

2

10219
Commercial

33

Serial No. 320

QB
875
435
no. 119

DEPARTMENT OF COMMERCE
U. S. COAST AND GEODETIC SURVEY
E. LESTER JONES, DIRECTOR

TIDAL BENCH MARKS

DISTRICT OF COLUMBIA

BY

L. A. COLE

Assistant Mathematician, U. S. Coast and Geodetic Survey

Special Publication No. 119

LIBRARY
AUG 1 1 1992
N.O.A.A.
U.S. Dept. of Commerce



PRICE 5 CENTS

Sold only by the Superintendent of Documents, Government Printing Office
Washington, D. C.

WASHINGTON
GOVERNMENT PRINTING OFFICE

1925

National Oceanic and Atmospheric Administration

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages

Faded or light ink

Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or www.reference@nodc.noaa.gov.

LASON

Imaging Contractor

12200 Kiln Court

Beltsville, MD 20704-1387

January 1, 2006

TIDAL BENCH MARKS, DISTRICT OF COLUMBIA

By L. A. COLE, *Assistant Mathematician, United States Coast and Geodetic Survey*

CONTENTS

	Page
Introduction.....	1
Standard datum.....	1
Mean tide level.....	2
Datum planes used.....	3
Explanation of table.....	4
Accuracy of the elevations.....	5
Standard bench mark.....	6
Changes in elevation.....	6
Elevations of bench marks.....	6
Descriptions of bench marks.....	7

ILLUSTRATION

Figure 1. Standard bench mark.....	6
------------------------------------	---

INTRODUCTION

In connection with its hydrographic operations the United States Coast and Geodetic Survey has established from time to time many tidal bench marks along our coasts. Numerous requests from engineers and others for descriptions and elevations of these bench marks have led the bureau to begin publishing the data which are in manuscript form in the files, in order to be able to furnish the information more promptly and more economically. In addition to the bench marks established by this survey, it is proposed to include in these publications the descriptions and elevations of bench marks which have been well determined by other organizations, such as municipal, State, and Federal engineers.

It is planned to make this information available by sections of the coast, each section to be taken up as the other work of the bureau will permit. Because of the constant requests for this information relative to the vicinity of New York City, the first section to be published was that for the State of New York in Special Publication No. 83, which was issued in 1922. The second section of this work will contain the tidal bench marks for the District of Columbia.

STANDARD DATUM

In all engineering work where it is necessary to determine differences in elevation by spirit levels, and especially where it is desired to coordinate the work of various surveys, it is in the interest

of efficiency and economy that a uniform datum be used. It has frequently happened that the various engineers operating in the same locality have used different arbitrary datums, which has led to much confusion and waste. This condition can be obviated by the adoption of a single reliable datum. Datums based on tidal definition are the best for both practical and scientific work, since they may be recovered though all bench mark connections be destroyed.

Of all the tidal datums mean sea level is the most nearly fixed and therefore the best. It is now used by this bureau as the datum for all land surveys. By a network of precise level lines it has been carried to many parts of the interior of the country, and new lines are being added to this level net each year.

Where mean sea level has been sufficiently well determined for adoption as the standard of adjustment for the precise level net for any region it is designated as standard sea level.

Mean sea level, as determined at the primary tide stations on the open coasts, may be considered for all practical engineering and surveying purposes in the same equipotential surface and may be defined as the level about which the tide oscillates. Because of the disturbing influences of wind and weather an accurate determination of mean sea level must be based on observations over a considerable period of time. As determined by this bureau, mean sea level is derived from the hourly heights of the tide as referred to the zero of a fixed tide staff which has been connected with a primary bench mark by spirit levels. A fairly good value for mean sea level may be derived from a year of continuous observations, especially if corrected by the results from a primary tide station near by. For periods of less than a year in length only approximate results can be obtained on account of the annual inequality. Annual inequality in mean sea level is the variation in the height of mean sea level at different times of the year, depending in general upon the seasonal changes in the direction and strength of the wind and at river stations, also upon the rainfall and melting snow. There is a rough periodicity in these variations, but they can not be accurately foretold. A good determination of this variation requires several years of observations. But mean sea level determined from short series of observations may be corrected to a fairly accurate value by comparison with simultaneous observations at some near-by primary tide station.

MEAN TIDE LEVEL

Mean sea level should be carefully distinguished from mean tide level, the former being determined from the hourly heights of the tide and the latter from the high and low water readings and is a datum midway between mean high water and mean low water.

A fair approximation to this datum can be obtained from one lunation, or 29 days of observations; but, like mean sea level, if accurate results are desired, one or more years of observations would be required.

For most places on the open coast mean tide level does not differ much from mean sea level; but on inside waters, especially up tidal rivers, there may be a considerable difference in the elevations of the

two planes. For localities where this difference has been accurately determined the one datum may very readily be derived from the other. From the 10 years of observations in the District of Columbia, mean tide level is computed to be approximately 0.04 foot below mean river level; the latter is analogous to the mean sea level of the open coasts. Since this difference is so small as to be of little importance, it will not be necessary for practical purposes to make any distinction between the two datums.

DATUM PLANES USED

The bench marks in the District of Columbia have been connected with the precise level net through "Capitol Bench Mark," Serial No. 1, of this publication, and the elevations are therefore referred to standard sea level. This standard sea level is 0.289 foot below mean river level, based upon 10 years of hourly height readings of the water surface of the Potomac River as obtained from the records of automatic tide gauges located as follows: From 1892-1898, at the Washington Navy Yard; from 1899-1900, at the Norfolk & Washington Steamboat Co. wharf, foot of Seventh Street SW.; and for 1901 at the United States Engineer Wharf, Easby Point. The tide staffs at these places were connected with each other and with the "Capitol Bench Mark" by spirit levels at various times.

Since standard sea level is 0.289 foot below mean river level, the elevation of the bench marks may be referred to mean river level by subtracting that quantity from the standard sea level values, or 0.29 foot from the standard sea level values as listed in this publication.

In addition to standard sea level the elevations of the bench marks in this publication are referred to mean high water, mean low water, highest tide, and lowest tide, as determined for the navy yard.

