ School _____ Industry _____ Other <u>Government facility</u>		GROUTING: Method <u>Poured</u> Material <u>Cement</u> Depth <u>34</u> feet
WATER ANALYSIS AVAILABLE: Yes <u>X</u> No _____		PUMP: Type <u>Elec. Sub.</u> Capacity <u>8</u> gal per min Depth of intake <u>336</u> feet
DRILL CUTTINGS SAVED: Yes <u>X</u> No _____ (DRILL CUTTINGS SHOULD BE COLLECTED AT 10 FOOT INTERVALS. THESE SAMPLES MAY BE SHIPPED TO THIS OFFICE EXPRESS COLLECT. SAMPLE BAGS ARE FURNISHED FREE OF CHARGE UPON REQUEST.)		
REMARKS: _____ _____ _____ _____		
(LOG OF WELL) OVER		

LOG

FURNISHED BY: Frank W. Martin Drilling Co. DATE: August 16, 1966

DEPTH (feet)		TYPE OF ROCK OR SOIL PENETRATED (gravel, clay, etc., hardness, color, etc.)	REMARKS (water, caving, shot, screen, sample, etc.)
FROM	TO		
0	5	Dirt	
5	25	Boulder and Dirt	
25	50	Greenstone	
50	125	Greenstone and Red Streaks	
125	130	Greenstone and Brown	
130	225	Greenstone	Water 165
225	230	Brown	
230	250	Brown and Green	
250	290	Greenstone	
290	295	Light Green	
295	300	Quartz	
300	350	Greenstone	

(Use additional forms if necessary)

Land History

Form 10-559
(Nov. 1958)

U. S. DEPARTMENT OF THE INTERIOR - NATIONAL PARK SERVICE

FIXED PROPERTY RECORD

DESCRIPTION OF PROPERTY (Include reference to the location within the Park, how the asset was acquired, name of contractor, etc)

Location: Big Meadows - Central District

Three Springs

One 50,000 Gallon Concrete Reservoir

One Concrete Pumphouse (168 S.F.) w/pumping facility, electrically operated

16,014 Linear Feet of Pipe

Eight Stone Masonry Drinking Fountains

Eight Fire Hydrants

Pumping System

Constructed by CCC, Force Acct. 1938-1956

Line	DATE	REFERENCE		QUANTITY			COST		
		Journal Voucher	Other	Unit	No. of Units	Accumulated Total	Direct Costs	Indirect Costs	Accumulated Costs
1	8/27/59	37-10	System		1				38,900.00
2	7/29/59	37-1				1	773.32	135.41	33,808.73
3	3/8/63	37-71					24,604.30	4,689.58	63,102.61
4	4/13/64	37-107				1	2,446.27	389.70	65,938.58
5	10/22/64	37-33				1	1,357.31	217.17	67,513.06
G.L. Acct. No.		General Classification			Sub-Classification		Region	State	Park or Office
100.8		Utility			Water System		One	Va.	SNP

Supporting Hydro Data

LEWIS SPRING PROJECT

The Lewis Spring Project, PLATES IV and V, is a recent development and its supply is furnished from seepage through the talus formation and from fractured rock. Records of flow for this spring are published on pages 10 to 13. A study of the variation in the flow shows that the problems which had to be solved involved the taking care of surface run-off and large quantities of underground flow during certain periods and the installation of new types of equipment for leading the water to the collecting chamber.

This source of supply is practically on the edge of a large area of talus formation at a sharp break and drop-off of the bed rock at the head of Hawks Bill draw. The principal supply for the project comes from within a collecting gallery as shown in detail by section C-C. The base of this collecting gallery consists of fractured bed rock through which the water flows with an additional supply from seepage through and at the base of the talus formation. Two stone masonry walls were built along the line of two fractures from which the water is collected in 8-inch tile pipes and carried directly to the collecting chamber. The remaining area of this collecting gallery is filled with crushed stone permitting the water which has found its way by seepage through and at the base of talus to get into the area represented by section B-B on the left end and around the masonry wall on the right. Section B-B shows the construction of another section of this collecting gallery. The cut-off wall is located on bed rock its base tapers off towards the source in order to prevent the flow from seeping under the wall into the draw. An 8-inch tile resting on the concrete base and covered with a layer of large stones followed by a layer of crushed stone, carries the flow to the collecting chamber from that part of section C-C not incased in masonry receptacle, and from the collecting gallery represented by section A-A. The footing for the cut-off wall for the collecting gallery, represented by section A-A.

LEWIS SPRING PROJECT

and in other sections on clay, and is tapered as in section B-B. The gallery consists of a cut-off wall using 4-inch open tile to collect the flow. The tile rests on a concrete base first covered with large stones and followed by smaller stones. The construction of the right collecting gallery is similar to the left gallery represented by section A-A. All the water is collected in a collecting chamber which is 8-feet long, 3-feet wide, and 2-feet deep. In order to protect the underground flow and keep out surface water during periods of heavy precipitation a 4-inch concrete cover has been placed on the crushed stone, covering the three collecting galleries and the collecting chamber. On top of this concrete slab there was placed from 4 to 12 feet of earth. The water is carried away from the collecting chamber to the storage tank by an 8-inch pipe and the chamber is also provided with two 4-inch tile lines for taking away the overflow. Receptacles A and B are of concrete sealing fractured bed rock which produces a flow that is carried off by means of 4-inch tile to the main pipe leading to the storage tank. Both of these receptacles are equipped with overflow pipes for carrying away excess flow. Beyond receptacle A seepage was noted and a small collecting gallery 16 feet long, similar in construction to that at section A-A, was installed.

LEWIS SPRING

Daily discharge, in gallons per minute, 1934-35

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	325	116	383	130	191	180	171	198	86	51	69	150
2	325	113	390	138	186	180	171	191	86	51	69	147
3	325	111	383	124	181	180	171	184	86	51	69	144
4	317	109	375	130	175	180	171	176	86	51	69	162
5	311	108	369	118	171	181	171	168	86	51	69	383
6	308	103	34	116	166	178	170	160	80	51	69	383
7	324	99	339	113	162	178	170	183	80	51	64	355
8	301	96	310	116	160	171	170	148	80	80	69	355
9	301	98	300	120	163	162	170	144	80	80	64	355
10	301	99	290	113	176	154	170	140	80	74	64	355
11	196	99	276	106	184	145	170	136	80	74	64	342
12	191	99	265	104	131	136	166	138	77	74	64	329
13	188	99	265	101	130	144	201	128	74	74	64	302
14	185	86	243	100	120	157	203	124	69	77	69	303
15	181	83	233	99	121	163	246	120	69	80	69	291
16	173	80	211	99	120	155	267	116	66	80	64	279
17	174	80	211	99	200	168	277	113	64	80	64	255
18	171	80	211	99	200	171	279	112	64	80	64	233
19	169	80	211	118	201	171	274	110	64	80	64	273
20	167	78	206	130	130	171	269	108	64	80	74	222
21	165	69	201	144	191	171	265	107	59	77	113	211
22	162	70	185		188	171	260	106	59	74	144	201
23	153	72	170		186	171	255	103	59	74	136	191
24	144	74	153		184	171	248	100	59	69	136	181
25	140	72	150		181	171	240	97	59	69	144	171
26	136	70	147		181	172	238	94	59	60	153	162
27	118	69	144		181	171	225	92	55	55	153	153
28	120	80	142		181	171	215	90	55	60	153	153
29	128	90	139	201		171	211	92	55	69	153	144
30	120	100	136	198		171	206	88	51	74	153	136
31	118		133	195		171		86		69	153	

Note: Jan. 22-28, no record

LEWIS SPRING

Daily discharge, in gallons per minute, 1935-36

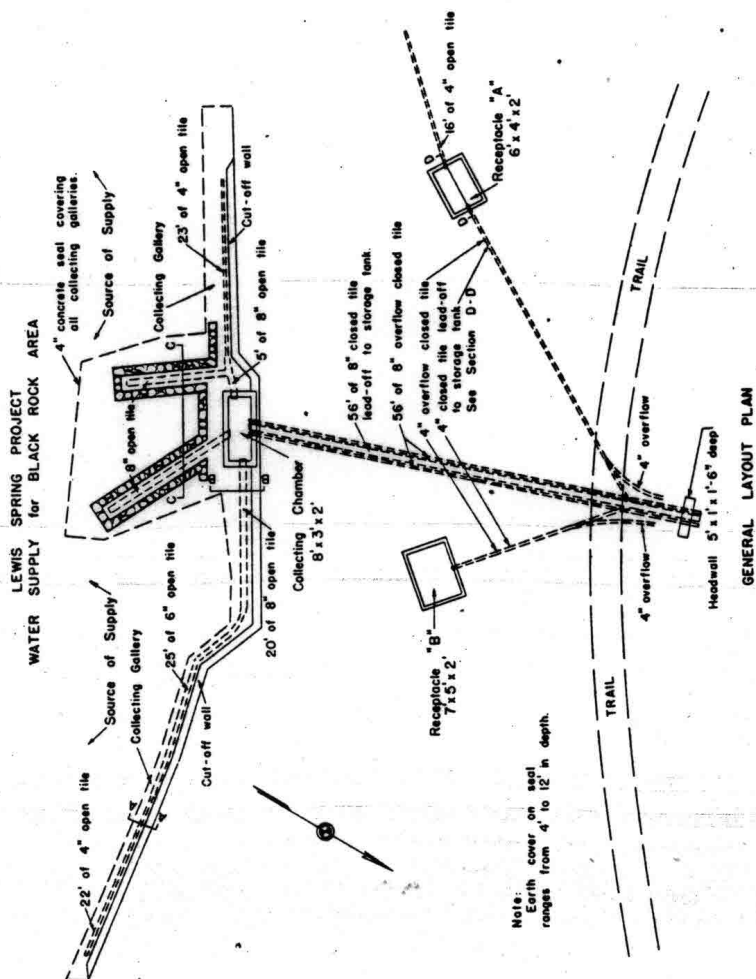
Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	136	69	171	201	153	191	291	128	64	39	36	30
2	128	69	162	201	153	181	279	128	64	39	36	27
3	120	75	153	211	153	181	279	128	64	39	36	27
4	120	80	153	211	153	171	267	120	64	39	36	27
5	116	64	153	222	162	162	250	120	59	39	36	30
6	112	64	153	233	171	153	233	113	59	36	33	30
7	108	64	153	222	171	153	222	113	59	36	33	27
8	106	64	153	222	171		211	106	59	36	33	27
9	99	64	153	211	171		211	106	55	36	33	27
10	99	61	153	191	171		222	106	55	36	33	27
11	92	58	153	191	171		211	99	55	36	33	27
12	92	55	144	191	162		206	99	55	36	33	27
13	91	69	154	191	162		201	99	55	36	33	24
14	92	80	171	191	153		191	92	51	36	33	24
15	86	80	201	191	153		201	92	51	33	33	24
16	80	80	211	191	153		191	92	51	33	33	24
17	80	80	233	191	153		191	86	51	33	33	24
18	80	86	244	191	162		191	86	51	36	33	24
19	80	92	244	233	162		181	86	51	36	33	24
20	77	99	233	211	171		181	80	47	33	30	21
21	74	128	233	211	181		171	80	47	33	30	21
22	71	128	222	211	181		171	80	47	33	30	21
23	69	128	222	201	191		171	80	47	33	30	21
24	69	128	222	191	191		162	74	47	33	30	21
25	60	128	211	181	201		153	74	47	33	30	21
26	64	128	211	171	233		150	74	43	33	30	18
27	62	128	211	171	211		147	74	43	36	30	18
28	59	120	201	181	201		144	69	43	36	30	18
29	120	144	191	181	191		136	69	43	36	30	18
30	69	153	191	171			136	69	43	36	30	18
31	69		191	171		303		69		36	30	

Daily discharges for period Oct. 1-15, 1936, are as follows: Oct. 1-6, 18 gallons per minute; Oct. 7-12, 16 gallons per minute; Oct. 13-15, 14 gallons per minute.

Note: Mar. 8-30, flow in excess of 380 gallons per minute

LEWIS SPRING PROJECT
WATER SUPPLY for BLACK ROCK AREA

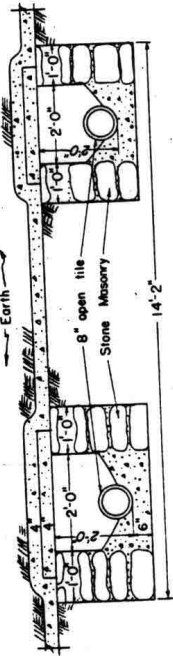
PLATE IV



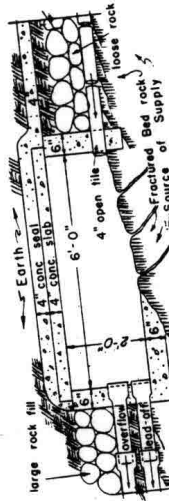
LEWIS SPRING PROJECT
WATER SUPPLY for BLACK ROCK AREA

PLATE V

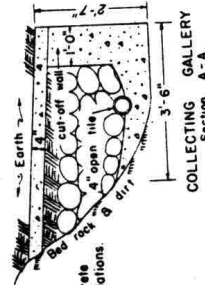
LEWIS SPRING PROJECT
WATER SUPPLY for BLACK ROCK AREA



COLLECTING GALLERY
Section C-C



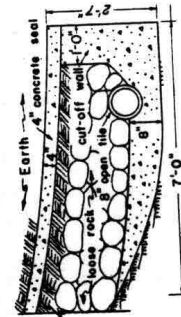
RECEPTACLE "A"
Section D-D



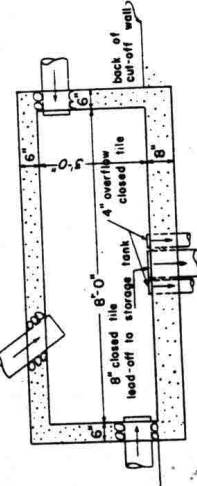
COLLECTING GALLERY
Section A-A

Note:
Reinforced concrete
used on all installations.

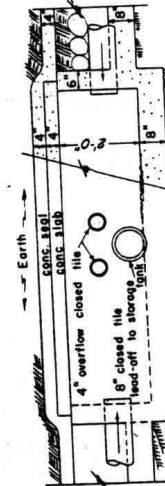
DETAIL OF INSTALLATIONS



COLLECTING GALLERY
Section B-B



PLAN OF COLLECTING CHAMBER



FRONT ELEVATION OF COLLECTING CHAMBER

PLATE V

I-a. 9-10-25.

y Gage Height, in Feet, and Discha

per min.

cond-Feet, of

Lewis Spr

-Diver

-Creek

in Shenandoah National Park, Va.

for the Year Ending September 30, 1936

nage Area Square Miles.

[Water Resources Engineers

Observer.]

DAY	OCTOBER		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min
1		136		69						153		
2		123		69		162		201				
3		120				153		211		153		181
4		120		60		153		211		153		171
5				64		153				162		162
6				64		153		233		171		153
7						153		222		171		153
8		106		64				222				
9		99		64		153		211				
10		99				153		191		171		
11		92				153				171		
12		92		55		144				162		
13				69		153				162		
14		92		80		171		191		153		
15		86		80				191		153		
16		80						191				
17		80				233		191		153		
18		80		86		244				162		
19		80		92						162		
20				99				211				
21				128				211		181		
22				128				211				
23		69				222		201				
24		69				222				191		
25										201		
26		64		128		211						
27				128		211		171		211		
28		59				201						
29		120						181		191		
30		69				191						
31		69				191		171				
TOTAL												
feet per square mile												
, depth in inches												
in acre-feet												
in												

Lewis Spring

9-192-a. 8-10-25.

Daily Gage Height, in Feet, and Discharge, in Second-Feet, of Lewis Spring River
At in Shenandoah National Park, Va. for the Year Ending September 30, 19
Near

Drainage Area Square Miles. Water Resources Engineers Observer.]

DAY	1935 ~~October~~ June		1935 ~~November~~ July		1935 ~~December~~ August		1935 ~~January~~ September		1935 ~~February~~ October		MA
	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	
1						69				136	
2						69				128	
3				51		69		144		120	
4								162		120	
5		86		51		69		383			
6		80		51		69		383			
7		80		51		64		355			
8				80		69				106	
9				80		64		355		99	
10		80		74		64		355		99	
11		80		74				342		92	
12				74		64		329		92	
13		74		74		64		303			
14		69				69		303		92	
15		69		80		69				86	
16				80		64		279		80	
17		64		80		64		255			
18		64		80				233			
19		64		80		64		233			
20		64		80		74		222			
21		59				113		211			
22		59		74		144					
23				74		136		191			
24		59		69		136		181			
25		59		69				171			
26		59		69		153		162			
27		55		55		153		153			
28		55				153		153			
29		55		69		153					
30		51		74		153		136			
31				69		153					
TOTAL											
Mean											
Second-feet per square mile											
Run-off, depth in inches											
Run-off in acre-feet											
M											

Lewis Spring

Water System - Operating Costs - Sheppard National Park.

December 1959.

Reference E-1.		Location of System:		Program		Skyland		Big Meadows		Sally Ann Gap		Elk Hollow		Dixie Ridge		Total			
INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.	INT.	DEPT.
Investment (Ref. E-2)		\$4,055		\$15,950		\$17,550		\$1,445		\$5,150		\$19,187		\$21,547					
Depreciation Rate		10%		6.15		1.510		71		680		5,420		171		252			
5%		30		1,440		1,420		72		64		17		12		12			
2 1/2%		25		6,750		10,505		282		70		2		17,405		435			
2%		2,250		4,115		4,115		82		14		1,740		35		478			
		100		486		566		50		50		206							
Annual Operating Costs																			
Electric Energy		25		324		590		20		50		75		914		214		54	
Repairs		25		100		100		20		50		75		570		875		24	
Labor		25		500		500		20		50		75		1,170		275		64	
Total Annual Costs		150		1,410		1,756		90		506		628		4,540		1104		234	
Annual Water Output		2,500		4,500		8,000		1,500		1,000		1,500		19,800					

Average Unit Cost - \$4.540 - \$0.25 per M. Gal.
18,800

9-192-a. 6-10-25.

9-192-a. 6-10-25.

Gallons per min

Daily Gage Height, in Feet and D arge, in Second Feet, of Day Spring. Ever
Creek

At in Shenandoah National Park, Va. for the Year Ending September 30, 19
Year

Drainage Area _____ Square Miles. [Water Resources Engineers _____ Observer.]