Mean high water is the mean height of all the high waters, and mean low water the mean height of all the low waters for the period of the observations. The relation of mean high water and mean low water to mean tide level at any point is equal to the half mean range of tide. The mean tidal range is the difference in height between mean high water and mean low water, and mean tide level is the half sum of those two datums. The mean range of tide for all points in the District of Columbia does not vary more than about one-tenth of a foot, and in this publication it is taken as 2.9 feet, which is the same as that derived for the navy yard.

The highest and lowest tides represent the probable extreme heights for each locality, and in places where long series of observations are not available they are usually estimated to the nearest half foot. The bench marks for the District of Columbia, however, are all referred to the highest and lowest tides as observed at the navy yard.

A table showing the elevations of various tidal datums which have been used by the Coast and Geodetic Survey and other engineering bodies in the District of Columbia as referred to standard sea level is given in the table which follows.

Name of datum	Elevation above standard sea level, in feet	Name of datum	Elevation above standard sea level, in feet
Highest tide (Oct. 14, 1893, at navy yard).....	+8.14	Pennsylvania Railroad.....	+0.72
Mean high water (navy yard).....	+1.74	Mean river level (navy yard).....	+0.29
Washington Aqueduct and filtration plant.....	+1.09	Standard sea level.....	0.00
District of Columbia Engineer Department.....	+0.85	Mean low water (navy yard).....	-1.16
Topographic Survey of District of Columbia, United States Coast and Geodetic Survey (not used after 1903).....	+0.73	United States Engineer Office (mean low water).....	-1.26
		United States Navy Yard.....	-4.16
		Lowest tide (Mar. 13, 1888, at navy yard).....	-6.06

EXPLANATION OF TABLE

For convenience of reference the bench marks in this publication have been given consecutive serial numbers and grouped according to the general localities in which they fall.

The table of elevations gives the elevations of the bench marks above five principal tidal planes. The elevation above mean tide level (mean river level) has been omitted, since there is a constant relation between that datum and standard sea level. As already mentioned, the elevations above mean tide level may be obtained by subtracting 0.29 foot from the standard sea level elevations.

The elevations above the planes of mean high water and mean low water are referred to mean high water and mean low water as observed at the navy yard. These datums probably do not vary more than a few hundredths of a foot for all points in the District of Columbia, and the elevations are given in this publication to the nearest tenth of a foot.

The elevations above the planes of highest and lowest tides are based on the highest and lowest values for the navy yard. The highest tide occurred on October 14, 1893, and was due to a hurricane. The lowest tide occurred March 13, 1888. The lowest tides for the District of Columbia are caused by strong northerly winds.

Freshet high waters for points above Georgetown are frequently much higher than the extreme high waters, due to other causes. The freshet of November 25 and 26, 1877, which was one of the highest on record, was investigated by Charles Junken, of this office. In United States Coast and Geodetic Survey Report of 1878, page 24, the following account is given:

At the Chain Bridge the water reached fully up to the level of the top of the old piers, and Mr. Junken found that the rise amounted to 36 feet above the level of mean high tide. At Lockmills the rise was 27 feet; at the Aqueduct, 13 feet 9 inches; at the Philadelphia Steamboat Co.'s wharf, Georgetown, the rise was 10 feet 7 inches; at the Long Bridge, 6 feet 2 inches; at the Arsenal Wharf, 5 feet 6 inches; and at Alexandria the water rose 3 feet above the level of mean high tide.

The following table gives the elevation of this freshet at the points mentioned as referred to standard sea level. It is here assumed that the mean range of tide is 2.9 feet, and that mean high water is 1.74 feet above standard sea level.

Freshet of November 25-26, 1877

Locality	Elevation above standard sea level in feet	Locality	Elevation above standard sea level in feet.
Chain Bridge.....	37.74	Long Bridge.....	7.91
Lockmills.....	28.74	Arsenal Wharf.....	7.24
Aqueduct.....	15.49	Alexandria.....	4.74
Philadelphia Steamboat Co. Wharf, Georgetown.....	12.32		

While no elevation is given for this high water at the navy yard, it may be assumed to have been a little less than at the Arsenal Wharf, or about a foot lower than the highest tide of October 14, 1893.

Following the table of elevations is a detailed description of each bench mark given under the same serial number as used in the table. In addition to the serial number there is also given the number by which the bench mark is known by the organization establishing it or furnishing its description and elevation. So far as it is known when the bench mark has been established or the description furnished by someone outside this bureau, the name of the organization is given in the description. The names of these organizations and the initials when used are as follows:

District of Columbia Engineers.....	D. C. E.
United States Engineers.....	U. S. E.
United States Geological Survey.....	U. S. G. S.
Baltimore & Ohio Railroad.....	B. & O. R. R.

At the end of each description the elevations of the bench mark is given above the datums of mean low water and standard sea level, as determined for the navy yard.

ACCURACY OF THE ELEVATIONS

As already stated, the bench marks in the District of Columbia have been connected with the precise level net through "Capitol Bench Mark," Serial No. 1. The standard elevation of "Capitol Bench Mark" is 90.686 feet above standard sea level. All of the other bench marks in the District of Columbia have been connected with "Capitol Bench Mark" by precise levels. In view of the fact that the leveling was done with the same precision as is usually employed in such work, the standard sea-level elevations as given in this publication may be considered as correct to the nearest hundredth of a foot.

The elevations above the planes of mean high water and mean low water are obtained from mean river level through the mean range of tide for the navy yard and are given to the nearest tenth of a foot. There is a slight variation in the mean range for the various points in the District, but since these datums are one-half the mean range above and below mean river level, respectively, it is believed the maximum error at any point would not exceed 0.05 foot.

The elevations above the planes of the highest and lowest tides are based on the extremes as observed at the navy yard, and they are

therefore representative of such conditions due directly to wind and weather for all the tidal waters adjacent to the District of Columbia. From Chain Bridge to Georgetown, however, the freshet high waters often far exceed in height any that are due solely to winds. For example, see table giving the elevations of freshet of November 25-26, 1877, on page 5.

STANDARD BENCH MARK

In this publication the standard identification mark used by this bureau is referred to as the Coast and Geodetic Survey standard disk. The present model of this mark is a brass disk or cap about 3 inches in diameter and has the following inscription, "U. S. Coast and Geodetic Survey Bench Mark. For elevation write to Director, Washington, D. C. \$250 fine or imprisonment for disturbing this mark." The standard disk bench mark has a shank about 3 inches long for insertion in a building or other substantial support (see fig. 1).

CHANGES IN ELEVATION

Although a bench mark may appear to be quite permanent in character and correspond with its description, the elevation may have changed materially since its determination because of settling of the immediate locality from construction work or from other causes. Engineers are therefore cautioned to make use of at least two bench marks where possible. They will confer a favor on the profession and on this bureau by reporting to the Director, United States Coast and Geodetic Survey, any changes in elevation or destruction of bench marks noted, in order that information in regard to these marks may be kept up to date and this publication revised when necessary.

ELEVATIONS OF BENCH MARKS, SERIAL NOS. 1 TO 83: DISTRICT OF COLUMBIA

Serial Number	Locality	Elevation of bench marks above—				
		Highest tide	Mean high water	Standard sea level	Mean low water	Lowest tide
		<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
1	Capitol Hill.....	82.5	88.9	90.69	91.8	96.7
2	do.....	82.6	89.0	90.70	91.9	96.8
3	do.....	68.7	73.1	74.83	78.0	80.9
4	do.....	67.2	73.6	75.30	76.5	81.4
5	Navy yard.....	10.2	16.6	18.39	19.5	24.4
6	do.....	35.5	41.9	43.61	44.8	49.7
7	do.....	35.2	41.6	43.85	44.5	49.4
8	do.....	8.2	14.6	16.85	17.5	22.4
9	do.....	3.7	10.1	11.86	13.0	17.9
10	do.....	1.2	7.6	9.84	10.6	15.4
11	do.....	0.8	7.2	8.90	10.1	15.0
12	Southwest Washington.....	2.8	9.2	10.96	12.1	17.0
13	do.....	3.0	9.4	11.11	12.3	17.2
14	do.....	13.6	20.0	21.74	22.9	27.8
15	do.....	16.4	22.8	24.53	25.7	30.6
16	do.....	13.5	19.9	21.04	22.8	27.7
17	do.....	14.4	20.8	22.56	23.7	28.6
18	do.....	10.8	17.2	18.96	20.1	25.0
19	do.....	3.2	9.6	11.31	12.5	17.4
20	do.....	9.8	16.2	17.93	19.1	24.0
21	do.....	20.9	27.3	29.00	30.2	35.1

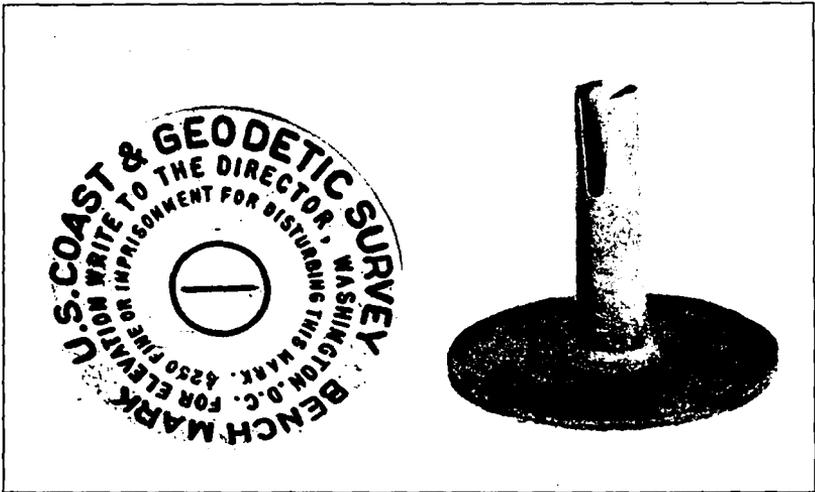


FIG. 1.—STANDARD BENCH MARK

Elevations of bench marks, serial Nos. 1 to 83, etc.—Continued

Serial Number	Locality	Elevation of bench marks above—				
		Highest tide	Mean high water	Standard sea level	Mean low water	Lowest tide
		Feet	Feet	Feet	Feet	Feet
22	Southwest Washington	24.1	30.5	32.20	33.4	38.3
23	do	24.0	31.0	32.78	33.9	38.8
24	The Mall	21.0	28.0	29.72	30.9	35.8
25	do	23.3	29.7	31.48	32.0	37.5
26	do	20.1	35.5	37.28	38.4	43.3
27	Monument Grounds	12.5	18.9	20.02	21.8	26.7
28	do	28.8	35.2	36.91	38.1	43.0
29	do	33.2	39.6	41.30	42.5	47.4
30	do	32.4	38.8	40.53	41.7	46.6
31	do	31.4	37.8	39.51	40.7	45.6
32	do	31.1	37.5	39.28	40.4	45.3
33	do	31.3	37.7	39.42	40.6	45.5
34	do	31.3	37.7	39.49	40.6	45.5
35	do	7.1	13.5	15.29	16.4	21.3
36	Ellipse	0.9	16.3	18.01	19.2	24.1
37	do	20.5	26.9	28.65	29.8	34.7
38	Tidal Basin	0.7	16.1	17.82	19.0	23.9
39	do	4.0	10.4	12.13	13.3	18.2
40	East Potomac Park	-2.1	4.3	6.08	7.2	12.1
41	do	4.2	10.6	12.34	13.5	18.4
42	do	-0.3	6.1	7.84	9.0	13.9
43	do	1.3	7.7	9.40	10.6	15.5
44	do	1.5	7.9	9.69	10.8	15.7
45	Twenty-third and B Streets NW	7.2	13.6	15.30	16.5	21.4
46	Easby Point	-2.3	4.1	5.83	7.0	11.9
47	C Street NW, Twenty-fifth to Twenty-sixth	15.1	21.5	23.27	24.4	29.3
48	Twenty-sixth and G Streets NW	25.1	31.5	33.23	34.4	39.3
49	do	24.7	31.1	32.81	34.0	38.9
50	K Street Bridge over Rock Creek	15.0	21.4	23.16	24.3	29.2
51	Georgetown	8.5	14.9	16.67	17.8	22.7
52	do	8.9	15.3	17.09	18.2	23.1
53	do	23.5	29.9	31.65	32.8	37.7
54	do	65.3	71.7	73.47	74.0	79.5
55	Rosslyn, Va	53.8	60.2	61.96	63.1	68.0
56	do	51.9	58.3	60.00	61.2	66.1
57	Chain Bridge	-3.0	3.4	5.17	6.3	11.2
58	do	37.8	44.2	45.92	47.1	52.0
59	do	-2.4	4.0	5.76	6.9	11.8
60	do	10.5	25.9	27.66	28.8	33.7
61	Maryland Avenue NE	81.4	87.8	89.58	90.7	95.6
62	Ninth and D Streets NE	81.3	87.7	89.44	90.6	95.5
63	Tenth and G Streets NE	38.4	44.8	46.50	47.7	52.6
64	Twelfth Street and Florida Avenue NE	47.1	53.5	55.25	56.4	61.3
65	Eleventh Street and Florida Avenue NE	44.5	50.9	52.60	53.8	58.7
66	Fifteenth Street and Florida Avenue NE	37.0	44.3	46.08	47.2	52.1
67	Benning Road and Fifteenth Street	39.8	46.2	47.98	49.1	54.0
68	Benning Bridge	5.1	11.5	13.26	14.4	19.3
69	do	5.3	11.7	13.48	14.6	19.5
70	Benning Road	8.2	14.6	16.34	17.5	22.4
71	Benning	13.3	19.7	21.44	22.6	27.5
72	Seat Pleasant	109.5	115.9	117.65	118.8	123.7
73	Metropolitan Branch B. & O. R. R.	33.1	39.5	41.25	42.4	47.3
74	do	87.3	93.7	95.48	96.6	101.5
75	do	90.3	105.7	107.45	108.6	113.5
76	do	121.0	127.4	129.15	130.3	135.2
77	do	152.5	158.9	160.67	161.8	166.7
78	do	196.5	202.9	204.65	205.8	210.7
79	do	268.8	265.2	266.02	268.1	273.0
80	Philadelphia Division B. & O. R. R.	33.9	40.3	42.00	43.2	48.1
81	do	50.2	56.6	58.29	59.5	64.4
82	do	59.0	65.0	67.79	68.9	73.8
83	do	60.3	66.7	68.43	69.6	74.5