		1935 ~~December~~ June		1935 ~~November~~ July		1935 ~~December~~ August		1935 ~~January~~ September		1935 ~~February~~ October		1935 ~~March~~ November	
		Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min	Gage height	Discharge Gals/min
1							20				32		
2							20				29		
3					16		20		32		29		
4									39		29		
5			23		16		23		181				
6					16		20		130				
7			23		16		23		101				
8					20		26				26		
9					20		23		77		26		
10			23		20		23		77		26		
11			23		20				66		26		
12					20		23		56		26		
13			23		20		23		56				
14			20				20		47		26		
15			20		20		20				23		
16					20		20		47		20		
17			20		20		20		47				
18			20		20				43				
19			20		20		20		39				
20			20		20		26		39				
21			20				43		35				
22			20		23		43						
23					23		39		35				
24			18		18		35		35				
25			20		18				32				
26			18		18		32		32				
27			18		18		35		32				
28			18				32		32				
29			16		20		32						
30			16		20		32		32				
31					20		32						
TOTAL													
Mean													
Second-feet per square mile													
Run-off, depth in inches													
Run-off in acre-feet													

David Stur

	June	July	August	September	October	November	December	Jan. '35	February	1935 March	1935 April
	Gas height Gals/min	Discharge Gals/min	Gas height Gals/min	Discharge Gals/min	Gas height Gals/min	Discharge Gals/min	Gas height Gals/min	Discharge Gals/min	Gas height Gals/min	Discharge Gals/min	Gas height Gals/min
1		26	20	DAVID	35	26	146		35		32
2								29			
3		26	20		35		83				
4		26						29			
5		26		14	32	26	66			32	32
6											
7						23	56	26	32		
8	29				35	23		26		29	
9		26						26			
10			23	14	35						
11	29	23	23				43	26			
12	29				35	23			39	32	
13		23	16	14		20	39				43
14	26										
15	26	23	16	16	32		39	26	47	39	
16	26	23				20					66
17			16	77			35				
18		20		61	29			26		35	56
19	32	20		56		20	39		47		
20	32										
21	32	20	16	47		20	35	26	39	32	
22			14		29						47
23	29	20				20	32				
24		20		39	29	20			32		
25	29		39								
26		18		39	29	20	29			32	
27	29					20	29				
28		20		35		20		39	32		
29	29		14		29						
30	29	20	14		26					32	39
31			14								
TOTAL											

Other Supporting Information

Form 10-174
(Rev. 8-25)UNIT. STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

COMPLETION REPORT OF CONSTRUCTION PROJECT

REGION One	AREA Shenandoah National Park	COUNTY Page	STATE Virginia
PROJECT OR JOB TITLE Project 332.6 - Water and Sewer Service for Multiple Concession Cottage - Big Meadows			PCP NO. None
LOCATION IN AREA Big Meadows - Central Section		MASTER PLAN NO. NP-SHE 2115	BUILDING NO. None
WORKING DRAWING NO. AND TITLE None			
APPROPRIATION TITLE AND SYMBOL 14X1035 Construction NPS			WORK ORDER NO. B-6-SNP
CONTRACT NO.		DATE WORK STARTED April 1959	DATE WORK COMPLETED May 1959
NAME OF CONTRACTOR		ADDRESS	

COST ANALYSIS

CONSTRUCTION ITEMS	QTY.	UNIT COST IN PLACE	TOTAL COST IN PLACE
Copper water line, 2" includes meter valves, 3' x 4' brick valve and meter box.	320 lin. ft.	No unit cost kept.	
Orangeburg sewer line, 6"	163 lin. ft.	No unit cost kept.	
Solid rock excavation in sewer line	16.4 cubic yards	\$30.73	\$503.95
TOTAL			\$2,319.85

Verified by Field Finance Office

A. P. Koster

A. P. Koster, Administrative Officer

SUMMARY OF EXPENDITURES

PERSONAL SERVICES 855.46	EQUIPMENT	MATERIALS AND SUPPLIES 960.50
OTHER 503.89		

CHANGE ORDERS

ORIGINAL CONTRACT AMOUNT	FIRST	SECOND	THIRD
FINAL CONTRACT AMOUNT	FOURTH	FIFTH	SIXTH

THIS PROJECT OR JOB HAS BEEN COMPLETED IN ACCORDANCE WITH
APPROVED DRAWINGS, SPECIFICATIONS, AUTHORIZED CHANGES

SUBMITTED BY (Name and title) <i>Francis D. LaNoue</i>	DATE June 11, 1959
APPROVED BY (Name and title) <i>Francis D. LaNoue</i>	DATE June 11, 1959

(ATTACH NARRATIVE STATEMENT, PHOTOGRAPHS, AND "AS BUILT" DRAWINGS TO THIS FORM)

38105

NARRATIVE REPORT

Project 332.6 - Water and Sewer Service for Multiple Concession Cottage,
Big Meadows

An allotment advice dated February 13, 1959, for \$2,330, was received. Supplies and materials for the project were immediately ordered.

Work on the project was initiated in April 1959, and the services of a backhoe employed through a local contractor. The piece of equipment was successful in the excavation of both the water and sewer line with all except 16.4 cubic yards of solid rock which was encountered in the sewer line excavation. This rock was drilled, blasted and removed by Park forces.

The 320 linear feet of 2" copper water line, a 3' x 4' brick valve and meter box, valves and meter, and 163 linear feet of 6" Orangeburg sewer line were installed and constructed during April.

The project was completed in May 1959, with the installation of a concrete cover on the brick meter and valve box.

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

REPORT 7 SPL

COMPLETION REPORT OF CONSTRUCTION PROJECT

SECTION One	AREA Shenandoah National Park	COUNTY Page	STATE Virginia
PROJECT OR JOB TITLE Site Development at the New Concessioner Employee Cottages			PCP NO. None
LOCATION IN AREA Big Meadows		MASTER PLAN NO. NP-SHE-3115	BUILDING NO. None
WORKING DRAWING NO. AND TITLE None			
APPROPRIATION, TITLE AND SYMBOL 1441095			ACCOUNT NO. 999.1
CONTRACT NO. None		DATE WORK STARTED September 1955	DATE WORK COMPLETED March 1956
NAME OF CONTRACTOR None		ADDRESS None	

COST ANALYSIS

CONSTRUCTION ITEMS	QTY.	UNIT COST IN PLACE	TOTAL COST IN PLACE
* Earth Fill Material - Grading	48 c.y.	\$ 3.60	\$ 172.80
2 1/2" Melkayne cement-lined C.I. water pipe Includes one hydrant and one water meter	780 ft.	3.45	966.76
2" Copper Water Pipe	150 ft.	4.38	656.56
1" Copper Water Pipe	120 ft.	3.91	469.56
6" Vitrifid Clay Pipe - Sewer Line	100 ft.	4.24	424.47
4" Vitrifid Clay Pipe - Sewer Line	170 ft.	3.68	625.20
* Includes 2 miles overhaul of material and the bulldozing of .2 acre of ground in the area.			
TOTAL			\$ 3,315.66

SUMMARY OF EXPENDITURES

PERSONAL SERVICES \$ 2,549.46	EQUIPMENT \$ 69.24	MATERIALS AND SUPPLIES \$ 287.90
OTHER \$ 189.46		

CHANGE ORDERS

ORIGINAL CONTRACT AMOUNT	FIRST	SECOND	THIRD
FINAL CONTRACT AMOUNT	FOURTH	FIFTH	SIXTH

THIS PROJECT OR JOB HAS BEEN COMPLETED IN ACCORDANCE WITH
APPROVED DRAWINGS, SPECIFICATIONS, AUTHORIZED CHANGES

SUBMITTED BY (Name and title) C. H. Baldwin, Asst. Park Engineer	DATE August 22, 1956
APPROVED BY (Name and title) Ray D. Edwards, Superintendent	DATE August 22, 1956

(ATTACH NARRATIVE STATEMENT, PHOTOGRAPHS, AND "AS BUILT" DRAWINGS TO THIS FORM)

NARRATIVE REPORT

Project: Site Development at the New Concessioner Employee Cottages - Big Meadows

Funds were allotted in the amount of \$2,290 on August 9, 1955, for the preparation of a site and the installation of water and sewer lines for five cottages which the concessioner proposed to move from Swift Run Gap to the Big Meadows area. The Concessioner proposed to use these dwellings to house the employees working in and about the Lodge area.

A tentative site was selected for the location and a topographic detail survey was made of the prospective site by Engineering personnel of the Maintenance Division. After a study had been completed of the topographical data, the site was further studied on the ground and the location for the five units was decided upon. This location superseded the original tentative location site to take advantage of additional screening of the cottages from adjacent roadways and to reduce the length of travel by the employees to their work. The revised location, however, positioned the five units in a rockier area than the original site and increased the length of utility lines by approximately 25%, which appreciably increased the cost of excavation.

In September of 1955, the location of the cottages was staked out and the utility lines were also staked. The area in front of the cottages, approximately .2 of an acre, was bulldozed off for the removal of stumps and rock which would be in the way of walking, planting, etc. Forty-eight cubic yards of fill material was hauled in from a borrow pit two miles distant and spread over the area as a leveling course.

In October, 270 feet of water main ditch, 300 feet of common water and sewer trench, and 75 feet of sewer main ditch were excavated. Both the common water and sewer trench and the sewer main ditch excavation were time-taking and expensive as the excavation required the removal of large amounts of rock both by hand and by shooting.

Due to the relocation of the cottage sites, and the attendant increase in length of the utility lines and their location in a rocky area, it was obvious that the original allotment would be insufficient to accomplish the required work. To supplement the shortage, an amount of \$1,028 was transferred by Journal Voucher No. 40 from the 332.01 account.

By the end of November progress on the project amounted to the installation of 280 feet of 24" McWane cement-lined cast iron water main; 190 feet of 2" copper water main; 120 feet of 1" copper water service line; one 1 1/2" water hydrant; 170 feet of 6" vitrified clay sewer main; 100 feet of 4" vitrified clay sewer service line, and the connection of the newly-installed water and sewer mains to existing mains.

Work on the project was suspended the latter part of November to the first part of March because of inclement weather.

Final backups were provided for the Concessioner and the project was completed and the allotted funds were expended in March.

Form 10-174
(June 1, 62)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Work Order No.

134-211727 Dips 2000

FACE SHEET FOR COMPLETION REPORT

Park Shenandoah National Park	Region Southeast	Fund Symbol 14X1035
Location in Park Big Meadows Central District	State(s) Virginia	Year Programmed 1968 Lump Sum
	County or Counties Madison	PCP No. U-171-1
		Master Plan No. -
☐ Contract and/or ☒ Day Labor		Master Plan Corrected By -
Work Order Title Improve Water System, Big Meadows		As Built Drawings By 134-60000
		Date Started March 1968
		Date Completed August 1969

DESCRIPTION OF FIXED ASSETS
(For completion by employee in charge of project)TOTAL COSTS
(For completion by FFO)

230 - Utility Systems

1. Water System: Tying of production well drilled in 1966 into existing water distribution system. This changed the system from a spring and pumped to spring and well pumped.....
- Main features of addition:
1. Pump house, concrete block, 118 sq. ft., w/concrete roof.
 2. Pump, lineshaft turbine, 10 H.P., 3 phase.
 3. Net addition of 675 feet of 4" C.L., Class 150 pipe to system.
 4. 100 foot deep well put into production at a design capacity of 100 g.p.m.