DESCRIPTION OF BENCH MARKS, SERIAL NOS. 1 TO 83, DISTRICT OF COLUMBIA

Serial No. 1. *Capitol Hill*: B. M. 51, or "Capitol B. M.," is the top of a bronze bolt in the middle of a bronze plate (5 inches square), placed vertically in the granite water table under the first window west of the southeast corner of the Senate wing of the Capitol. The plate was placed in position in June, 1884, and is inscribed "Capitol Bench Mark, U. S. Coast and Geodetic Survey,

1884." Elevation: 91.8 feet above mean low water; 90.69 feet above standard sea level.

Serial No. 2. Capitol Hill: B. M. 52, or Capitol B. M. of D. C. Engineers, is the extreme northeast corner of the blue imitation granite water table on the north side of the steps of the main eastern entrance to the Capitol. In the city "Book of Gradations," by Nicolas King, bearing the date of 1815, and referring back to 1797, the elevation of the foundation course of the Capitol is given as 86.86 feet above an assumed "mean high water." When this foundation course was covered, the bench mark was changed to the water table, and 3 feet added for the thickness of the intervening courses of stone. The grade maps in the office of the Engineer Commissioner of the District of Columbia are all referred to an assumed "mean high water," 89.86 feet below B. M. 52. Elevation: 91.9 feet above mean low water; 90.70 feet above standard sea level.

Serial No. 3. Capitol Hill: B. M. T is a Coast and Geodetic Survey standard disk on the east side of New Jersey Avenue SE., south of its intersection with B Street, south of the steps leading to the northwest entrance of the House Office Building, in top of the marble foundation stone about 9 inches above the sidewalk and a few feet north of a point opposite the main entrance to the United States Coast and Geodetic Survey Office, 205 New Jersey Avenue SE. Elevation: 76.0 feet above mean low water; 74.83 feet above standard sea level.

Serial No. 4. Capitol Hill: B. M. U is a Coast and Geodetic Survey standard disk set in the top of the fourth stone step from the bottom, at the north end of the step near the stone baluster, of the steps leading to the main entrance to the United States Coast and Geodetic Survey Office, 205 New Jersey Avenue SE. Elevation: 76.5 feet above mean low water; 75.30 feet above standard sea level.

Serial No. 5. Navy yard: B. M. V is a Coast and Geodetic Survey standard disk set in the sloping concrete foundation to the supporting column at the northwest corner of building No. 153, at the northwest corner of the navy yard, near Second and M Streets SE. Elevation: 19.5 feet above mean low water; 18.39 feet above standard sea level.

Serial No. 6. Navy yard: B. M. 17a. (D. C. Engineers) is on top of the northeast corner of stone foundation to the eastern column at entrance to main navy-yard gate at the foot of Eighth Street SE. and on south side of M Street. Elevation: 44.8 feet above mean low water; 43.61 feet above standard sea level.

Serial No. 7. Navy yard: B. M. W. is a Coast and Geodetic Survey standard disk set on south side of foundation of "Old Maine gun" at the west side of Dahlgren Avenue in the navy yard, near main entrance at foot of Eighth Street SE. Elevation: 44.5 feet above mean low water; 43.35 feet above standard sea level.

Serial No. 8. Navy yard: B. M. 14, or Ordnance B. M., is the bottom of a square hole about 0.15 inch deep, cut in the north end of granite doorstep (8 feet long, 14 inches wide, 8 inches thick, set on 3 feet of concrete) at the main entrance to the ordnance office, navy yard. Elevation: 17.5 feet above mean low water; 16.35 feet above standard sea level.

Serial No. 9. Navy yard: B. M. X is a Coast and Geodetic Survey standard disk set in the south end of doorsill of second door from the south end on west side of building No. 108 facing Dahlgren Avenue at navy yard. Elevation: 13.0 feet above mean low water; 11.86 feet above standard sea level.

Serial No. 10. Navy yard: B. M. 12, or C, is the outer ½-inch of the ledge about 1 foot above the pavement on the brick column under the southwest corner of the porch around the commandant's office at the navy yard. Elevation: 10.5 feet above mean low water; 9.34 feet above standard sea level.

Serial No. 11. Navy yard: B. M. Y is a Coast and Geodetic Survey standard disk on the south side of the concrete foundation supporting the east leg of the east wireless tower at the navy yard. Elevation: 10.1 feet above mean low water; 8.90 feet above standard sea level.