\$ 12,292.89

NOTE:

Cost of well drilling and preliminary work has been transferred to Capital Assets Accounts by Regional Office.

PS & S Added

1,966.86

TOTAL

\$ 14,259.75

DISTRIBUTION		THE FIXED ASSET DESCRIBED ABOVE HAS BEEN COMPLETED IN ACCORDANCE WITH APPROVED DRAWINGS, SPECIFICATIONS, AND AUTHORIZED CHANGES		
No.	To	Submitted By:	Title:	Date:
1	WASO	Thomas R. Lowe	Chief of Park Maintenance	AUG 10 1969
1	ESC	By: Thomas R. Lowe		
1	SERO	Approved R. Taylor Hoskins	Title: Superintendent	Date: AUG 10 1969
1	SERO FO	By: R. Taylor Hoskins		
1	Shenandoah			
COSTS VERIFIED		BY T. J. Baer	Title: Regional Accountant	Date: FEB 12 1971

Form 10-174A
(June 1962)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

COMPOSITION OF COST FOR COMPLETION REPORT

Work Order Number

134-211727

Fund Symbol

14X1035

Year Programmed

1968 Lump Sum

Park

Shenandoah National Park

Region

SE

Location in Park

Big Meadows, Central District

Work Order Title

Improve Water System, Big Meadows

COMPOSITION OF COST

COSTS CHARGED TO FUNDS ALLOTTED TO FIELD FINANCE OFFICE

(1) Personal Services.....	\$ 5,530.26	
(2) Travel.....		
(3) Contract Work.....		
(4) Supplies and Materials.....	5,421.77	
(5) Other Direct Expenses..... & Depreciation		
(6) Operation of Equipment.....	1,267.36	
(7) Depreciation of Equipment.....		
(8) Purchase of Construction Equipment.....		
(9) Purchase of Other Accountable Equipment.....		
(10) Other Costs:	73.50	
(11) TOTAL COST CHARGED TO FFO FUNDS	xxxxxxxxxx	\$ 12,292.89
OTHER COSTS:		
(12) PS&S, AP, and/or Facilitating Services @ 16 %.....	\$ 1,966.86	
(13) Inventory and Other Non-Fund Costs		1,966.86
(14) GROSS WORK ORDER COSTS	xxxxxxxxxx	\$ 14,259.75
LESS:		
(15) Residual Value of Construction Equipment on Line 8	\$	
(16) Other Credits		
(17) NET COST OF FIXED ASSETS	xxxxxxxxxx	\$ 14,259.75

Identify other costs and other credits by line item entry, on an attached schedule, or explain in narrative.

NARRATIVE TO ACCOMPANY PROJECT COMPLETION REPORT

WORK ORDER NO. 134-211727

Improve Water System, Big Meadows

Shenandoah National Park

Under the National Park Service Water Resources Development Program, the Park has been developing deep well water supplies at all of the major developed areas in the Park. This project provided the addition of a deep well to the Big Meadows water system.

The need for an additional source of supply became very evident during recent years when during peak periods, water usage far exceeded the pumping capacity of the spring. The reservoir capacity of the system had to carry the load during these peak periods.

In cooperation with the Division of Mineral Resources of the Commonwealth of Virginia, a high production well was drilled approximately 600 feet northeast of the Big Meadows Maintenance Area. This well is 100 feet deep and is cased to 68 feet with 6-inch steel casing. The main water zones are located at 70 to 80 feet. While the exact capacity of the well is unknown, it was pumped at a steady 92 g.p.m., for 24 hours with a resulting drawdown of only 6-3/4 feet.

Plans for the water system addition were prepared at the Park level and approved by the other offices concerned.

Work on the addition began in March and continued on until late June. During this time, the pumphouse foundations, below grade piping, drain lines, and the pumphouse floor were completed. Materials for the installation were ordered and stored in the warehouse until needed. The pump was purchased by competitive bidding with the low bidder furnishing a 10 horsepower Deming vertical turbine pump (see attached sketch for details). The 4-inch C.I., pipe was furnished by Glamorgan Pipe and Foundry Company, Lynchburg, Virginia. A Wallace and Tiernan, Inc., Series A-747, diaphragm metering pump (chlorinator), was purchased since it is similar to other units in the Park. Other piping, valves, and electrical supplies were purchased from local distributors.

Due to the heavy workload on the maintenance program, no further work was accomplished until late September. Work resumed with the installation of the pump by Park forces, assisted by a local contractor experienced in turbine pumps. The building was then completed using concrete block for the walls and a poured-in-place concrete roof.

While the building was being completed, the water line connection to the existing system was completed with 675 feet of 4-inch C.I., pipe.

The reservoirs are already equipped with float controls to the lower pumphouse at the spring. By using old abandoned underground power lines and approximately 1,000 feet of new 10-2 wire, a circuit was made from the lower pumphouse to the new pumphouse. With this hookup, either pump or both pumps can be used on automatic or if a control failure occurs, either or both can be manually operated.

During the winter and early spring the interior piping and valves and the electrical hookups were made as time permitted. Commercial power was available close by and was extended to the installation by the company.

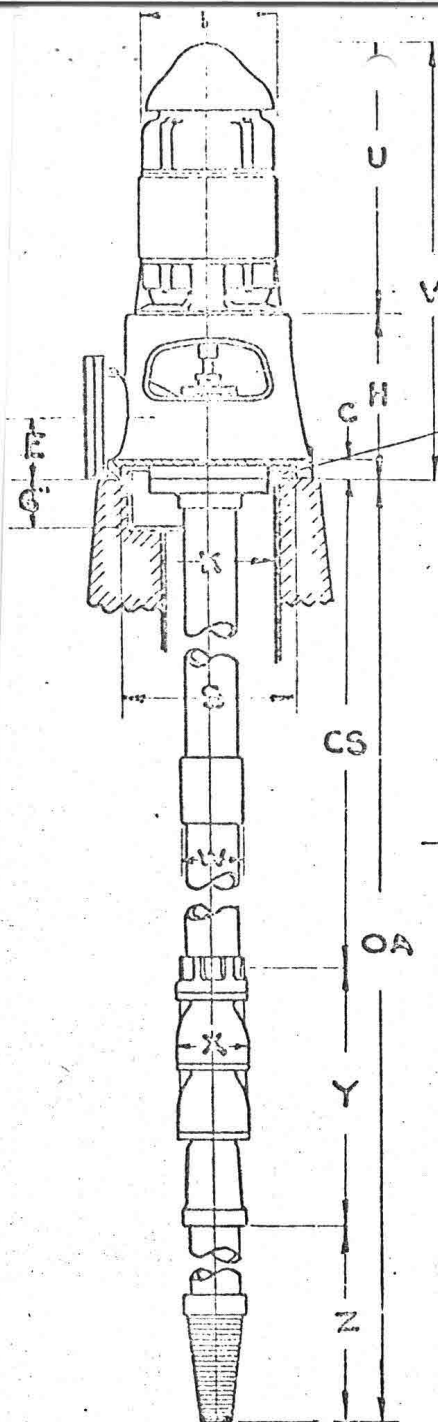
The installation was test pumped in late May. Maximum output was well in excess of 100 g.p.m., but in order to achieve better balance in the system and assure full development of the well, the output has been cut back to 60 g.p.m., for on-line duty at present.

The pumping installation has been used during the past season and has greatly eased the strain on the water system at Big Meadows. The value of two separate pumping units at a major development was demonstrated during July when lightning ran in on the electrical service to the lower pumphouse and put it out of commission for the better part of a week. The new pump supplied water during this period and thus averted a major curtailment of the visitor activities at the heaviest used area in the Park.

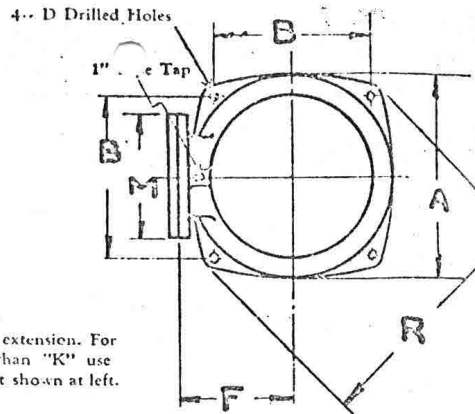

Thomas R. Lowe
Project Supervisor



Completed concrete block pumphouse. Well, pump, and all related equipment are completely enclosed in the building.



Recess for 1" casing extension. For well casing smaller than "K" use alternate arrangement shown at left.



DIMENSIONS

A	14"	S	13"
B	12 3/8"	T	10 7/8"
C	2"	U	23 1/8"
D	0 5/8"	V	39 3/8"
E	6"	W	5 1/4"
F	7 1/2"	X	5 3/4"
H	15 1/2"	Y	10'-1 1/2"
K	8"	Z	30'-11"
M	9"	CS	50'-0"
R	19 1/8"	OA	91'-0 7/8"

SPECIFICATIONS

DEMING Fig. 4700 Vertical Turbine Pump designed
100 GPM at 276 feet head, including:
10 HP 1750 RPM 460 Volt 3 Phase 60 C
G.E. Vertical Followshaft Motor WITH NON REVERSE
1155 F. 40°C AMBIENT RATED OPEN END
SD 4.5-10 Surface Discharge Head with 2 1/2 inch disc
flange with bolts and gasket.
50 feet 4 x 1 Column and shaft
MOUNTED FLUTED Bearings on 10 foot c
17 Stage 20 1/2 inch C.I. B.F. Bowl Ass
using Impeller 2610 from Curve 2610
30 feet 3 inch STEEL suction
3 inch GALVANIZED CORNUCOPIA TYPE st

When properly endorsed this print is correct for

Customer's P. O. _____ Turbine No. T. _____
Date _____ By _____

THE DEMING COMPANY

SALEM, OHIO

Form 314

Form 10-411
(July 1965)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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NO.	TO
6	SERO

PROJECT CONSTRUCTION PROPOSAL

1. STATEMENT OF MANAGEMENT'S REQUIREMENTS, PROPOSED WORK, AND ITS RELATIONSHIP TO OTHER FACETS OF THE PARK PROGRAM. (Provide detail data for "Management Information" on Form 10-411a, Supplemental Sheet and attach.)