Serial No. 12. Southwest Washington: B. M. 28, or U. S. 2, is the top of a 6-inch square granite block marked "U. S." on the southwest corner of M and Second Streets SW., 21.25 feet east of B. M. 27. Elevation: 12.1 feet above mean low water; 10.96 feet above standard sea level.

Serial No. 13. Southwest Washington: B. M. 27, or U. S. 1, is the top of a 6-inch square granite block marked "U. S." on the southeast corner of Dela-

ware Avenue and M Street SW. Elevation: 12.3 feet above mean low water; 11.11 feet above standard sea level.

Serial No. 14. *Southwest Washington:* B. M. 29 is the south end of a doorsill at No. 1200 Four-and-a-half Street SW., near M Street. Elevation: 22.9 feet above mean low water; 21.74 feet above standard sea level.

Serial No. 15. *Southwest Washington:* B. M. 30 is a rude cross on the southeast corner of top of stone doorsill of Providence Baptist Church, between Four-and-a-half and Sixth Streets SW. on M Street. Elevation: 25.7 feet above mean low water; 24.53 feet above standard sea level.

Serial No. 16. *Southwest Washington:* B. M. 31 is the center of a rude cross on the south end of the stone doorsill of Fifth Baptist Church, on Four-and-a-half Street near N Street SW. Elevation: 22.8 feet above mean low water; 21.64 feet above standard sea level.

Serial No. 17. *Southwest Washington:* B. M. Z. is a Coast and Geodetic Survey standard disk set in the water table about 4 feet above the ground and west of the third window from the east end of building No. 44a at Washington Barracks, on the south side of P Street SW., at the foot of Four-and-a-half Street. Elevation: 23.7 feet above mean low water; 22.56 feet above standard sea level.

Serial No. 18. *Southwest Washington:* B. M. A. 1 is a Coast and Geodetic Survey standard disk set in the top of stone base of the foundation at the southeast corner of Capitol Traction Co. car barn on the north side of P Street SW., west of its intersection with Four-and-a-half Street. Elevation: 20.1 feet above mean low water; 18.96 feet above standard sea level.

Serial No. 19. *Southwest Washington:* B. M. B. 1 is a Coast and Geodetic Survey standard disk set in the concrete foundation of south gatepost at entrance to Lighthouse Wharf, on the side next to driveway and on west side of Water Street SW., near its intersection with O Street. Elevation: 12.5 feet above mean low water; 11.31 feet above standard sea level.

Serial No. 20. *Southwest Washington:* B. M. 78 is a rude cross in the south corner of the south doorsill of the building being used in October, 1922, as a storehouse by the United States Department of Agriculture at the northwest corner of Seventh and K Streets SW. Elevation: 19.1 feet above mean low water; 17.93 feet above standard sea level.

Serial No. 21. *Southwest Washington:* B. M. 48 is the southeast corner of the red sandstone support to the lamp-post on the south side of main eastern entrance to St. Dominick's Church, on the southwest corner of Sixth and E Streets S. W. Elevation: 30.2 feet above mean low water; 29.00 feet above standard sea level.

Serial No. 22. *Southwest Washington:* B. M. 79 is a rude cross in the south corner of the south doorsill of St. Paul's African Methodist Episcopal Church, on Eighth Street SW., between D and E Streets. Elevation: 33.4 feet above mean low water; 32.29 feet above standard sea level.

Serial No. 23. *Southwest Washington:* B. M. 80 is a rude cross in the south end of top of stone doorstep of Kendall Green Baptist Church, on Ninth Street SW., between B and C Streets. Elevation: 33.9 feet above mean low water; 32.78 feet above standard sea level.

Serial No. 24. *The Mall:* B. M. 82 is a rude cross on the top of the granite doorsill at the foot of the supporting timber for the west outer door, about 3 feet east of the west brick wall of the main northern entrance to the National Museum. Elevation: 30.9 feet above mean low water; 29.72 feet above standard sea level.

Serial No. 25. *The Mall:* B. M. 84, or Smithsonian, is a cross cut in the stone coping of the area wall in front of a basement window on the north side of the building, about 12 feet west of the northeast corner of the Smithsonian Institution. Elevation: 32.6 feet above mean low water; 31.48 feet above standard sea level.

Serial No. 26. *The Mall:* B. M. 86, or H, is a cross on the base of a lamp-post at the east side of the entrance, 11 inches from the ground and close to the edge of a nick or place where a fragment of stone has been broken off at the north entrance to the red stone building of the Department of Agriculture on the Mall. Elevation: 38.4 feet above mean low water; 37.28 feet above standard sea level.

Serial No. 27. Monument Grounds: B. M. I is the southwest quadrant of a cross made by lines $\frac{3}{4}$ inch long on the east side of the small lodge just east of the Washington Monument on the top surface of the north end of the stone steps 3 inches from the east edge and 3 inches from the south side of the base of a column. Elevation: 21.8 feet above mean low water; 20.62 feet above standard sea level.

Serial No. 28. Monument Grounds: B. M. 92, or A (U. S. E.), is the top surface of an underground obelisk covered with an iron plate about 34 meters (112 feet) south of the Washington Monument, a few feet outside the driveway. Elevation: 38.1 feet above mean low water; 36.91 feet above standard sea level.

Serial No. 29. Monument Grounds: B. M. C. 1 is a Coast and Geodetic Survey standard disk set in the north end of the doorsill at the entrance to the Washington Monument, about 3 feet inside the doorway from the east face of the monument. Elevation: 42.5 feet above mean low water; 41.36 feet above standard sea level.

Serial No. 30. Monument Grounds: B. M. 93 is the top surface of an iron plate at the southwest corner of the Washington Monument about 2 inches below the surface of the granolithic pavement. Elevation: 41.7 feet above mean low water; 40.53 feet above standard sea level.

Serial No. 31. Monument Grounds: B. M. 95 is the top of a brass cap over an iron rod at the southwest corner of the Washington Monument, in the driveway just outside the granolithic pavement. Elevation: 40.7 feet above mean low water; 39.51 feet above standard sea level.

Serial No. 32. Monument Grounds: B. M. 96 is the top of a brass cap over an iron rod at the southeast corner of the Washington Monument, in the driveway just outside the granolithic pavement. Elevation: 40.4 feet above mean low water; 39.28 feet above standard sea level.