An additional source of water is needed to augment the existing spring-fed supply serving the Big Meadows Development.

Due to the expansion of facilities in the area, over the years, and the prolonged drought condition, the existing spring is being used to the limit of its production and has been barely adequate to meet the demands during the heavy travel season.

Additional visitor use facilities are planned for this area and it is believed that water wells will be needed to meet the needs.

2. ADVANCE REQUIREMENTS DATA

LAND STATUS	MASTER PLAN NO.	APPROVAL DATE
Government-owned (NPS)	NP-SHE 3110-E	5/11/65
PCP NUMBERS OF PREVIOUSLY COMPLETE PORTIONS	INTERRELATED & DEPENDENT PROJECT PCP NUMBERS	
U-165	None	
INTERPRETIVE PROSPECTUS APPROVAL DATA	DATE	
None	---	

WATER RIGHT NEEDS & STATUS

None

RESEARCH NEEDS & STATUS

None

OTHER

Water resources studies and investigations are currently underway in cooperation with the Virginia Division of Mineral Resources. The exact extent of work required to meet the objective of this proposal cannot be determined until these studies are completed.

3. RECOMMENDED BY SUPERINTENDENT (Signature & Date)

R. Taylor Hoskins
R. Taylor Hoskins, May 12, 1966

4. APPROVED BY REGIONAL DIRECTOR (Signature & Date)

Glenn B. Lee *5/12/66*

5. LOCATION WITHIN AREA OR TERMINI

Big Meadows - Central District

7. REGION

Southeast

8. PARK

Shenandoah National Park

9. PROJECT

Improve Water System, Big Meadows

Madison and/or

Page

(County)

Virginia

(State)

6. BLDG. OR RT.# AND SEC.

10. PCP INDEX NO.

U-171

CLASS ☐ (A) - Estimate based on working Drawings
 CLASS ☐ (B) - Estimate based on preliminary plans
 CLASS ☒ (C) - Estimate based on similar facilities in other parks

P.S. & S. by

BPR ☐ NPS ☒

ESTIMATE

ITEM

QUANTITY

COST

Drill Production Wells and Connect into System

RESEARCH ESTIMATE APPROVED:

(Asst. Director, Resource Studies) (Date)

CONSTRUCTION ESTIMATE APPROVED:

H. Reese Smith

6/15/66

(Design Office Chief)

(Date)

INTERPRETIVE ESTIMATE APPROVED:

(Asst. Regional Director, C. H. H. H.)

(Date)

ESTIMATE TOTALS

RESEARCH.....	
Construction.....	51,900
Plans, Surveys, and Supervision.....	10,380
Contingencies.....	6,920
CONSTRUCTION SUB TOTAL.....	69,200
INTERPRETIVE SUB TOTAL (100%).....	
GRAND TOTAL.....	\$69,200

GSA DC 66-2827

For 10-411
July 1965)UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Page 1 of 1 pages

SUPPLEMENTAL INFORMATION FOR PROJECT CONSTRUCTION PROPOSAL

PARK Shenandoah National Park	FACILITY Improve Water System, Big Meadows	P.C.P. NO. U-171
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1. MANAGEMENT INFORMATION

One of the additional installations proposed for this area is a walk-in campground on the east side of the Skyline Drive. In order to avoid crossing the "Meadow" between this location and the present development with a water line, it would be desirable to provide a separate water system for the walk-in campground if a production well can be found on both the east side and the west side of the Drive.

2. TECHNICAL INFORMATION

Under the Water Resources Program, two holes were drilled for exploratory and stock purposes in 1965. One of these wells is productive, but due to its location and distance from the developed area, two additional holes are to be drilled during the summer of 1966. The sites of these additional wells are closer to the development and can be more easily and economically connected into the system if productive.

The holes drilled in 1965 were at Sites 2 and 4 as described in the Preliminary Report for the Big Meadows Area prepared by the Virginia Division of Mineral Resources, dated May 28, 1965. The well at Number 2 Site was productive and has a capacity of approximately 50 gpm.

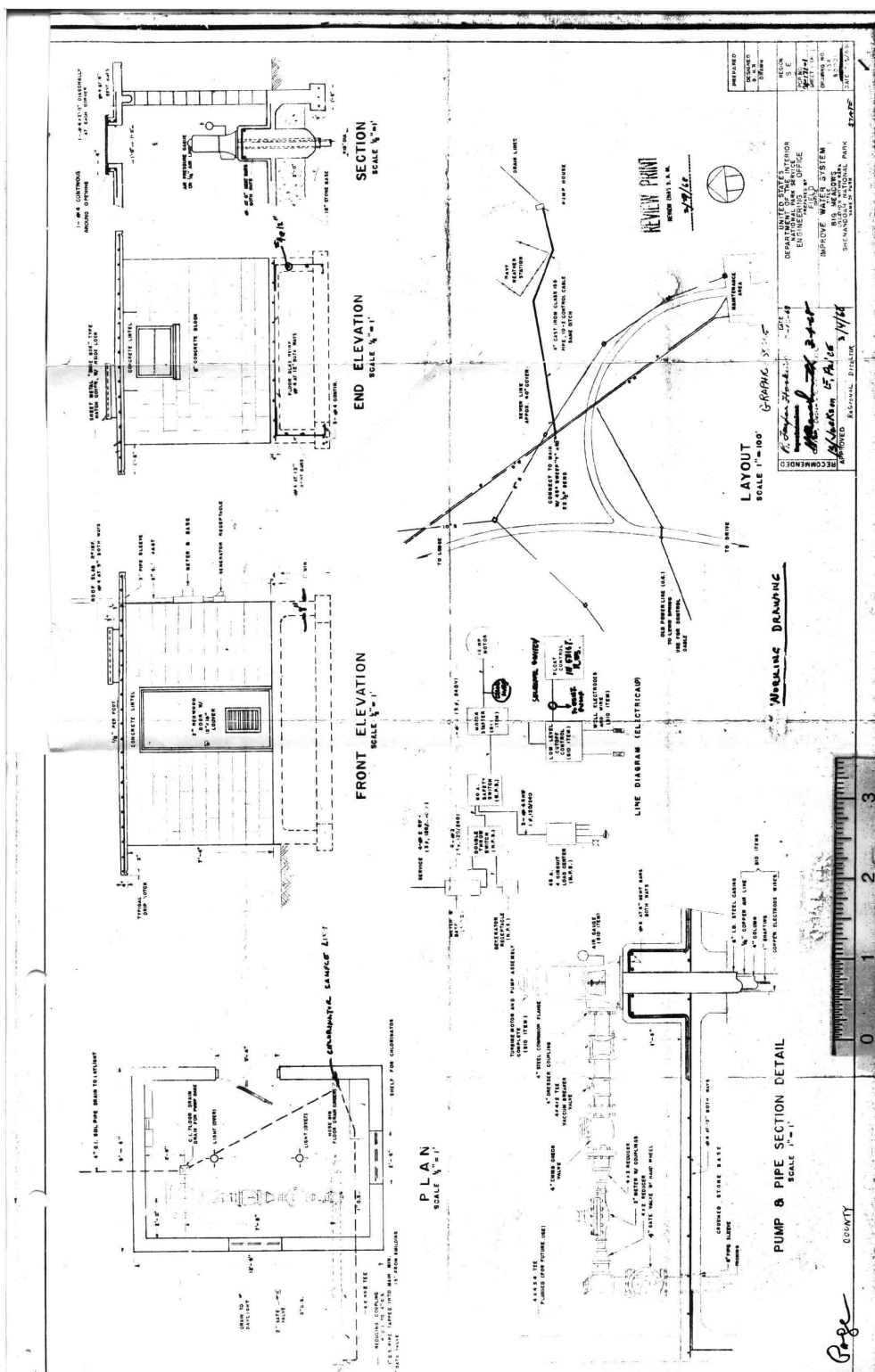
The holes to be drilled in 1966 are shown as Sites E-1 and T-5 in Preliminary Report No. 2 for the Big Meadows Area, dated October 12, 1965.

A comprehensive Water Resources Final Report for this area will be prepared by the Virginia Division of Mineral Resources upon completion of test well drilling.

Present storage tanks have a total capacity of 200,000 gallons. Maximum daily demands in 1965 ran approximately 50,000-gallons occasionally for several consecutive days.

Minimum spring flow during the heavy use season was approximately 35,000 gallons per day. Weir readings indicate that the spring flow is dropping yearly.

Commercial 3-phase (Delta) electric power services the developments.



In reply refer to:
D5039

September 24, 1959

Memorandum

To: Regional Director, Region One
From: Superintendent, Shenandoah National Park
Subject: Water Systems at Big Meadows, Panorama and Skyland

This is in reply to Mr. Smith's memorandum of September 16, forwarding a copy of the concessioner's letter of August 6 discussing the Park water systems in relation to the subject mentioned developments. Our comments and the information requested are as follows:

Big Meadows

We agree that the points needing basic support are the adequacy of the supply and the inadequacy of the storage facilities. At the present time, we have a 90,000 gallon reservoir at this location. The source of water is Lewis Spring, and the electric pump has a maximum capacity of 46 g. p. m. There is installed in the pump-house a gasoline stand-by pump which will deliver approximately 20 g. p. m. in case of emergency.

The minimum flow of Lewis Spring was recorded on September 17, 1957 when the out-put was 38.6 g. p. m. Some other recent observations are given below:

August 16, 1957	- 47.2 g. p. m.
December 20, 1957	- 196.0 g. p. m.
February 25, 1959	- 106.0 g. p. m.
March 20, 1959	- 166.0 g. p. m.
May 11, 1959	- 156.0 g. p. m.
July 31, 1959	- 64.2 g. p. m.

During August of this year, the total water consumption at Big Meadows was 1,887,400 gallons, or a daily average of 35,077 gallons. These figures are from actual meter readings. However, the use during week-ends was noted at approximately 40,000 gallons per day. Of the total amount, the concessioner facilities used 628,900 gallons, and the Park activities consumed 468,500 gallons.

Our records show that in this past August, 14,180 people used the campground, and 7,060 used the picnic area. Peak day uses were 1200 and 750 respectively. While even disregarding the water used at the Park residences and maintenance area, it will be seen that the per capita consumption in the campground and picnic area has been well below the computation standards of 40 gallons per camper and seven gallons per picnicker. We feel that this situation is due to the overcrowded situation and that when adequate facilities are provided, the per capita consumptions will approximate the standards. For this reason, it is believed that future requirements should be based on the standard figures rather than on our present records.

After discussing the concessioner's future plans at Big Meadows, it appears that an increase of 40% in consumption will take care of the company's requirements. The amount of water needed for this purpose will be tabulated in the recapitulation below.

Our Naturalist believes that the proposed Visitor Center will receive an average daily use of 500 persons, and a peak-day use of 5,000 people. These figures will be used in the re-cap.

The current plans are to expand the campground from the present 62 designated sites to a total of 312 sites, accommodating 1,248 people. It is estimated that the daily average use will be 100% of capacity and that peak-day use will be 50% in excess of capacity.

The capacity and use of the picnic area will probably remain unchanged along with the maintenance area and Park residences.

Recapitulation of estimated ultimate requirements:

	<u>Average Daily Use</u>	<u>Peak Day Use</u>
Concessioner	35,000 gallons	45,000 gallons
Campground	50,000 gallons	75,000 gallons
Picnic Area	1,000 gallons	5,000 gallons
Visitor Center	1,000 gallons	10,000 gallons
Maintenance Area	1,000 gallons	---
Residences	---	---
(Less than 500 g.p.d.)	---	---
Total	88,000 gallons	135,000 gallons

It will be seen from the fore-going that a spring flow and pumping capacity of 61 g. p. m. will be required to supply the average daily use during the busy part of the season. While the average flow of the spring is in excess of this amount, there is the danger that the minimum flow may occur during the peak travel season. Obviously, this factor should be taken into consideration in the studies.

Panorama

The minimum flow of the source spring was recorded on September 16, 1957 when the out-put was 5.0 g. p. m. Some other readings follow:

August 16, 1957	-	7.5 g. p. m.
December 19, 1957	-	6.8 g. p. m.
February 20, 1958	-	10.0 g. p. m.
October 22, 1958	-	14.0 g. p. m.
March 20, 1959	-	27.6 g. p. m.
May 11, 1959	-	18.8 g. p. m.

There are two other unused springs in the vicinity having a combined out-put approximately equal to the source spring which could be used for additional supply if desired.

The above data and field survey information were furnished to the Public Health Service and EODC personnel for use in the design of the system. As you know, the new water system at Panorama was completed this past summer, but the facilities there were not operated, so we have no actual experience on its performance. It is understood that there may be some loss of water from the source, and this will be investigated and corrected as far as possible by our Park maintenance forces before next season.

As to the amount of water needed by the concessioner for the sprinkler system, we have asked Mr. Davis to get the information for us from his architects. As soon as the data is available, we will furnish it to you.

Skyland

The minimum flow of the supply spring was recorded on September 17, 1957 when the out-put was 14.0 g. p. m. Some other recent readings were:

August 16, 1957	-	17.5 g. p. m.
December 20, 1957	-	99.2 g. p. m.
February 20, 1959	-	51.8 g. p. m.
March 20, 1959	-	99.2 g. p. m.
May 11, 1959	-	99.2 g. p. m.
July 31, 1959	-	24.5 g. p. m.
August 18, 1959	-	21.6 g. p. m.
August 31, 1959	-	18.8 g. p. m.

The electric pump will deliver a maximum of 46 g. p. m. we have no stand-by pumping equipment at Skyland, but it may be possible to install a gasoline unit in the pump house, for emergency operation by re-arranging the existing pumping plant.

Last month, the total water consumption at Skyland was 928,900 gallons, or a daily average of about 30,000 gallons. Peak-day use has been approximately 36,000 gallons.

As near as we can determine from the Master Plan and from the concessioner, it appears that the ultimate development at Skyland will result in an expansion of 50% greater than at present. Using this as a basis, the ultimate daily average would be 45,000 gallons, and the peak-day use would be 54,000 gallons.

When sufficient water is available, our present pump could deliver something over 60,000 gallons per day. However, it will be seen that with a possible minimum spring flow of 14.0 g. p. m., only 20,000 gallons of water per day could be supplied. As previously reported, we have had a few instances in recent years, when the consumption at Skyland exceeded the out-put from the source, and we were facing the prospect of hauling water on an emergency basis to supply the demand. Fortunately, we were able to get by with the reserve amount in the reservoir. However, it seems to us that even under present circumstances, additional sources of water are urgently needed.

We hope that the foregoing will supply the information desired by Mr. Smith. As indicated earlier, we will furnish the data concerning the Panorama sprinkler system as soon as we get it from the concessioner.

If there is other information we can provide, please let us know.

R. Taylor Hoskins
Superintendent

In duplicate

WWZ/mtv



UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

Region One
Richmond 20, Virginia

SEP 16 1959

IN REPLY REFER TO:

D5039

SHEN NATL. PARK	
SEP 18 1959	
☒	Mr. Tolson
☒	Mr. E. A. Tamm
☒	Mr. Clegg
☒	Mr. Glavin
☒	Mr. Ladd
☒	Mr. Nichols
☒	Mr. Rosen
☒	Mr. Tracy
☒	Mr. Harbo
☒	Mr. Mohr
☒	Mr. Winterrowd
☒	Tele. Room
☒	Mr. Holloman
☒	Miss Gandy

Memorandum

To: Superintendent, Shenandoah National Park

From: Regional Chief of Operations

Subject: Water Systems at Big Meadows, Panorama and Skyland

The attached copy of the concessioner's letter of August 6 discusses the park water systems in relation to the subject mentioned developments. We should like to have your comments on his statements and on the following:

Big Meadows

Two points are made which we think need basic support; the adequacy of the supply and the inadequacy of the storage facilities. We do not believe that the example of the sprinkler head is necessarily an indication that the storage capacity is too small. Any leak in excess of the minimum spring flow, if allowed to continue long enough, might deplete the available storage. You should have your engineer estimate the daily average and the maximum daily consumption for the ultimate development at Big Meadows. We believe you have meter readings and other data which may be used as a basis for such an estimate and for extending present consumption into the future. These figures can be checked against the capacity of the source and pump, and the amount of storage needed can be determined.

Panorama

With the new water system, we can get two fire streams of about 50 gpm each. With a total storage of 70,000 gallons these streams could be thrown for 10 hours which should be of more than sufficient duration. Mr. Beniss says the supply here is adequate. Is it? What is the minimum flow of the spring? We should also like to know how much water in gpm Mr. Beniss needed for his sprinkler system.

Skyland

The 50,000 gallon storage tank would last for 4 hours using two 100 gpm fire streams. We do not know what the minimum flow of the spring is for this supply, nor the rate at which the pump delivers. Your engineer should estimate the requirements for the ultimate development at this site also, so that there will be some factual data on which to base enlargement of the storage facilities and the need for searching for a new supply.

660-05

UNITED STATES
DEPARTMENT OF THE INTERIOR
SHENANDOAH NATIONAL PARK
LURAY, VIRGINIA

June 15, 1935

Mr. O. G. Tayler, Deputy Chief Engineer,
National Park Service,
Washington, D. C.

Dear Mr. Tayler:

As requested in the foot note on copy of your memorandum of June 12 to Mr. Peterson, I transmit herewith a topographic drawing of the Big Meadows development area which was compiled by the Branch of Plans and Designs from the field sheets made by Buttery, Fields and me. I assume that it will be necessary for you to retrace this in order to obtain usable prints.

I would like to call your attention to the possibility of using David Spring as a Source of water supply with Lewis Spring for an auxiliary supply. David Spring is at elevation 3490 and Lewis Spring is at elevation 3385, which would add 105 feet to the pumping head. The lowest reading we have on David Spring is 18 gallons per minute which is 25,000 per day. Allowing per capita consumption of 40 gallons per day it should be sufficient for this type of development. David Spring would supply a community of 600 people.

Sincerely yours,

J. R. Lassiter,

JRL/tts

WATER SYSTEMS - SHENANDOAH NATIONAL PARK

Dec. 1939

General

Water supply systems have been developed in fifteen separate areas in Shenandoah National Park. Additional systems will be required as new areas are opened and the Skyline Drive is extended. Some of these are little more than a developed spring, a drinking fountain and connection pipe line.

Where practical, gravity supply systems are developed and at other points pumping plants are installed. The present system may be classified as follows:

<u>Group</u>	<u>Gravity Supply</u>	<u>Pumped Supply</u>
1	Serving Park Operator, Public and Government.	
	Panorama Swift Run Gap Elk Wallow Dickey Ridge	Skyland <u>Big Meadows</u>
2	Serving Public & Govern- ment only.	
	Sexton Knoll Hased Mountain Hughes River Gap Naked Creek Parking Area Bald Face Mountain South River Picnic Grounds Pass Mountain Clear Spring	Lewis Mountain

Charge for Water Service

This report deals with the water systems which jointly serve the National Park Service and the park operators (Group 1) where the cost of water service furnished is prorated on the basis of use.

Cost and utilization information has been estimated based upon limited data accumulated over the period November 1, 1938 -- November 30, 1939. As more complete data is obtained any necessary change in the rates can be made. Most of these installations have been equipped with water meters for measuring the output of the system and the individual consumption.