Serial No. 33. Monument Grounds: B. M. 97 is the top of a brass cap over an iron rod at the northeast corner of the Washington Monument, in the driveway just outside the granolithic pavement. Elevation: 40.6 feet above mean low water; 39.42 feet above standard sea level.

Serial No. 34. Monument Grounds: B. M. 98 is the top of a brass cap over an iron rod at the northwest corner of the Washington Monument, in the driveway just outside the granolithic pavement. Elevation: 40.6 feet above mean low water; 39.49 feet above standard sea level.

Serial No. 35. Monument Grounds: B. M. "Engine House" is a crosscut in the stone on the east side of the engine house between the Washington Monument and the Tidal Basin, on the top surface at the north end of the granite doorsill in the center of the east face of the building, about 15 feet south of its northeast corner. Elevation: 16.4 feet above mean low water; 15.29 feet above standard sea level.

Serial No. 36. Ellipse: B. M. "Meridian Stone" is the center of the surface of the meridian stone in the center of the Ellipse, north of the Washington Monument. Elevation: 19.2 feet above mean low water; 18.01 feet above standard sea level.

Serial No. 37. Ellipse: B. M. "Zero Milestone" is the top of the point in the bronze tablet in top of the zero milestone post, on the south side of the driveway just south of the White House Grounds, between the two cement walks on the north side of the Ellipse. Elevation: 29.8 feet above mean low water; 28.65 feet above standard sea level.

Serial No. 38. Tidal Basin: B. M. D 1 is a Coast and Geodetic Survey standard disk in the west parapet at the north end of the concrete highway bridge at the outlet gates on the east side of the Tidal Basin, about 2 feet above walk and facing same. Elevation: 19.0 feet above mean low water; 17.82 feet above standard sea level.

Serial No. 39. Tidal Basin: B. M. "Outlet Gates" (U. S. E.) is an iron bolt leaded into the stone at the south end of the outlet gates on the east side of the Tidal Basin, west of the concrete highway bridge, in the southwest corner of the upper horizontal surface of the top stone. Elevation: 13.3 feet above mean low water; 12.13 feet above standard sea level.

Serial No. 40. East Potomac Park: B. M. "Engineer Wharf" (U. S. E.) is a $\frac{1}{2}$ -inch brass pipe leaded in the sill at the northwest entrance to the storehouse at the United States Engineer Wharf, east of the railroad tracks between

the Tidal Basin and Washington Channel. Bench mark is in the left-hand side of the doorsill as one enters the storehouse, $\frac{3}{4}$ foot from the doorframe and $\frac{1}{2}$ foot out from the face of the wall. Elevation: 7.2 feet above mean low water; 6.08 feet above standard sea level.

Serial No. 41. East Potomac Park: B. M. "Potomac Park NW. Base" is a Coast and Geodetic Survey standard disk in top of concrete post in the middle of the strip of land between the docks (Washington Channel) and the Potomac River, 250 feet east of railroad, almost in line with the north face of the wall under the track, $1\frac{1}{2}$ feet above the surface of the ground. Elevation: 13.5 feet above mean low water; 12.34 feet above standard sea level.

Serial No. 42. East Potomac Park: B. M. "Potomac Park SE. Base" is a Coast and Geodetic Survey standard disk set in a concrete post near the southeast point of the strip of land between the docks (Washington Channel) and the Potomac River, about 100 feet north of the stone wall bordering the river and 6 feet south of the edge of the roadway, 8 inches above the surface of the ground. Elevation: 9.0 feet above mean low water; 7.84 feet above standard sea level.

Serial No. 43. East Potomac Park: B. M. "U. S. E. 10.72" is a $\frac{3}{4}$ -inch iron bolt leaded into the stone at the north end of the railroad bridge across the Potomac River, in the face of the northeast abutment, $2\frac{1}{2}$ feet west of the southeast corner and $2\frac{1}{2}$ feet above the ground. Elevation: 10.6 feet above mean low water; 9.40 feet above standard sea level.

Serial No. 44. East Potomac Park: B. M. "U. S. E. Highway Bridge" is a $\frac{3}{4}$ -inch iron bolt leaded in the stone at the north end of the Highway Bridge over the Potomac River, in the top of the west-wing wall of the north abutment, south of the angle in the west stairway leading up to the level of the bridge floor. Elevation: 10.8 feet above mean low water; 9.69 feet above standard sea level.

Serial No. 45. Twenty-third and B Streets NW.: B. M. "Braddock's Rock" is a $\frac{1}{2}$ -inch bolt leaded in the top of the rock at the northwest quarter of the intersection of Twenty-third and B Streets NW., about halfway along the south side of the northwest wing of the second Naval Hospital Building, on the south side of the driveway from Twenty-third Street, in a square brick inclosure. Elevation: 16.5 feet above mean low water; 15.30 feet above standard sea level.

Serial No. 46. Easby Point: B. M. "Easby Point Sewer" is a $\frac{3}{4}$ -inch iron bolt leaded in the rock on the north side of the Potomac River, on the sewer outlet at Easby Point, in top of the coping of the west wing wall, near its southwest corner. This bolt is also Transit Station O of Georgetown Harbor lines. Elevation: 7.0 feet above mean low water; 5.83 feet above standard sea level.

Serial No. 47. C Street between Twenty-fifth and Twenty-sixth Streets NW.: B. M. E. 1 is a Coast and Geodetic Survey standard disk in the south wall of the Heurich Brewery, on the north side of C Street NW., between Twelfth-fifth and Twenty-sixth Streets, about 15 feet west of the entrance to the office and 2 feet above the ground. Elevation: 24.4 feet above mean low water; 23.27 feet above standard sea level.

Serial No. 48. Twenty-sixth and G Streets NW.: B. M. 102 is the outer west corner of the doorsill at the entrance on G Street NW. to the Washington Gas Co.'s office, on the northeast corner of Twenty-sixth and G Streets. Elevation: 34.4 feet above mean low water; 33.23 feet above standard sea level.

Serial No. 49. Twenty-sixth and G Streets NW.: B. M. F 1 is a Coast and Geodetic Survey standard disk $\frac{3}{4}$ foot south of the northwest corner of the office of the Washington Gas Co. on the northeast corner of Twenty-sixth and G Streets NW., $3\frac{1}{2}$ feet above the sidewalk on Twenty-sixth Street. Elevation: 34.0 feet above mean low water; 32.81 feet above standard sea level.

Serial No. 50. K Street Bridge over Rock Creek: B. M. G 1 is a Coast and Geodetic Survey standard disk at the east end of the south parapet of the K Street Bridge over Rock Creek, about $2\frac{1}{2}$ feet above the ground. Elevation: 24.3 feet above mean low water; 23.16 feet above standard sea level.

Serial No. 51. Georgetown: B. M. H 1 is a Coast and Geodetic Survey standard disk on Key Bridge in Georgetown, on the north side of the pier between Water Street and the north bank of the Potomac River, at what is known as the 18-foot level, on a horizontal surface about 12 feet east of the northwest

corner of the pier and about on a level with Water Street. Elevation: 17.8 feet above mean low water; 16.67 feet above standard sea level.

Serial No. 52. Georgetown: B. M. "Archway" (U. S. E.) is a $\frac{3}{4}$ -inch iron bolt leaded into the stone on the Aqueduct Bridge on the north side of the Potomac River at Georgetown, in top of the water table at the southeast corner of the archway over Water Street, 4 feet above the ground. Elevation: 18.2 feet above mean low water; 17.09 feet above standard sea level.

Serial No. 53. Georgetown: B. M. XI is the bottom of a 1-inch square cut on the north end of the Aqueduct Bridge over the Potomac River in Georgetown, on the southerly face of the west wing wall to the bridge pier just south of the Chesapeake & Ohio Canal, on the water table below the canal level, about 7 feet below the top of the wing wall and on the fourth stone (about 11 feet) from its west end. Elevation: 32.8 feet above mean low water; 31.65 feet above standard sea level.

Serial No. 54. Georgetown: B. M. J 1 is a Coast and Geodetic Survey standard disk in the north end of the Key Bridge, in the west side of the west sidewalk near the baluster, at the foot of the fourth lamp post (about 60 feet) from the northwest corner of the bridge and over the southwest corner of the Georgetown abutment. Elevation: 74.6 feet above mean low water; 73.47 feet above standard sea level.

Serial No. 55. Rosslyn, Va.:¹ B. M. "USGS 62" is a United States Geological Survey aluminum tablet stamped "62 feet above sea level," at the northwest corner of the Arlington National Bank on the corner of Hume and Harlow Avenues, in the west face of the foundation stone about $2\frac{1}{2}$ feet above the sidewalk. Elevation 63.1 feet above mean low water; 61.96 feet above standard sea level.

Serial No. 56. Rosslyn, Va.:¹ B. M. "USGS 60" is a chiseled square in the stone doorsill of the Arlington National Bank at the corner of Hume and Harlow Avenues, $\frac{1}{3}$ foot from the west end of the doorsill and $\frac{1}{2}$ foot from its south edge. Elevation: 61.2 feet above mean low water; 60.09 feet above standard sea level.

Serial No. 57. Chain Bridge: B. M. "USGS" is a chiseled square 15 feet southwest of southeast corner of lower half of west abutment. Elevation: 6.3 feet above mean low water; 5.17 feet above standard sea level.

Serial No. 58. Chain Bridge: B. M. "USGS 46" is a United States Geological Survey aluminum tablet stamped "46" in the north end of west abutment, top of parapet wall, level with bridge floor, 12 inches southwest of northeast corner, 3.43 feet higher than iron pin in foundation masonry 4 feet north of bridge seat and on first course below bridge seat. Elevation: 47.1 feet above mean low water; 45.92 feet above standard sea level.

Serial No. 59. Chain Bridge: B. M. 1 is a cross cut in rock in the face of the west or Virginia shore abutment of Chain Bridge, the center of which is 21.9 feet below B. M. 2 (measured by steel tape) or top of said abutment. Elevation: 6.9 feet above mean low water; 5.76 feet above standard sea level.

Serial No. 60. Chain Bridge: B. M. 2 is a cross cut in rock on top of Virginia shore abutment on south side of Chain Bridge, 0.2 foot from face of abutment, 21.9 feet above B. M. 1, and 13.13 feet from south end of abutment. Elevation: 28.8 feet above mean low water; 27.66 feet above standard sea level.

Serial No. 61. Maryland Avenue NE.: B. M. S. is a Coast and Geodetic Survey standard disk at the Maryland Avenue entrance to the Pope School (Northeast), opposite Stanton Park, on the stone slab coping on the west side of the steps. Elevation: 90.7 feet above mean low water; 89.58 feet above standard sea level.

Serial No. 62. Ninth and D Streets NE.: B. M. R is a Coast and Geodetic Survey standard disk on the corner of D and Ninth Streets NE., in the west front of the Edmunds School, just north of the entrance. Elevation: 90.6 feet above mean low water; 89.44 feet above standard sea level.

Serial No. 63. Tenth and G Streets NE.: B. M. Q is a Coast and Geodetic Survey standard disk in the west front of the Madison School, just south of the entrance, on the corner of Tenth and G Streets NE. Elevation: 47.7 feet above mean low water; 46.50 feet above standard sea level.

¹ Bench marks, Serial Nos. 55 and 56, although located in the State of Virginia, are included in this list on account of being connected to the District of Columbia bench marks by precise levels over Key Bridge.

Serial No. 64. *Florida Avenue and Twelfth Street NE.*: B. M. P is a Coast and Geodetic Survey standard disk in the west face of the brick wall forming the entrance to J. D. Rosser's grocery store, on the corner of Twelfth Street and Florida Avenue NE. Elevation: 56.4 feet above mean low water; 55.25 feet above standard sea level.

Serial No. 65. *Florida Avenue and Eleventh Street NE.*: B. M. J is an iron bolt leaded in the concrete pavement at the southwest corner of Florida Avenue and Eleventh Street NE. Elevation: 53.8 feet above mean low water; 52.60 feet above standard sea level.

Serial No. 66. *Florida Avenue and Fifteenth Street NE.*: B. M. K is a copper bolt with a cross cut in its top, in the sharp angle between Florida Avenue and Fifteenth Street NE., in the concrete pavement. Elevation: 47.2 feet above mean low water; 46.08 feet above standard sea level.

Serial No. 67. *Benning Road and Fifteenth Street NE.*: B. M. L is a Coast and Geodetic Survey standard disk set in the south side of the granite steps of the Washington Railway & Electric Co.'s car barn on Benning Road just east of Fifteenth Street NE. Elevation: 49.1 feet above mean low water; 47.98 feet above standard sea level.