At certain developed areas where the park operator conducts operations and where park visitors, other than patrons of the park operator, assemble, the

May 1938

Big Meadows - 1936-37 WPA Job 7
1937 CCG Job 184

50,000 gal. concrete tank (33'dia.x 8' deep)	\$2,500.00	} 2 1/2	
Spring development	530.00		
Pump house, 14' x 16' - 2 story	1,285.00		
Pump equipment - 425 ft. head -			
45 GHP - 2 cyl.reciprocating pump (F-M)			
7 1/2 HP motor, 2 phase, 220 volt			
Automatic control, 3000 ft. #10/2			
parkway control cable	1,510.00	-10 1/2	
6800 ft.- 6" C.I. pipe @ \$1.26	\$8,700.00		
1900 ft. - 4" " @ .95	1,805.00		
2000 ft. 2" galv. W.I. pipe .80	1,600.00		
100 ft. 1 1/2" " " .50	50.00		
		5 1/2	11,755.00
Water meters 1-2"	\$ 82.00		
4-3/4"	88.00		
			170.00
			\$17,550.00

Swift Run Gap - 1937.

650 gal. concrete tank 10 cu.yrds.	\$165.00	
Spring development	530.00	
200 ft. - 4" terra cotta pipe @ 35¢	\$70.00	
1400 ft.-2" used galv. W.I.pipe @ 45¢	630.00	
Water meters 1 - 1 1/2"	50.00	
		\$1,445.00

**Shenandoah National Park
BIG MEADOWS AREA
Final Report**

**National Park Service
Contract No. 14-10-1-134-2**

HISTORY

On September 25, 1964 the Acting Superintendent of Shenandoah National Park requested a hydrogeologic study of the Big Meadows Area be made for the purpose of developing additional water supplies. A specific portion of the Area was designated by park personnel within which the location of water wells was desirable. In lieu of the usual Preliminary Report with drilling recommendations, a letter was dispatched (see Reconnaissance Report, January 27, 1965) in which it was stated the designated portion of the Area was not considered favorable for the development of ground-water supplies. Two other portions were suggested for further studies that were approved by park authorities during a meeting at park headquarters on February 12, 1965.

A Preliminary Report was submitted on May 28, 1965 in which four drilling sites were recommended. Test holes were subsequently drilled at sites No. 2 and No. 4, and although a water well was developed from the test hole at site No. 2 an additional source of water was still needed. As springs could not be utilized to meet the water requirements, additional field studies were made and discussed in Preliminary Report No. 2, dated October 12, 1965. In this report recommendations were given for one test hole at site No. 5 and for one exploration hole at site E-1. With the completion of drilling at these sites and the development of the exploration hole into a water well, adequate water sources from wells were established on the east (Well No. 1 at Test Hole Site No. 2) and on the west (Well No. 2 at Exploration Hole Site E-1) sides of Skyline Drive in the Big Meadows Area.

- 2 -

TEST-HOLE DRILLING AND EVALUATION

Drilling of the first test hole was begun at Test Hole Site No. 2 by the Valley Drilling Corporation on July 28, 1965, and completed on August 20, 1965 at a total depth of 265 feet. Fifty-five feet of soil and weathered rock were penetrated before bedrock was reached, and from 55 to 100 feet metamorphosed basalt of the Catoctin Formation was encountered. A contact zone of epidotized basalt was then drilled from 100 to 115 feet, and the last 150 feet of the hole is in altered granodiorite of the Pedlar Formation. Water-filled fracture zones were penetrated from 200 to 205 and from 215 to 220 feet, each in granodiorite. After the test hole was reamed, cased, and grouted to a depth of 52 feet, a pump test of 36 1/4-hours duration was conducted and water samples were collected for analyses. However, because of a malfunction of the air line the only portion of the pump test for which valid readings are available is the last 14 hours. Although the rate of discharge at the end of the test period was 60 gallons per minute the pumping level was still declining, and had reached the depth of the first aquifer zone. Had the pump test been conducted until a stabilization of the pumping level been obtained for at least eight hours, the final yield would have certainly been less than 60 gallons per minute. Because the test was terminated prematurely, the capacity of this test hole as a water well is unknown. Analysis of a water sample collected near the end of the pump test indicates the water is slightly hard but otherwise is of good chemical quality (see attached analyses sheet).

The second test hole was drilled at Test Hole Site No. 4 by the Valley Drilling Corporation; drilling began on August 2, 1965, and was

- 3 -

terminated at a depth of 500 feet on August 6, 1965. At this location, on the west side of Skyline Drive near Lewis Spring, only metamorphosed basalts of the Catoctin Formation were penetrated beneath the 70 feet of soil and weathered rock. As the general water-bearing characteristics of the Catoctin Formation are known to be poor, this site had been selected for drilling only in the event the sites east of Skyline Drive were inaccessible, and a maximum drilling depth of only 400 feet was suggested (Preliminary Report of May 28, 1965). However, the test hole was drilled to a depth of 500 feet, and as no water was obtained no further tests were made.

The third test hole was drilled at Exploration Site E-1 by the Frank W. Martin Drilling Company on June 27, 1966. The selection of this site was motivated by the need to develop an additional source of water west of Skyline Drive, but because hydrogeologic conditions were not fully known near the maintenance area, an exploration hole was recommended. Metamorphosed basalts of the Catoctin Formation were encountered beneath 50 feet of soil and weathered rock, some of which are fractured and water-bearing. After drilling was terminated at 100 feet the hole was reamed, cased, and grouted to a depth of 66 feet. This construction eliminated an unmeasured quantity of water in the lower portion of the weathered zone that is susceptible to contamination, and a deeper water supply was developed from fractures penetrated at depths between 70 and 80 feet. A 24-hour pump test was conducted on July 17 and 18, 1966, and a drawdown of only 6 3/4 feet was measured during the first four hours of the test, after which no further

- 4 -

decline of the pumping level was recorded while pumping at a rate of 92 gallons per minute. Not only is this a relatively large-capacity well, but aside from the slight hardness and turbidity a chemical analysis of a water sample collected during the pump test indicates the water is of good chemical quality (see attached analyses sheet).

In the Reconnaissance Report of January 27, 1965 the area along the dirt road and power line east of Skyline Drive was described as being unfavorable for test drilling. This is also near Test Hole Site No. 3 noted as an inferior location for ground water (Preliminary Report of May 28, 1965). However, another study of this area was made in response to a later request for a water supply near the power line, and Test Hole Site No. 5 was selected (Preliminary Report No. 2, October 12, 1965) as the best location in an unfavorable area. Drilling at this site was begun on June 28, 1966 by Frank W. Martin Drilling Company, and was terminated at the recommended maximum depth of 350 feet on July 11, 1966. Metamorphosed basalt of the Catoclin Formation was penetrated beneath the 25 feet of soil and weathered rock and only a small supply of water was obtained. A 24-hour pump test was conducted after the hole was reamed, cased, and grouted to a depth of 34 feet, and water samples were collected for analyses. Although the water is of good chemical quality, (see attached analyses sheet), the rate of discharge from this well at the end of the pump test was only two gallons per minute with the drawdown of 212.5 feet having stabilized only during the final two hours.

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RECOMMENDATIONS

Aside from the problem of obtaining accessible drilling sites, the possibility of additional successful water wells in the Big Meadows Area is good. As in some other portions of Shenandoah National Park near the crest of the mountains where recharge areas are extremely limited, it may be advisable to locate future well sites in one of the other local drainage basins. It is also suggested that no ground-water supplies be developed from depths less than 150 feet at sites less than 1200 feet from Test Hole No. 3 (Exploratory Site E-1). The attached Water Well Completion Report forms, drillers logs, geologic logs, Pump-Test Data sheets, drawdown curves and chemical analyses contain information that will be helpful in any future water-well drilling operations at Big Meadows. These data are also on file at the Virginia Division of Mineral Resources and the sample drill cuttings have been placed in the permanent well-sample repository.

Virginia Division of Mineral Resources
Charlottesville, Virginia
March 27, 1967

Partial Chemical Analysis* of Big Meadows Test Hole No. 1
(values in Parts Per Million except for pH)

pH	7.3	Phosphate	0.55
Total Hardness	60.0	Iron	0.10
Calcium Hardness	50.0	Nitrate	0.004
Silica	6.4	Manganese	0.0
Sulfate	3.0	Turbidity	0.0

* Virginia Division of Mineral Resources, Sept. 17, 1965

Chemical analyses of Big Meadows Test Hole No. 3 and No. 4**
(values in Parts Per Million except for pH)

	Test Hole #3	Test Hole #4
pH (Electrometric)	8.3	8.2
Total Solids @ 103° C	90.0	89.0
Ignition Loss (organic & volatile)	29.0	25.0
Mineral Residue (non-volatile)	61.0	64.0
Free Carbon Dioxide	0.0	0.0
P. Alkalinity as CaCO ₃ (carbonate)	8.0	4.0
M. O. Alkalinity as CaCO ₃ (bicarbonate)	58.0	66.0
Total Hardness as CaCO ₃ (titration)	69.5	71.2
ANALYSIS OF MINERAL RESIDUE		
Silica and insoluble matter	0.5	0.5
Iron	0.02	0.01
Manganese	NIL	NIL
Calcium	14.0	14.5
Magnesium	8.4	8.5
Sodium & Potassium (as Sodium)	3.8	4.4
Bicarbonate (calculated)	70.8	80.5
Carbonate (Calculated)	4.8	2.4
Chloride	5.0	4.0
Sulfate	4.5	4.9
Nitrate	0.7	0.6
Fluoride	NIL	NIL

** Froehling and Robertson, Inc., October 3, 1966

WATER-SUPPLY IN SHENANDOAH NATIONAL PARK

PANORAMA TO SWIFT RUN GAP

**U. S. Geological Survey
Water Resources Division
J. J. Mursulaitis, District Engineer**

**University, Virginia
July 1, 1935**

David Spring

Location.-- At edge of meadows above Fox Hollow about 1 mile north of CCC Camp No. 2 and about one-half mile east of Black Rock peak.

Establishment.-- Established June 8, 1934.

Equipment.-- A 6 inch 90 degree V-notch weir installed in 36 foot concrete cut-off wall (See photographs).

Records of flow.-- June 8, 1934, to May 31, 1935; record continued after May 31, 1935.

Elevation.-- Mean sea level elevation 3,495 feet.

Remarks.-- Gage read several times a week. Measurements of flow made by volumetric method. Small spring, about 100 feet below and to one side of main spring, is not included in this record.