Serial No. 68. *Benning Bridge*: B. M. M is a Coast and Geodetic Survey standard disk set on the south side of the west abutment of the Washington Railway & Electric Co.'s bridge over the Anacostia River on Benning Road. Elevation 14.4 feet above mean low water; 13.26 feet above standard sea level.

Serial No. 69. *Benning Bridge*: B. M. K 1 is a Coast and Geodetic Survey standard disk set with cement on top of west abutment of the traffic bridge crossing the Anacostia River on Benning Road. It is 11.63 feet from west end of stone and 0.88 foot from the middle of the lamppost on the southwest corner of the bridge. Elevation: 14.6 feet above mean low water; 13.48 feet above standard sea level.

Serial No. 70. *Benning Road*: B. M. L 1 is a Coast and Geodetic Survey standard disk cemented in the west end of the doorsill at the southwest corner of the power house of the Potomac Electric Power Co. near the eastern end of the bridge over Anacostia River near Benning, D. C. Elevation: 17.5 feet above mean low water; 16.34 feet above standard sea level.

Serial No. 71. *Benning*: B. M. N is a Coast and Geodetic Survey standard disk on top of the north end of the second course of stone from the bottom of the west abutment of the Pennsylvania Bridge over the Washington Railway & Electric Co.'s District line track near Benning. Elevation: 22.6 feet above mean low water; 21.44 feet above standard sea level.

Serial No. 72. *Seat Pleasant*: B. M. O is a Coast and Geodetic Survey standard disk in the concrete pavement in the vestibule of the Farmers & Mechanics Bank, to the right on entering, between the column and the wall of the building, at Seat Pleasant on the District line. Elevation: 118.8 feet above mean low water; 117.65 feet above standard sea level.

Serial No. 73. *Metropolitan Branch, Baltimore & Ohio R. R. Yards*: B. M. "B. & O. 2" is a cross cut in the top of a rail set vertically in the ground between the tracks of the Metropolitan Branch of the Baltimore & Ohio Railroad, opposite mile post "Washington, 1 mile." Elevation: 42.4 feet above mean low water; 41.25 feet above standard sea level.

Serial No. 74. *Metropolitan Branch, Baltimore & Ohio R. R., near Eckington*: B. M. "B. & O. 3" is a cross cut on top of rail set vertically in the ground between the tracks of the Metropolitan Branch of the Baltimore & Ohio Railroad at Eckington, opposite mile post "Washington, 2 miles." Elevation: 96.6 feet above mean low water; 95.48 feet above standard sea level.

Serial No. 75. *Metropolitan Branch, Baltimore & Ohio R. R., near Brookland*: B. M. "B. & O. 3A" is a copper bolt in the bridge seat between the tracks at the south end of bridge No. 2A, under the grade crossing of the electric car line near Brookland on the Metropolitan Branch of the Baltimore & Ohio Railroad. Elevation: 108.6 feet above mean low water; 107.45 feet above standard sea level.

Serial No. 76. *Metropolitan Branch, Baltimore & Ohio R. R., near Brookland*: B. M. "B. & O. 4" is a copper bolt in the bridge seat between the tracks at the north end of the bridge culvert No. 3A, at Brookland, on the Metropolitan Branch of the Baltimore & Ohio R. R. Elevation: 130.3 feet above mean low water; 129.15 feet above standard sea level.

Serial No. 77. *Metropolitan Branch, Baltimore & Ohio R. R., 1 mile northwest of Brookland:* B. M. "B. & O. 5" is a copper bolt on the west side of the railroad tracks on the south side of a box culvert, opposite telegraph pole 3/25, about 1 mile northwest of Brookland, on the Metropolitan Branch of the Baltimore & Ohio R. R. Elevation: 161.8 feet above mean low water; 160.07 feet above standard sea level.

Serial No. 78. *Metropolitan Branch, Baltimore & Ohio R. R., at Stotts Station:* B. M. "B. & O. 6" is a copper bolt in the west end of the bridge seat on the south abutment of bridge No. 5B, at Stotts Station, on the Metropolitan Branch of the Baltimore & Ohio R. R. Elevation: 205.8 feet above mean low water; 204.65 feet above standard sea level.

Serial No. 79. *Metropolitan Branch, Baltimore & Ohio R. R., near Takoma Park:* B. M. "B. & O. 7" is a copper bolt between the tracks in the bridge seat on the east abutment of bridge No. 7A, near Takoma Park, on the Metropolitan Branch of the Baltimore & Ohio R. R. Elevation: 268.1 feet above mean low water; 266.92 feet above standard sea level.

Serial No. 80. *Philadelphia Division, Baltimore & Ohio R. R., near Washington:* B. M. "B. & O. 1" is a cross cut on the top of a rail set vertically in the ground, opposite mile post "W. 2—Baltimore 38," on the Philadelphia Division of the Baltimore & Ohio R. R. Elevation: 43.2 feet above mean low water; 42.00 feet above standard sea level.

Serial No. 81. *Philadelphia Division, Baltimore & Ohio R. R., at Trinidad Yards:* B. M. "B. & O. 2" is a copper bolt about 50 feet southwest of telegraph pole 37/13, in the northwest end of the northwest abutment of a culvert, on the Philadelphia Division of the Baltimore & Ohio R. R., at the southwest end of the Trinidad Yards. Elevation: 59.5 feet above mean low water; 58.29 feet above standard sea level.

Serial No. 82. *Philadelphia Division, Baltimore & Ohio R. R., near Winthrop Heights:* B. M. "B. & O. 3" is a copper bolt in the northeast end of the southeast coping of the arch culvert opposite telegraph pole 36/16, about $\frac{1}{6}$ mile southwest of Winthrop Heights, on the Philadelphia Division of the Baltimore & Ohio R. R. Elevation: 68.9 feet above mean low water; 67.79 feet above standard sea level.

Serial No. 83. *Philadelphia Division, Baltimore & Ohio R. R., at Langdon:* B. M. "B. & O. 4" is a copper bolt in the southwest end of the northwest coping of a culvert, about 150 feet southwest of the Baltimore & Ohio R. R. depot at Langdon. Elevation: 69.6 feet above mean low water; 68.43 feet above standard sea level.