Average.-- Average discharge shown on form 9-192a is not the mean discharge for the month but the average discharge for the number of days on which discharge is recorded.

Lewis Spring

Location.-- 1,500 feet northwest of intersection of Skyline Drive and Hoover Camp road, 3,000 feet south of Black Rock peak and 3,500 feet northwest of CCC Camp No. 2.

Establishment.-- Established June 14, 1934.

Equipment.-- An 8-inch 90 degree V-notch weir installed in a 75 foot concrete cut-off wall. (See photograph).

Records of flow.-- June 14, 1934 to May 31, 1935; record continued after May 31, 1935.

Elevation.-- Mean sea level elevation 3,324 feet.

Remarks.-- Gage read several times a week. Measurements of flow made by volumetric method and by use of the Venturi Flume. Recorded flow does not include flow from several small springs beyond cut-off wall, near sharp cliff.

Average.-- Average discharge shown on form 9-192a is not the mean discharge for the month but the average discharge for the number of days on which discharge is recorded.

LEWIS SPRING WATER SUPPLY PROJECT

Location.- The project is located 1,500 feet northwest of intersection of Skyline Drive and Hoover Camp road, 3,000 feet south of Black Rock peak, 3,500 feet northwest of C. C. C. Camp No. 2, and about 52 miles from the north end of the Drive at Front Royal.

Installation.- The various units of the installation are as follows: one large collecting area "E, F and G"; 3 concrete receptacles; one weir house under construction; sump and pump house; reservoir, 50,000 gallons capacity; 108 feet of 8-inch open tile; 84 feet of 4-inch open tile; 60 feet of 8-inch closed tile; 185 feet of 4-inch closed tile; 170 feet of 5-inch cast iron pipe; 2,250 feet of 4-inch cast iron pipe; and 750 feet of 6-inch cast iron pipe.

The plans for the completed survey of this project are shown on sheets Nos. 33 and 34 and the field notes for the survey are shown on pages 69 and 70.

Monuments.- Thirteen concrete monuments, marked by the letters "C, D, M, R, S, T, U, V, W, X, Y, Z, and AA", were used in the survey to locate the underground units. Six of these monuments, "C, D, V, X, Z and AA", were used as bench marks for the survey and were tied into mean sea level elevation.

Elevation.- The elevations of the following monuments and units of the installation were determined by an uncheckered line of levels from Federal Bureau of Public Roads Bench Mark No. 16 BC described as spike in 12-inch stump 60 feet $\pm$ west of Drive at station 121 $\pm$ between culverts marked 119 $\div$ 28 and 122 $\div$ 70. M. S. L. elevation 3,431.614 feet.

Monument C, elevation 3,335.25 feet, is located about 90 feet east of the Appalachian Trail and about 55 feet from the area containing the headworks of Lewis Spring.

Monument D, elevation 3,314.07 feet, is located 100 feet southeast of the concrete pump house and 160.8 feet north of monument C.

Door sill of pump house, elevation 3,301.63 feet.

LEWIS SPRING WATER SUPPLY PROJECT

Top of manhole on reservoir, elevation 3,713.64 feet.

Monument I, elevation 3,645.51 feet, is located at station 24 + 20.6 which is at the first point of distribution on the line. There are four valves near this monument.

Monument V, elevation 3,662.62 feet, is located 225 feet northeast of monument I about 60 feet from the east edge of pavement on road to reservoir.

Monument J, elevation 3,667.11 feet, is located at the second point of distribution where the pipe turns from the road and leads up the mountain to the reservoir. This monument is 25 feet west of the western edge of pavement and may be located by the presence of four valves visible from the road.

Monument AA, elevation 3,707.59 feet, is located 36 feet southeast of the center of the manhole on the reservoir.

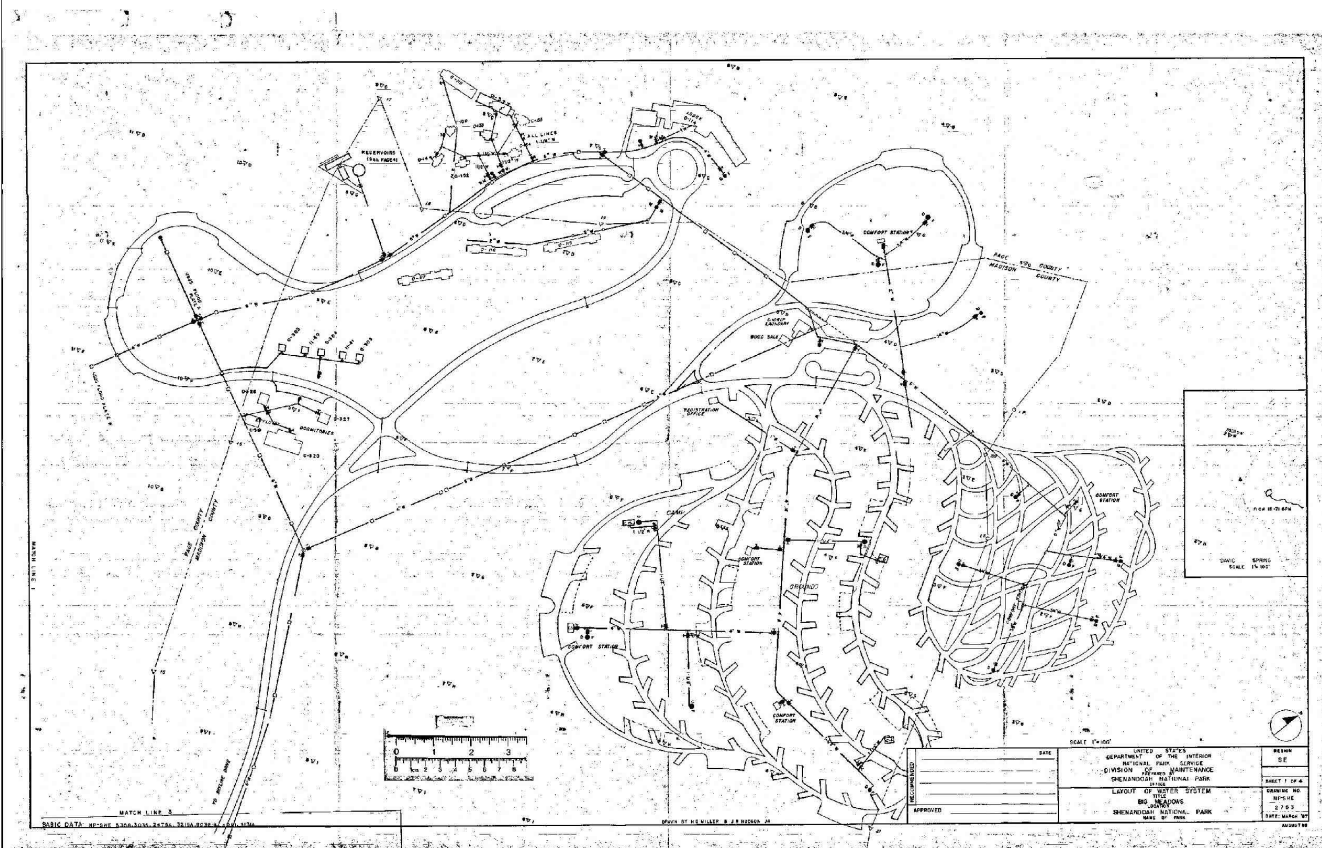
Description of System.- This source of supply is practically on the edge of a large area of talus formation at a sharp break and drop-off of the bed rock at the head of Hawks Bill draw. The principal supply for the project comes from within a collecting gallery as shown in detail by section C-C. The base of this collecting gallery consists of fractured bed rock through which the water flows with an additional supply from seepage through and at the base of the talus formation. Two stone masonry walls were built along the line of two fractures from which the water is collected in 8-inch tile pipes and carried directly to the collecting chamber. The remaining area of this collecting gallery is filled with crushed stone permitting the water, which has found its way by seepage through and at the base of talus, to get into the area represented by section B-B on the left and around the masonry wall on the right. Section B-B shows the construction of another section of this collecting gallery. The cut-off wall is located on bed rock and its base tapers off towards the source in order to prevent the flow from seeping under the wall into the draw. An 8-inch tile resting on the concrete base and covered with a layer of large stones followed by a layer of crushed stone,

LEWIS SPRING WATER SUPPLY PROJECT

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carries the flow to the collecting chamber from that part of section C-C not enclosed in the receptacle, and from the collecting gallery represented by section A-A. The footing of the cut-off wall for the collecting gallery, represented by section A-A, is located in some sections on bed rock and in other sections on clay, and is tapered as in section B-B. The gallery consists of a cut-off wall using 4-inch open tile to collect the flow. The tile rests on a concrete base first covered with large stones and followed by smaller stones. The construction of the right collecting gallery is similar to the left gallery represented by section A-A. All the water is collected in a collecting chamber which is 8 feet long, 3 feet wide, and 2 feet deep. In order to protect the underground flow and keep out surface water during periods of heavy precipitation a 4-inch concrete cover has been placed on the crushed stone, covering the three collecting galleries and the collecting chamber. On top of this concrete slab there was placed from 4 to 12 feet of earth. The water is carried away from the collecting chamber to the weir house by an 8-inch pipe and the chamber is also provided with two 4-inch tile lines for taking away the overflow. Receptacles "A" and "B" are of concrete sealing fractured bed rock which produces a flow that is carried off by means of 4-inch tile to the main pipe leading to the storage tank. Both of these receptacles are equipped with overflow pipes for carrying away excess flow. Beyond receptacle "A" seepage was noted and a small collecting gallery 16 feet long, similar in construction to that at section A-A, was installed. The flow from the weir house is taken to the sump and pump house by means of 5-inch cast iron pipe lines and pumped through 4-inch and 6-inch pipe lines into the storage reservoir.

Remarks.- The distributing system was not surveyed, and neither were the changes of units from the collecting area to pump house.



Docket Information

Number of Documents in Docket 60

Documents Dated from 6/15/1935 to 3/27/1967

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